Stormwater Management Master Plan - Uxbridge Urban Area and Hamlet of Coppin's Corners, Township of Uxbridge, ON

Prepared for:
Township of Uxbridge

Prepared by:
Stantec Consulting Ltd.
300-675 Cochrane Drive West Tower
Markham, ON L3R 0B8
Tel: (905) 944-7777

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Sign-off Sheet

This document entitled Stormwater Management Master Plan - Uxbridge Urban Area and Hamlet of Coppin's Corners, Township of Uxbridge, ON was prepared by Stantec Consulting Ltd. for the account of Township of Uxbridge. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by ______________________________
(signature)

Tim Ng, Water Resources

Prepared by ______________________________
(signature)

Wendy Burke, Water Resources

Prepared by ______________________________
(signature)

Marla Bojarski, Aquatic Ecology

Prepared by __________________ for: __________
(signature)

Hagit Blumenthal, Hydrogeology

Prepared by ______________________________
(signature)

Colin Varley, Archaeology

Reviewed by ______________________________
(signature)

Roy Johnson, Water Resources

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Introduction

The Township of Uxbridge has retained Stantec Consulting Ltd. (Stantec) to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management Master Plan (SWMMP) for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWMMP has been prepared in accordance with the *Comprehensive SWM Master Plan Guidelines*, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the *Municipal Class Environmental Assessment Guideline*, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011). The Township of Uxbridge (the Township) has received a letter from the Ministry of Environment (MOECC) indicating that the required scope of the SWM Master Plan must include the settlement areas noted above.

The intent of the Stormwater Management Master Plan (SWMMP) was to prepare a practical and implementable framework which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities. The MOECC published the *Lake Simcoe Protection Plan* in June of 2009 that called for all settlement areas to prepare and implement comprehensive SWMMP that would improve the management of stormwater for both existing and planned development.

The Study Area encompasses locations within both The Township of Uxbridge and Coppin's Corners, located south of Lake Simcoe. The Uxbridge study sub-area is generally bounded by Ball Road (north), Concession Road 7 (east), Wagg Road (south), Concession Rd#6 (west). The Coppin's Corners study sub-area is generally bounded by Regional Road HWY 47 (north), Concession Regional Road No. 1 (east), Regional Road No.21 (south) and Concession Road #4 (west). The Study Area is the urban areas from the Town's Official Plan (OP) and can be seen in **Figure 1**. It is important to note that the urban area from the Town's OP slightly differs from that of Durham Region's.

The Study Area drains to two sub watersheds: Uxbridge Brook and Pefferlaw Brook. There are various existing Stormwater Management (SWM) facilities within the Study Area. There are parts of the Greenbelt and Oak Ridges Moraine that are within the Township Boundary. The intent of the SWMMP is to develop the practical and implementable framework, which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities. The land use within the Town's Urban Boundary is predominantly residential, commercial, and institutional with some park and open space areas. There are several employment areas at the intersection of Main and Maple St and the intersection of Reach St and Hamilton St. There is a cemetery to the south west within Lot 27 and Lot 28. Mixed land use areas are generally in the north eastern section from lot 31 to lot 33.

There is also a small section of private open space for a golf course at the east end of the urban boundary along Lot 29. There are several Environmental Constraint Areas that are within the vicinity of watercourses and bounded by the floodplain.

SWMMP Strategy

The primary objective of the project is to meet the requirements of the Lake Simcoe Protection Plan (specifically Section 4.5 SA), the Lake Simcoe *Comprehensive Stormwater Management Master Plan Guidelines* and the LSRCA Watershed Development Policies, while considering the intentions of the Township's OP and applicable strategies/goals/guidelines set out by the Region of Durham's OP. The objectives of each plan in detail are described below:

Public Information Centre / Stakeholder Consultation

A Public Information Centre was held May 8, 2014.

SWM Recommendations

Using the existing conditions, the Township's OP, and the results of this Study, recommendations based on each settlement area have been developed.

Area A – Uxbridge Northwest Settlement Area

The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – a SWM pond for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.

As this Future Settlement Area is designated for Residential development, increasing imperviousness requires peak flow control and erosion control. The use of LID BMPs at the lot level could reduce costs over a traditional SWM wet pond, which requires draining, soil testing, hauling, etc. In addition, wet ponds can produce odours, which LID measures can reduce.

When SWM Ponds and LID measures are utilized in conjunction with one another (i.e. a treatment train approach), TP loading can be reduced further over Traditional SWM (Ponds) alone.

Area A sits predominantly within the Dundonald Sandy Loam soils region. Based on the MOECC Manual, these soils generally have percolation rates greater than the recommended minimum of 15 mm/hours for infiltration measures; which supports LID measures.

Area B – Uxbridge Southeast Settlement Area

The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – a SWM pond for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.

It is important to note that within this settlement boundary there are areas of high aquifer vulnerability and wellhead protection areas that should be avoided when attempting to infiltrate stormwater runoff. The DROP should be consulted when determining the regulations surrounding the implementation of SWM ponds and LIDs.

Area C - Coppin's Corners

As noted in Section 1.0, Coppin's Corners is to drain internally to the Wyndance Infiltration SWM Pond, which is within the jurisdiction of the TRCA.

Uxbridge Urban Area

For areas that experience redevelopment in the future, the preferred strategy is the Traditional SWM with Urban Retrofits Strategy. Pond upgrades and LID measure should be evaluated for feasibility of implementation on a site specific basis.

1.0 INTRODUCTION

1.1 BACKGROUND

The Township of Uxbridge retained Stantec Consulting Ltd. (Stantec) to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management Master Plan (SWMMP) for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWM Master Plan has been prepared in accordance with the *Comprehensive SWM Master Plan Guidelines*, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the *Municipal Class Environmental Assessment Guideline*, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011). The Township of Uxbridge (the Township) received a letter from the Ministry of Environment (MOECC) indicating that the required scope of the SWM Master Plan must include the settlement areas noted above.

The intent of the SWMMP is to prepare a practical and implementable framework which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities. The Ministry of Environment (MOECC) published the *Lake Simcoe Protection Plan* in June of 2009 that called for all settlement areas to prepare and implement comprehensive SWMMP that would improve the management of stormwater for both existing and planned development.

1.2 LOCATION

The Township office is located at 51 Toronto Street South in south-central Ontario in the Regional Municipality of Durham. The Township of Uxbridge and Coppin's Corners study areas are located south of Lake Simcoe.

Future Settlement Areas in Uxbridge and Coppin's Corners were identified as being generally described as (refer to **Figure 1**):

- Residential Area A – (Uxbridge) south of Maple Brook Drive, east of Concession Road 6, north of Bolton Drive, and west of Concession Road 7;
- Residential Area B – (Uxbridge) south of Munroe Crescent and Enzo Crescent, east of Concession Road 7, north of an extension eastward of Elgin Park Drive, and west of Foxbridge Golf Club; and,
- Residential Area C – (Coppin's Corners) west of Regional Road 1, north of Regional Road 21, within the northwest corner of the existing Sandhills Golf Club Community (Wyndance).

The Study Area encompasses locations within both The Township of Uxbridge and Coppin's Corners, located south of Lake Simcoe. The Study Area is shown on **Figure 1**, including subwatershed and Conservation Authority boundaries and future settlement areas. **Figure 2** and **Figure 3** illustrate the pond locations within the urban boundaries of Uxbridge and Coppin's Corner's, respectively.

Based on a review of the Coppin's Corners future growth, and discussions with LSRCA and Toronto and Region Conservation Authority (TRCA), the existing Estates of Wyndance Pond is under the jurisdiction of TRCA. The Future Settlement Area of Coppin's Corner is within the drainage boundaries specified in the SWM report for the Estates of Wyndance.

1.3 STUDY OVERVIEW

In 2007, the Township developed a Consolidated Official Plan (OP) Document outlining the proposed developments and standards through to the year 2020. The applicable policies in the Durham Regional Official Plan also apply to the Township of Uxbridge and take priority in the event of conflict between the provisions of the Uxbridge Official Plan and the Durham regional Official Plan. It is important to note that The Township of Uxbridge OP's purpose is to provide general guidelines for the planning of the Township and should not be interpreted as direct statements of planning policy, rather they form the basis for formulation of policies within the plan that include: managing growth, land use over the proposed planning period and environmental protection.

The OP notes "The population of the Urban Area in 1996 was approximately 7,745. It is anticipated that the population of this area would increase to approximately 12,500 people during the planning period (1999 - 2021)". The Township's OP provides strategic direction to achieve the community Vision, and related goals and objectives and is summarized in the following table (**Table 1**):

Table 1 Township Official Plan: Strategic Directions, Goals, and Objectives

STRATEGIC DIRECTIONS, GOALS AND OBJECTIVES		
STRATEGIC DIRECTIONS	**GOALS**	**RELATED OBJECTIVES**
1. The Future of Uxbridge's Downtown	1. To establish the Downtown as the social, business and retail centre of the community.	1.1 To maintain existing and attract new retail and commercial activities to the Downtown. 1.2 To create an environment in the Downtown that is attractive to residents and visitors.
2. Uxbridge's Economy Now and in the Future	2. To ensure the health of the Township's local economy by supporting its business and tourism sectors.	2.1 To support the agricultural and aggregate industries and the expansion of farm - related businesses in the Township. 2.2 To encourage self-reliance, entrepreneurship and growth of the small business sector. 2.3 To promote increased tourism, building on the Township's assets and heritage.
3. Managing Growth for Sustainable Development	3. To manage the growth of the community in a sustainable manner that balances environ-mental protection, the preferred lifestyle of residents, and economic viability.	3.1 To guide and direct the location, type and amount of future residential and commercial development. 3.2 To give consideration to the costs and benefits of the physical infrastructure provided to support growth. 3.3 To encourage an appropriate mix of residential, commercial and industrial development to maintain a viable tax base while protecting the rural and small town character of the community.
4. Environmental Protection	4. To protect, enhance and restore natural resources in Uxbridge Township in a manner that contributes to the community's quality of life, identity and economy.	4.1 To protect the quality of surface and ground water in the community. 4.2 To preserve and protect the Oak Ridges Moraine. 4.3 To preserve and promote unique environmental attributes of the community in a manner that contributes to recreational and tourism opportunities.
5. Community Services to Support Quality of Life	5. To maintain and enhance where possible community services to support a high quality of life for Township residents	To work with the Province and other levels of government to maintain and support health and social services to meet the changing needs of residents.

The work plan for completing this Class EA will identify any potential environmental effects and recommend appropriate Stormwater Management (SWM) requirements for future development in the Master Plan. The two phases included in the 'Master Plan' MEA Class EA process are Phase 1 (Identification and Description of the Problem) and Phase 2 (Identification /Evaluation of Alternative Solutions to the Problem). Phase 3 to Phase 5 of the MEA Class EA process will not be required as part of the SWMMP.

The study area is contained within one subwatershed (Uxbridge Brook) within the Lake Simcoe Watershed.

1.4 PREVIOUS STUDIES

A number of previous studies have been developed within the study area by the Township and the Lake Simcoe Region Conservation Authority (LSRCA), which include:

- Report on the Phosphorus Loads to Lake Simcoe – Lake Simcoe Region Conservation Authority, 2007-2009;
- Growth Plan for the Greater Golden Horseshoe – Ministry of Public Infrastructure renewal, 2006;
- Lake Simcoe Basin Stormwater Management and Retrofit Opportunities 2007 – Lake Simcoe Conservation Authority, 2007; and,
- Uxbridge Brook Watershed Plan – Lake Simcoe region Conservation Authority, 1997.
- TSH Associates, Donald Weatherbe Associates Inc., James Li. *Township of Uxbridge – Uxbridge Urban Area Stormwater Management Study Final Report July 2000*. July 2000 (TSH Report)

A full list is included in Section 14.0 (References).

In addition, SWM reports for various ponds within the study area were made available by LSRCA and were reviewed and incorporated into the analyses completed as part of the SWMMP.

The tributaries of the Pefferlaw River include the Main Branch, flowing northward from a point south of the community of Uxbridge, and the Uxbridge Brook branch that flows northward and joins together with the Main Branch in the Township of Georgina, just north of the Township of Uxbridge. These two tributaries are normally treated as two separate subwatersheds (Pefferlaw Brook and Uxbridge Brook). However, they were combined for subwatershed planning purposes as the Pefferlaw River subwatershed.

1.5 DATA GAPS

Data, including previous studies, models, etc. was collected from a variety of sources including the Township, Region, and LSRCA. It should be noted that within those studies there are some gaps in available information as well as reports that have yet to be completed or reports that are unavailable to the public. Examples of data gaps are:

- Existing storm sewer information;
- Drainage area information outside of settlement areas;
- Drainage areas to oil grit separators;
- Drainage areas to uncontrolled outlets;
- Existing SWM Pond IDs and reports; and,
- No information on Pond 14 drainage area from the Pefferlaw Uxbridge Subwatershed report.

Stantec has done its best to gather all available information in support of the SWMMP.

1.6 PROBLEM AND OPPORTUNITY STATEMENTS

The Township has retained Stantec to develop a SWMMP to define all anticipated works necessary to maintain, expand and improve the existing storm drainage system (including SWM ponds) while protecting the valued natural resources both within and beyond Township limits. The SWMMP has been prepared in accordance with the Class EA process and is available for public review.

This project presents an opportunity to improve the management of stormwater for both existing and planned development, which is based on changes in land use as outlined in the *Consolidated OP 2020* for the Township (Aug 2007) and the *Durham Regional Consolidated OP 2021* (June 2008). In addition, the LSRCA has prepared a document entitled *Comprehensive Stormwater Management Master Plan Guidelines*, dated April 26, 2011, which is to be followed for all SWMMPs within their jurisdiction.

An opportunity exists to implement a drainage strategy within the Township to meet the requirements as set out in the Lake Simcoe Protection Plan. While implementing drainage improvements, there will be opportunities to minimize ongoing erosion and sedimentation, phosphorus loadings and changes in water balance which may cause a negative impact on the Lake Simcoe watershed.

1.7 OBJECTIVES OF THE STUDY

The primary objective of the study is to meet the requirements of the Lake Simcoe Protection Plan (specifically Section 4.5 SA), the Lake Simcoe *Comprehensive Stormwater Management Master Plan Guidelines* and the LSRCA Watershed Development Policies, while considering the intentions of the Township's OP and applicable strategies/goals/guidelines set out by the Region of Durham's OP. The objectives of each plan in detail are described below:

Objectives of the Lake Simcoe Protection Plan

The objectives of the Plan as set out in the Lake Simcoe Protection Act, 2008 are to:

- Protect, improve or restore the elements that contribute to the ecological health of the Lake Simcoe watershed, including, water quality, hydrology, key natural heritage features and their functions, and key hydrologic features and their functions;
- Restore a self-sustaining coldwater fish community in Lake Simcoe;
- Reduce loadings of phosphorus and other nutrients of concern to Lake Simcoe and its tributaries;
- Reduce the discharge of pollutants to Lake Simcoe and its tributaries;
- Improve the Lake Simcoe watershed's capacity to adapt to climate change;
- Provide for ongoing scientific research and monitoring related to the ecological health of the Lake Simcoe watershed; and,
- Improve conditions for environmentally sustainable recreation activities related to Lake Simcoe and to promote those activities.

Objectives of Section 4.5-SA of the Lake Simcoe Protection Plan

Within five years of the date the Plan comes into effect, municipalities, in collaboration with LSRCA, will prepare and implement comprehensive SWMMP's for each settlement area in the Lake Simcoe watershed. The SWMMP's will be prepared in accordance with the Class EA guidelines and will include:

- A characterization of existing environmental conditions on a subwatershed basis, consistent with any relevant subwatershed evaluations, if available;
- An evaluation of the cumulative environmental impact of stormwater from existing and planned development;
- A determination of the effectiveness of existing SWM works at reducing the negative impacts of stormwater on the environment, including consideration of the potential impacts of climate change on the effectiveness of the works;
- An examination of any stormwater retrofit opportunities that have already been identified by the municipality or the LSRCA for areas where stormwater is uncontrolled or inadequately controlled;
- The identification of additional SWM retrofit opportunities or improvements to existing SWM works that could improve the level of treatment within a particular settlement area;
- A description of existing or planned programs for regular maintenance of SWM works;
- An identification of the recommended approaches for SWM in each settlement area; and,
- An implementation plan for the recommended approaches.

The LSRCA has prepared a document entitled *Comprehensive Stormwater Management Master Plan Guidelines*, dated April 26, 2011. In this document, the LSRCA has established what is referred to as the Ten Steps, which are described in detail and generally summarized as follows:

Scoping: Identify the urban areas or rural settlement areas where development is concentrated and lands are designated in the Official Plan for development over the long term. The Uxbridge Urban Area and Hamlet of Coppin's Corners have already been identified.

Determine Study Area for the Settlement Area: Identify the existing settlement area designated in the Official Plan, proposed or contemplated future development, and all associated permanent and intermittent streams within the same.

Develop a Characterization of the Study Area: Establish an understanding of existing and future land uses, natural environment, cultural environment, and watershed conditions. Interpretation of relevant planning/regulatory policies and identification of any known restrictions and/or constraints.

Divide Study Area into Management Units: In the event that portions of the study areas would be better broken down into separate management units due to distinct natural heritage characteristics, then those specific management areas need to be identified. This could include differences based on receiving watercourse characteristics, abrupt changes to existing/proposed land uses, unique underlying soil characteristics, etc.

Evaluate Cumulative Environmental Impact of Stormwater from Existing and Planned Development: Undertake an assessment of water balance, water quality, and water quantity considerations for both existing and proposed conditions to establish an understanding of the potential cumulative effects to the existing receiving systems.

Determine Effectiveness of Existing Stormwater Management Systems: Assess the existing SWM facilities, their inlet/outlet structures, and their apparent ability to address water quality/quantity and erosion controls in their receiving watercourses. Review effectiveness of SWM facilities to satisfy climate change implications.

Identify and Evaluate Stormwater Improvement and Retrofit Opportunities: Opportunities to be identified based upon the effectiveness of existing facilities, conditions of receiving watercourses, background studies, infrastructure constraints, and land availability. Opportunities to introduce Low Impact Development, land form alterations, and/or re-vegetation techniques within existing open spaces will also be considered. In addition, past SWM recommendations from planning policy, will also be revisited to ensure continued relevance with current SWM practices and the findings of this study. Alternatives will be evaluated against each other regarding technical effectiveness, construction feasibility, natural environmental, social/cultural environment, and cost.

Establish a Recommended Approach for Stormwater Management for the Study Area: Develop an overall SWM strategy for the study area that will be effective at managing the stormwater flow characteristics, water quality, water quantity, and erosion controls. Establish specific and quantifiable SWM design criteria for future development in the study area. Stantec will provide justification/rationale for the recommended approach in accordance with Phase 1 and Phase 2 of the Municipal Class EA (Master Plan process).

Develop an Implementation Plan for the Recommended Approaches:
Stantec will outline how the recommended SWM measures, policies, and operation/maintenance strategies are to be implemented with consideration for responsible party, schedule, and funding mechanisms.

Develop Programs for Inspection and Maintenance of Stormwater Management Facilities:
Stantec will prepare an inspection and maintenance program for the recommended SWM works as part of this study. The plan will provide for annual reporting with a sufficient level of detail to determine if the implemented SWM recommendations are operating in a manner consistent with the intended design.

The LSRCA has prepared a document entitled *Lake Simcoe Region Conservation Authority Watershed Development Policies*, dated March 23, 2012. In this document, the LSRCA has established policies pertaining to SWM in sections 6 and 7 of the document. Section 6 of the document describes the policies as it relates to quantity and quality control. Section 7 of the document refers to site alteration within the regulatory floodplain. Section 6 and 7 of the document are briefly summarized below:

- New development shall comply with Enhanced (formerly, "Level 1") stormwater quality protection in accordance with the 2003 MOECC document titled "Stormwater Management Practices-Planning and Design Manual";
- The SWM plan must make every feasible effort to maintain the predevelopment infiltration and evapotranspiration rates and temperatures to the receiving waterbody and watershed;
- Stormwater runoff peak flow discharges must be controlled to a minimum of the pre-development levels for all design storms up to the 100 year storm;
- A minimum of 24 hour detention of run off from a 25mm storm shall be required for erosion protection and baseflow maintenance where feasible;
- The SWM facilities are to be located above the existing 1:100 year floodplain. The incremental storage between the 1:100 year and regulatory floodlines is to be maintained. Volume below the pond's high water level shall not be considered as available storage for the regulatory floodplain. Berming, for such facilities within the floodplain, shall not exceed a 0.3m elevation higher than the existing ground elevation;
- Storm water facilities must effectively treat sediment, phosphorus, thermal pollution and hydrocarbons (if the facility has vehicle parking);
- All proposed end-of-pipe water quality control facilities must be designed to meet or exceed current Authority SWM and Ministry of Environment (MOECC) guidelines; and,
- Development within the floodplain is discouraged; however, it can be considered provided that all the requirements are adhered to (see section 7.1 of Lake Simcoe Region Conservation Authority Watershed Development Policies for more detail).

Objectives of the Township's OP

The policies/guidelines of the OP as it pertains to SWM are to promote "good water management" to protect what is healthy, and to rehabilitate what is degraded. The primary objectives (see Section 2.2 of the OP) include:

1. Undertaking a comprehensive evaluation of all stormwater discharges to the Uxbridge Brook from existing and approved, but unconstructed development, in the Urban Area; and, developing a remediation plan including an implementation strategy to implement Best Management Practices for stormwater quality management to minimize the impact of these discharges.

The preparation of the remediation plan will include, but will not be limited to, examination of the following potential implementation mechanisms:

i. Working with landowners abutting the Uxbridge Brook and other agencies to rehabilitate degraded areas of the stream in accordance with the recommendations of the Watershed Plan;
ii. Investigating in detail the opportunities for upgrading the existing urban stormwater system and the measures recommended in the Uxbridge Urban Area Secondary Plan: Background Report, September 1998, Appendix 1.
iii. Ensuring that old and new stormwater management systems are combined wherever opportunities to do so arise, except where crossover into different watershed catchments will result; and,
iv. Carrying out regular maintenance of existing stormwater management facilities.

All new development shall:

i. Meet Enhanced quality control criteria with state of the art phosphorus removal systems;
ii. Provide 24 hour detention for runoff from a 40 mm storm event; and,
iii. Provide full peak control for site runoff (post to pre) for up to and including the 1:100 year storm event.

Policies of The Durham Region's OP

The policies/guidelines of the OP as it pertains to Water Resources and SWM are summarized below:

To ensure that water resources are available in sufficient quality and quantity to meet existing and future needs of the Region's residents, Regional Council shall:

- Promote and support water resource conservation and management initiatives;

- In the process of assessing development, require lakes and streams and adjoining lands to be retained in or rehabilitated to a natural state, the protection of fish and wildlife habitat and minimize alterations to natural drainage systems and sediments entering a watercourse lake;
- Discourage alterations to watercourses. Minor adjustments to watercourses may be considered by the authority having jurisdiction where evidence can be provided that the functions of the watercourse will not be adversely affected;
- Ensure that, where appropriate, area municipal official plans require stormwater management and erosion and sedimentation control plans to be prepared in the context of subwatershed plans, or other similar plans and that stormwater management facilities be implemented as part of the pre-servicing of development proposals
- Ensure that for lands located on the Oak Ridges Moraine and the lands within the Protected Countryside of the Greenbelt Plan, stormwater management and watershed plans and their components, meet the requirements of the Oak Ridges Moraine Conservation Plan and the Greenbelt Plan respectively; and,
- Where appropriate promote groundwater infiltration, through improved stormwater management design.

Regional Council shall cooperate with the Provincial Government and the conservation authorities to promote the effective use and conservation of surface and groundwater resources and to protect against adverse cumulative impacts of development on water quality and quantity.

Development that maintains hydrological functions and minimizes direct alteration to groundwater flows shall be encouraged.

Development applications in areas where groundwater discharge could be significantly affected shall be accompanied by an appropriate study demonstrating that groundwater quantity and quality will be protected, improved or restored.

Development applications (excepting wetland restoration projects and domestic usage and livestock operations) that require a permit to take water under the Ontario Water Resources Act, or that have the potential to impact water quantity, shall be accompanied by a study verifying that there is a sustainable basis, confirm that there will not be a negative impact on the surrounding water users and the natural environment which cannot be appropriately mitigated.

Development may be considered on a lot where there is an abandoned well or borehole, only if applicant demonstrates, to the satisfaction of the municipality, that actions have been taken to decommission the well or borehole, in accordance with provincial requirements.

1.8 PURPOSE OF THE PROJECT FILE

The purpose of this Project File is to provide a summary, consistent with the requirements of the Municipal Class EA process, of the problem statement, investigation of options, and selection of the preferred alternative.

The report documents the EA process for public review. The project file is intended to meet (where appropriate) the objectives as set out in the Lake Simcoe Protection Plan (LSPP), the Township OP, the Region of Durham OP and the Municipal Class EA document.

2.0 PLANNING CONTEXT AND THE EA PLANNING PROCESS

2.1 MUNICIPAL CLASS EA

The Municipal Class EA (2007) planning and design process was followed for this project as it allows the Township to meet the requirements of the Ontario Environmental Assessment Act (OEAA) for municipal infrastructure without having to either undertake an Individual Environmental Assessment or request a specific exemption for the project. The Class EA is a planning process approved under the OEAA for a class or group of undertakings including municipal infrastructure. Municipal projects included in the Class EA may be implemented without further approval under the OEAA, provided that the approved Class EA planning and design process (Exhibit A.2) is followed.

Since the Township's SWMMP Class EA is a high level document relating to the future planning of SWM guidelines and principles, it is classified as a Master Plan project. The SWMP will follow the Schedule B Class EA process.

Master Plans are specified as "long range plans which integrate infrastructure requirements for existing and future land use with environmental assessment planning principles. These plans examine an infrastructure system(s) or group of related projects in order to outline a framework for planning for subsequent projects and/or developments."

Section A.2.7 of the Municipal Class EA document states:

> *"At a minimum, Master Plans address Phase 1 and 2 of the Municipal Class EA process".*

Schedule 'B' Projects have the potential for some adverse environmental effects. The municipality is required to undertake a screening process (Phases One and Two) involving mandatory contact with directly affected public and relevant review agencies to ensure that they are aware of the project and that their concerns are addressed. Schedule 'B' projects require that a Project File report be prepared and submitted for review by the public and review agencies. If there are no outstanding concerns, then the municipality may proceed to Phase Five for implementation.

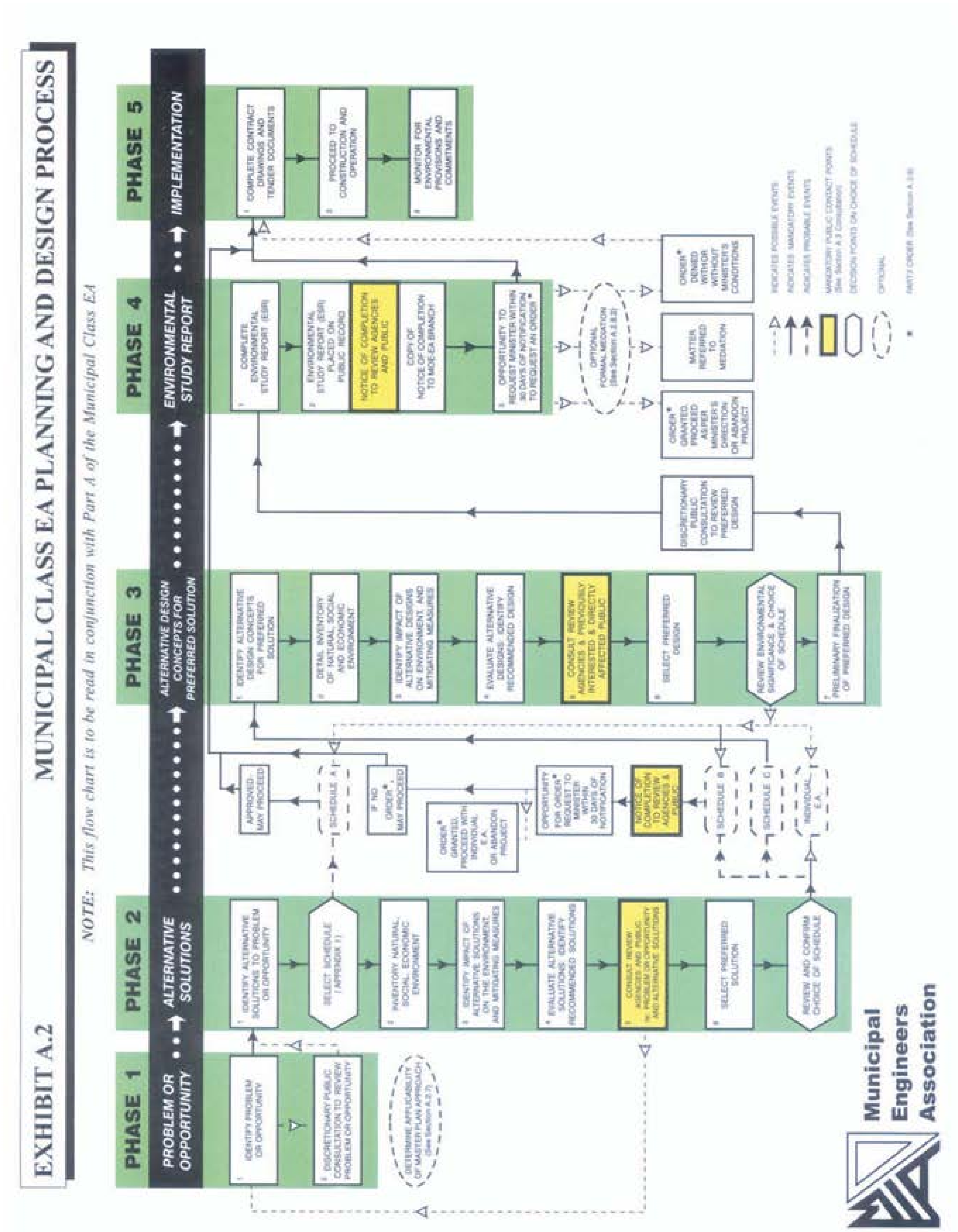


EXHIBIT A.2
MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS
NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA
PHASE 1
PROBLEM OR OPPORTUNITY
PHASE 2
ALTERNATIVE SOLUTIONS
PHASE 3
ALTERNATIVE DESIGN CONCEPTS FOR PREFERRED SOLUTION
PHASE 4
ENVIRONMENTAL STUDY REPORT
PHASE 5
IMPLEMENTATION
Municipal Engineers Association

2.1.1 SWMMP Process Overview

The work plan for completing the Class EA will identify any potential environmental effects and recommend appropriate SWM requirements for future development in the Master Plan. The two phases included in the 'Master Plan' MEA Class EA process are Phase 1 (Identification and Description of the Problem) and Phase 2 (Identification /Evaluation of Alternative Solutions to the Problem). Phase 3 to Phase 5 of the MEA Class EA process will not be required as part of this study.

Phase 1

Phase 1 is primarily focused on collecting and reviewing relevant background data, confirming the project objectives and schedule with Township staff, and developing a clear and concise problem statement, which is generally identified in the LSRCA's guidelines. During Phase 1, we will develop a project contact list in consultation with the Township and LSRCA noting relevant government agencies and stakeholders within the community, which will include, for example:

- **Provincial Agencies:** Ministry of the Environment; Ministry of Natural Resources; Ministry of Aboriginal Affairs; Ministry of Public Infrastructure and Renewal; and, Ministry of Transportation.
- **Federal Agencies:** Department of Fisheries and Oceans (if required); Department of Indian and Northern Affairs; and, Environment Canada.
- **Municipal Governments:** Region of Durham and Township of Uxbridge.
- **Stakeholder Organizations:** Lake Simcoe Region Conservation Authority; various interested community organizations.
- **Relevant Utilities and Local Stakeholders:** Enbridge Gas; Veridian; Hydro One; and, study area property owners.

Input from the public and affected agencies will be obtained through two required notifications, which will include one Open House event (Public Information Centre). The first point of contact with the public will be a "Notice of Study Commencement and Open House" that would be prepared and provided to the Township for placement in local newspapers during the appropriate time in Phase 2. At the same time, a cover letter and a copy of the Notice of Study Commencement and Open House will be mailed or delivered by the consulting team to stakeholders identified on the project contact list.

Phase 2

During Phase 2, the preliminary alternative solutions to the problem will be discussed with the Township and will be evaluated as part of the Class EA process. Phase 2 will include the following tasks:

1. **Identify and describe the relevant alternative solutions** to the stated problem(s) in consultation with the Township. Our preliminary list may include but will not necessarily be limited to the following alternatives:

   a) Do nothing (included as required by the MEA Class EA);
   b) Retrofit of Existing SWM Facilities;
   c) Low Impact Development Opportunities (New or Retrofitted Development);
   d) Integration of Land Form Alterations and Vegetation Techniques in Open Spaces;
   e) Phosphorus Reduction Techniques;
   f) Future SWM Facilities;
      a. End-of-Pipe Controls;
      b. Source Controls;
      c. Conveyance Controls; and,
      7. Public SWM Education/Outreach.

Review the relevant natural, and social/cultural background information, followed by any literature searches and field investigations as required to expand on the key components of the environment potentially affected. Stantec staff will review key background reports and provide a summary of our findings as it relates to relevant natural heritage and social/cultural information. It is anticipated that field assessments of the natural heritage systems will be necessary for the major receiving watercourses in the Study Area. Stage 1 Cultural Heritage assessments will be sufficient to support the SWM Master Plan.

Review and analyze the relevant technical information available through the Township, LSRCA, and Region and conduct technical field investigations required to augment the existing data.

Develop evaluation criteria pertaining to water quality, water quantity, water balance, erosion controls, general storm drainage, natural environment, and cost based on the existing conditions inventories, technical studies and any other identified issues raised by agency and public stakeholders during the process.

Evaluate the alternative solutions using the evaluation criteria. Identify the potential net effects and advantages/disadvantages, after mitigation measures have been applied, for each alternative. The various alternatives will then be rated on a relative basis to each other as the basis for the selection of a recommended alternative solution as it relates to establishing proper SWM planning and design criteria.

Consult review agencies and the public. The newspaper advertisement prepared in Phase 1 for the "Notice of Study Commencement and Open House" will be posted in local paper(s).

The materials at the open house will describe the Class EA process being followed, the problem being addressed, identification and evaluation of the alternative solutions and design concepts, the recommended alternative solution, the potential environmental effects associated with the preferred solution, and next steps.

Incorporate the information provided by stakeholders and confirm the preferred alternative solution.

Prepare the Project File for the proposed SWM Master Plan that documents each step of the Class EA process undertaken and the results in a traceable, easily understood manner, and meets all MEA Class EA requirements. We will provide the Township and LSRCA with a draft of the Project File for review.

Place the Project File in a public forum (i.e. Municipal Clerk's Office, library, etc.) for the required 30 day review period.

Prepare a "Notice of Completion" in the form of a letter and a newspaper advertisement, which advises stakeholders where the Project File may be reviewed and the manner in which comment is to be received. The notice will also advise stakeholders and review agencies of their rights with regard to requesting a Part II Order under the EA Act.

2.2 PUBLIC CONSULTATION

In order to fulfill the requirements for a municipal class EA, a Public Information Center (PIC) was held on May 7, 2014 at the Uxbridge Municipal Office. **Section 11.0** describes the public consultation process in detail.

2.3 POLICY REVIEW

2.3.1 Fisheries Act

The (Federal) Department of Fisheries and Oceans (DFO) is the agency that applies the Federal Fisheries Act. Under Section 35, the Act prohibits any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery and Section 36 of the Act prohibits the release of substances deleterious to fish habitat. Proponents are now required to conduct a self-assessment to determine if serious harm can be avoided during implementation of the project. In cases where is it unclear to the proponent that serious harm will be avoided, a Request for Project Review can be submitted to DFO to determine if a project will result in serious harm. Where serious harm cannot be avoided DFO will issue an Authorization for the project once the proponent has prepared an Offsetting Plan to offset the serious harm caused by the project.

In general SWMFs are not considered fish habitat, however, natural wetlands, lakes and the creeks connected to SWMFs are considered fish habitat. As such, it is the responsibility of the Township to ensure that proposed works which may affect wetlands, lakes and creeks do not have a negative impact on the natural fish habitat.

2.3.2 Oak Ridges Moraine

The Oak Ridges Moraine Conservation Plan (ORMCP) was established by the Ontario government under the *Oak Ridges Moraine Conservation Act* (2001) and guides the land use and resource management direction for over 190,000 ha of land and water within the Moraine. Decisions of provincial ministers, ministries and agencies made under the Planning Act (1998) or in relation to a prescribed matter must conform to the ORMCP.

The southern portion of the Town of Uxbridge study area falls within the "Settlement Area" designation of the Oak Ridges Moraine Conservation Plan (ORMCP) Area. Settlement Area includes urban uses and development plans, the boundaries of which are better defined in official plans and zoning by-laws, conforming to Section 10 of the ORMCP. All uses permitted by the applicable official plan are permitted. Site plan approval under Section 41 of the *Planning Act* is not required within Settlement Areas that do not include a key natural heritage feature or a hydrologically sensitive feature.

Coppin's Corners falls within the "Countryside Area – Rural Settlement" designation of the ORMCP Area. These are existing hamlets or similar small, generally long established communities that are identified in official plans. Infrastructure and utilities are permitted in Countryside Areas (Section 41 of ORMCP).

SWM policies are discussed in Section 45 and 46 of the ORMCP and outline requirements for application for development or site alteration to be accompanied by SWM plans. Section 45 outlines planning, design and construction practices to protect water resources. New SWM ponds are prohibited on lands within key natural heritage features and hydrologically sensitive features.

Any development that is to occur on lands under the Oak Ridges Moraine Conservation Plan (ORMCP) legislation must be accompanied by a SWM plan as set out in section 46 of the Oak Ridges Moraine Conservation Plan. The objectives of a SWM plan are to:

a) maintain groundwater quantity and flow and stream baseflow;
b) protect water quality;
c) protect aquatic species and their habitat;
d) prevent increases in stream channel erosion; and

e) prevent any increase in flood risk.

A SWM plan shall provide for an integrated treatment train approach that uses a planned sequence of methods of controlling stormwater and keeping its impact to a minimum by techniques including, without limitation,

a) lot level controls such as devices and designs that direct roof discharge to rear yard ponding areas;
b) conveyance controls such as grassed swales; and,
c) end-of-pipe controls such as wet ponds at the final discharge stage.

2.3.3 The Greenbelt Plan

The Greenbelt Plan (2005) was established under Section 3 of the *Greenbelt Act* (2005) through the Ministry of Municipal Affairs and Housing. It serves to identify where urbanization should not occur, providing permanent protection to agricultural land base and ecological features and functions within its landscape. The Greenbelt Plan includes lands within, and builds upon the ecological protections provided by, the Niagara Escarpment Plan and the ORMCP.

Protected Countryside lands of the Greenbelt Plan are intended to enhance special extent of agriculturally and environmentally protected lands covered by the Niagara Escarpment Plan and the ORMCP, while also improving linkages between these areas and the surrounding major lake systems and watersheds.

The goals of the Greenbelt Plan are to enhance urban and rural areas and overall quality of life by promoting matters within the Protected Countryside such as:

- Agricultural Protection;
- Environmental Protection;
- Culture, Recreation and Tourism;
- Settlement Areas; and,
- Infrastructure and Natural Resources.

Both Uxbridge Urban Area and Coppin's Corners study areas fall within the ORMCP designations of the Greenbelt Plan Area; thus any development or site alterations with associated SWM facilities are to follow the guidelines provided within the ORMCP.

In summary, Section 4.2.3 of the Greenbelt Plan provides policies on SWM infrastructure.

1. SWM ponds are prohibited in *key natural heritage features* or *key hydrologic features* or their vegetation protected zones, except for those portions of the Protected Countryside that define the major river valleys that connect the Niagara Escarpment and Oak Ridges Moraine to Lake Ontario. In these areas, naturalized SWM ponds are permitted provided they are located a minimum of 30 metres away from the edge of the river/stream and in the

vegetation protection zones of any abutting *key natural heritage features* or *key hydrologic features*.

2. Applications for *development* and *site alteration* in the Protected Countryside shall be accompanied by a SWM plan which demonstrates that:

   a) Planning, design and construction practices will minimize vegetation removal, grading and soil compaction, sediment erosion and impervious surfaces;
   b) Where appropriate, an integrated treatment approach shall be used to minimize SWM flows and structures through such measures as lot level controls and conveyance techniques such as grass swales; and,
   c) Applicable recommendations, standards or targets within watershed plans and water budgets are complied with.

2.3.4 Lake Simcoe Protection Plan

The *Lake Simcoe Protection Act* was passed in 2008 and provides legislative framework to protect the Lake Simcoe watershed. It included a requirement for a protection plan, upon which the Lake Simcoe Protection Plan (LSPP) was developed (2009) by the Ministry of Environment (MOECC). The plan guides watershed protection and directs efforts to restore the health of Lake Simcoe. It focuses on the most critical issues, including:

- Restoring the health of the cold water fisheries and other aquatic life within the Lake Simcoe watershed;
- Improving and maintaining water quality;
- Reducing the amount of phosphorus going into the lake;
- Protecting and rehabilitating important natural areas such as shorelines; and,
- Addressing impacts of invasive species, climate change and recreational activities.

The objectives of the LSPP are:

- protect, improve or restore the elements that contribute to the ecological health of the Lake Simcoe watershed, including, water quality, hydrology, key natural heritage features and their functions, and key hydrologic features and their functions;
- restore a self-sustaining coldwater fish community in Lake Simcoe;
- reduce loadings of phosphorus and other nutrients of concern to Lake Simcoe and its tributaries;
- reduce the discharge of pollutants to Lake Simcoe and its tributaries;
- respond to adverse effects related to invasive species and, where possible, to prevent invasive species from entering the Lake Simcoe watershed;
- improve the Lake Simcoe watershed's capacity to adapt to climate change;
- provide for ongoing scientific research and monitoring related to the ecological health of the Lake Simcoe watershed;

- improve conditions for environmentally sustainable recreation activities related to Lake Simcoe and to promote those activities;
- promote environmentally sustainable land and water uses, activities and
- development practices;
- build on the protections for the Lake Simcoe watershed that are provided by provincial plans that apply in all or part of the Lake Simcoe watershed, including the Oak Ridges Moraine Conservation Plan and the Greenbelt Plan, and provincial legislation, including the Clean Water Act, 2006, the Conservation Authorities Act, the Ontario Water Resources Act, and the Planning Act; and,
- pursue any other objectives set out in the Lake Simcoe Protection Plan.

Section 4.5-SA to 4.12-SA of the LSPP provides guidance for both existing and planned development in terms of SWM. The LSPP outlines the requirement for municipalities to collaborate with LSRCA in preparing and implementing comprehensive SWM master plans for settlement areas within the Lake Simcoe watershed. Applications for major development are to be accompanied by SWM plans.

2.3.5 Durham Regional Official Plan

The Durham Regional Official Plan (DROP), consolidated June 2008, also provides guidance for proposed development with respect to the natural environment and key natural features. Section 2: Environment, subsection 2.2: General Policies notes that the natural environment includes areas designated as Oak Ridges Moraine, waterfronts, major open space areas, Greenbelt Natural Heritage System and "key natural heritage *and* hydrologic features. Planning and development activities in the Region must include an assessment of cumulative impacts on the environment, with protection included for woodlands, wetlands and there must be additional features listed.

2.3.5.1 Greenbelt Natural Heritage System

Schedule B, Map B1 of the DROP illustrates the Greenbelt Natural Heritage System of the Greenbelt Plan, which includes areas of the Greenbelt Protected Countryside having the highest concentration of the most sensitive/significant natural features and functions. The area is to be managed as a connected and integrated natural heritage system, in accordance with the Greenbelt Plan and the DROP.

2.3.5.2 Key Natural Heritage and Hydrologic Features

Such features are indicated, generally, on Schedule B, Map B1 of the DROP. The official plans and zoning by-laws of planning authorities should include more detailed mapping of the individual features and their associated vegetation protection zones.

To support proposed development, the exact location and extent of such features must be confirmed through additional studies (e.g. watershed plan, or environmental impact study), following the DROP policy 2.3.42.

Section 2.3.14 of the DROP states notes that development/site alteration is not permitted in key natural heritage/hydrologic features or their associated protection zones, with the exception of:

a) Forest, fish and wildlife management;
b) Conservation/flood or erosion control projects demonstrated to be necessary in the public interest and after all alternatives have been considered;
c) Infrastructure, subject to the policies of the DROP and the Greenbelt Plan;
d) Minor recreational uses such as trails, footbridges and picnic facilities, and existing uses;
e) Agriculture, in accordance with Policy 2.3.17 and 14.4.4 of the DROP; or,
f) Aggregate extraction, in accordance with Policy 9D.2.9 and 9D.2.10 of the DROP.

As storm water management is considered infrastructure, SWM facilities can be allowed within key natural heritage and hydrologic features but are subject to the policies of DROP and/or the Uxbridge OP.

2.3.5.3 Vegetation Protection Zone

Outside of urban areas and rural settlements, an Environmental Impact Study (EIS), following Policy 2.3.42 of the DROP, is required for development/site alteration within 120 m of key natural heritage/hydrologic features. The EIS must identify the vegetation protection zone which:

a) Is of sufficient width to protect the feature and its functions from impacts of the proposed change/associated activities that may occur before/during/after construction;
b) Where possible, will restore/enhance the feature and/or its function; and,
c) Will maintain natural self-sustaining vegetation.

The vegetation protection zone for wetlands, seepage areas and springs, fish habitat, permanent and intermittent streams, lakes and significant woodlands shall be a minimum of 30 m in width, measured from the outside boundary of the feature.

SWM facilities are not typically permitted within the 30 m vegetation protection zone from natural heritage features.

2.3.5.4 Environmental Impact Studies

An EIS is required for any proposed development or site alteration within 120 m of a key natural heritage/hydrological feature. It is to be developed in cooperation with the Region, Municipality and Conservation Authority and shall apply to the area to be developed or be expanded to include additional lands if deemed necessary.

An EIS may also include the need for a separate natural heritage evaluation and/or hydrological evaluation, as detailed in the Oak Ridges Moraine Conservation Plan, in accordance with Policy 10B.2.7.

An EIS is not required for developments that otherwise are subject to the provisions of the *Environmental Assessment Act*, except in cases where the Integration Provision of the Municipal Engineers Association Municipal Class Environmental Assessment applies.

2.3.6 Township of Uxbridge Official Plan

The Township of Uxbridge Official Plan (TUOP) (August 2007) specifies the policies that apply to new development within its jurisdiction.

Natural Heritage features within the Township include stream valleys, wetlands and forested areas, as well as parkland and trail systems and areas of significant wildlife habitat. According to the Uxbridge OP, development shall only be permitted in areas designated Environmental Constraint or Forest Area on Schedule "B" as part of the Natural Heritage System. Developments therein must be in accordance with the policies of Section 2.3 of the Plan. In addition, all development shall be evaluated with respect to its conformity with the provisions of Section 2.3 of the Plan. The key components of the Natural Heritage System are further discussed in Section 3.4: Designated Features.

The Environmental Constraint Area designation includes those lands that could be unsafe for development due to naturally occurring processes such as flood or erosion susceptibility. All floodplain areas which have been mapped by the Conservation Authority are included in the Environmental Constraint Area designation and the floodplain boundaries are identified on Schedules "A" and "B" to the Plan.

According to Section 2.3.2.2, stormwater control facilities in flood susceptible areas are permitted, but only where a net environmental benefit can be determined by the Township in consultation with the Conservation Authority, usually requiring undertaking an Environmental Assessment or Environmental Impact Study.

As noted in the Township OP:

> *"All watercourses shall be, where feasible, maintained or enhanced as distinct ecosystems, and lands immediately adjacent to these watercourses shall be retained or rehabilitated to a natural self-sustaining state. Alterations to watercourses, including riparian features such as intermittent streams and drainage swales, shall generally be discouraged. However, the necessity for retention/restoration of riparian features such as intermittent streams and drainage swales, will be evaluated on a site by site basis and some modifications of these features may be approved where deemed appropriate by the Township, in consultation with the Conservation Authority."*

Stormwater Quality and Quantity

To ensure the health and sustainability of the subwatersheds in both the Township and downstream areas, SWM practices are put in place.

The policies/guidelines of the OP as it pertains to SWM for the Uxbridge Urban area are to promote good water management to protect what is healthy and to rehabilitate what is degraded. The primary objectives (see Section 2.2 of OP) include:

i. undertaking a comprehensive evaluation of all stormwater discharges to the Uxbridge Brook from existing and approved, but unconstructed development, in the Urban Area; and,
ii. developing a remediation plan including an implementation strategy to implement Best Management Practices for stormwater quality management to minimize the impact of these discharges.

The preparation of the remediation plan will include, but will not be limited to, examination of the following potential implementation mechanisms:

i. working with landowners abutting the Uxbridge Brook and other agencies to rehabilitate degraded areas of the stream in accordance with the recommendations of the Watershed Plan;
ii. investigating in detail the opportunities for upgrading the existing urban stormwater system and the measures recommended in the Uxbridge Urban Area Secondary Plan: Background Report, September 1998, Appendix 1.
i. ensuring that old and new SWM systems are combined wherever opportunities to do so arise, except where crossover into different watershed catchments will result; and,
ii. carrying out regular maintenance of existing SWM facilities.

All new development shall:

a. meet Enhanced (80% TSS Removal) quality control criteria with state of the art phosphorus removal systems;
b. provide 24 hour detention for runoff from a 40 mm storm event; and,
c. provide full peak control for site runoff (post to pre) for up to and including the 1:100 year storm event.

The Primary Objectives of the Hamlet of Coppin's Corners as they pertain to SWM (Section 5.2.2) include:

> *Prior to the final approval of plans of subdivision, plans of condominium or other significant new development applications in the Secondary Plan Area, a SWM plan and associated landscaping plan must be prepared by the applicant, and approved by the Township, in consultation with the Region of Durham and the*

Conservation Authority. Such plans must be prepared based on terms of reference approved in advance by the Township, in consultation with the Region of Durham and the Conservation Authority. In the case of the golf course/hamlet residential development, the plan will be prepared for the combined development, although each component of the development may proceed independently.

In addition, a detailed water balance model shall be prepared for the combined golf course/hamlet residential development for pre- and post-development conditions. The post-development conditions will be based on the final site grading and configuration.

The water balance model must be conducted using a methodology acceptable to, and approved in advance by the Conservation Authority, in consultation with the Township of Uxbridge, and the Region of Durham. The water balance model must account for changes in site characteristics following development including, but not limited to:

i. Earthwork activities (cut and fill) and their potential impact on the overall site infiltration;
ii. The proposed storm water management scheme for the property, including SWM ponds, infiltration facilities, and other similar features; and,
iii. Potential interim changes to the water balance during the construction of the development, particularly if the development is constructed in a number of phases.

The water balance must demonstrate that the rate of infiltration on the property is maintained or enhanced relative to existing pre-development conditions. The rate of infiltration shall be maintained, on an area basis within each pre-development surface water catchment area, provided that it shall not drop below 80% of the pre-development situation in any of the pre-development catchment areas.

3.0 EXISTING CONDITIONS

This Section summarizes existing environmental conditions in the Study Area. Existing environmental conditions were based on a review of background information as outlined in Section 1.4 of this report. Further information on existing environmental conditions can be found in the Township consolidated OP 2020.

3.1 NATURAL ENVIRONMENT

3.1.1 Natural Hazards

Subsection 2.2.6 of the DROP notes that Natural Hazards are lands with unstable or organic soils, poor drainage, steep slopes, flood, erosion or landslide susceptibility or any other physical conditions that could create risk to life/property, or damage to the environment; these are typically found in the Greenlands system and associated with natural features. Such areas should primarily be for preservation and conservation.

Development and site alterations are not permitted within dynamic beach hazards, areas that are considered hazard lands (unless otherwise demonstrated to be safe) as described in subsection 2.2.7 (b), nor in floodways, unless in accordance with relevant provincial policies and regulations.

3.1.2 Natural Heritage

As per the Township of Uxbridge's Official Plan, natural Heritage features within the Township are identified as natural features including stream valleys, wetlands and forested areas, as well as parkland and trail systems and wildlife habitat. These features are generally included in the OP designations of "Environmental Constraint" and "Forest Area". According to the Township's OP development shall only be permitted in areas designated Environmental Constraint or Forest Area on Schedule "B" as part of the Natural Heritage System in accordance with the policies of Section 2.3 of this Plan. In addition, all development shall be evaluated with respect to its conformity with the provisions of Section 2.3 of the Plan.

The Environmental Constraint Area designation includes those lands that could be unsafe for development due to naturally occurring processes such as flood or erosion susceptibility. All floodplain areas which have been mapped by the Conservation Authority are included in the Environmental Constraint Area designation and the floodplain boundaries are identified on Schedules "A" and "B" to the Plan.

Based on discussions with LSRCA, the key components of the Natural Heritage System are:

i. Habitat for Endangered and Threatened Species;
ii. Wetlands;
iii. Woodlands;
iv. Valleyland;
v. Wildlife Habitat;
vi. Areas of Natural and Scientific Interest;
vii. Fish Habitat; and,
viii. Linkages.

According to the Township of Uxbridge Official Plan, programs, studies and facilities which are designed to enhance the function of the Natural Heritage System include:

a) Water Management;
b) Tree Planting and Conservation;
c) Trail System;
d) Significant Wildlife Habitat Areas; and,

e) Zones of Influence.

Refer to the Natural Heritage System section of the Township of Uxbridge Official plan for information on how each of the items mentioned above enhance the natural heritage system.

3.2 TERRESTRIAL ENVIRONMENT

3.2.1 Designated Natural Areas

Available mapping indicates that designated natural areas are present within the Uxbridge urban study area and Coppin's Corners study area. Please refer to **Figure 4** of **Appendix A** (Figures).

Consultation with the Region and Township will be required at the preliminary/detailed design phases in order to determine the limits of natural areas, along with any potential impacts and recommended mitigation measures for proposed SWM facilities. The LSRCA will comment and advise based on the term so their Memorandum of Understanding (MOU) with the Region.

The southern half of the Uxbridge urban study area is dominated by the High Groundwater Vulnerability Environmentally Significant Area (ESA), while the Coppin's Corners study area is almost entirely inside the Uxbridge Infiltration Area ESA. The LSRCA has identified ESA boundaries for the Study Area and will advise the Region and Township during review of any proposed SWM facilities within these ESAs. The LSRCA will review the proposals and advise The Region and Township regarding potential impacts, developmental constraints, and required mitigation measures.

The southern portion of the the Uxbridge Urban Study Area (UUSA) overlaps with large tracts of the Uxbridge Brook Headwater Wetland Provincially Significant Wetland (PSW) complex, and the Uxbridge Bog PSW is found just east of the study area.

According to available mapping no wetlands occur in, or adjacent to (within 120 m of), the Coppin's Corner study area (see **Figure 4**).

Infrastructure including SWM facilities may be permitted in a PSW subject to an environmental assessment process. The LSRCA should be involved in any such assessment process. Proposed SWM facilities will also be reviewed by the LSRCA when they occur in the zone of influence of a wetland as specified in Ontario Regulation 179/06. The LSRCA would advise the Region and Township on Planning Act review under the MOU.

3.2.2 Vegetation

The study areas fall within the Huron-Ontario section of the Great Lakes – St. Lawrence Forest Region (Rowe 1972). Common forest species include sugar maple and beech, along with basswood, white and red ashes, yellow birch, red maple, and red, white and bur oaks. Species frequently associated with these include eastern hemlock, eastern white pine, and balsam fir within tolerant hardwood types, as well as scattered largetooth aspen, butternut, bitternut hickory, hop-hornbeam, black cherry, sycamore, and black oak (*ibid*). River-bottom and swamp sites host blue-beech, silver maple, slipper and rock elms, and black ash; while eastern white cedar is found in swampy depressions or in old fields (*ibid*).

3.2.3 Breeding Birds

The Uxbridge Study Area falls within atlas square 17PJ58 and 17PJ48, and Coppin's Corner's study area falls within atlas square 17PJ47 of the Ontario Breeding Bird Atlas (OBBA) (OBBA 2010). The Atlas includes records of 120 species of birds known to breed in the Uxbridge study area; and records of 115 birds known to breed in the Coppin's Corners study area.. These are listed in **Appendix B**. The siting of SWM facilities may impact breeding birds in the area through habitat reduction or removal. Any such potential impacts should be addressed as part of SWM design studies.

In addition, the *Migratory Birds Convention Act* regulates activities that disturb migratory birds and/or the nests of migratory birds. The Canadian Wildlife Service (CWS) has established guidelines for the timing of vegetation clearing activities that may affect migratory birds and these guidelines should be followed during the construction and operation of SWM facilities.

3.2.4 Reptiles and Amphibians

The Ontario Nature's Atlas of the Reptiles and Amphibians (2013 contains records of 13 species of amphibians and nine species of reptiles for the combined study areas. None of the recorded species are provincially or federally ranked as Threatened or Endangered. Three reptiles are, however, provincially-ranked as Special Concern.

3.2.5 Species at Risk

Background data include records for Species At Risk (SAR) in the Study Area. These species are listed in in **Appendix B**.

SAR may be encountered if suitable supporting habitat is present in the study areas. When a proposed SWM facility may impact SAR habitat the MNRF should be consulted at to determine the studies that may be required address SAR issues.

3.3 AQUATIC ENVIRONMENT

Section 36 of the federal Fisheries Act prohibits deposit of deleterious substances (including suspended solids, and temperature) into waters frequented by fish. Section 38 requires any person with knowledge and control of works that may result in deposit of deleterious substances into waters frequented by fish to notify DFO if such deposit occurs or is imminent. This responsibility would apply to persons that conduct or supervise SWM facility construction, operation and maintenance.

The Storm Water Management Planning and Design Manual (MOECC, 2003) outlines levels of water quality protection that can be required based on ecological characteristics of the receiving watercourse. The LSRCA has required Enhanced (Level 1) protection for the entire Lake Simcoe watershed since 1995.

3.3.1 Aquatic Habitat and Fish Community

Aquatic habitat in the *Study Area* is generally high quality. Groundwater inputs result in thermal stability of the streams, which support coldwater fish species as well as healthy warmwater community. The Pefferlaw River system includes coldwater and coolwater tributaries that flow into a warmer western main branch; however most of the watershed is managed as a coldwater fishery. A total of 45 fish species have been observed in the Pefferlaw River (Refer to **Appendix B**: **Table 1**).

The tributaries of Uxbridge Brook support coldwater fish communities. Cold water salmonid species recorded in and around the study area include Brook Trout, Brown Trout, and Rainbow Trout. The presence of Brook Trout in this system indicates good water quality relatively low and stable water temperatures, diverse substrate and in-stream cover conditions, groundwater upwelling areas and relatively high dissolved oxygen levels.

The fish community present in the Pefferlaw River subwatershed (which includes Uxbridge Brook) represents a diverse mix of cold, cool and warmwater fish species. Top predators are present in both warmwater systems (Muskellunge, Largemouth bass) and coldwater systems (Brook trout, Rainbow trout, Brown trout). The fish community also includes a diverse range of forage fish (such as Central stoneroller, Golden shiner, Creek chub, Ciscoe, Spotfin shiner, Rosyface shiner). The system also sustains several fish species that are intolerant of high sediment loads (such as Blacknose shiner, Ciscoe, Brown trout, Brook trout, Rainbow trout, Rainbow darter and Slimy sculpin).

The SWM Master Plan should include strategies to maintain low sediment levels, and allow for continued ground water inputs throughout the watersheds.

3.3.2 Water Quality

The Pefferlaw River Subwatershed Plan identifies two provincial water quality stations in the Pefferlaw River subwatershed; one station is located on Uxbridge Brook approximately 2 km downstream of Uxbridge Urban Area, the second is located on the Pefferlaw River downstream of its confluence with Uxbridge Brook.

Water quality in the Pefferlaw River is better than other tributaries in the Lake Simcoe Basin, however general issues within the watershed which affect quality include increased phosphorus levels, sedimentation in streams and chloride levels.

Water quality in Uxbridge Brook is not negatively impacted, with the exception of high phosphorus concentrations. High phosphorus levels here occur because the station is downstream from the urban community of Uxbridge, and therefore receives stormwater runoff and effluent from the Water Pollution Control Plant. There also is a substantial amount of agriculture in the surrounding areas.

3.3.2.1 Phosphorus

TP levels at the Pefferlaw Station show a decreasing trend, likely due to improved farming practices, the implementation of BMPs through programs such as LSRCA's LEAP, or improved stormwater controls.

Monitoring station at Uxbridge Brook showed that total phosphorus levels are regularly above target levels. Median values for phosphorus concentrations in surface water were above the PWQO at the Uxbridge monitoring station with no decreasing trend evident, as that station was only initiated there in the mid-1990s. Elevated levels at this station are mainly attributed to its location downstream of the urban community of Uxbridge, which received stormwater runoff and effluent from the Water Pollution Control Plant (LSRCA, 2010).

3.3.2.2 Total suspended Solids

Suspended sediment concentrations downstream of Uxbridge have been high enough to cause concern with its effect on spawning shoals. Median values reported in the Pefferlaw River Subwatershed Plan (2010), which were collected between 2006 and 2010, were above Canadian Water Quality Guideline (CWQG).

For Uxbridge Station, concentrations above 10mg/L were during periods of increased flows and decreased to background levels during low flows. Fifteen percent of the data collected and reported at this time was above 50mg/L and ranged as high as 267mg/L, which indicated that there were times when aquatic life may have been negatively affected (LSRCA, 2010).

3.3.2.3 Chloride

None of the chloride levels reported between 2006 and 2009 exceeded those put forth by the Canadian Council of Ministers of the Environment (128mg/L). However, a long term trend towards increasing chloride levels, with the main source being noted as road salt, is evident at both Pefferlaw and Uxbridge stations (LSRCA, 2012).

3.4 ARCHAEOLOGICAL ASSESSMENT

3.4.1 Objectives

For the purposes of this Stage 1 assessment the Ministry of Tourism, Culture and Sport's (MTCS) 2011 *Standards and Guidelines for Consultant Archaeologists (*Government of Ontario 2011) were followed. The objective of the Stage 1 background study is to document the subject properties' archaeological and land use history and present conditions. This information will be used to support recommendations regarding cultural heritage value or interest as well as assessment and mitigation strategies. The Stage 1 research information was drawn from:

- The MTCS' Archaeological Sites Database (ASDB) for a listing of registered archaeological sites within a one kilometre radius of the study area;
- Reports of previous archaeological assessment within a radius of 50 metres around the Study Area;
- Recent and historical maps of the study area;
- Archaeological management plans or other archaeological potential mapping when available; and,
- Commemorative plaques or monuments.

For the full Stage 1 report, refer to **Appendix C**. Figure numbering within this Section refers to the numbering within the report in **Appendix**.

3.4.1.1 Euro-Canadian Settler Resources

By the time of the 1877 Historical Atlas of Ontario County all of the lots in the Township had been taken up and homesteads built (**Figure 5**) (Beers, 1877). The Township map shows not only the locations of the residences of each lot occupant but also indicates the locations on important public and commercial buildings, including churches, schools, meeting halls and mills. In particular, within the study area there are three churches and a school shown along Concession 6. A saw mill is shown in the east part of Lot 21, Concession 7. There are also cemeteries shown in Lots 28 and 29, Concession 6.

3.4.1.2 Recent Reports

Previous archaeological assessment reports for the study area include reports by Archaeological Services Inc. (ASI, 1996) and by Kim Slocki (Slocki, 2009).

3.4.2 Archaeological Context

3.4.2.1 The Natural Environment

There are relatively few areas of permanently saturated ground in the study area. These are largely restricted to the western boundary of the study area and a few margins along the headwaters of the Uxbridge Brook in the south and west of the study area and the Beaverton River in the east of the study area(**Figures 6** and **7**).

3.4.2.2 Previously Identified Archaeological Sites and Surveys

In order that an inventory of archaeological resources could be compiled, the registered archaeological site records kept by the MTCS were consulted. In Ontario, information concerning archaeological sites is stored in the ASDB maintained by the MTCS. This database contains archaeological sites registered according to the Borden system. Under the Borden system, Canada is divided into grid blocks based on latitude and longitude. A Borden Block is approximately 13 kilometres east to west and approximately 18.5 kilometres north to south. Each Borden Block is referenced by a four-letter designator and sites within a block are numbered sequentially as they are found. The study area under review is within Borden Block BaGs.

Information concerning specific site locations is protected by provincial policy, and is not fully subject to the Freedom of Information and Protection of Privacy Act. The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to all media capable of conveying location, including maps, drawings, or textual descriptions of a site location. The MTCS will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

An examination of the ASDB has shown that there are at present two registered archaeological sites within a one kilometre radius of the study area (**Table 2** and **Figure 5**).

Table 2 Registered Archaeological Sites within a One Kilometre Radius of the Study Area

Borden #	Name	Cultural Affiliation
BaGs-25	Gould	19th century Euro-Canadian
BaGs-32	Charlie	19th century Euro-Canadian

3.4.3 Field Methods

The Stage 1 archaeological assessment compiled available information about the known and potential archaeological heritage resources within the study area, including a property inspection. This Stage 1 archaeological assessment was conducted under archaeological consulting license P381 issued to Vincent Bourgeois, MA, of Stantec by the MTCS. No field visit occurred for this overview report.

3.4.4 Analysis and Conclusions

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Stantec applied archaeological potential criteria commonly used by the Ontario Ministry of Tourism, Culture and Sport (Government of Ontario 2011) to determine areas of archaeological potential within the region under study. These variables include proximity to previously identified archaeological sites, distance to various types of water sources, soil texture and drainage, glacial geomorphology, elevated topography and the general topographic variability of the area.

Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and, considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential. Finally, extensive land disturbance can eradicate archaeological potential (Wilson and Horne, 1995). Much of the area within the limits of the municipal study areas has been identified as having been previously disturbed (**Figure 4**).

Distance to water is an essential factor in archaeological potential modeling. When evaluating distance to water it is important to distinguish between water and shoreline, as well as natural and artificial water sources, as these features affect sites locations and types to varying degrees. The MTCS (Government of Ontario 2011) categorizes water sources in the following manner:

- Primary water sources: lakes, rivers, streams, creeks;
- Secondary water sources: intermittent streams and creeks, springs, marshes and swamps;
- Past water sources: glacial lake shorelines, relic river or stream channels, cobble beaches, shorelines of drained lakes or marshes; and,
- Accessible or inaccessible shorelines: high bluffs, swamp or marshy lake edges, sandbars stretching into marsh.

The study area is widely intersected by several small arms of the headwaters of the Uxbridge Brook, and in the north-east part by headwaters of the Beaverton River. While there are several ponds along these headwaters, these are the result of damming of the watercourses and in their present form should not be considered to reflect natural hydrology.

Soil texture can be an important determinant of past settlement, usually in combination with other factors such as topography. The study area is characterized by well drained sandy loam or silty loam soils of variable quality for crop production. Any of these soils would have been suitable for pre-contact Aboriginal horticulture, and much of the study area has been used for cultivation over the last 150 years. As such there are no specific areas of greater archaeological potential based on soil texture.

For Euro-Canadian sites, archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; properties listed on the municipal register or designated under the *Ontario Heritage Act*; and property that local histories or informants have identified with possible historical events, activities or occupations. The study area and its environs are located within an area with a record of settlement and growth in the 19th century, and the archaeological potential could be high (**Figure 3**).

When the above listed criteria are applied to the study area, the archaeological potential for Aboriginal and historic Euro-Canadian sites is deemed to be high for much of the study area (**Figures 6** and **7**). Within the Town of Uxbridge itself and some sub-urban areas to the north and south the archaeological potential is considered low due to extensive and deep modern disturbances. These activities have subjected the study area to extensive and deep land alterations which would have severely damaged the integrity of any archaeological resources, thus removing archaeological potential as per Section 7.7.3 Standard 2 of the *Standards and Guidelines for Consultant Archaeologists*.

3.4.5 Archeological Recommendations

The Stage 1 archaeological assessment determined that portions of the study areas exhibit high potential for the identification and recovery of archaeological resources. As such, a Stage 2 archaeological assessment will be required for the location of any SWM facilities that are located outside of areas identified as previously disturbed (i.e. developed).

Figures 6 and **7** identify areas where 300 m buffer zones have been applied to MTCS criteria for determining archaeological potential. In all areas covered by these buffer zones all Stage 2 AA must be carried out at 5 m survey intervals whether by pedestrian survey of open ploughed fields or test pit excavation survey in areas that are wooded and/or inaccessible to ploughing. For areas outside of these buffer zones pedestrian survey must still be carried out at 5 m survey intervals. The interval for test pit excavation survey outside of these buffer zones can be extended to 10 m.

3.4.6 Advice on Compliance with Legislation

This report will be circulated to the Ontario Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18 (Government of Ontario 1990c). The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Cemeteries Act*, R.S.O. 1990 c. C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ontario Ministry of Consumer Services.

3.5 GEOLOGY/HYDROGEOLOGY

3.5.1 Topography and Physiography

The study area comprising the main area within the town of Uxbridge and a smaller area encompassing the hamlet of Coppin's Corners is located within the northern boundary of the Oak Ridges Moraine (ORM) (Chapman, 1984) with a topography that varies from hummocky and undulating to flat lands, most of which lie within the Goodwood plain (Egorov, 2002). The topographic elevation ranges from 270 masl (meters above sea level) in the northern portion of the study area to 350 masl in the southern portion of the study area with a topographic relief of approximately 80 m (**Figure 5**). The area is drained by Uxbridge Brook, Pefferlaw Brook and a wetland.

3.5.2 Soils

Three soil types were identified within the Uxbridge portion of the study area (**Figure 6**). The main soil type is sandy loam which includes Dundonald Sandy Loam, Pontypool Sandy Loam and Brighton Sandy Loam. Schomberg Silt Loam is found in the north east corner of the study area and muck is associated with low relief zones and drainage. The study area at Coppin's Corners includes Pontypool Sand and Brighton Sandy Loam. The soil types shown in **Figure 6** are classified based on their physical soil characteristics.

3.5.3 Geology

Bedrock

The bedrock in the study area consists of Ordovician clastic and carbonate rocks of the Georgian Bay and Blue Mountain Formations previously known as the Whitby Formation which overlies limestone and shale of the Middle Ordovician Simcoe Group (Egorov, 2002, LSRCA, 2011) is found at elevations ranging from 100 masl to 260 masl. Based on MOECC Water Well Records (WWR), the greatest depth to bedrock is found near Utica located approximately 5 km southeast of the Uxbridge Urban Area, where the bedrock is covered by approximately 260 m of ORM deposits. The bedrock is not exposed within the study area.

Surficial geology

There are four main stratigraphic units composing the overburden in the study area including (from oldest to youngest): lower (drift) deposits; Newmarket/Northern Till; ORM; and Halton Till. The lower (drift) deposits consist of York Till, Don Formation, Scarborough Formation, Sunnybrook Till and the Thorncliffe Formation. These are characterized by mostly sand and silt with some lenses of clay (Egorov, 2002). The Newmarket/Northern Till consists mostly of dense sandy silt with up to 15% pebbles and cobbles and ranges in thickness between 5 and 60 m (Sharpe et al., 2002). The Oak Ridge Moraine is comprised of interbedded sand and gravel and could be as much as 150 m thick (Egorov, 2002). The Halton Till consists of sandy silt to clayey silt till and ranges in thickness from 3 to 6 m, although in some places it could be up to 30m thick. A map of the surficial geology showing the surficial geological units at the study area is presented in **Figure 7**.

3.5.4 Hydrogeology

Groundwater in the area is used for municipal and domestic water supply, agricultural and industrial uses, and golf course irrigation. WWR indicate maximum yields of up to 2,000 L/min and groundwater levels range significantly from flowing artesian (above ground surface) to approximately 50 m below ground surface. The distribution of wells located within 500 m of the proposed developments is presented in **Figure 8** Shallow groundwater typically flows from topographic highs (recharge zones) to topographic lows (discharge zones). Discharge areas commonly include creeks, streams, ponds and wetlands. In Uxbridge, the shallow groundwater flow is generally from south to north.

Three significant aquifer complexes which occur in the study area include: the Oak Ridges aquifer complex (ORAC) which occurs in the ORM (the upper unit); the Thorncliffe aquifer complex (the middle unit); and the Scarborough aquifer complex (the lower unit). The ORM is generally characterized by medium to high permeabilities. The main regional aquitards or confining units which separate the aquifer complexes within the study area are the Newmarket Till and the Sunnybrook Drift. The Newmarket/Northern Till acts as a regional aquitard which divides the shallow aquifer system (ORAC) from the deeper Thorncliffe aquifer complex (LSRCA, 2011). Generally, downward hydraulic gradients are present between the ORM and Thorncliffe aquifers and between Thorncliffe and Scarborough aquifers (LSRCA, 2011).

3.5.5 Groundwater Vulnerability and Wellhead Protection

Groundwater vulnerability refers to the vulnerability of an aquifer and its susceptibility to contamination infiltrating into shallow groundwater. Factors affecting groundwater susceptibility include: soil type, water table elevation, type of contaminant and concentration, as well as the physical characteristics of the aquifer. Groundwater vulnerability zones in Uxbridge are mainly located within the Wellhead Protection Areas (WHPA) near municipal wells. The WHPAs have been established to protect municipal groundwater supplies. There are two significant WHPAs in the Township (**Figure 9**). The WHPAs show the capture zone of a potential contaminant to migrate to a municipal well within time frames of 2, 5 and 25 years. The vulnerability of groundwater in Uxbridge is typically considered low because the municipal wells are relatively deep and the overburden above the aquifer is known to be relatively thick (LSRCA, 2011). Of the three main proposed developments, the southeast proposed development in the Township is the only one located within the WHPA and fully within the 25 year time of travel zone.

3.5.6 Wellhead and Intake Protection Zones

Wellhead Protection Areas are zones established by the Region of Durham that are in the vicinity of domestic water supply wells. They are in place to protect groundwater quality from contamination, degradations and to ensure sources of water are not compromised in the future as a result of land use decisions.

The Region has determined its WHPAs based on mathematical computer modelling to predict groundwater flow patterns in a specified area and identify the length of time it takes water to reach each well.

This area is also known as the "capture zone" or "capture area" of the well and is commonly considered as the Wellhead Protection Area. The Region identified capture zones based the following time frames: 50 days, 1 year, 2 years, 5 years, 10 years and 25 years. To explain what the time frame means, take, as an example, contamination from a potential spill within the 2-year capture zone. The contamination would take two (2) or less than two (2) years to reach the municipal well if the well is pumped at its maximum permitted rate.

3.6 WATERCOURSES/WATERBODIES

Within the Study Area, the main watercourse is Uxbridge Brook, which is a tributary of Pefferlaw River in the Pefferlaw River Subwatershed Plan (LSRCA, 2012); Uxbridge Brook is combined with Pefferlaw Brook for subwatershed planning purposes. The watershed of the Pefferlaw River includes portions of the Townships of Brock, Scugog and Georgina, and Uxbridge. The headwaters for the Pefferlaw River originate from discharge springs and seepages along the northern flanks of the Oak Ridges Moraine (LSRCA, 2012). Uxbridge Brook has a total watershed area of 178 km^2 upstream of its outlet into Pefferlaw Brook, within the Pefferlaw River system (LSRCA, 1997). Uxbridge Brook converges with Pefferlaw Brook and flows northwards where it eventually drains into Lake Simcoe (LSRCA, 2012). Generally the subwatershed is considered a rural one in the Lake Simcoe basin with only 5.5% of land use allocated to urban areas (LSRCA 2012). The majority of land use is agricultural/rural (48%) and natural cover (43%). A 2.2% increase in urban area for this subwatershed over the next 20 years, the majority of which will consist of high intensity development (LSRCA, 2013).

3.6.1 Elgin Pond and Electric Light Pond

As per the *Hydrology Report on Dams at Elgin Pond, Electric Light Pond and the Preserve Pond*, prepared by Stantec Consulting Ltd., June 6 2013, the Elgin Pond watershed is a rural subwatershed in the Uxbridge Brook watershed in the Lake Simcoe Basin and has a drainage area of 1,730 ha. Approximately 3% of the land is urban area. The primary land use is designated as rural/agricultural at 53 %. The ground topography ranges from 268 m at Elgin Pond to 346 m at the Oak Ridges Moraine. The southern portion of the watershed lies in the Oak Ridges Moraine area. Soil Conservation Service (SCS) hydrologic soil group A (HSG A) dominate the watershed (MNR GIS data base, 2012) and consist of sands, sandy loams and gravels. HSG A soils have low runoff potential and high infiltration rates even when thoroughly wetted. Refer to **ERSN 1** for location of Elgin Pond. Elgin Pond is not a stormwater management pond and is therefore not discussed further in the report.

The Electric Light Pond watershed is a rural subwatershed in the Uxbridge Brook watershed in the Lake Simcoe Basin and has a drainage area of 526 ha. Approximately 11% of the land is urban area. The primary land use is designated as rural/agricultural at 35%. The ground topography ranges from 271 m at Electric Light Pond to 372 m at the Oak Ridges Moraine. The southern portion of the watershed lies in the Oak Ridges Moraine area. Soil Conservation Service (SCS) hydrologic soil group A (HSG A) dominate the watershed (MNR GIS data base, 2012). HSG A has low runoff potential and high infiltration rates even when thoroughly wetted. Refer to **ERSN 1** for location of Electric Light Pond. Electric Light Pond is not a stormwater management pond and is therefore not discussed further in the report.

3.7 MUNICIPAL INFRASTRUCTURE

3.7.1 Inventory of SWMF

Stantec completed an assessment report for twenty-two (22) SWM facilities within the Township of Uxbridge in January 2013. These assessments were conducted at various periods spanning from July through December of 2012. The report provided a summary of our findings documented in a table format, which included typical MOECC SWM monitoring requirements, as outlined in the MOECC's *Stormwater Management Planning and Design Guidelines*, dated

2003. **Drawing 1** of the report is attached in **Figure SWMF-1**, tabulating the 22 SWM ponds and showing their locations. The summary tables expanded on the MOECC's recommended monitoring requirements to include municipal operation and maintenance considerations. Photo documentation for each SWM facility and engineering drawings (where available) were also provided for the Township's reference.

Based on our observations at the time of each SWM facility assessment, maintenance recommendations for the assessed SWM facilities include (but are not necessarily limited to) surveys of accumulated sediment and/or sediment cleanout, debris removal from inlet/outlet control structures, repairs to outlet control structures, installation of erosion control measures, vegetation maintenance/removal, improvements to maintenance access roads, and safety improvements (signage, hand rails, etc.).

Stantec has identified maintenance considerations as either 'required' or 'recommended' to help assist the Township with prioritization. In general, it as our opinion that the following SWM Facilities should be considered as higher priority and it was our recommendation that any immediate maintenance expenditures/efforts be focused at these locations. The SWM facilities referenced below are in no particular order of priority (**Figure 2**) within the Study Area.

- Estates at Wooden Sticks (Pond 4);
- Forsythe West Subdivision (Pond 7); and,
- Testa Heights (Pond 13).

3.7.2 Transportation Network

Section 2.6 and 5.6 of the townships OP outlines the purpose of the transportation plan on Schedule "A "and Schedule "F".

As noted in the OP,

> *Additional lands in excess of the typical right-of-way widths may also be required to be conveyed for works related to, but not limited to, extensive cut/fill operations, intersection improvements, bridges, sight triangles, and drainage and buffering improvements.*

which could possibly support the development of LID measures in the ROW, such as curb extensions. Curb extensions are, like extended tree pits, installed in the road right-of-way and can also act as a traffic calming device. In place of an otherwise raised concrete surface, the area is constructed as a depression with vegetation and used for stormwater treatment. That is consistent with the OP's Section 2.6.2.2 v):

> *New roads shall be designed to integrate "traffic calming" measures as appropriate. In addition, where traffic problems are identified in existing areas through studies carried*

out by the municipality, the Township shall consider the introduction of "traffic calming" measures where appropriate to assist in the resolution of such concerns.

Transportation, infrastructure and utilities uses, subject to the provisions of Section 41 of the Oak Ridges Moraine Conservation Plan and regulatory requirements such as the provisions of the Environmental Assessment Act.

3.7.3 Municipal and Private Services

Sewage Treatment Facility

Sewage treatment for the majority of existing development in the Uxbridge Urban Area is provided by the Uxbridge Brook Water Pollution Control Plant (WPCP). All of the existing capacity of the Uxbridge Brook Water Pollution Control Plant is currently fully committed, including reserve capacity for lands on private services to reflect the objective of ultimately providing full services to all development within the Urban Area. There is however some provision for limited infilling.

An Environmental Assessment for the WPCP has been approved. The Environmental Assessment identified as the preferred solution the expansion of the existing plant with treated effluent discharge to the Uxbridge Brook, subject to the preparation of the comprehensive stormwater quality management study identified in Section 2.2.3.1.

The Region of Durham is responsible for the expansion of the Uxbridge Brook Water Pollution Control plant in accordance with the approved Environmental Assessment.

3.7.4 Flood Study

In 1983 a flood relief study was prepared by LSRCA (then the South Lake Simcoe Conservation Authority) which identified a flood risk for the lands adjacent to the main branch of Uxbridge Brook, from Elgin Pond to just north of Brock Street (downtown Uxbridge) during a Regional Storm Event (Hurricane Hazel). The potential flooding is due to the presence of a long culvert which encloses the creek from Centennial Drive to approximately 100 m north of Brock Street. The Study recommended the construction of new twin 4.2 m x 2.4 m concrete box culverts under Brock Street adjacent to the existing culvert and create an open gabion or concrete gabion-lined channel north of Brock Street, to alleviate or minimize the potential for future flood related damage in the downtown area.

As the recommended solution was not implemented, in 2010 the Uxbridge Watershed Advisory Committee recommended to Council that an update to the 1983 Flood Relief Study be Undertaken, resulting in the *Township of Uxbridge and Region of Durham – Downtown Uxbridge Flood Reduction – Schedule 'C' Municipal Class Environmental Assessment – Environmental Study Report*, prepared by Sernas Associates, November 15, 2012 (Sernas Study).

The Sernas Study recommended the installation of twin culverts to reduce the impact of flooding to keep the Regional storm below the first floor elevations of the buildings, however there would be some flooding in the valley and basements south of Brock Street. The flooding would not however, get high enough to overtop Brock Street and flood the downtown.

The flooding solution was the replacement of the existing culvert, combined with opening of ~60 m of channel. This solution provides an opportunity to open up a section of the watercourse, which would "have significant environmental and social benefits".

Twin culverts were proposed to replace the existing culvert:

- The west culvert would be 135 m long, with an open-bottom structure aligned with the natural channel of Uxbridge Brook, to maintain fish passage. The culvert would end approximately 40 m north of Brock Street, to allow for creation of an open channel where Uxbridge Brook is currently under the parking lot.
- The existing section of culvert under #34 Brock Street (Youth Centre) can be retained.
- The east culvert would be 195 m long, extending the entire length of the existing structure under Brock Street. This culvert would have a concrete bottom, and would only function during large storm events. The building at #30/32 Brock Street would have to be demolished to accommodate construction of the east culvert.

As noted in the Study:

The section of open channel would have steep side slopes, approximately 4.5 to 6.0 m high, to account for the difference in elevation between the existing ground surface and the invert of the creek. The side slopes would consist of vegetated rock, to balance the need for structural stability and providing shade and habitat for the creek. The channel within the 7.0 m wide corridor would be designed with natural channel design principles, in consultation with the Lake Simcoe Region Conservation Authority. Pedestrian railings would be required along the top of the channel corridor for pedestrian safety.

Given the likelihood for increasing flows due to climate change (refer to **Section 5.2**), it is recommended that the culvert twinning be carried out.

4.0 EVALUATION OF THE CUMULATIVE ENVIRONMENTAL IMPACT OF STORMWATER

4.1 GENERAL

LSPP Section 4.5 SA b. states that the SWM master plans will be prepared in accordance with the Municipal Class Environmental Assessment and will include: an evaluation of the cumulative environmental impact of stormwater from existing and planned development. This evaluation is required based on the changes in land use from the future conditions of the Township's OP 2021.

4.2 LAND USE CHANGES

4.2.1 Existing Land Use

Existing land use within the Township can be classified into several categories, including: parks, open space, recreational mixed areas, residential, institutional, commercial, and employment. The land uses were based on the Township's OP. The existing land use within the Township of Uxbridge and Hamlet of Coppin's Corners is illustrated on the Town's Official Plan (Schedule A and Schedule F), see **Figure OP-A** and **Figure OP-F,** respectively**.**

4.2.2 Future Land Use

The Township's Official Consolidated Plan (Aug 2007), indicates on Schedule A (see **Figure OP-A)** that there will be new development in the form of residential areas. There is also indication of a proposed school. The future land use in the Township is illustrated in **Figure 11**. The future land use in each drainage area is summarized in **Appendix A**.

A comparison of the impacts of stormwater due to the changes in land use will be assessed in the following sections. It will compare peak flow values, phosphorus, water budget and erosion.

4.3 PEAK FLOW MODELLING

4.3.1 General

Section 4.5 SA of the LSPP indicates that an assessment of stormwater peak flows from existing and future conditions is required to evaluate the environmental impact of the future development in the Township.

4.3.2 Objectives

To determine the impact of the future settlement areas on peak flows within the Uxbridge watershed and determine what, if any, criteria should be applied to these areas, or existing areas, to meet the objectives of the OP and the Pefferlaw SWS.

4.3.3 Existing Conditions

The Visual OTTHYMO Version 2 (VO2) hydrologic model for Pefferlaw/Uxbridge was received from LSRCA in December 2013. According to LSRCA, the model was last updated by Marshall Macklin Monaghan (MMM) Group in February of 2009.

After a detailed review of the model, the following modifications were made to establish an updated existing conditions model:

- The 2009 LSRCA VO2 model determined peak flows for the 2 to 100-year storm events using the12 hour SCS Type II Storm distribution. The total rainfall for the various storm events was determined by applying the Thiessen Polygon method for two rainfall stations: Orillia Basin and Toronto Lester B. Pearson Airport. For this assessment, peak flows for the 2 to 100-year storm events were determined using the12 hour SCS Type II Storm distribution; however the total rainfall for the various storm events were revised to use the Township of Uxbridge Rainfall Intensity Duration Curves. A comparison of the total rainfall depths is provided below in Table 3.

Table 3 Comparison of Total Rainfall Depth

Return Period	Total Rainfall Depth for 12 hour Duration (mm)	
	2009 LSRCA Model	Updated Existing Conditions Model
2-Year	41	44
5-Year	57	60
10-Year	67	71
25-Year	79	83
50-Year	89	N/A[1]
100-Year	98	104

Notes:

1 The Township of Uxbridge does not have a 50-Year Rainfall Intensity Duration Curve.

- The Study Area is located in the headwater area of Uxbridge Brook; therefore to reduce the size of the model, applicable subcatchments were extracted and a smaller model was created.

- Information obtained from the Township and LSRCA (SWM reports and Drainage Area drawings) along with topographic information, and storm sewer information, allowed Stantec to identify areas draining to ponds and uncontrolled areas within the Study Area. In some cases it was not possible to definitively determine pond drainage areas based on the information available. In these cases, the areas were considered uncontrolled. Once the areas draining to ponds and uncontrolled areas within the Study Area where identified, the LSRCA subwatershed boundaries within the Study Area were revised. **Figure 11** shows the subwatershed boundaries, the Study Area, uncontrolled areas and areas draining to ponds.

- The updated LSRCA subwatersheds were then subdivided to represent the different areas within the subwatershed, as required. The various different areas and VO2 modeling approach are as follows:

  - Areas, within the Study Area, draining to a SWM pond have been modeled as STANDHYDs with flows being directed to ROUTE RESERVOIRs;

  - Uncontrolled areas within the Study Area have been modeled as STANDHYDs; and,

  - The remaining areas outside the Study Area, the rural areas, have been modeled as NASHYDs.

  The various VO2 command outputs (STANDHYDs, NASHYDs, and ROUTE RESERVOIRS) in the subwatersheds were then added together (ADDHYDs) to obtain a total peak flow from the subwatershed.

- Two new NASHYDs were created in Subwatershed 1045 and Subwatershed 1059 to represent the two Future Residential Lands. They have been modeled to have similar characteristics to the subwatershed they were removed from.

- The imperviousness of the STANDHYDs was determined based on land use, as shown on **Figure 11**. Typical impervious values (for residential subdivisions, commercial blocks, etc.) were utilized in the calculation (refer to **Appendix A**).

- The rating curves for the ROUTE RESERVOIRs (the lumped storage-discharge relationships for the ponds) have remained as per the original model. If a ROUTE RESERVOIR was not present in the original model, a ROUTE RESERVOIR command was inserted and sized to simulate post development flows controlled to pre development levels, which is consistent with the modeling approach used in creating the 2009 LSRCA model.

- For all NASHYDs, including the two new NASHYDs, the initial time to peak was calculated using the Williams 2-parameter formula. In accordance with the modeling approach utilized in the 2009 LSRCA model, the initial time to peak for the NASHYDs were calculated based on the total catchment area (including any STANDHYD areas within the catchment) draining to that flow node location. The initial time to peak was then multiplied by a time to peak multiplier to obtain a calibrated time to peak. The calibrated time to peak was inserted into the model. Detailed calculations are provided in **Appendix A**.

- In the 2009 LSRCA model, catchment 1060 was added to the main channel downstream of catchment 1059 instead of directly to catchment 1059. The manner in which the catchments are added together has been revised in the updated existing conditions model such that catchment 1060 now adds directly to catchment 1059.

The peak flow for the 5-year and 100-year events for the updated existing conditions model and the 2009 LSRCA model are summarized below in **Table 4**. Flow node locations are shown on **Figure 11**. Detailed model output for the 2 to 100-year storm events are provided in **Appendix A**.

Table 4 Peak Flow Comparison

Node	2009 LSRCA			Updated Existing Conditions		
	Area (ha)	Peak Flow (m3/s)		Area (ha)	Peak Flow (m3/s)	
		5-year	100-Year		5-year	100-Year
9018	1097.4	0.78	5.05	1097.4	1.07	5.98
1047	479.6	0.62	3.65	479.6	0.82	4.29
9017	1826.0	1.23	10.15	1837.5	1.63	12.00
5065	544.8	3.56	7.23	538.7	5.88	11.98
9041	2370.8	3.66	14.04	2376.2	6.18	16.42
5003	2428.7	3.32	14.12	2446.8	6.88	16.78
1060	407.0	3.34	10.23	407.0	3.88	11.50
7016	N/A[1]			1176.4	7.11	19.46
5004	3596.7	7.37	30.19	3623.2	11.79	34.82
5005	4322.5	8.51	28.21	4323.0	11.11	33.09

1-Node 7016 does not exist in the 2009 LSRCA model as catchment 1060 was added to the main channel as opposed to being added to catchment 1059. This was revised in the updated existing condition model

It should be noted that the rating curve for the ROUTE RESERVOIR located in Catchment 1032 has been exceeded and VO2 has extrapolated an outflow and maximum storage used.

4.3.4 Future Conditions

Existing conditions models were modified to create future conditions models to evaluate the impact of future developments on peak flows in the Township. The two NASHYDs (Subwatersheds 1045 and 1059), created to represent the Future Residential Lands, were converted to

STANDHYDs. The imperviousness of the STANDHYDs was determined based on typical impervious values for residential subdivisions. For more details on future condition modeling refer to **Section 9.0**.

4.4 PHOSPHORUS LOADING

4.4.1 General

Elevated total phosphorus (TP) levels in Lake Simcoe were confirmed to be a significant water quality issue during the 1970s. Phosphorous is a naturally occurring nutrient, an excess of which causes significant plant growth in aquatic environments, decreasing available oxygen in the Lake. Current phosphorus levels are still too high to adequately support aquatic life and the lake continues to feel the effects of increased human activity. Reducing phosphorus levels in stormwater runoff and erosion is therefore a key objective in the health of Lake Simcoe.

4.4.2 Background

4.4.2.1 Information

The main sources of phosphorus loading into Lake Simcoe are:

- stormwater runoff entering tributaries from high intensity development areas and agricultural areas;
- water extracted from polders (low-lying tract of land enclosed by embankments (barriers) known as dikes that forms an artificial hydrological entity, meaning it has no connection with outside water other than through manually operated devices);
- treated wastewater from sewage treatment plants (STPs);
- leakage from septic systems, atmospheric deposits; and
- sediment erosion and re-suspension.

4.4.2.2 Documentation

Various studies, reports, and legislation have been prepared on the subject of phosphorus to Lake Simcoe, including:

- Lake Simcoe Environmental Management Strategy (LSEMS). 1990;
- TSH Associates, Donald Weatherbe Associates Inc., James Li. *Township of Uxbridge – Uxbridge Urban Area Stormwater Management Study Final Report July 2000*. July 2000 (TSH Report);
- Lake Simcoe Region Conservation Authority. *Lake Simcoe Basin Stormwater Management and Retrofit Opportunities*. 2007 (LSRCA Retrofit);
- Lake Simcoe Protection Act. December 2008;
- Lake Simcoe Protection Plan. June 2009;
- LSRCA, MOECC. *Report on the Phosphorus to Lake Simcoe 2004-2007*. 2009;

- LSRCA, MOECC. *Report on the Phosphorus to Lake Simcoe 2007-2009*;
- Phosphorus Reduction Plan. July 2010;
- The Louis Berger Group, Inc. *Estimation of Phosphorus Loadings to Lake Simcoe*. September 2010 (Berger Report); and,
- Uxbridge Brook Water Pollution Control Plant Annual Performance Report 2014
- Uxbridge Urban Area Stormwater Management Study, Report to MOECC (February 11, 2016)

Lake Simcoe Protection Act

Based on the objectives set by the Lake Simcoe Environmental Management Study (LSEMS), the province passed the Lake Simcoe Protection Act in December 2008, which provides a legislative framework for protecting the Lake Simcoe watershed. The Act includes:

- clear objectives to protect and restore the ecological health of the Lake Simcoe watershed;
- the requirement for a protection plan with legally binding policies;
- the requirement for scientific and stakeholder committees to provide advice; and,
- legal authority to create regulation that provides even further protection.

4.4.2.2.1 Lake Simcoe Protection Plan

The Lake Simcoe Protection Plan focuses on critical issues, including:

- restoring the health of the coldwater fishery and other aquatic life;
- improving water quality, including reducing the amount of phosphorus going into the lake and the development of a Phosphorus Reduction Strategy;
- maintaining water quantity;
- protecting and rehabilitating important natural areas such as shorelines; and,
- addressing impacts of invasive species, climate change and recreational activities.

Ontario's strategy to reduce phosphorus levels in Lake Simcoe puts in place source specific reduction goals and potential opportunities. These opportunities will work towards reducing the high phosphorus levels in the lake to the goal of 44 tonnes per year. While total phosphorus loads to Lake Simcoe have decreased since the 1990s they are still above the 44 Tonnes/year level, corresponding to a desired dissolved oxygen target of 7 mg/L (MOECC, 2009).

The Ontario Ministry of the Environment, Environment Canada, Parks Canada and the Lake Simcoe Region Conservation Authority operate monitoring sites throughout the watershed. Information collected at these sites includes:

- weather;
- the amount and quality of rain and snow fall;
- the amount and quality of water in the rivers and streams;
- the amount and quality of water discharged from sewage treatment plants;
- the characteristics of the land: agricultural, forested, urban and natural areas; and,
- stormwater controls and stream side activities.

4.4.2.2.2 TSH Report

The *Uxbridge Urban Area Stormwater Management Study (2000,* prepared by TSH Associates provided an outline of a SWM Plan for urban development areas (existing and future) to provide for phosphorous control. TSH reviewed and made recommendations on SWM retrofit opportunities, including new SWM facilities where none currently exist. The report provided an implementation plan, including a summary of techniques, conditions, time table, a monitoring program, and recommended methods for ensuring that the principles of total phosphorous management are implemented in accordance with the Uxbridge Brook Watershed Plan.

TSH's approach included:

- Review of background material related to TP control needs/loadings;
- Review of current land use conditions and planned expansions;
- Investigation of current drainage conditions and opportunities for new SWM facilities for TP control;
- Review of (then) current SWM facilities and identification of retrofit opportunities for TP control;
- Assessment of SWM opportunities (new and retrofit) to evaluate feasibility, cost, and long term effectiveness;
- Investigation of future development areas and opportunities for SWM including facilities that would jointly control existing and future development areas;
- Public meeting to discuss opportunities and an approach prior to finalization; and,
- Selection of a SWM plan/approach for existing and future development areas.

Based on achieving the Watershed objectives (no increase in urban runoff), and assuming that approved developments were to achieve 50% TP reduction via SWM ponds, TSH assessed increased TP loads to Lake Simcoe and made recommendations for mitigation.

Urban TP Loads to Uxbridge Brook as calculated by TSH are presented in **Table 5** below:

Table 5 Urban Total Phosphorous Loads to Uxbridge Brook (TSH, 2000)

	A) Existing TP Load (kg/yr)	B) Future TP Load (kg/yr)	C) With Recommended BMP (kg/yr)
Urban Point Sources	110	285	285
Urban Runoff	1253.6	1324.2	1168.9
Total Urban Loads	1363.6	1609.2	1453.9

If the urban load increase (B-A = 245.6 kg/yr) could be mitigated, it would represent zero increase in TP.

The UBWP recommended value of 1453.9 kg/yr with BMP's is 155.3 kg/yr less than Scenario B, meaning that if this additional reduction from B could be achieved, the UBWP criteria could be satisfied. To achieve that additional overall reduction would require a combination of retrofits to existing infrastructure, as well as additional controls for new development.

Using the Subwatershed Area designation developed by TSH, load reductions are summarized in **Table 6** below and areas are illustrated from an excerpt of the report in **Figure TSH-1**:

Table 6 Breakdown of Recommended Urban Runoff TP Loadings

Urban Area	TP Load Reduction (kg/yr)	Subwatershed Area
Existing urban area retrofits	122.4	A, B, F, G, I, S
Approved Developments	-	E
Vacant Lands to be Developed	32.8	K
TOTAL	155.3	

Area K represents new areas (i.e. not retrofit opportunities).

Existing Development Target

The reduction target for existing areas was based on reasonable retrofit methods, a 150.6 kg/yr TP reduction, and that adoption of that target in conjunction with the load reduction for future development in Area K meets the overall target of zero net increase in TP loading.

New Development Targets

The study performed an analysis of the impacts of Area K on TP loading, and concluded that, in order to achieve no net increase in P, additional controls to provide 90% TP reduction are required. That level of reduction was noted as being achievable only through a treatment train approach, including LIDs, conveyance, and end of pipe measures in combination.

4.4.2.2.2.1 SWM Opportunities

The TSH Report evaluated opportunities for retrofitting existing ponds and new facilities for existing and future developments.

Four existing ponds and one new pond (as of 2000) in a redevelopment area were identified as having retrofit potential. The existing ponds were in areas M, L, N, and S; the proposed pond was in Area A. Based on the mapping, these would correspond to Stantec Pond IDs 13, 10, 9, 2, and 6.

Locations were also identified in the UBWR, including 6 possible locations for SWM/TP removal enhancement, including ponds, wetland enhancement, OGS and filters. These were called Locations 12 and 13 in the TSH Report.

Eight areas currently (as of 2000) without quality control, and not in the UBWR, were identified for SWM enhancements (new ponds, wetland enhancement where "informal" wetlands now exist, infiltration ponds, etc.). These are Locations 18-21 in LSRCA Area Q (TSH Report).

TSH evaluated the relative effectiveness of each option, and presented a series of recommendations based on costs and other factors.

LSRCA Retrofit

The study purpose was to create a complete, consistent and contemporary data set of all urban catchments, outlets, existing SWMFs and locations of potential SWMFs, and to calculate the phosphorus load associated with urban stormwater runoff in the Lake Simcoe Watershed. It identified potential retrofit opportunities, consisting of upgrades to existing SWMFs or construction of new ones. It did not evaluate BMP effectiveness.

Phosphorus loads were calculated by catchment based on catchment size, level of imperviousness (residential area = 0.45, industrial / commercial = 0.85), Level of control (if a Stormwater facility exists) and an average phosphorus load per hectare per year of 1.32 kg/ha/year (residential) or 1.82 kg/ha/year (industrial / commercial) based on monitoring data from Liang, 1999.

In an examination of each of the urban areas, Uxbridge stands out with the highest percentage of urban area treated by SMF at 47%. The study identified a total urban area in Uxbridge (and Uxbridge Brook subwatershed) of 678 ha, with 338 ha uncontrolled, and318 ha controlled by SWMFs providing at least Level 4 (50% TSS Removal) quality control.

In total, the urban areas of the Lake Simcoe Watershed represent a modeled phosphorus load of 26,916.87 kg/yr, of which approximately 4262.08 kg/yr (16%) has been reduced through the existing stormwater controls (Table 4.3). With a resulting phosphorus load of approximately 22,654.79 kg/yr, stormwater runoff contributes approximately 1/3 of the yearly phosphorus load to Lake Simcoe. Uxbridge achieved the highest percent reduction in phosphorous loading due to SWMFs compared to other urban areas.

The study found that pre-treatment phosphorus loading in Uxbridge/Uxbridge Brook subwatershed was 972 kg/year, after treatment was 628 kg/year, resulting in an annual reduction of 35%.

The study evaluated retrofit opportunities consisting of new ponds or upgrades to existing. Within Uxbridge, they identified 14 retrofit opportunities, with 170 ha affected by retrofits, pre-treatment

TP loading of 628 kg/yr, after treatment of 421 kg/yr, resulting in a potential annual reduction of 207 kg/yr, or 33%.

Report on the Phosphorus to Lake Simcoe 2004-2007

Total phosphorus loading (average per year) for Pefferlaw River/Uxbridge Brook is 3,203 kg.

Report on the Phosphorus to Lake Simcoe 2007-2009

Total phosphorus loading (average per year) for Pefferlaw River/Uxbridge Brook is 6,400 kg.

Untreated urban runoff is a large contributor to TP levels in Lake Simcoe. The LSRCA and MOECC in partnership with municipalities and the development community have identified opportunities where municipal stormwater facilities could be introduced or upgraded to improve overall treatment and phosphorus removal. LSRCA also encourages the use of Low Impact Development (LID), a term used to describe SWM techniques that emulate the natural flow of water as it infiltrates into the soil. That minimizes the impact of urban development by reducing the volume of stormwater runoff as well as potential pollutants the runoff may carry.

Berger Report

The Berger report's objective was to estimate TP loading to Lake Simcoe under three different scenarios: Base Case (existing), Growth, and various BMP scenarios. Key findings of the report include:

- Surface runoff is the largest single contributor (77%) of phosphorus loads under existing conditions, and 80% under the growth scenario;
- High intensity development (and cropland) are the largest runoff sources;
- Highest loading under growth scenarios is in Barrie Creek, East Holland, West Holland, and Black Creek subwatersheds; and,
- Only selected agricultural BMPs were tested in the BMP scenario.

Although only agricultural BMPS were tested, the report made recommendations with respect to urban runoff:

- Retrofit/Maintenance of existing SWM facilities to enhance reduction of phosphorus such as stormwater ponds, catchbasin sumps, and oil/grit separators;
- Implementation of innovative SWM practices – LID approaches such as green roofs, bioretention and raingardens, infiltration trenches, rainwater harvesting, soakaway pits, and permeable pavement to improve the quality and reduce the quantity of stormwater entering the Lake Simcoe subwatersheds from urban areas;
- Actions by Homeowners – Homeowners can reduce their input of phosphorus into the watershed by eliminating/reducing the use of phosphorus rich fertilizers, planting natural

meadow field lawns (requiring little/no fertilizer), and using rain barrels to harvest rainwater for lawns; and,

- Application of the red sand technology (current pilot project) at stormwater ponds to remove phosphorus.

It is noted that atmospheric phosphorus (a large portion of the total phosphorus loading to Lake Simcoe) was not accounted for in this study.

4.4.2.2.3 Uxbridge Brook Water Pollution Control Plant Annual Performance Report 2014

The Uxbridge Brook Water Pollution Control Plant (WPCP) serves the Uxbridge urban area in the Township of Uxbridge, and is located between Uxbridge Brook and Main Street just south of the CNR railway tracks at 129 Main Street North.

The MOECC Class 3 wastewater treatment plant utilizes an extended aeration process with tertiary treatment to treat the wastewater. The treated effluent is discharged to the Uxbridge Brook. The following Environmental Compliance Approvals and Certificates are mentioned in the report:

ECA Compliance Approval

- Approval No: 8357-8CTQ5V (June 28, 2012)
- Approval No: 6581-67GRPR (December 10, 2004)

Wastewater Treatment Facility Certificate Classification

- Certificate No: 12 (March 11, 2008), Class 3

According to the report the total phosphorus ECA effluent quality limit is 0.15 mg/l, 0.78 kg/d or 286 kg/year. The ECA Effluent quality objectives are 0.1 mg/l. The 2014 Average Total Phosphorus concentration was 0.06 mg/l, which is in compliance with both the ECA limit and objective. An excerpt of Table C from the report detailing the average phosphorus concentration is included in **Appendix E**. The Total Phosphorus concentration exceeded the ECA objectives a total of 35 times within the recorded year. An excerpt of Table E from the report detailing the exceedances is included in **Appendix E**.

4.4.2.2.4 Uxbridge Urban Area Stormwater Management Study, Report to MOECC

The Uxbridge Urban Area Stormwater Management Study, Report to MOECC identified all measures taken to the date (as of February 2016) of the report that reduce phosphorus loading within Uxbridge Brook. The report summarized phosphorus removal targets under plans of subdivision, Site Plans, retrofitting of existing SWM Ponds and Elgin Pond Rehabilitation. The report concludes that the Township of Uxbridge has achieved 100% of the original target of 122.4 kg/year set by the TSH report.

4.4.3 Methodology

The objectives of the phosphorus loading assessment are summarized as follows:

- Use the base case (existing conditions)and future land use (future residential areas) unit area phosphorus loadings from the Report on the Phosphorus Loads to Lake Simcoe – LSRCA, 2007-2009, (May 2010) to generate existing and future phosphorus loading rates for the Uxbridge Brook subwatershed;
- Apply the unit area phosphorus loading rate for each subwatershed to each applicable settlement area within the Township; and,
- Assess the changes in phosphorus loadings at each settlement area from existing to future conditions, without additional treatment; then with additional treatment options.

4.4.4 Phosphorus Loading Assessment

Coppin's Corners drains internally to the Wyndance infiltration SWM pond and is therefore assumed to have a net increase of 0 for total phosphorus in the existing and future conditions (accounting for development in Area C).

The Uxbridge Urban Area phosphorus loading rates were generated based on calibrated loadings from the Estimation of Phosphorus Loadings to Lake Simcoe Report (LSRCA, September 2010). The existing conditions land use and base case loading rates scenario from **Table 2-3** and **Table 2-4** of the report respectively were calibrated to represent the loading rates of the existing and future urban area of Uxbridge. It was assumed that **Table 2-3** and **Table 2-4** of the report were based on natural phosphorus loadings without SWM quality mitigation measures. Similar to table E of the report the land use classification system has been modified and condensed based on the land use categories from the Township's OP. The revised land use classification system and resulting phosphorus loading rates per land use area for the existing conditions and future conditions land use without treatment are summarized in **Table 7**, below**.** Detailed phosphorus loading unit rate calculations/methodology are provided in **Appendix E** and CANWET landuse areas are displayed in **Figure 10**. It is important to note that the landuse areas displayed in **Appendix E** and **Table 7** are not all CANWET landuse areas. The residential and commercial/industrial area categorization and loading rates are based on monitoring results from Liang (1999) and the *Lake Simcoe Basin Stormwater Management and Retrofit Opportunities (*2007). As per comments from the MOECC on May 9 2016, the loading rate for forest areas is 0.03 kg/ha/year as suggested by the MOE phosphorus loading tool and is used in **Table 7** below.

Table 7 Existing and Future Phosphorus Loadings

CANWET Land Use Category	Existing and Future Condition Land Use	Existing and Future Condition Average Annual Phosphorus Loading Rate (kg/ha)
		Pefferlaw-Uxbridge Brook
Hay-Pasture	General Agricultural Area, Permanent Agricultural Area	0.068
Cropland		
Quarry		
Turf-Sod		
Tile Drainage		
Forest	Forest Area, (Future Residential Area is Currently Existing as a Forest Area)	0.03
Wetland	Environmental Constraint Area	0.120
Stream Banks		
Groundwater		
Transition	Recreational Mixed Use Area, Cemetery Area, Park and Open Space Area, Private Open Space Area Golf Course, Major Open Space Area, Oak Ridges Moraine	0.098
Septics		
*Residential (Liang 1999)	Residential Area, Residential Area Higher Density, Mixed Use Area, Employment Area, , Proposed School Site	1.32
*Industrial/commerial (Liang 1999)	Corridor commerical Area, Employment Area, Institutional Area, Brock St. Mixed Used Area	1.82

4.4.5 Existing Conditions

The existing conditions scenario assessed the changes in phosphorus loadings with current treatment measures (wet pond treatment). The results are presented below in **Table 8** with the future development Areas A and B included within the Uxbridge Urban area and Areas A and B evaluated separately in **Table 9**.

Table 8 Existing Phosphorus Loadings – Uxbridge Urban Area

Existing Conditions	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	6.03
Environmental Constraint Area	0.12	0.52	77.86	9.37
Forest Area	0.03	2.42	106.51	3.21
Residential, Schools, Roads, etc.	1.32	228.64	225.63	409.50
Commercial, Employment Area, Institutional	1.82	12.11	47.98	95.48
	Total	**280.00**	**506.18**	**523.58**

Table 9 Existing Phosphorus Loadings – Areas A and B

Existing Conditions	Phosphorus Loading (kg/ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year)
Forest Area	0.03	81.04(Area A and B to be converted to Future Residential Area)	2.43
	Total	**81.04**	**2.43**

4.4.6 Future Conditions

The future conditions scenario assessed the changes in phosphorus loadings as a result of future residential in Areas A and B. The results are displayed below in

Table 10 with and without treatment measures for the Uxbridge Urban Area (including Areas A and B), **Table** 11treatment measure for the Uxbridge Urban Area (excluding Areas A and B)and Areas A and B evaluated separately in **Table 12**. Refer to **Figure 10** for the location of the future development areas, commercial lands, and areas draining to existing ponds.

Table 10 Future Phosphorus Loadings – Uxbridge Urban Area and Areas A and B

Future Conditions Scenario (Uxbridge Urban Area Including Future Development Areas) A and B)	Total Phosphorus Loading (kg/year)
Future Conditions (no SWM measures for future development (Area A and B))	627.94
Future Conditions (Wet Ponds for future development (Area A and B))	560.74
Future Conditions (LID treatment for future residential (Area A and B) and commercial lands)	236.94
Future Conditions (Wet Ponds and LID's for future development (Area A and B)and commercial lands)	223.15
Future Conditions (Wet Ponds for future development (Area A and B), LID's for future development and commercial lands and retrofit of existing ponds)	126.79

Table 11 Future Phosphorus Loadings – Urban Area Excluding Future Development

Future Conditions Scenario	Total Phosphorus Loading (kg/year)
Future Conditions (no SWM measures for future development (Area A and B))	520.97
Future Conditions (Wet Ponds for future development (Area A and B))	521.16
Future Conditions (LID treatment for commercial lands)	215.01
Future Conditions (LID's for commercial lands)	215.04
Future Conditions (LID's for commercial lands and retrofit of existing ponds)	118.68

Table 12 Future Phosphorus Loadings –Areas A and B

Future Conditions Scenario (Future Development Areas A and B only)	Total Phosphorus Loading (kg/year)
Future Conditions (no SWM measures for future development (Area A and B))	106.97
Future Conditions (Wet Ponds for future development (Area A and B))	39.58
Future Conditions (LID treatment for future residential (Area A and B) and commercial lands)	21.93
Future Conditions (Wet Ponds and LID's for future development (Area A and B)and commercial lands)	8.11
Future Conditions (Wet Ponds for future development (Area A and B), LID's for future development and commercial lands and retrofit of existing ponds)	8.11

4.4.7 Phosphorus Loading Assessment Results

The existing conditions and future conditions with and without various treatment measures are compared to assess the environmental impact of development on phosphorus loadings to Lake Simcoe. The results are provided below in **Table 13**.

Table 13 Phosphorus Loading Results

Future Conditions	Total Phosphorus Loading (kg/year) After Treatment	Change in Phosphorus Loading Post -Pre (kg/year)
Future Conditions (no SWM measures for future development (Area A and B))	627.94	104.36
Future Conditions (Wet Ponds for future development (Area A and B))	560.74	37.15
Future Conditions (LID treatment for future residential (Area A and B) and commercial lands)	236.94	-286.65
Future Conditions (Wet Ponds and LID's for future development (Area A and B)and commercial lands)	223.15	-300.43
Future Conditions (Wet Ponds for future development (Area A and B), LID's for future development and commercial lands and retrofit of existing ponds)	126.79	-396.79

Note:

A level 1 pond total phosphorus removal is 63% based on MOECC's Lake Simcoe Phosphorus Loading Development Tool (2012)

A level 3 pond phosphorus removal is 63% based on MOECC's Lake Simcoe Phosphorus Loading Development Tool (2012)

An average LID total phosphorus removal rate of 79.5 % was used, as per TRCA LID Manual

An average Total phosphorus removal for LID's and wet pond was calculated as 92.4%

As per MOE comments the MOE Lake Simcoe Phosphorus Tool land use phosphorus loading coefficients were used to verify the post development mitigation in phosphorus loadings. The change in phosphorus loadings resulted in a -396.68 kg/year load for the Future Conditions (Wet Ponds for future development (Area A and B), LID's for future development and commercial lands and retrofit of existing ponds). This is very similar to the result shown in **Table 13** above (-396.79 kg/year). Calculations are provided in **Appendix E**.

Phosphorus Mitigation Recommendations

The phosphorus loading assessment has indicated that future development of the two residential areas at the northwest and southeast (Areas A and B) will increase phosphorus loadings to Lake Simcoe without BMPs in place. To reduce the environmental impact from increased phosphorus loadings it is recommended to implement source/lot level controls, conveyance controls and end of pipe controls (i.e. roof storage, swales, filter strips, wet ponds, etc.). More detailed information on alternative methods for phosphorus reduction and BMP's are summarized in **Section 8.2.1**. The specific mitigation measure to be utilized to reduce phosphorus loadings are to be confirmed on a site specific basis at the functional design stages of development.

4.5 WATER BUDGET

Section 4.8-SA in the Lake Simcoe Protection Plan requires a water budget assessment under the Lake Simcoe Protection Plan for the existing and proposed land use. It is expected that new developments will increase impervious areas resulting in a change to the hydrologic characteristics of the study area, such as an increase in the volume and intensity of runoff and a decrease in evapotranspiration and infiltration. To characterize the impacts of future development conditions, a water budget which assesses rainfall, evapotranspiration, runoff and infiltration was developed. This water budget which is based on the methodology of Thornthwaite and Mather (1955) and the MOECC's Stormwater Management Planning and Design Manual (2003), is developed for each proposed development area separately (sub areas A, B and C, **Figure 1**).

Existing and future development conditions for each settlement area are compared and changes to the components of the water budget are estimated. As required by Lake Simcoe Protection Plan, the annual predevelopment infiltration rates must be maintained as much as possible under post-development conditions.

Based on Lakes Simcoe and Couchiching-Black River SPA Part 1 Approved Assessment Report (LSRCA, 2011), the annual averages for precipitation and evapotranspiration in the Uxbridge Brook subwatershed are 831 mm/yr and 560 mm/yr, respectively (sub areas A and B). The annual averages for precipitation and evapotranspiration in Pefferlaw Brook (Sub Area C) are 852 mm/yr and 561 mm/yr, respectively. The annual water surplus is estimated to be 271 mm/yr in Sub Areas A and B and 291 mm/yr in sub area C. Pre-development total annual infiltration was calculated as 154 mm/yr in Sub Areas A and B and 166 mm/yr at Coppin's Corners (Sub Area C). The infiltration average was generated based on topography, soil texture and ground cover yielding an infiltration factor of 0.57 (MOECC, 2003) in all three sub areas.

Given that the majority of the Township is characterized by a similar soil type (sandy loam) with the exception of the northeast corner where silt loam is present, the infiltration factor is expected to be similar throughout the study area. Annual runoff which is estimated by subtracting infiltration from the water surplus was estimated to be 117 mm/yr in sub Areas A and B and 125 mm/yr in sub area C. The components of the pre-development water balance for the proposed developments are summarized in **Table 14**.

Table 14 Summary of Pre-Development Water Budget

Component of Water Balance	Annual (mm/yr)	
	Sub Areas A and B	Sub Area C
Sub-Watershed	Uxbridge Brook	Pefferlaw Brook
Precipitation	831	852
Actual Evapotranspiration	560	561
Water Surplus	271	291
Total Infiltration	154	166
Total Runoff	117	125

Table 15 summarizes the pre-development annual volumetric runoff and infiltration for each sub area.

Table 15 Pre-Development Annual Volumetric Runoff and Infiltration

Sub Area	Total Area (m^2)	Total Volumetric Infiltration (m^3/yr)	Total Volumetric Runoff (m^3/yr)
A	545,800	84,310	63,602
B	264,600	40,873	30,834
C	13,461	2,233	1,684

Note – discrepancies in between Table 1 and Table 2 are due to rounding errors.

Post-development annual volumetric runoff and infiltration are summarized in **Table 16**. Post-development land use is assumed to be a single family residence with an impervious factor of 0.40 and a runoff coefficient of 0.45.

Table 16 Post-Development Annual Volumetric Runoff and Infiltration

Sub Area	Total Area (m^2)	Total Volumetric Infiltration (m^3/yr)	Total Volumetric Runoff (m^3/yr)	Volumetric Infiltration Deficit (m^3/yr)
A	545,800	50,586	201,443	33,724
B	264,600	24,524	97,658	16,349
C	13,461	1,340	5,139	893

The proposed developments are expected to result in an increase in runoff of approximately 217% in sub Areas A and B and 205% in sub area C and a decrease in infiltration of approximately 40% in all sub areas. The infiltration deficit, which is the difference between the pre- and post- development infiltration volumes ranges from approximately 33,724m^3/yr in sub area A to 16,349 m^3/yr in sub area B. This estimated deficit will provide a guide to the target for infiltration across the developments through the use of Low Impact Development (LID) techniques.

As noted in Section 1.0, Area C will drain to the existing Wyndance infiltration pond.

Areas A and B total some 81.04 ha, with a total volumetric deficit of 50,073 m^3/year. That averages to approximately 62 mm/year. Based on the average precipitation volume of 831 mm/year, 62 mm/year equates to 7.4% of precipitation volume.

Based on rainfall data collected and supplied by LSRCA, events up to and including 6 mm events correspond to approximately 7.4% of average annual rainfall depth. Therefore, future development should target retention of 6 mm events as a minimum to offset the infiltration deficit and in some areas greater infiltration amounts can be achieved. Detailed calculations at the time of development would be required. The LSRCA is currently developing updated SWM policies/guidelines that will target the capture and retention on site of 25mm of runoff from the new and/or fully reconstructed impervious surfaces (90 percentile storm).

In June, 2013, the technical document *Hydrogeological Assessment Submissions - Conservation Authority Guidelines to Support Development Applications*, prepared by Shelly Cuddy, Gayle Soo Chan and Ryan Post, was released. It was developed to attempt to standardize the hydrogeological study requirements to support development applications reviewed by Conservation Authorities. This document should be followed at the site-specific scale for future development applications in the Study Area.

5.0 EFFECTIVENESS OF EXISTING SWM WORKS

5.1 PEAK FLOW MODELLING

A detailed assessment of the effectiveness of the existing SWM Ponds in reducing the peak flow was not completed as as-built storage discharge curves for the ponds was not available. ROUTE RESERVOIR commands included in the model were sized to simulate post development flows controlled to pre development levels.

5.2 CLIMATE CHANGE

Climate change refers to the long term trend in the change of the world's weather patterns, including changes in average temperature and rainfall distribution. Stormwater runoff is intrinsically a function of rainfall, therefore change in the intensity, duration, and frequency of rainfall events has an impact on runoff, and the response of stormwater systems. Aquatic habitat health is also linked to temperature.

The Institute for Catastrophic Loss Reduction (ICLR) produced two reports of relevance to this study.

In the first, they note that with respect to climate change, that there were seven flood-producing heavy rain events in the Toronto area with intensities exceeding the expected return period value (the highest precipitation value on average occurring once in a 20-year period) during the period of 1987– 2007(ICLR, 2012).

> *While the days with greater than 10 mm precipitation remained unchanged, the number of days with higher precipitation, above 30 mm, has moderately increased with warmer temperature, which has the capability to hold more moisture; this trend is projected to continue. Projecting forward for Ontario, the annual maximum 24-hour precipitation rate that at present occurs once every 20 years, will occur more often and become a once every 12–14 year event. Meanwhile, in northern Ontario the occurrence rate will lower from once every 20 years to closer to once every 10 years. With more heavy precipitation events over Ontario, there will be an increased risk of flash floods.*
>
> *A study of April–November rainfall extremes of four selected river basins (Grand, Humber, Rideau and Upper Thames) showed large percentage increases in future three-day accumulated rainfall extremes with a warming climate. The 20-year return values of annual maximum three-day accumulated rainfall totals are projected to increase by 30% to 55% for the period 2026 to 2075. Since the observed annual maximum three-day accumulated rainfall totals are about 80 mm, these are larger changes (25–45 mm) than the average projected for*

> *Canada as a whole. There are uncertainties in all these projections, but they all show significant increases in the intensity of extreme precipitation events.*

In the second report, it is noted that urban flood damages are a recurrent and growing issue for municipalities, insurers and homeowners across Canada. Damages from urban flood events often total in the $10s and $100s of millions of dollars. In July, 2012, a storm moved through southern Ontario affecting several neighbourhoods in Hamilton and Ottawa, resulting in $90 million in insured damages (ICLR, 2013).

An extreme rainfall event that affected a large region of southern Ontario from Hamilton to Durham Region in August, 2005 resulted in over $500 million in insured damages, $247 million of which was associated with sewer backup.

It is noted that Canadian municipalities have faced litigation for sewer backup events. Homeowners can have home damage, item loss, and health issues from flooding and sewer backups. Homeowners may also experience sewer backup insurance coverage limits, increasing premiums or cancellation of sewer backup coverage after the experience of multiple basement flood events. Flood insurance in Canada does not cover damages from overland flow.

Therefore, changes in rainfall patterns which affect SWM facility performance can have significant social and economic effects when the systems are no longer able to as effectively meet the objectives they were designed for.

In order to assess the impact of climate change, the performance of SWMFs must be assessed accounting for changes in rainfall patterns.

MTO Studies

The MTO published their Identification of the Effect of Climate Change on Future Design Standards of Drainage Infrastructure in Ontario – Final Report in June, 2005, the purpose of which was to identify the effect of climate change on future highway drainage infrastructures in Ontario. Specifically, the study determined that the intensity-duration-frequency (IDF) curves station shows significant changes in the precipitation intensity between the current and the future time periods. Climate change that produces an increase in the intensity of precipitation will increase the magnitude of the design discharge and that would most likely result in adverse effects on existing drainage facilities.

The study notes that "Although many organizations are undertaking various researches on climate change, there are no well-established methodologies to relate the anticipated changes in weather to the impact of such changes on the performance of hydraulic structures such as bridges, culverts and sewer systems."

As such, the study developed a methodology to assess the potential impacts of climate change on IDF values. Two study areas of interest were selected: The Grand River Region in southern Ontario, and the Kenora and Rainy River Region in northwestern Ontario.

The study found that:

> *overall, rainfall intensities with an X-year return period (X= 5, 10, 20, 50, 100) under current climate conditions are almost equal to those with (X/2)-year return period under future climate conditions. As an example, rainfall intensities with 10-year return period under current climate conditions are almost equal to those with 5-year return period under predicted climate conditions. As an example, an actual 10-year drainage system will be able to withstand only 5-year storms by 2050s, whereas a current 50-year drainage structure will be able to handle only 20-year storms by 2050s.*

The existing IDF curves were then updated to 2050 and 2080 levels.

As a basis for analysis and discussion, and using Station G6140954 (in the Grand River Region) as a basis for comparison, the existing Uxbridge IDF curves were then modified by applying the percent change in rainfall intensities used in Sta G6140954 and updated IDF curves were developed for the 5-year and 100-year return periods for 2050 and 2080. (Refer to **Appendix F**)

Similar to the approach taken in the MTO study, the effects of climate change on conveyance systems was assessed by comparing future rainfall intensities to existing, specifically, comparing the 5-year intensities with an inlet time of 10 minutes, as these are representative of minor system conveyance structure requirements.

Storm sewer capacity is a function of cross-sectional area, which is related to the square of the pipe diameter. Storm runoff rates are proportional to rainfall intensity.

Therefore, a general relationship between pipe diameter and increase in rainfall intensity (with tc = 10 minutes) can be developed as follows:

$$D_2/D_1 = \sqrt{(i_2/i_1)}$$

Where D_1 = diameter for intensity 1

D_2 = diameter for intensity 2

i_1 = intensity 1

i_2 = intensity 2

Under the existing Uxbridge 5-year IDF curve, evaluating the increase in rainfall intensities for 2050 and 2080 yields increases in pipe diameter of 30% and 38%, respectively.

For example, a system currently sized at 525 mm diameter, would need to be upgraded to 675 mm and 750 mm to convey the expected increase in 5-year flows for 2050 and 2080, respectively.

For assessing the function of SWMFs such as quantity control ponds, the IDF data noted above was used to update the hydrologic model representing existing and future conditions.

Although the study completed by the MTO did not specifically address Uxbridge IDFs, it is within the same climatic region and likely will experience comparable increases in rainfall intensities.

Based on the example above, climate change could compromise the efficacy of existing and proposed conveyance structures if current IDF curves are not updated to reflect projected changes in precipitation intensities. It is therefore recommended that the Township investigate the update of their IDF curves for future conditions. Similar IDF updates have been completed for the Cities of Barrie and Welland.

The VO2 model was therefore re-run with updated IDF data to assess the degree of peak flow increases due to climate change.

Table 17 summarizes the future condition flow, which assumes Future Settlement Areas A and B have been developed and the ponds will have been designed such that post developed flows are controlled to pre-developed levels using current IDF data, and flows for the year 2050 and 2080, at various flow nodes. For the 2050 and 2080 simulation, no modifications have been made to the pond's storage-discharge relationships. Flow node locations are shown on **Figure 11**.

Table 17 Comparison of Future Condition, 2050, and 2080 Flows

Node	Return Period (year)	Future Condition Flow[1] (m^3/s)	2050 Flow (m^3/s)	2080 Flow (m^3/s)
9018	5	1.07	2.27	3.23
	100	5.98	12.03	16.53
1047	5	0.83	1.66	2.35
	100	4.32	8.70	11.8
9017	5	1.64	3.73	6.14
	100	12.05	24.80	33.71
5065	5	5.88	7.64	8.89
	100	11.98	22.95	28.52
9041	5	6.18	8.05	9.38
	100	16.53	33.61	45.56
5003	5	6.88	9.26	11.05
	100	16.90	34.15	46.33
1060	5	3.88	5.91	7.45
	100	11.50	19.8	24.43
7016	5	7.10	10.02	12.90
	100	19.82	33.84	43.24
5004	5	11.73	17.02	20.92
	100	35.37	67.20	88.92
5005	5	11.09	15.98	19.51
	100	33.60	66.52	88.51

Notes:

1 Future Condition Flow assumes Future Settlement Areas A and B have been developed and ponds have been designed such that post developed flows are controlled to pre-developed levels using current IDF data.

Based on the above, if the existing ponds are not retrofitted, and current criteria are applied to future settlement areas, flows will generally increase under climate change.

The VO2 model was then updated for both 2050 and 2080 IDF data, and re-run to determine what storage increases would be required to maintain target flows at the catchment level. These are summarized in **Table 18** and **Table 19**, below, for the two future ponds; refer to **Figure 11** for catchment location and **Appendix F** for detailed modeling.

Table 18 Storage Requirement (Future Pond for Future Residential B in Catchment 1045) to Maintain Existing Flows for 2050 and2080

Return Period (year)	Current Storage (m³)	2050		2080	
		Storage (m³)	% Increase	Storage (m³)	% Increase
5	6,262	8,335	33%	9,961	59%
100	10,799	17,409	61%	21,893	103%

Table 19 Storage Requirement (Future Pond for Future Residential A in Catchment 1059) to Maintain Existing Flows for 2050 and2080

Return Period (year)	Current Storage (m³)	2050		2080	
		Storage (m³)	% Increase	Storage (m³)	% Increase
5	14,810	18,789	27%	22,591	53%
100	23,855	37,149	56%	46,108	93%

Environment Canada indicates that the equipment for creating IDF data, the tipping bucket rain gauge, was never part of the observing programs at any sites that were located in Uxbridge. The set of curves currently being used would likely be data from a nearby site that has been (re)named Uxbridge. Possibly the closest site with updated data could be Toronto Buttonville Airport.

It is recommended that Uxbridge install and monitor a rain gage for future use. A suggested location would be at the Water Pollution Control Plant (WPCP) (refer to **Figure 1** for WPCP location) as it is well within the Uxbridge Urban Area. Similar to *Toronto's Future Weather and Climate Driver Study* (2011), this rainfall information gathered would be useful so that the Township can be better prepared to address and adapt to changes that will occur as a result of local weather and climate factors. It would help identify intense events that occur within a limited geographical area and over short time frames. The information would prove valuable in predicting increased peak flows and could be used to evaluate whether existing SWMF would be able to still meet the required post to pre requirements or if further retrofits or expansions would be required.

5.3 EROSION AREAS OF CONCERN AND RECOMMENDATIONS

5.3.1 Field Visit

On Oct 29, 2014 Stantec staff completed a site walk of the Reaches within the Study Area to identify potential areas of erosion concern (refer to **Figure ERSN 1**). A photo log (**Figure ERSN 2**) illustrates and describes the erosion sites.

5.3.2 Summary of Erosion Sites

Reaches with erosion issues indicated downstream of future development areas (Reaches 16 and 19) can reasonably expected to worsen if Areas A and B are developed without mitigation techniques (i.e. erosion control). Reaches that do not currently have erosion issues would also have the potential to be negatively affected by uncontrolled future development.

Coppin's Corner's (Area C) appeared to only have a dry ditch (**Figure 3**) and was not visited for the purposes of erosion assessment, however it is assumed that the areas downstream of development Area C would potentially experience issues if mitigation techniques are not utilized to reduce flows to pre-development levels.

Stantec has identified a number of erosion sites based on the site visit. They are summarized below by Reach:

Reach 2:

- Channel has unstable sections. Headcuts, undercut banks and a perched culvert were noted that can lead to declined channel stability and increased erosion deposition. Refer to **Figure ERSN 2**, photos 1-4.

Reach 3

- The channel has some unstable sections. Several undercut banks, slight head cuts that can lead to declined channel stability and increased erosion deposition were noted. Refer to **Figure ERSN 2,** photo 5-7.

Reach 4

- A slumping gabion basket within the channel has the potential to fall or impede flow, which can lead to declined channel stability. Refer to **Figure ERSN 2**, photo 8.

Reach 10

- The channel had several perched culverts that could cause scouring. There was a large jam with a wheel barrow and several trees. Refer to **Figure ERSN 2**, photo 9-11.

Reach 12

- A very large head cut was found immediately west of Turner Street, that has caused much of the land within that area to erode. In that area were undercut sections that could lead to decreased bank stability and increased levels of erosion downstream. Refer **to Figure ERSN 2**, photo 12-13.

Reach 13

- Headcuts and a series of log jams were noticed near the intersection of reach 13 and 14. The head cuts and jams would cause scouring of the channel bed increasing erosion downstream. Refer to **Figure ERSN 2**, photo 14.

Reach 16

- An elliptical perched culvert was located that is causing scouring at the channel bed and increasing erosion downstream. Refer to **Figure ERSN 2**, photo 15.

Reach 19

- There is debris located near a bridge that is obstructing flow within the channel. Refer to **Figure ERSN 2**, photo 16.

5.3.3 Recommendations

Any sites that may affect public safety should be evaluated by the Township to further refine the potential impacts.

Priority should be given to **Reaches 12** and **19**, as they have debris jams within the channel that could cause channel flows to back up into nearby residential/commercial properties, causing flooding concerns.

The perched culverts identified in **Reaches 10** and **16** have potential to cause problems with structural integrity of the road material and should be assessed in more detail.

Although more site specific investigation is required to develop site specific solutions, general approaches to mitigating the erosion might include:

- Lining channels with rock to reduce active erosion;
- Re-grading the channel to remove head cutting and undercutting and maintain a more gradual slope;
- Installing plunge pools at the outlet of the perched culverts to dissipate the energy, decrease flows and scouring and thereby reducing erosion;
- Removing debris jams; and,
- Performing maintenance on gabion walls.

For future development purposes to ensure that the erosion control component of ponds will be sufficient, the following recommendations have been developed:

- Complete a detailed fluvial assessment in problem reaches immediately downstream of Areas A and B including cross-sectional surveys, establishment of erosion thresholds, and identification of critical reaches/flows;
- Develop an erosion model (for example, QUALHYMO is a continuous hydrologic model with critical flow exceedance statistical summary capabilities) to determine if retrofits to existing facilities would be effective at mitigating existing erosion issues;
- Use erosion model developed above to evaluate impacts of development of Areas A, B and C (see **Figure ERSN1**) and whether extended detention levels provided by the ponds would be enough to mitigate the erosive effect, or if additional LID's would be required; and,
- For other general recommendations to reduce peak flows and improve quality control to the reaches indicated in **Figure ERSN 1** refer to Section 8 of the report.

6.0 EXAMINATION OF STORMWATER RETROFIT OPPORTUNITIES

6.1 GENERAL

As noted in Section 3.7.1, Stantec completed an assessment report for twenty-two (22) SWM (SWM) facilities within the Township of Uxbridge in January 2013. **Drawing 1** of the report is attached **in Figure SWMF-1**, tabulating the 22 SWM ponds and showing their locations.

Stantec has identified maintenance considerations as either 'required' or 'recommended' to help assist the Township with prioritization. In general, it as our opinion that the following SWM Facilities should be considered as higher priority and it was our recommendation that any immediate maintenance expenditures/efforts be focused at these locations. The SWM facilities within the Urban boundary referenced below are in no particular order of priority.

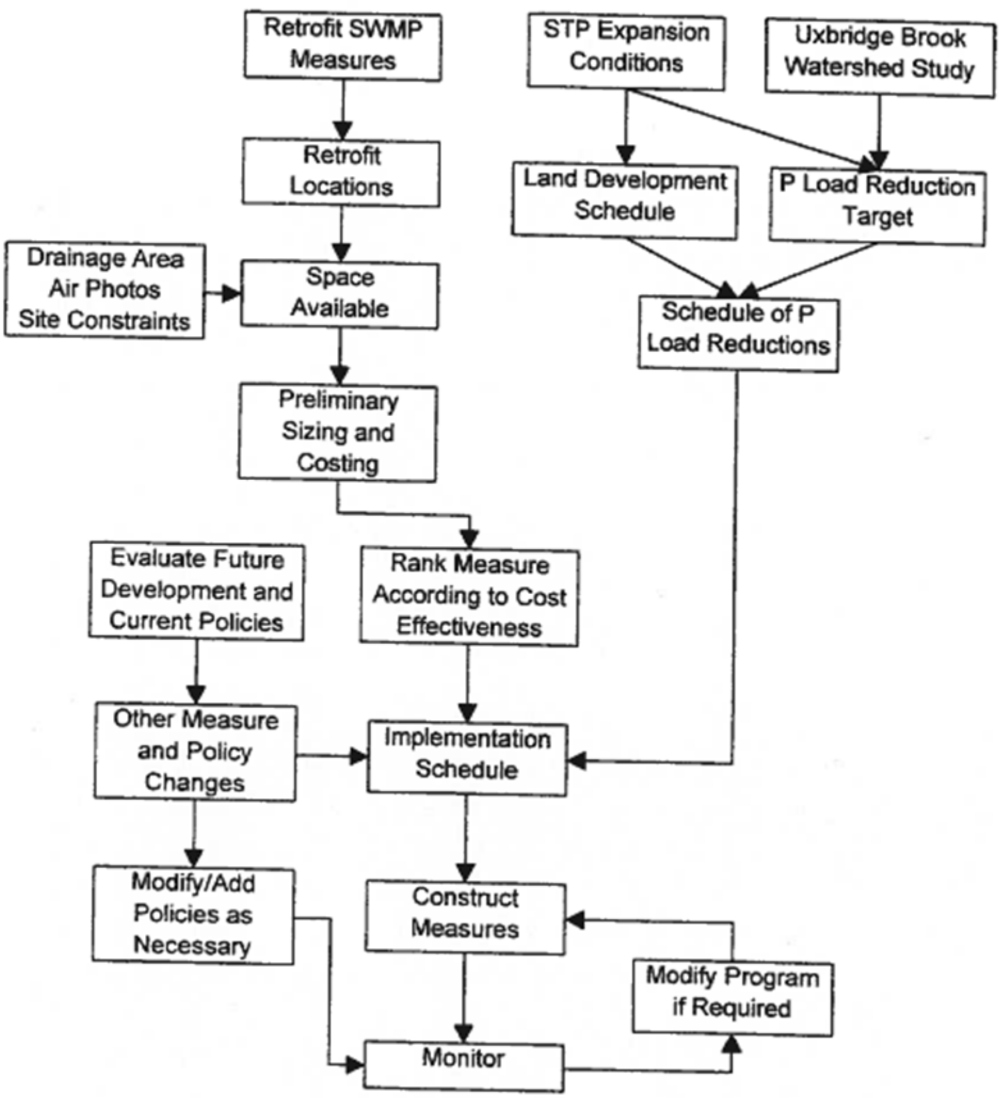
- Estates at Wooden Sticks (Pond 4);
- Forsythe West Subdivision (Pond 7); and,
- Testa Heights (Pond 13).

6.2 EXAMINATION OF EXISTING RETROFIT STRATEGY

The Township has identified areas and several existing SWM facilities that would benefit a retrofit. The Uxbridge Urban Area Stormwater Management Study (2000) identified several existing pond retrofit locations. Below is an excerpt from the Uxbridge Urban Area SWM Study summarizing the retrofit approach.

FIGURE 1.3.1

UXBRIDGE SWM STUDY RETROFIT APPROACH
TOWNSHIP OF UXBRIDGE



Section 5 of the report outlines recommendations for retrofitting of existing facilities as well as the installation of new facilities. Table 3.3.1 of the report outlines the potential SWM retrofit locations and their associated phosphorus loading reductions. Table 3.4.1 of the report outlines the costs of the retrofits.

It is important to note that in each report the retrofit location names are different. **Table 20** below matches Stantec Pond locations with the Uxbridge Urban Area SWM Study 2000 reports retrofit locations. Refer to **Figure 2**.

Table 20 SWM Pond IDs

Uxbridge Urban Area SWM Study 2000 Pond ID	Stantec Pond ID
5	2
15	4
	6
6	7
3	9
2	10
18	11
	12
1	13
	14
4	15

6.3 RETROFIT STRATEGY DEVELOPMENT

The development of a new retrofit strategy is required as part of section 4.5SA of the LSPP when a retrofit strategy is not present. Existing areas that require retrofit should correspond to the areas identified by the LSRCA in the Lake Simcoe Basin SWM and Retrofit Opportunities (2007) report that are within the study area. These retrofits recommend the installation of new Enhanced wet ponds, and upgrades to Enhanced wet ponds (see **Appendix 2** of the report). Existing SWMFs were surveyed and recommendations based on the current conditions are developed and incorporated into a SWM Maintenance Program detailed in **Section 7.0** of this report.

7.0 SWM MAINTENANCE PROGRAM

7.1 INTRODUCTION

The Township is responsible for the operations and management of 22 identified SWMFs of which only 11 are within the urban boundary (study area). There are also 3 privately owned ponds identified – one southeast of Cemetery Rd and Toronto St and two others at the Northeast corner of Toronto St. and Elgin Park Dr.

Stantec was retained by the Township to conduct a SWMF Assessment and Maintenance Study to facilitate the on-going management of these existing SWMFs, and promote effective management techniques. Please refer to the *Township of Uxbridge Stormwater Management Facility Assessment 2012*, prepared by Stantec Consulting, 2012.

This report presents a summary of findings collected.

7.1.1 Objective

This section outlines the objectives required for the SWMF Assessment and Maintenance Study:

- Obtain field and existing document information of all the Township owned facilities;
- Perform a detailed field assessment and evaluate all of the SWMFs and their components;
- Estimate available permanent pool volumes in assumed wet ponds;
- Assess the operation and maintenance requirements to keep the facilities in proper operating condition; and,
- Forecast future maintenance requirements including tasks, resources, schedules and costs.

A good maintenance plan should incorporate a detailed analysis of data and be proactive to ensure that inspections, maintenance works for repairs and restorations are facilitated appropriately. These assessments will determine resource requirements for maintenance, such as: staff requirements, equipment, labour and budget resources. Proper planning is a sustainable approach to reducing liabilities and costs.

7.2 BACKGROUND

The Township is currently responsible for the operation and maintenance of 11 SWMFs and the Township may incorporate additional SWMF's/retrofits. Refer to Section 6 Examination of Stormwater Retrofit Opportunities. Most of the ponds were designed and constructed by developers to meet the current SWMF design standards of the time. Ownership is then transferred to the Township once construction in the associated development area is complete.

7.3 FUNCTION AND MAINTENANCE OF SWMFS

Storm water management facilities have been introduced to mitigate/decrease the impacts of urban runoff from existing and new development areas. It is important that these facilities be maintained to ensure that they continuously meet the standard guidelines for quality and quantity control.

Due to severe water quality problems in Lake Simcoe, and the potential destruction of the coldwater fishery (e.g. Lake Trout [*Salvelinus namaycush*]), the entire watershed has been deemed a special policy area. As a result, all new development in the watershed since 1996 has been required to construct SWMF that meet the most stringent criteria or Enhanced Level 1 protection. This special policy designation was a result of a recommendation contained in the Lake Simcoe Environmental Management Strategy (LSEMS) "Our Waters, Our Heritage, 1995" report, which deals exclusively with efforts to reduce phosphorus inputs to Lake Simcoe.

Since 1995, all new development within the Lake Simcoe watershed has been required to provide Level 1 (equivalent to Enhanced in the 2003 MOECC Guidelines) SWM facilities for the treatment of stormwater run-off. Level 1 facilities are designed to remove approximately 80% of suspended solids (MOECC 2004) and can reduce P runoff by 60% to 90% (LSRCA 2007).

Depending on their design, SWMFs can provide:

- Flood protection;
- Water quality treatment;
- Erosion control;
- Base flow augmentation;
- Infiltration;
- Spill management;
- Aesthetics; and,
- Buffer between urbanized areas and/or natural areas

The following sections describe the basic functions, along with related maintenance activities, that can keep SWMFs operating as intended.

7.3.1 Applicable Legislation Regulations and Guidance Documents

The following section provides discussion on legislation, regulation and guidance documents which are currently applicable to the construction, operation and maintenance of SWMFs from the federal, provincial, municipal level.

Ontario Environmental Assessment Act

SWMFs are generally subject to following the Schedule A (see **Figure OP-A**)Class EA process for maintenance, which is an undertaking usually limited in scale and anticipated to have a negligible environmental effect. These projects usually include the majority of municipal maintenance and operational activities.

Ontario Water Resources Act

As per the MOECC Environmental Compliance Approvals (ECA) (formerly known as a Certificate of Approval (C of A)) issued under Section 53 of the *Ontario Water Resources Act*, owners of SWMFs are responsible for maintaining them in proper working condition (i.e. as per the original design specifications and includes all components in the original design such as inlet and outlet structures, side slopes, sediment forebay, shading measures, erosion protection lining, manhole covers and the approved volumes).

The ECA clearly outlines the legal requirements where the owner must:

> *"ensure that the works will be operated, maintained, funded, staffed, and equipped in a manner enabling compliance with the terms and conditions...such that the environment is protected and deterioration, loss, injury, or damage to any person or property is prevented"*

For sediment removal:

> *"regular removal of sediment from the approved SWM works is required to mitigate the impacts of sediment on the downstream receiving watercourse. It is also required to ensure that adequate storage is maintained in the SWMFs at all times, as required by the design"*

Land Developers typically construct, own, and maintain SWMFs as part of the development block until the municipality assumes ownership during the Assumption Process.

Conservation Authorities Act

The Lake Simcoe Region Conservation Authority (LSRCA) is authorized through O.Reg. 179/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. Regulated areas are mapped by the LSRCA who regulates and may prohibit work from taking place within valley and stream corridors, wetlands, hazardous lands and associated areas of interference, which may include maintenance related activities; therefore, the proponent of any SWM maintenance activities shall contact the LSRCA to determine if a permit is required. Permission to develop may be granted by the LSRCA and an application for permission would be required to follow. Further details on O.Reg. 179/06 can be found at: http://www.e-laws.gov.on.ca/navigation?file=home

Endangered Species Act

The Endangered Species Act (ESA) could apply in situations where the discharge from SWMFs would pose a threat to species protected under the ESA (endangered or threatened species), or their habitat. Based on a review of DFO records, NHIC information and the Pefferlaw River Subwatershed Study, there are currently no known records of protected aquatic species in the *STUDY AREA* [DLC1]. Even if unknown SAR were present in the watershed the requirement for water quality treatment to the Enhanced level reduces the risk of impact on SAR or SAR habitat. SAR lists are constantly updated and the MNRF should be consulted if potential harm to protected species or habitats is identified in future planning, construction or operations for SWM facilities.

Environmental Protection Act

To ensure that SWMFs are performing efficiently at their design levels, they will require periodic maintenance to restore the permanent pool volume. The sediment quality, management and disposal of dredged material should conform to MOECC requirements and regulations under the Environmental Protection Act:

- MOECC. Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario. December 1996;
- MOECC's Management of Excess Soil – A Guide for Best Management Practices, issued in January 2014;
- O.Reg. 153/04 as amended by O.Reg. 511/09 – Records of Site Condition; and,
- O.Reg. 347/90 as amended by O.Reg. 558/00 – General Waste Management.

Agencies Consultation and Approvals

Permit and approval requirements for the SWM ponds depend on site specific conditions (potential environmental impacts). Several types of legislation and regulations are applicable and potential ones are summarized in **Table 21** below based on the type of agency and applicable approvals.

Table 21 Agencies and Applicable Approvals

Agency	Applicable Approvals
Department of Fisheries and Oceans	Potential threats to fish habitats, such as: Wetlands, lakes, and on-line ponds would need to be reviewed for federal requirements. If a Harmful, Alteration, Disruption and Destruction (HADD) of fish habitat or a release of substances

Table 21 Agencies and Applicable Approvals

Agency	Applicable Approvals
	deleterious to fish habitat is anticipated, the DFO should be consulted. The DFO can also determine whether approval under the Canadian *Environmental Assessment Act* (CEAA) is required for the project.
Ministry of Environment	Removal of sediment in SWMF is a regular maintenance activity and generally requires a Schedule 'A' Environmental Assessment, which is an undertaking usually limited in scale and anticipated to have a negligible environmental effect (refer to Durham Region *Municipal Class Environmental Assessment Process and Master Planning Process*.) If environmental impacts are anticipated or other requirements; they should be reviewed on a site specific basis. Sediment sampling procedures for quality analysis; the management and disposal of impacted dredged material should comply with the following MOECC requirements: *MOECC. Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario. December 1996.* *O.Reg. 153/04 as amended by O.Reg. 333/13 - Records of Site Condition* *O.Reg. 347/90 as amended by O.Reg. 558/00 – General Waste Management*
Ministry of Natural Resources	In most cases, MNR involvement is not anticipated for the management of sediments in SWMFs, unless changes to flows in rivers, creeks or discharges from SWMFs are expected. If it is suspected that endangered species are within the project area, the MNR should be consulted to determine if specific measures are required.
Lake Simcoe Region Conservation Authority	Some SWMFs fall within regulated areas which are mapped by the CAs who regulate and may prohibit work from taking place within valley and stream corridors, wetlands and associated areas of interference. Refer to regulation 179/06.
Durham Region	Approval for construction access may be required on Regional property Tree Removal/Protection By-Law may need to be reviewed as part of the development of the sediment removal.

7.4 RESULTS

In 2012, Stantec inspected 22 SWM ponds that are currently owned (or soon to be owned) by the Township. All SWMFs are end-of-pipe. Stantec recommended the Township strongly consider implementing an annual maintenance program targeting 2 SWM ponds per year. A 'rotational' program would cover all the ponds approximately every 11.5 years, which is within the typical cleanout range of 10-15 years. There are two larger ponds that may fully utilize the allocated annual budget; therefore there would be two years where the budget only accommodates one pond cleanout. Given that, the rotation period would be closer to 15 years.

Since most of the ponds are of small/medium size, based on Stantec's historical information of pond cleanout cost tracking, an average cleanout and maintenance cost obligation of approximately $150 000 - $200 000 per pond. That cost includes mobilization/demobilization, pumping, erosion & sediment controls, planting/restoration and sediment removal/disposal. That estimate would vary with actual conditions (pond location, volume of sediment to remove, etc.) Typical values are $70/m^3$ - $90/m^3$, including onsite works to support the removal. If the soil is contaminated, the costs can be substantially greater, due to hauling to MOECC approved disposal sites.

It was recommended that detailed pond surveys be completed to determine cleanout volumes. Additionally, Stantec recommends that the Township include a $25 000 budget allocation for each SWMF to include sediment surveys (pre- and post- cleanout), sediment quality testing, LSRCA permit coordination (as required), tender document preparation, bid review, contract administration, and final engineering certification.

Based on the recommended maintenance program proposed above, the Township would need to consider reserving $350 000 – $450 000 per year for pond maintenance needs, placing the Township on a scheduled maintenance track to keep up with the appropriate maintenance obligations for its current pond inventory.

7.4.1 Inventory

For a full inventory of the Township's SWM Ponds, please refer to the *Township of Uxbridge Stormwater Management Facility Assessment 2012*, prepared by Stantec Consulting, 2012.

7.4.2 Inspections

7.4.2.1 Frequency of Inspection

Typical facilities will require careful monitoring, particularly in the initial years of operation. Inspections are an important part of this monitoring program. Regular visual inspections should be conducted:

- After every significant rainfall (>10 mm) for the first two years of operation;
- Minimum of 4 visits per year after the first two years (winter, spring, summer and fall); and,
- Long term monitoring should be completed every 10 years or as needed.

7.4.2.2 Checklist

A sample inspection checklist is presented in **Appendix N**. This checklist can be completed for each site visit and a record of the completed checklists may be kept by the Owner to provide an ongoing record of maintenance activities.

7.4.2.3 Inspection of SWM Facility Features

All inlet and outlet headwalls should be checked for blockages, such as debris or buildup of ice and snow. Any damage to the headwalls or associated components, (i.e. grates, erosion protection) should be noted and/or repaired as appropriate. As well, any sediment accumulation or erosion issues in the sediment forebay or outlet headwall should be documented and addressed as appropriate. Refer to **Section 4.0** for maintenance procedures.

The inlet overland flow routes and the emergency overflow weir should be inspected for blockage such as debris, or buildup of snow and ice. Any erosion or damage to the bottom treatment should also be recorded and/or repaired as appropriate.

As a minimum, the gate valves should be exercised annually by briefly opening and closing the valves. The valves should be visually inspected for any evidence of corrosion and lubricated, if required, as per the manufacturer's recommendation.

Aquatic, shoreline and upland vegetation should be inspected to ensure no re-seeding or replanting is required.

As well, any evidence of fish presence, waterfowl activity or other wildlife habitat should be recorded.

7.5 SEDIMENT REMOVAL PROCESS

7.5.1 Background Review

Although SWMFs are designed for similar purposes, site specific constraints make each pond unique. As such, it is important to obtain and review background data for each pond, including design drawings, reports, and bathymetric surveys.

Field Investigations

As noted previously, Stantec completed a field review of the ponds in 2012 and that report should be referred to in conjunction with updated surveys.

Public Consultation / Liaison

In order to effectively implement sediment removal of SWM facilities the local community will need to be notified of the work to be carried out. The following information are key aspects that should be provided to the affected property owners:

- When and where the construction activities would be taking place;
- Any required easement and construction access through private property;
- The method of sediment removal and dewatering;
- Odour, dust and noise generation during operations; and,
- The duration of dewatering and sediment removal;

7.5.2 Design and Tender

Several key issues must be addressed to successfully manage the challenges of the maintenance and sediment removal from SWMFs.

Pond cleanout operations require:

i. an essential understanding of regulatory compliance with the various agency review/approval processes as it relates to sediment removal from SWM facilities and working in/around environmentally sensitive areas;
ii. sediment sampling in advance of tender so as to understand the types of materials and the appropriate means for disposal and potential costs;
iii. identifying all remedial work required in each pond to ensure its healthy function over the long term;
iv. developing a suitable restoration plan to ensure that any vegetation impacted by the cleanout operations will be restored to the satisfaction of the Township, TRCA, and general public; and,
v. ensuring effective communication with City staff, regulatory agencies, residents, and other stakeholders.

Pond cleanouts will also involve dealing with important aspects such as, access restrictions, tree protection, bank stabilization, construction adjacent to private property, and minimizing noise, air, traffic and other environmental disruptions and inconvenience to residents. Township staff will need to be kept aware of the project and it is imperative that the work be monitored continuously to ensure no complaints arise due to public inconveniences. The proposed SWM facility maintenance plans and construction documents must be practical and efficient, and identify and account for constraints that add risk to the project that may impact sediment removal methodology and pricing.

A detailed condition survey for all ponds will need to be captured and all available data, drawings, photographs, etc. will have to be analyzed to confirm the extent of the anticipated sediment cleanout operations. Sediment surveys, sediment volumetric analysis, design, erosion and sediment control planning, and preparing complete contract tender documents that are all encompassing to facilitate contract administration and inspection services, all are paramount to a successful project.

Although consultants are able to investigate methodology for sediment removal (and there are various methods such as excavate/mix with dry material and haul, excavate, store and mix with "drying agents", vacuum or suction and removal), we believe that the "open market" will often be the best at deciding on the best methodology which will be based on any one contractor's past experience, ability and equipment, environmental considerations for each pond, minimizing neighbourhood inconvenience, approvability, and price.

Based on previous work completed by Stantec on similar projects, we believe that having a consultant work with the Township as they prepare a Bidder Prequalification Tender (public process) from which the available methods/technologies are brought to the Township by prospective bidders. The Township could pre-select bidders for each pond. In this manner, the best methodology for each specific pond can be identified, as each pond will have different opportunities and constraints.

Based on the success of this approach with other municipalities, we highly recommend this process to be followed on this project. This work will require detailed sequencing by the contractor with advance notifications to affected residents or Township Park/Works Department Staff.

7.5.2.1 Deliverables

Drawings should be prepared to illustrate the recommended plan and provided to the Township with details of the proposed maintenance/cleanout strategies for review, discussion and a decision on the preferred scheme. This will be discussed at meetings with the Township staff, as appropriate. Engineering drawings and site restoration drawings should be prepared to illustrate the following information:

- 1:1000 General Location plan;
- 1:500 Base plans with;
  - Depiction of additional remedial works, as determined in the field, with appropriate details;
  - Construction access route(s) and identification of tree protection, removal and restoration plans as necessary; and,
  - Erosion and sediment control measures with details to describe temporary flow diversion methods and related monitoring requirements.
- Typical Sections and Details depicting sediment depths and areas, existing and proposed cross-section profile(s), as appropriate;
- General Notes related to construction sequences, practices, and general site considerations.

In conjunction with the confirmation of the proposed sediment removal strategy, erosion and sediment control plans, and restoration designs with the Township, coordination with approval agencies to obtain the required permits to support the proposed maintenance activities and remedial works is also required. A supporting report should be provided for the purpose of agency approvals. The report may include additional background memorandums from various disciplines (e.g. terrestrial, soil quality, survey, etc.), as appropriate. Tender documents should also be provided to the Township as part of the Consultant's deliverable.

There are five key considerations to ensure a successful project, as further outlined below:

(i) **Understanding of Regulatory Compliance:** Sediment removal plans should reflect an understanding of regulations that are relevant to the proposed works. If a SWMF is within an area regulated by the LSRCA, then an approval under Ontario Regulation 179/06 may be required. If the sediment cleanout operations occur during bird nesting periods (April 1st through July 31st), then nest surveys would be recommended prior to starting cleanout operations. If fish are confirmed to exist within a SWM pond, then a Fish Rescue plan and associated permit request may be required from the MNFR. Refer to **Table 21**.

(ii) **Sediment Quality Testing:** In situ sediment sampling in advance of the tender so as to understand the types of materials and the appropriate means for disposal and associated costs is strongly encouraged. Completing these tests upfront will minimize the financial uncertainty and ensure that the Township, the Consultant, and prospective bidders are well aware of the appropriate sediment disposal means and the respective costs. The quality and quantity of the accumulated sediments will likely be the majority of the costs associated with these SWM ponds cleanout works. As such, it is very important to quantitatively understand both aspects so that bids may be received from 'well informed' contractors.

(iii) **Remediation Planning:** Identifying all remedial work required in each pond to ensure its healthy function over the long term is a key consideration. Since the Township will be undertaking the sediment removal efforts and mobilizing contractors to each SWM facility location, this provides a timely opportunity to undertake any infrastructure repairs/improvements and/or to address any other observed deficiencies at the same time.

(iv) **Restoration Plan:** Developing a suitable restoration plan to ensure that any vegetation impacted by the cleanout operations will be restored to the satisfaction of the Township and LSRCA. In addition, restoration may also include improvement/replacement to existing deteriorated maintenance access roads, sediment drying areas, or other SWM pond appurtenances.

(v) **Communication**: The key to any successful project is to ensure effective communication with Township staff, regulatory agencies, residents, contractors, and stakeholders. We recommend initiating dialogue with all parties early in the process to ensure all requirements, methods, and schedules, are well documented shortly after the project onset.

7.6 MAINTENANCE

The following items are generic approaches to SWMF maintenance, and should be tailored specifically to each pond as site conditions dictate.

7.6.1.1 Grass Cutting

In order to maintain a "natural" environment and increased water quality benefits grass cutting will not be required for this pond. Upland Seed Mix will be planted around the perimeter of the pond eliminating the need for grass cutting. Should the Owner wish to cut any grass that may appear around the facility, the following practices should be considered:

- minimize frequency of cutting;
- do not cut grass up to edge of pond which maintains shading and nutrient uptake; and,
- do not blow grass clippings into pond (to minimize organic loading in pond).

7.6.1.2 Weed Control

Weed control is not an anticipated or recommended practice for this facility. Should the Owner wish to control weeds around the pond, the following items should be considered:

- Prohibit the use of herbicides and insecticides due to potential water quality concerns; and,
- Limit the use of fertilizer with weed control (because of the potential nutrient loading on downstream systems).

7.6.1.3 Plantings

Any replacement plantings required due to disturbance or die-out (upland, shoreline fringe, aquatic), are to be in accordance with the approved Landscape Planner as otherwise deemed appropriate by the Township or the Ministry of Environment. Native species should be utilized where possible for all plantings.

7.6.1.4 Litter/Debris Removal

Accumulated litter and debris within the facility can be removed by hand during regular inspection visits.

7.6.1.5 Extended Detention Outlet

The extended detention outlet device should be inspected on a regular basis (at the same time as the pond inspections).

7.6.2 Oil-Grit Separators

Oil-Grit Separators (OGS) shall be inspected and maintained in accordance with the specific manufacturer's recommendations. Typically, inspections should be completed once per year at a minimum.

7.7 COSTS

As noted above, information of pond cleanout cost tracking, an average cleanout and maintenance cost obligation of approximately $150 000 - $200 000 per pond. That cost includes mobilization/demobilization, pumping, erosion & sediment controls, planting/restoration and sediment removal/disposal. That estimate would vary with actual conditions (pond location, volume of sediment to remove, etc.) Typical values are $70/m^3 - $90/m^3, including onsite works to support the removal. If the soil is contaminated, the costs can be substantially greater, due to hauling to MOECC approved disposal sites.

It was recommended that detailed pond surveys be completed to determine cleanout volumes. Additionally, Stantec recommended that the Township include a $25 000 budget allocation for each SWMF to include sediment surveys (pre- and post- cleanout), sediment quality testing, LSRCA permit coordination (as required), tender document preparation, bid review, contract administration, and final engineering certification.

Based on the recommended maintenance program proposed above, the Township would need to consider reserving $350 000 – $450 000 per year for pond maintenance needs, placing the Township on a scheduled maintenance track to keep up with its current pond inventory.

The maintenance costs represent the costs to ensure the proper operation, longevity and aesthetic functioning of the pond.

Table 22 is a form of table utilized to assess pond maintenance costs, which should be updated for each specific pond based on site specific conditions.

Table 22 Typical Estimated Annual Maintenance Cost Template

Type of Maintenance	Maintenance Interval (years)	Size	Unit	Price 1 ($/unit)	Total Cost (per year)
Inspection (Inlet/Outlet, etc.)	0.25		each	$ 100	

Table 22 Typical Estimated Annual Maintenance Cost Template

Type of Maintenance	Maintenance Interval (years)	Size	Unit	Price 1 ($/unit)	Total Cost (per year)
Bi-annual Operation of Maintenance By-pass	0.5		each	$ 100	
Grass Cutting	0.5		ha	$ 250	
Weed Control	1		ha	$ 2,500	
Litter Removal	1		ha	$ 2,000	
Pervious Pipe Cleanout (Flushing) of Outlet Pipe			m	$ 1	
Vegetation Maintenance (Aquatic/Shoreline Fringe)			ha	$ 3,500	
Vegetation Maintenance (Upland Flood Fringe)			ha	$ 1,000	
Total (in 2003 Prices) (1)					
Total (Adjusted to 2013 Prices) (2)					

1. Prices taken from Table 7.5 MOECC, SWM Planning and Design Manual, March, 2003
2. Cost adjusted for inflation to 2013 dollars (Bank of Canada).

A template for estimated pond cleanout costs are shown in **Table 23** below.

Table 23 Typical Estimated Cleanout Cost Template

Type of Maintenance	Size	Unit	Total Cost (per cleanout)
Dewatering (Using September Cleanout Window) and Pumping Storm Flows Around Pond		lump	
Installation and Removal Of Sediment Fence		lump	
Sediment Removal and Disposal (Offsite Landfill Assuming Acceptable Sediment Conditions)		m^3	
Sediment Characteristic Testing (Refer to Section 4.5.4)		each	
Toxicity Characteristic Leachate Procedure (Refer to Section 4.5.4)		each	
Pipe Cleanout (Flushing) of the 3 -		m	

Table 23 Typical Estimated Cleanout Cost Template

900mm Diameter Connecting Pipes			
Landscape Restoration (Aquatic/Shoreline Fringe)		ha	
Landscape Restoration (Upland Flood Fringe)		ha	

7.7.1 Sediment Removal

In order to maintain the removal efficiency of the extended detention portion of the facility, the accumulated sediment will need to be removed periodically.

7.7.1.1 Frequency

The accumulated sediment should be cleaned out of the facility when the sediment removal efficiency is reduced by 5% or when 50% of forebay volume is filled with sediment; the result is reported in cleanout every x years, typically every 10-20 years. The recommended month for cleanout is September wherever possible, to avoid the breeding season of birds. Further information with regards to cleanout timing and the breeding season of birds can be found here: http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=8D910CAC-1.

7.7.1.2 Sediment Disposal

To adequately characterize the sediment for proper disposal, the appropriate number of soil samples needs to be determined. This determination is based on the sampling frequency prescribed in the amended Ontario Regulation 153/04 of the Environmental Protection Act (EPA) that states in *SOIL EXCAVATED AT OR BROUGHT TO THE PHASE II PROPERTY*, Section 34 (2) "at least one soil sample shall be analyzed for each 160 cubic metres of soil for the first 5,000 cubic metres to be assessed at each source from which soil is being brought to the phase two property, following which at least one sample for each additional 300 cubic metres of soil which is to remain on, in or under the phase two property shall be analyzed."

Sediment sampling procedures should generally conform to the requirements of the amended O.Reg.153/04 and the Ontario Ministry of Environment (MOECC) *Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario* (December 1996).

Sediment sampling locations should include, as a minimum, the inlet and outflow areas of the SWM pond. The sediment should be analyzed for a variety of contaminants-of-concern including the parameters listed below:

- Sediment Characteristic samples, a minimum of (xx), as stated earlier, should be analyzed for volatile organic compounds (VOCs), petroleum hydrocarbons in the F1-F4 fractions, selected metals, electrical conductivity, sodium adsorption ratio, and polycyclic aromatic hydrocarbons; and,

- One (1) representative sediment sample, should also be analyzed using the toxicity characteristic leachate procedure (TCLP) for inorganics, VOCs, semi-VOCs, and ignitibility to ensure that any contaminated sediment would be classified as a non-hazardous waste suitable for offsite disposal at an MOECC approved facility, if required.

Tenders should be requested from several reputable waste management companies that operate landfill sites or treatment facilities approved by the MOECC to accept non-hazardous waste in Ontario. If the contract administrator, primary contractor, or excavation subcontractor is responsible for the selection of a waste disposal company, the Township should approve that company prior to finalization of the contract documents. The Town's involvement will ensure that contaminated soils are handled and disposed of in accordance with the requirements of O.Reg.558/00.

The contractor should provide the name, address, and acceptance criteria for a soil disposal site that will receive any non-contaminated surplus soils. The City should require written acceptance from the receiver site stating they will accept the soils based on the chemical analysis provided. Again, the receiver site should be specified in the contract documents. An industrial/commercial fill receiver site is preferred over a residential fill receiver site.

If the sediment does not meet the most stringent O.Reg.153/04 Table 1 Site Condition Standards (SCS), then the sediment may stay on-site if it meets the applicable SCS for the property or it should be disposed of at an MOECC approved facility.

8.0 DEVELOPMENT OF LONG LIST OF ALTERNATIVES

8.1 GENERAL

Several alternative solutions were generated for SWM measures for the existing and future land uses within the Township that consist mainly of urban areas. The approach for developing and evaluating alternatives is consistent with the requirements of the planning and design process for Master Planning projects described in the Municipal Class EA (Municipal Engineers Association, June, 2000; amended 2007, 2011). It involves reviewing Phase 1 work (i.e. Identification of the Problem) and undertaking Phase 2 (i.e. Establishing Existing Conditions, Identification of Long List of Alternatives, Development and Assessment of Alternative Management Strategies and Selection of a Preferred Strategy). In addition, consultation with stakeholders is a necessary step in this process.

8.2 OVERVIEW OF ALTERNATIVES

The MOECC divides SWM measures into three broad categories:

1. Source/lot level controls;
2. Conveyance controls; and
3. End of pipe controls.

The preferred SWM strategy is to provide an integrated treatment train approach to water management based on providing control at the lot level and in conveyance (to the extent feasible) followed by end-of-pipe controls. This combination of controls is typically the only means of meeting the multiple criteria for water balance, water quality, erosion control, and water quantity.

The reasoning behind that approach is to maximize the benefits from the combination of those elements, including:

- more effective SWM;
- reduction in land area required to implement end-of-pipe solutions;
- enhanced opportunities to integrate SWMPs effectively as amenities;
- decreased total cost when land value is factored in; and,
- increased level of public awareness and involvement in the implementation and management of SWM initiatives.

8.2.1 Source Controls

In 2010, Credit Valley Conservation (CVC) and Toronto Region Conservation Authority (TRCA) prepared the *Low Impact Development Stormwater Management Planning and Design Guide* as "a tool to help developers, consultants, municipalities and landowners understand and implement sustainable stormwater planning and practices in the CVC and TRCA watersheds. The use of sustainable stormwater planning and practices will help ensure the continued health of the streams, rivers, lakes, fisheries and terrestrial habitats in our watersheds."

"The guide is intended to provide engineers, ecologists and planners with up-to-date information and direction on landscape-based SWM planning and low impact development SWM practices such as rainwater harvesting, green roofs, bioretention, permeable pavement, soakaways and swales. The information contained in the guide will help practitioners adopt landscape-based SWM approaches, and will help select, design, construct and monitor more sustainable SWM practices."

Although developed for use in the CVC and TRCA watersheds, the underlying principles have been adopted for use by engineers for applying LID in other jurisdictions. As noted in the LSRCA *Technical Guidelines for Stormwater Management Submissions* prepared April 26,2013, SWM submissions to LSRCA should show that effort has been made to follow the LID approach by incorporating lot level and conveyance controls as recommended in the MOECC's "Stormwater Management Planning and Design Manual" (2003) or most current version.

The LID Manual notes that "Effective stormwater management strategies employ a treatment train approach that combines a suite of lot level, conveyance and end-of-pipe controls to treat runoff efficiently and effectively. At the present time, reliance on larger end-of-pipe detention pond facilities as the primary component of a stormwater management strategy is the norm. This compromises opportunities to implement low impact development practices that enhance the performance of stormwater management systems and provide ecological sustainability benefits."

For new development areas, potential opportunities to integrate SWMPs at the site level stage in the planning process include:

- harvesting of rainwater from rooftops for non-potable uses (e.g., irrigation, toilet flushing) using rain barrels or cisterns;
- installation of green roofs;
- drainage of runoff from rooftops to pervious or depression storage areas;
- integration of soakaways (e.g., infiltration trenches or chambers) below landscaped areas, parking areas, parks, sports fields, etc.;
- incorporation of bioretention areas, rain gardens, biofilters or constructed wetlands into the landscape design for the site;
- use of permeable pavement in low and medium traffic areas;
- incorporation of bioretention areas, vegetated filter strips, and swales to intercept and treat parking lot and road runoff;
- incorporation of woodland restoration in upstream areas to reduce runoff rates;

- integration of detention ponds and wetlands as large aesthetic and recreational features within the landscape.

For infill and redevelopment sites, application of LID SWM measures needs to consider context and the limits of both landscape and built form. SWM opportunities that should be explored for infill and retrofit developments include:

- rooftop storage;
- green roofs;
- rainwater harvesting;
- bioretention areas;
- biofilters;
- grassed swales;
- permeable pavement;
- rain gardens;
- stormwater planters and fountains;
- depression storage;
- soakaways;
- constructed wetlands; and,
- enhanced urban tree canopy.

Source controls are applied at the individual lot level, typically serving small drainage areas (approximately 2 hectares). Typically, they take the form of either storage or infiltration controls.

Storage controls are for the temporary detention of stormwater to attenuate peak flows to a desired level. They could include such mechanisms as:

- Roof storage – control flow roof drains and temporary detention storage on flat roofs;
- Parking lot storage – detention storage on top of parking lots, using an underground orifice control;
- Rear lot storage – using catchbasin restrictors to create temporary ponding in rear yards; and,
- Underground storage – consisting of either upsized pipes (used for detention instead of merely conveyance of flows) or specialized tank structures (like modified box culverts, or plastic storage units) in combination with an orifice control.

Infiltration controls are typically designed to provide for water balance opportunity; that is, offsetting the increase in impervious cover associated with urban development by providing a mechanism to infiltrate water back into the soil. Typical mechanisms include:

- reduced grading to allow greater ponding of stormwater and natural infiltration;
- directing roof leaders to rear yard ponding areas, soakaway pits, or to cisterns or rain barrels;
- sump pumping foundation drains to rear yard ponding areas;

- infiltration trenches;
- grassed swales;
- vegetated filter strips; and,
- stream and valley corridor buffer strips.

The primary function of infiltration controls is to mitigate the impacts that urbanization normally has on the water balance (i.e., increased surface runoff, reduced soil moisture replenishment and groundwater recharge). Concentrated infiltration of stormwater collected from larger areas (e.g., infiltration basins, an end-of-pipe infiltration type control) will not match the characteristics of distributed infiltration which occurred under pre-development conditions. The natural hydrologic cycle can be maintained to the greatest extent possible by lot level infiltration controls.

Infiltration technologies can achieve water quality enhancement; however, stormwater containing high concentrations of suspended solids will tend to clog these controls. Further, infiltration of contaminated water can impair groundwater quality. Therefore, these measures are ideally suited to the infiltration of relatively clear stormwater, such as stormwater from rooftops which contains only atmospheric contaminants (i.e., contaminants deposited on the rooftop by precipitation or dryfall) or foundation drainage.

Residential Rain Garden

The successful design and application of lot level controls begins with the design of the subdivision and requires private owners to maintain such systems.

8.2.2 Conveyance Controls

Conveyance controls are mechanisms like pervious pipes, grassed swales, or vegetated filter strips designed to provide for water balance (infiltration) or water quality benefits to tradition conveyance measures. Above ground features like swales an strips are relatively easy to inspect and maintain, while pervious pipes require a greater investment of time and money, and may become clogged, resulting in reduced function.

Grassed Drainage Swale w/ Rock Check Dams

Lot level and conveyance controls are often lumped together as lot level/conveyance controls.

Due to the presence of lot level controls on private lands, landowner education is key to ensuring that systems remain effective over time. The successful application of lot level landscape solutions therefore requires the commitment of the municipality and the establishment of creative partnerships between the developer, municipality and landowner to realize consistent benefits over the long term.

8.2.3 End of Pipe Measures

Historically, end-of-pipe measures have been the predominant means of providing for water quality, water quantity, and erosion control. They typically take the form of SWM facilities which receive stormwater runoff from large areas via conveyance measures like sewers or ditches and discharge treated water to watercourses. Typical end of pipe measures include:

- wet ponds;
- wetlands;
- dry ponds; and,
- infiltration basins.

Quaker SWM Pond (Pond 9)

With the exception of infiltration basins, they may consist of any of the following components, alone or in combination:

- Permanent pool – a volume of stormwater that does not drain, designed to provide for settling and dilution of settlement (Quality Control);

- Extended detention – temporary (24-72 hour) storage of relatively small, frequent stormwater runoff volumes to reduce erosion in the receiving system (Erosion Control); and,
- Active storage – stormwater detention for larger, less frequent events to attenuate peak flows (Quantity Control).

Infiltration basins are designed without a traditions outlet, instead capturing, storing, and infiltrating stormwater into the ground, which replenishes the groundwater table, increases baseflow, decreases erosion, and eliminate peak flows (up to design storage volumes events).

8.2.4 Restoration Measures

These would consist of direct restoration/enhancement of existing habitats in the Township; as opposed to improvements to SWMFs. Examples include stream restoration, aquatic/terrestrial habitat enhancement.

9.0 DEVELOPMENT AND ASSESSMENT OF ALTERNATIVE SOLUTIONS

9.1 IDENTIFICATION/DESCRIPTION OF ALTERNATIVE SOLUTIONS

Alternative solutions can broadly be divided into upgrades to existing facilities and/or addition of new facilities. Traditional SWM measures have typically consisted of variations on end-of-pipe solutions (Section 8.2.3), but for the past several years, source and conveyance measures (often referred to as Best Management Practices, or BMPs; or Low Impact Development (LID)) have become increasingly supported.

LID as described by the United States Environmental Protection Agency (U.S. EPA, 2007) is:

> *a SWM strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to its source as possible. LID comprises a set of site design strategies that minimize runoff and distributed, small scale structural practices that mimic natural or predevelopment hydrology through the processes of infiltration, evapotranspiration, harvesting, filtration and detention of stormwater. These practices can effectively remove nutrients, pathogens and metals from runoff, and they reduce the volume and intensity of stormwater flows.*

9.2 GENERAL

Alternative SWM strategies were developed which, alone or in combination, can provide for an effective method of meeting the environmental requirements of the Township.

The SWM Strategy represents the set of BMPS which, when implemented alone or in combination, mitigate to the degree possible the impact of future land use changes (Future Settlement Areas) on watershed health.

The Strategy was developed by the synthesis of the inter-disciplinary inputs to the project, including computer modeling, terrestrial and aquatic habitat assessments, water balance and hydrogeology, social, cultural, and economic considerations. The approach in developing and evaluating the alternative was generally consistent with the Class EA planning/design process for Master Planning project.

9.3 DEVELOPMENT OF ALTERNATIVE SWM STRATEGIES

Various methods or strategies were identified (as listed in **Section 8.0**), consisting of lot level, conveyance, and end of pipe solutions.

The SWM strategies are divided broadly into the following alternatives:

1. Do Nothing;
2. Traditional SWM Strategy;
3. Traditional SWM with BMP Implementation Strategy; and,
4. Traditional SWM with Urban Retrofits Strategy.

9.3.1 Do Nothing

With the "Do Nothing" approach, existing SWMFs are left "as is" and Future Settlement Areas are developed without SWM measures. That strategy would result in water balance deficit, reduced baseflows, increased erosion; increased peak flows, and increased P loading.

For example, the peak flow for the 5-year and 100-year events for the existing conditions and future "Do Nothing" approach are summarized below in **Table 24** at the catchment and node level. Refer to **Figure 11** for catchment and node locations. Detailed model output for the 2 to 100-year storm events are provided in **Appendix F**.

Table 24 Existing/Proposed "Do Nothing" Peak Flow Comparison

VO2 ID/ Catchment	Peak Flow (m^3/s)			
	5-year		100-year	
	Existing Conditions	"Do Nothing"	Existing Conditions	"Do Nothing"
5064 / Catchment 1045	2.70	4.49	6.65	11.48
5061 / Catchment 1059	7.11	11.15	15.96	23.98
5005	11.11	11.88	33.09	33.77

As shown above, there is a significant increase in flows in the immediate vicinity of the future development; however, there is less of an impact further downstream.

9.3.2 Traditional SWM Strategy

SWM ponds should be implemented in proposed development or redevelopment areas. The ponds would follow MOECC guidelines for quantity, quality and erosion control. Conventional storm sewer systems would service proposed developments and where appropriate source control measures would be implemented. This strategy is more effective than the do nothing approach; it reduces high flow rates and erosion potential and phosphorus debris, therefore reducing damage to the environment and property. It does not address water balance deficits, increasing baseflows, nor reducing runoff volumes.

ROUTE RESERVOIR commands were inserted into the VO2 model, future conditions with SWM controls, and were sized to control post development flows to pre development levels. **Table 25** below summarizes the peak flows for the 5-year and 100-year storm events for the existing conditions and future condition with SWM ponds at a catchment and nodal level. Detailed model output for the 2 to 100-year storm events are provided in **Appendix F**.

Table 25 Existing/Proposed "Traditional SWM" Peak Flow Comparison

VO2 ID / Catchment	Peak Flow (m^3/s)			
	5-year		100-year	
	Existing Conditions	Future Conditions With SWM Ponds	Existing Conditions	Future Conditions With SWM Ponds
5064 / Catchment 1045	2.70	2.70	6.65	6.67
5061 / Catchment 1059	7.11	7.10	15.96	16.19
5005	11.11	11.09	33.09	33.60

As shown above, post to pre control has been generally achieved at the catchment level. As increase at the downstream node during a 100-year storm is only 1.5 %, post to pre controls do not need to be achieved at the node level.

SWMFs are land intensive and typically require separation from the groundwater table.

As noted in **Section 5.0**, if SWMFs are designed and constructed only to existing IDF data they would function less effectively at reducing peak flows to targets for all return periods.

9.3.3 Traditional SWM with BMP Implementation Strategy

This approach consists of SWM ponds in conjunction with BMPs/LIDs for Future Settlement Areas. This combination can reduce water balance deficit, decrease volumetric runoff, increase baseflow, reduce erosion, reduce peak flows, and reduce P loading.

9.3.4 Traditional SWM with Urban Retrofits Strategy

This approach consists of SWM ponds in conjunction with BMPs/LIDs for Future Settlement Areas; as well as retrofitting of existing SWMFs, or application of BMPs in areas with SWMFs. This combination can reduce water balance deficit, decrease volumetric runoff, increase baseflow, reduce erosion, reduce peak flows, and reduce TP loading.

9.4 DEVELOPMENT OF EVALUATION CATEGORIES AND CRITERIA

Evaluation categories and criteria were developed for the project, based on the requirements outlined in **Table 26** and are summarized in the table below:

Table 26 Evaluation Categories and Criteria

Category	Criteria
Technical	• Peak flow reduction. • Reduce erosion/increase baseflow. • Improve water quality. • Reduce TP loading. • Water balance. • Reduce Thermal Impacts (see section 12.1.3)
Natural Heritage Features	• Provisions of direct/indirect fish habitat. • Improve terrestrial habitat. • Impacts to natural hazard features.
Social Environment	• Ability to improve public health/safety. • Impacts to private properties. • Impacts to public property.
Cultural Environment	• Impacts to built/cultural heritage landscape. • Impacts to archaeological resources.
Economic Environment	• Capital costs. • Operations and Maintenance Costs. • Risk Management.

A summary of recommendations based on multi-disciplinary input is provided below:

The southern half of the Uxbridge urban study area is dominated by the high Groundwater Vulnerability Environmentally Significant Area (ESA), while the Coppin's Corners study area is almost entirely inside the Uxbridge Infiltration Area ESA. Any proposed SWM facilities within these ESAs will require consultation with the LSRCA, under their regulation 179/06, if it affects watercourses or wetlands, and under the LSRCA MOU with the Region of Durham for Planning Act approvals, to determine potential impacts, developmental constraints, and required mitigation measures.

Development and infrastructure within a PSW are not permitted. Development within 120 m of a PSW (known as a Zone of Influence per Township of Uxbridge Official Plan 2007) requires consultation with the LSRCA's MOU as well as an Environmental Impact Study (EIS) following municipal or conservation authority guidelines to determine potential adverse impacts and mitigation measures.

LSRCA has required enhanced water quality treatment in the entire Lake Simcoe watershed areas since 1995.

Within the Township of Uxbridge itself and some sub-urban areas to the north and south the archaeological potential is considered low due to extensive and deep modern disturbances. These activities have subjected the study area to extensive and deep land alterations which would have severely damaged the integrity of any archaeological resources, thus removing archaeological potential as per Section 7.7.3 Standard 2 of the *Standards and Guidelines for Consultant Archaeologists*.

The Stage 1 archaeological assessment determined that portions of the study areas exhibit high potential for the identification and recovery of archaeological resources. As such, a Stage 2 archaeological assessment will be required for the location of any SWM facilities that are located outside of areas identified as previously disturbed.

Of the three main proposed developments (A, B, and C), the southeast proposed development in the Township of Uxbridge is the only one located within the Wellhead Protection Area (WHPA) and fully within the 25 year time of travel zone. As required by Lake Simcoe Protection Plan, the annual pre-development infiltration rates must be maintained as much as possible under post-development conditions.

The proposed developments are expected to result in an increase in runoff of approximately 290% in sub Areas A and B and 280% in sub area C and a decrease in infiltration of approximately 64% in all sub areas. The infiltration deficit, which is the difference between the pre- and post- development infiltration volumes ranges from approximately 18,317 m^3/yr in sub area B to 33,434 m^3/yr in sub area A. This estimated deficit will provide the target for infiltration across the developments through the use of Low Impact Development (LID) techniques which can include surface methods such as swales, bioswales, and running roof leaders to ground, and subsurface methods such as infiltration trenches and perforated pipes.

As noted in the Section 5.2, under the climate changes scenarios run indicate that the existing 25-year flows will essentially become the future 5-year flow. In order to maintain the function of the existing municipal infrastructure without increasing surcharging, it is recommended that the Township require the installation of inlet control devices on Township catchbasins. Inlet control devices (ICDs) are designed to restrict flow into storm sewer systems, forcing larger stormwater runoff rates to utilize overland flow routes (the road) to convey flows, and reduce the impact and frequency of storm sewer surcharging. Their installation could be used to offset the increase in the magnitude of storm events due to climate change.

In order for SWMF's to provide quantity control to existing levels under climate change, they would typically need to be increased in volume by 100 %.

10.0 PREFERRED ALTERNATIVE STRATEGY

The preferred alternative strategy is outlined below: to provide site specific recommendations on a settlement area basis where growth is expected to occur as part of the Township OP. The following sections detail the preferred alternative within each settlement area and the opportunities and constraints associated in the implementation of the strategy and information inclusive to future developments within each settlement area.

The following list summarizes the key elements for SWM criteria for future development and redevelopment within the Study Area:

- Future SWMFs will be designed to MOECC standards:
- LID Measures will be designed, to the extent practicable, as per the latest version of CVC/TRCA LID Manual;
- Stormwater Quality Control: Enhanced (80% TSS removal);
- Stormwater Quantity Control: Post-development peak flows to be reduced to pre-development levels for all storm events up to and including the 100-year storm;
- Provide a minimum 24 hour detention for runoff from a 40 mm storm event;
- Future developments will follow the standards as outlined in the Lake Simcoe Protection Plan (LSPP);
- BMPs (including LID measures) will be implemented where applicable to establish a treatment train approach (i.e. source, conveyance and end-of-pipe treatment);
- Provide for inlet control devices on catchbasins in municipal ROWs to minimize surcharging of storm sewer systems;
- Investigate updating IDF data to account for Climate Change;
- Where opportunities exist, implement enhanced vegetation for shading, bottom draw outlets, cooling trenches at SWMF locations to reduce stormwater temperature;
- Where opportunities exist, reduce phosphorus discharge, improve infiltration and reduce erosion potential within settlement areas and expansion of settlement area boundaries;
- To reduce the environmental impact from increased phosphorus loadings it is recommended to implement source/lot level controls, conveyance controls and end of pipe controls (i.e. roof storage, swales, filter strips, wet ponds, etc.).

- Future development should target retention of 13 mm events to offset the water budget deficit. Detailed calculations at the time of development would be required to develop specific targets. The retention of 13 mm events is an average amount to attain and in many locations, additional infiltration volumes can be achievable.

- Proceed with retrofit opportunities and maintenance operations of select SWM facilities as identified by the LSRCA and Section 7.0 of the SWM Master Plan.

- Carry out the culvert twinning outlined in the *Township of Uxbridge and Region of Durham – Downtown Uxbridge Flood Reduction – Schedule 'C' Municipal Class Environmental Assessment – Environmental Study Report*, prepared by Sernas Associates, November 15, 2012 (Sernas Study).

The recommendations provided are indicative of the Master Plan process and that future developments will require detailed analysis of existing site conditions and approval by the LSRCA and other approval agencies before implementing any recommendations described. The Township is not yet in a position to analyze their 10 year forecast to be able to determine which projects may be retrofit priorities; these projects will come forward as the budget is approved on an annual basis. Therefore, site specific recommendations are at the Area A/B/C level.

10.1 SITE SPECIFIC RECOMMENDATIONS

Using the existing conditions, the Township's OP, and the results of this Study, recommendations based on each settlement area have been developed. Requirements as per the Township's OP are listed in **Table 27** below:

Table 27 - Settlement Area SWM Requirements

Stormwater Management Requirements	
Criteria	**Requirement**
Water Quality	Meet Enhanced (80% TSS Removal) quality control criteria with state of the art phosphorus removal systems
Erosion Control	Provide 24 hour detention for runoff from a 40 mm storm event
Water Quantity	Provide full peak control for site runoff (post to pre) for up to and including the 1:100 year storm event
Water Balance	Maintained or enhanced relative to existing pre-devleopment conditions. The rate of infiltration shall be maintained on an area basis within each pre-development surface water catchment area, provided that it shall not drop below 80% of the pre-development situation in any of hte pre-development catchment areas.
Thermal Impact Reduction	As per **Section 12.1.3**

LSRCA is currently encouraging the use of dry ponds to be utilized in conjunction with LIDs. Dry ponds should be utilized for quantity control to reduce peak flows to be less than or equal to pre-development flows, while LID's would be used for erosion control and to have a net increase of 0 for total phosphorus loads. Although dry ponds are encouraged, the SWM targets may only be met by using wet ponds, or wet ponds in conjunction with LIDs. It should be noted that the phosphorus loadings to Lake Simcoe that were addressed in Section 4.4.4 were based upon wet ponds in conjunction with LID measurements.

Hydrogeological Assessment Submissions - Conservation Authority Guidelines to Support Development Applications, should be followed at the site-specific scale for future development applications in the Study Area.

Climate change could compromise the efficacy of existing and proposed conveyance structures if current IDF curves are not updated to reflect projected changes in precipitation intensities. It is therefore recommended that the Township investigate the update of their IDF curves for future conditions.

It is recommended that Uxbridge install and monitor a rain gage for future use. A suggested location would be at the Water Pollution Control Plant (WPCP).

Specific recommendations for each future development area are presented below:

10.1.1 Area A – Uxbridge Northwest Settlement Area

The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – SWM pond(s) for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.

As this Future Settlement Area is designated for Residential development, increasing imperviousness requires peak flow control and erosion control. The use of LID BMPs at the lot level could reduce costs over a traditional SWM wet pond, which requires draining, soil testing, hauling, etc. In addition, wet ponds can produce odours, which LID measures can reduce.

When SWM Ponds and LID measures are utilized in conjunction with one another (i.e. a treatment train approach), TP loading can be reduced further over Traditional SWM (Ponds) alone. The LID's would also be capable of providing infiltration to offset the deficit of 33,724 m^3/yr (see **Section 9.4**). The dry pond(s) has been conceptually determined to require a detention storage of 10,799 m^3 for the 100 year event (see **Section 5.2, Table 19**).

Area A sits predominantly within the Dundonald Sandy Loam soils region. Based on the MOECC Manual, these soils generally have percolation rates greater than the recommended minimum of 15 mm/hours for infiltration measures; which supports LID measures. Controls on soil areas that have low infiltration rates may not be as effective as those with higher infiltration rates. According to the Interpretation Bulletin Ontario Ministry of Environment and Climate Change

Expectation Re: Stormwater Management, prepared by the MOECC (February 2015), "if the lot level and conveyance facilities can be sized such that they empty between events, or will be installed in areas where quantity control is not a primary concern (areas draining directly to a large surface water body like Lake Ontario, for example), LID facilities can be used where the infiltration rate is less than 15 mm/hr to achieve water balance and water quality (including thermal impacts) through retention, filtration, evaporation and transpiration. Thus, the soil infiltration capacity guidance in the manual should not be interpreted as a prohibition. Rather, it should be interpreted as a caution that controls relying primarily on infiltration may not be as effective on soils with low infiltration rates as they would be on soils with higher rates of infiltration"

10.1.2 Area B – Uxbridge Southeast Settlement Area

The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – SWM pond(s) for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis. The LID's would be capable of providing infiltration to offset the deficit of of 16,349 m^3/yr (see **Section 9.4**). The dry pond(s) has been conceptually determined to require to have a detention storage of 23,855 m^3 for the 100 year event (see **Section 5.2**, **Table 18**).

It is important to note that within this settlement boundary there are areas of high aquifer vulnerability and wellhead protection areas that should be avoided when attempting to infiltrate stormwater runoff. The DROP should be consulted when determining the regulations surrounding the implementation of SWM ponds and LIDs.

10.1.3 Area C - Coppin's Corners

As noted in Section 1.0, as per the approved SWM Report, Coppin's Corners is to drain internally to the existing Wyndance Infiltration SWM Pond, which is within the jurisdiction of the TRCA. By internally draining to the Wyndance infiltration SWM pond the requirements for quantity control are met (post development flows less than or equal to pre-development flows), water quality is provided as TSS and phosphorus is trapped within the infiltration pond and the water balance requirements are met as the water is allowed to infiltrate.

10.1.4 Uxbridge Urban Area

For areas that experience redevelopment in the future, the preferred strategy is the Traditional SWM with Urban Retrofits Strategy. Pond upgrades and LID measure should be evaluated for feasibility of implementation on a site specific basis. Any retrofits that are proposed should incorporate significant thermal reductions and minimize impairments to phosphorus reduction of the system, refer to **Section 12.1.3**. Education is also very important to reduce phosphorus loadings to Lake Simcoe and can be used as a way to reduce loads from future development areas A, B and C. Refer to section 12.3 for more detail on how education plays a role in reducing phosphorus loads.

11.0 PUBLIC CONSULTATION

Public consultation will be carried out as per the Municipal Class Environmental Assessment, prepared by the Municipal Engineers Associations, October 2000, as amended in 2007 & 2011.

11.1 CONSULTATION ACTIVITIES

Initial meetings w/ LSRCA and Township were held to discuss the project scope and purpose, as well as to refine the deliverables. In addition, both agencies were contacted to develop a list of stakeholders in the area.

11.1.1 Notice of Commencement

A notice of commencement was placed in the Uxbridge Times-Journal for two consecutive weeks, starting September 12, 2013.

11.1.2 Notice of Public Information Centre

A notice of PIC was placed in the Uxbridge Times-Journal for two consecutive weeks, starting April 10, 2013.

11.1.3 Public Information Centre

To satisfy the Municipal Class EA process, an Open House was arranged (May 7, 2014). The materials at the open house described the Class EA process being followed, the problem being addressed, identification and evaluation of the alternative solutions and design concepts, the recommended alternative solution, the potential environmental effects associated with the preferred solution, and next steps.

A draft of the open house materials was provided to the Township for review and comment prior to finalization and issuance. Refer to **Appendices I** and **J**.

11.2 FIRST NATIONS CONSULTATION

The provincial government is responsible for ensuring consultation with First Nations and Métis in Ontario is completed. The trigger for consultation is whenever the Crown contemplates a decision that may have an adverse impact to their rights. A SWM master plan triggers a provincial decision (*i.e. Municipal Class EA)* and so requires consultation with potentially impacted communities.

Stantec notified potentially affected First Nations communities, and has followed up with the communities and has received no response. Correspondence with the communities can be found in **Appendix K**.

If archaeological work (stage 2 or more) is carried out, Stantec would recommend notifying:

- Huron-Wendat Nation (Conseil de la Nation huronne-wendat) www.wendake.ca

No Métis need to be notified unless the Provincial Regulator specifically addresses this issue.

11.3 CONSULTATION WITH LSRCA

A meeting was held with LSRCA on December 6, 2012. LSCRA has issued comments throughout the project and the Stantec response letters are included in **Appendix L**.

11.4 CONSULTATION WITH THE MINISTRY OF THE ENVIRONMENT

The MOECC was informed of the progress with a letter provided in February 2014 (refer to **Appendix M**). A copy of the report was issued September 25, 2015. The MOE issued comments on the report and the original comments and response letters are included in **Appendix M**.

12.0 IMPLEMENTATION

12.1 POLICY CONSIDERATIONS

12.1.1 General

As part of Section 4.5 SA of the LSPP, recommended policies and SWM standards are required for future developments within the Township. Policies examined are discussed below and future SWM guidelines are discussed in **Section 10.0**.

12.1.2 Road Salts

Road salts enter the Canadian environment through their storage and use, and through the disposal of snow cleared from roadways. Environment Canada assessed inorganic chloride salts and concluded that road salts in high concentrations are harmful to the environment. Environment Canada recognizes that use of road salts is an important component of strategies to ensure roadway safety during winter months. As a result, risk management of road salts is done through a Code of Practice that recommends the preparation of a salt management plan and the implementation of best management practices developed by specialists in the field.

The Canadian Environmental Protection Act has defined road salts containing chloride as toxic under the Act (2001). This was based on research that found that the large amounts of road salts being used can negatively impact ground and surface water, vegetation, and wildlife. While elevated chloride levels are primarily found around urban centres, chloride levels have been found to be steadily increasing across the Lake Simcoe watershed, and throughout Ontario, including what could be considered pristine northern rivers as well as in Lake Simcoe itself (Pefferlaw SWS).

Various supplements to road salt have been explored in Ontario, including the use of Eco-Solutions' FUSION Treated Salt, which utilizes a beet juice component in a granular de-icing. They claim it is less corrosive than road salt, and can reduce the overall environmental damage from winter maintenance operations.

The RiverSides website notes that research has been dedicated to exploring alternative deicing products that have less ecological and economic impacts than traditional road salts. Non-chloride based alternatives include acetate and formate products.

RiverSides and Sierra Legal Defence Fund issued a report entitled *A Low-Salt Diet for Ontario's Roads and Rivers*, which discusses various BMP options for reducing road salt.

As a BMP policy it is the responsibility of the Township and Durham Region to use road salt, sand and dust suppressant sparingly; dust suppressant should be environmentally friendly (Uxbridge Subwatershed Plan, Table 7.5).

The Pefferlaw SWS notes several recommendations:

> *These are very general policies that in no way require the management of road salt and its impacts to water quality and aquatic biota. While urban areas have not been expanding to the same degree in the Pefferlaw River subwatershed as in others, there has been some growth, and the increasing chloride concentrations are not unexpected.*
>
> ***Recommendation #10 -*** *That the LSRCA, municipalities and NGO's undertake a program to raise awareness and to educate property owners and property managers about salt management, and work with snow removal contractors to encourage their adoption of the salt applicator's license program, recognizing that public safety remains paramount.*
>
> ***Recommendation #11 -*** *That the municipalities in conjunction with the LSRCA review the locations of their snow disposal sites and investigate innovative ways of reducing the impacts of excess chloride through the use of storage facilities such as wetland cells and/or stormwater treatment facilities.*
>
> ***Recommendation #12 -*** *Recognizing that increasing concentrations of chloride in watercourses is an emerging issue shared by all municipalities in the Lake Simcoe watershed, that watershed municipalities, LSRCA, MOECC and MNR form a Salt Working Group as a mechanism to share information on best practices for salt application, methods of increasing public awareness of the environmental impacts of road salt, and the effectiveness of municipal Salt Management Plans.*

12.1.3 Water Temperature

The MOECC Manual Section 3.3.4.2 notes:

> *Temperature is a major concern in regard to fish and their habitat, especially where discharge is to a cold water stream. Urbanization causes temperature increases in stormwater and ponds can compound this increase since open water will tend to acclimate with the ambient air temperature. Design for temperature mitigation is discussed in Section 4.4. Where temperature is a significant concern it is recommended that the designer consult with the local conservation authority, the federal Department of Fisheries and Oceans (Fisheries and Habitat Management) and the Ontario Ministry of Natural Resources, during the design process.*

Climate change is expected to impact stream temperatures dramatically. Predicted changes include increases in air temperatures, increases in rainfall in winter and spring, and a lack of water (rainfall) in the summer. The MOECC Vulnerability Report for Lake Simcoe watershed wetlands, streams, and rivers (Chu, 2010) suggests that several streams in the Lake Simcoe basin may not be able to support coldwater habitat in the future due to the loss of baseflow, through increases in stream temperature, changes in timing of the spring freshet, and changes in wetland composition. (Pefferlaw SWS)

Wet ponds and wetlands can compound the temperature increase due to urbanization by maintaining water in the facility between storms and allowing it to acclimate to the air temperature. The MOECC notes various methods to reduce thermal impacts:

Pond Configuration

The length-to-width ratio should be maximized to prevent the occurrence of large open areas of water which cannot be shaded by riparian vegetation.

Riparian Planting Strategy

Planting in the shoreline fringe and flood fringe zones of a wet pond help to shade the pond and minimize temperature increases during inter-event periods. The planting strategy should incorporate designs which shade open water areas when the vegetation reaches maturity.

Bottom-draw Outlet

Lower temperatures (in the order of several degrees Celsius) occur several metres below the permanent pool surface. Bottom draw outlets have been recommended by the MOECC since 1994, and are typically incorporated into modern pond designs.

However, by creating deeper ponds this can develop anoxic conditions resulting in a reduction in phosphorus removal. The MOECC Stormwater Pond design manual (2003) stipulates a maximum depth of 2.5 to 3 m (MOECC 2003).

According to the Stormwater Pond Maintenance and Anoxic Conditions Investigation, prepared by the LSRCA (2011), hypoxic conditions can also develop rapidly with storm events for ponds less than 2 m deep causing a mixing of water and release of unbound phosphorus to receiving water bodies. Further information can be found at:
http://www.lsrca.on.ca/pdf/reports/stormwater_maintenance.pdf

Due to the potential for thermal impairments to Uxbridge Brook, traditional SWM wet ponds are not the preferred approach in this area. Any retrofits proposed should incorporate significant thermal reduction measures.

Subsurface Trench Outlet

Treatment of water, by routing the discharge through a subsurface trench filled with clear stone, has also been suggested to reduce temperature. As the water flows through the trench, heat is transferred to the stone. It is purely a conveyance system which does not rely on infiltration; however, there is relatively little knowledge with respect to the success of these systems.

The dimensions of the system depend on the intended range of release rates, and the proximity of the pond to the watercourse. The length of the trench should be maximized to increase the opportunity for heat transfer. The cross-sectional area of the trench should be sized based on the design conveyance flow which does not necessarily have to match the design release rate from the pond (especially if the pond will accommodate the runoff from relatively large storms; i.e., > 25mm). The trench should be designed to accommodate frequent events (i.e., _ 10 mm) which will have a greater effect on the thermal regime of the receiving water. The trench should be wrapped with non-woven filter fabric to prevent the native material from blocking the pore space in the stone/rock. The stone should be relatively small (13 mm - 25 mm) since smaller stones will have a greater total surface area available for heat transfer.

Outlet Channel Design

In cases where there is a lengthy outlet channel from the end-of-pipe SWM facility to the receiving waters, natural channel design techniques can be employed. Guidance on natural channel design techniques is provided in "Natural Channel Systems". The outlet channel from an end-of-pipe SWM facility to the receiving waters should be shaded by plantings to minimize the temperature of the water discharged to the receiver.

12.2 PUBLIC CONSULTATION/EDUCATION

It should be noted that SWM can be more effective with the addition of a public education program. A program should be focused on informing residents and businesses about the use of best management practices and low-impact development measures. The LSRCA is committed to continuing community and public outreach to engage the communities and encourage their participation in developing the future implementation plans. The LSRCA currently runs workshops and other outreach programs that the Township could use as a foundation to an education program.

Moreover, The Township can model programs after those of The Region of York, such as their Water for Tomorrow Website or their Rain Barrel program to assist homeowners in reusing stormwater in their gardens.

12.3 SOURCES OF FUNDING

The MOECC has a program called Showcasing Water Innovation; to fund leading edge, innovative and cost-effective solutions for managing drinking water, wastewater and stormwater systems in Ontario communities.

It complements Ontario's Water Opportunities Act by fostering innovation, creating opportunities for economic development and protecting water resources.

Under the Showcasing Water Innovation program, the province is funding projects that:

- take an integrated and sustainable approach to solve water management challenges;
- use new and innovative approaches and technologies;
- produce results that can be easily used by other communities; and,
- create partnerships that highlight the benefits of collaboration.

In 2012, that program was used to fund the Lincoln SWM Pond (Pond 15) Retrofit, which was done to address resident concerns with respect to odor due to phosphorus loadings.

LSRCA's Landowner Environmental Assistance Program (LEAP) provides landowners with funding and technical assistance for environmental projects on their land. LEAP is administered by the LSRCA and made possible by funding from municipal partners and the support of the York, Durham, and Simcoe chapters of the Ontario Federation of Agriculture.

LEAP Funding Limitations:

- Work that proceeds prior to funding approval does not qualify for funding assistance;
- New operations, new buildings, work associated with additions to homes, or building expansions to increase herd capacity are not eligible;
- Funds are limited in each municipality. As a result, grants will be allocated by the committee, on a priority basis;
- Properties are limited to a maximum of $25,000 for capital projects over the life of the program; and,
- If you have an outstanding violation with the LSRCA, or other regulatory agency, you may not be eligible.

Further information regarding this funding program can be found on the LSRCA website (http://www.lsrca.on.ca/leap). Note that in the past this program has been very popular so it is recommended that applications be submitted early in the year.

The LSRCA has developed the "Lake Simcoe Phosphorus Offset Program", a 5-year program (2014-2018) to offset TP generation for stormwater retrofits in existing areas (under Phase 1), consisting of conventional controls and LID measures. It is predicated on a zero TP load, via a partial "cash-in-lieu" type of system wherein new development pays an offset fee that would be applied to other areas which can be more effectively mitigated.

For example, a new development producing an unmitigated TP load of 3.5 kg/year would have an "offset ratio of 2.5 applied to it; or, 3.5 kg/year x 2.5 = 8.8 kg/year, with a total offset cost of $303 600 ($34 500/kg). That money would be applied to mitigating larger scale TP loading sources, such as farmer's fields. Currently the LSRCA Phosphorus Offsetting Program has not yet been approved by the Province of Ontario.

13.0 NOTICE OF STUDY COMPLETION

A notice of Study Completion for this report was issued on November 12, 2015 and is included in **Appendix O**.

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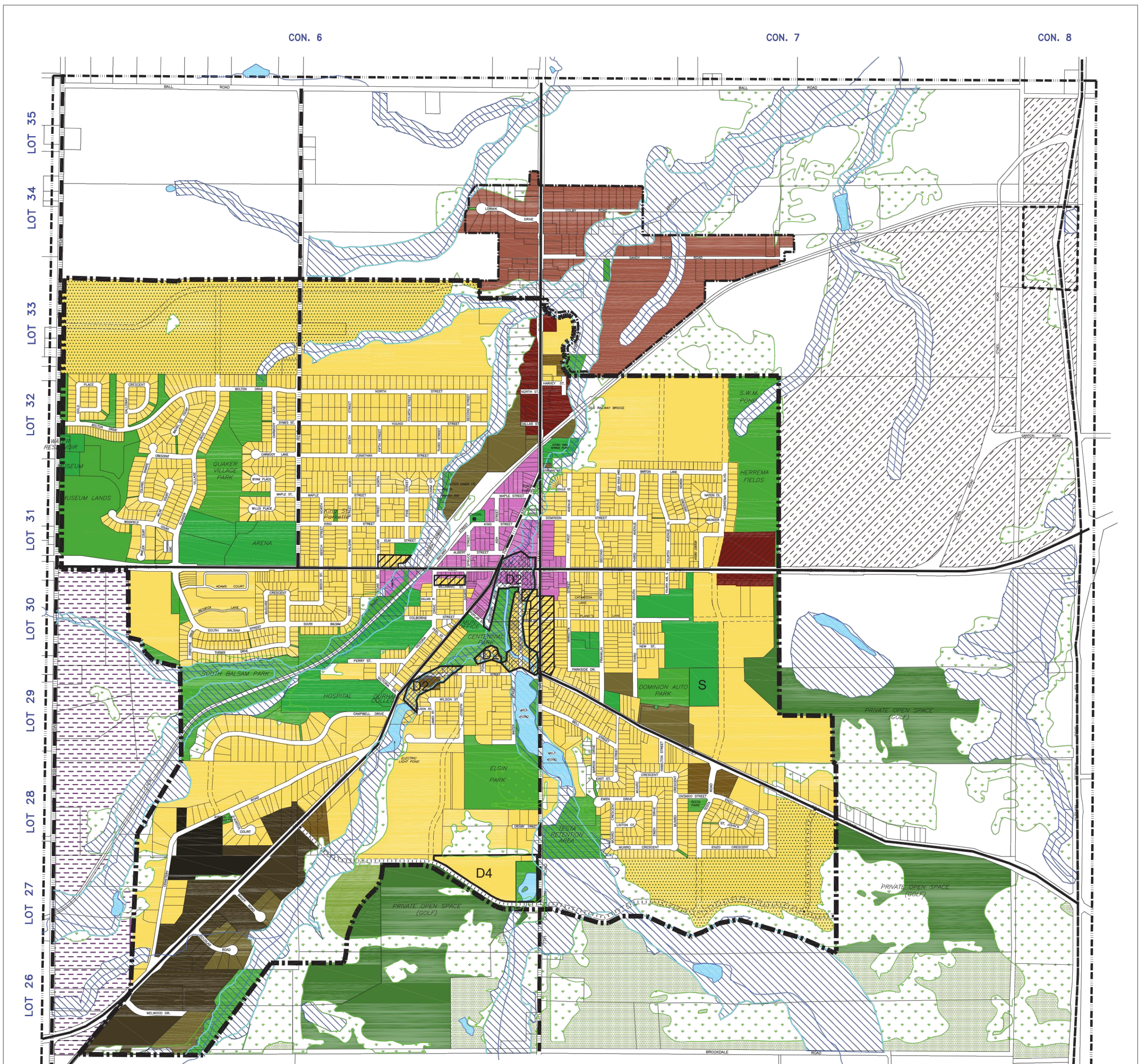
Appendix A FIGURES



Residential Area	Cemetery Area	D2	Deferral		
Residential Area Higher Density	General Agricultural Area		Floodplain		
Future Residential Area	Permanent Agricultural Area		Type A Arterial Road		
Main Central Area	Environmental Constraint Area		Type B Arterial Road		
Mixed Use Area	Forest Area		Collector Road		
Corridor Commercial Area	Park and Open Space Area		Potential Future Collector Road (Subject to Environmental Assessment)		
Employment Area	Institutional Area		Local Road		
Hamlet Area	Private Open Space Area Golf Course		Proposed Local Road		
Rural Estate Area	Major Open Space Area Oak Ridges Moraine		Urban Area Boundary		
Recreational Mixed Use Area	S Proposed School Site		Hamlet Boundary		
Brock St. Mixed Use Area			Waste Disposal Area		
			Secondary Plan Area		
			Special Policy Area	D2	
			Mixed Use Special Policy Area		

SCHEDULE "A"

LAND USE AND TRANSPORTATION PLAN UXBRIDGE URBAN AREA

OFFICIAL PLAN OF THE TOWNSHIP OF UXBRIDGE

Office Consolidation Including Modifications, Deferrals and Appeals Ontario Municipal Board. April 2008

100 0 100 200 300 400 Meters

ORIGINAL SHEET - ANSI B

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Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
OP-A

Title
Township of Uxbridge Official Plan
Schedule "A"

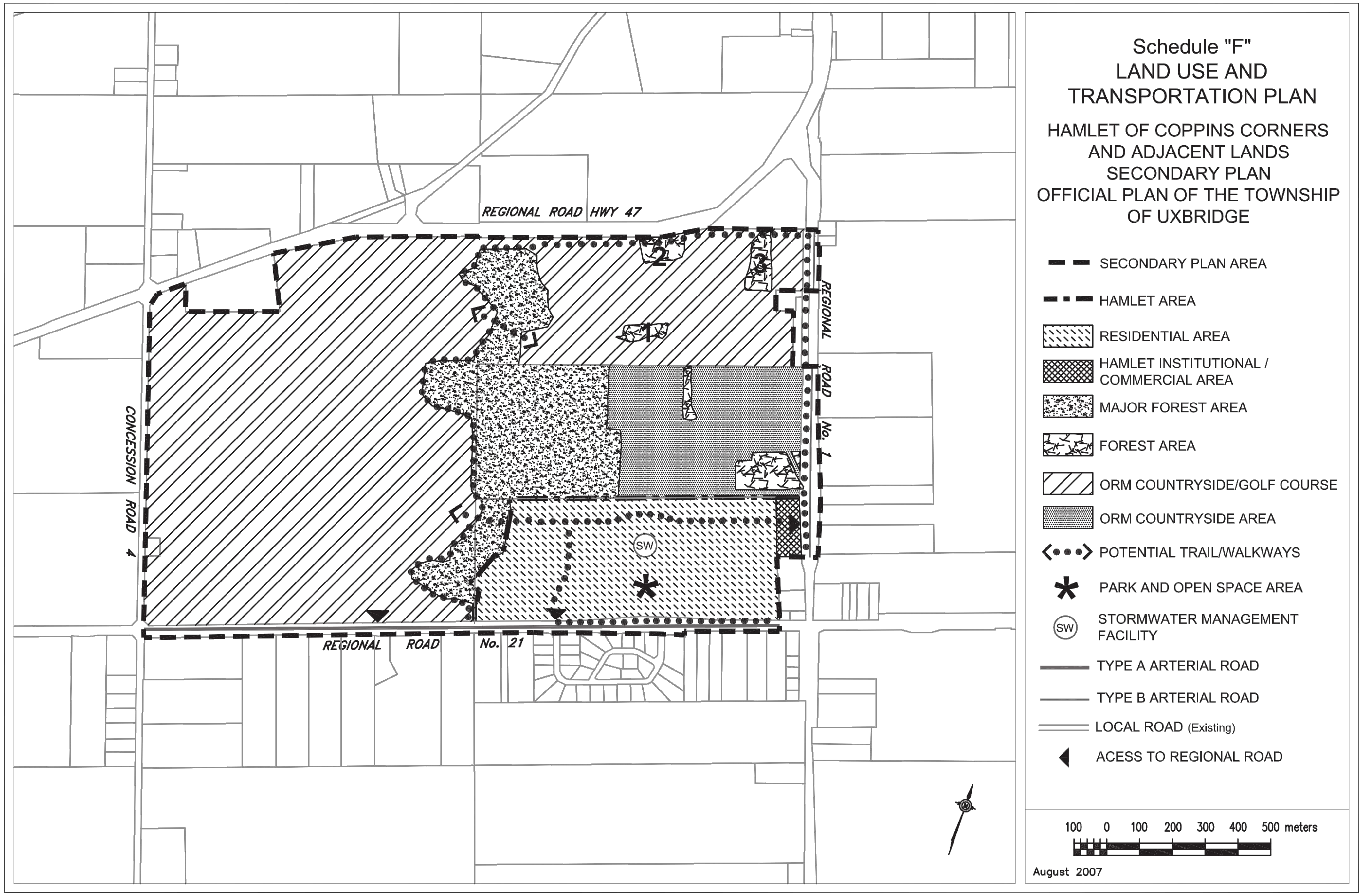

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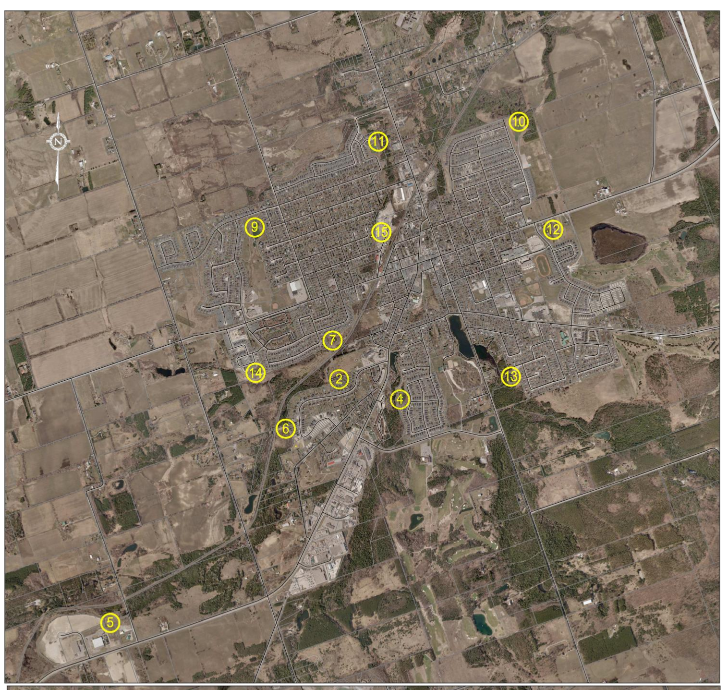
Figure No.
OP-F

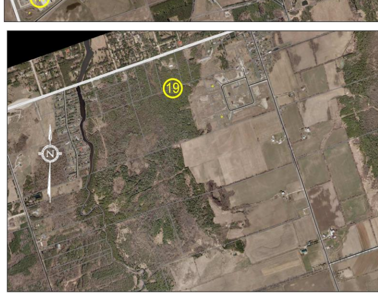
Title
Township of Uxbridge Official Plan
Schedule "F"



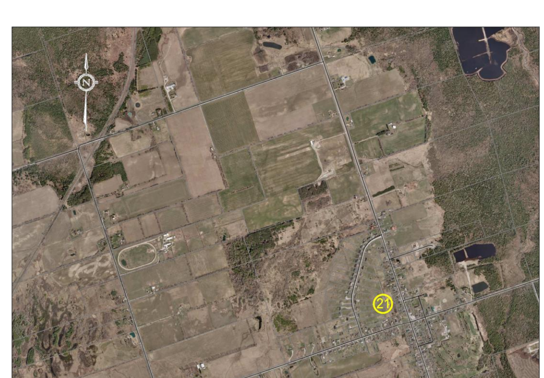
Pond I.D.	Pond Name
2	Campbell Drive
4	Estate at Wooden Sticks
5	Acton Industrial S.D.
6	Cemetery Road
7	Forsythe West
9	Quaker Village
10	Barton Farm
11	Mason Homes
12	Estate of Avonlea
13	Testa Height
14	Butternut Village
15	Maple Street

Pond I.D.	Pond Name
1W	Industrial Park West
1E	Industrial Park East
3	McGuckin
8	Deer ridge
17	Trifeletti West Goodwood
18	Trifeletti East Goodwood

Pond I.D.	Pond Name
16	Siloam
22	Sandford S.D.



Pond I.D.	Pond Name
19	Udora S.D.
20	Leasudale S.D.



Pond I.D.	Pond Name
21	Zephyr S.D.

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Township of Uxbridge
Stormwatermanagement Master Plan
Uxbridge Stormwater Assessment Areas

Figure No.

SWMF-1

Title

Uxbridge Stormwater Management Facility Assessment (2013), SWM Pond Facility Index

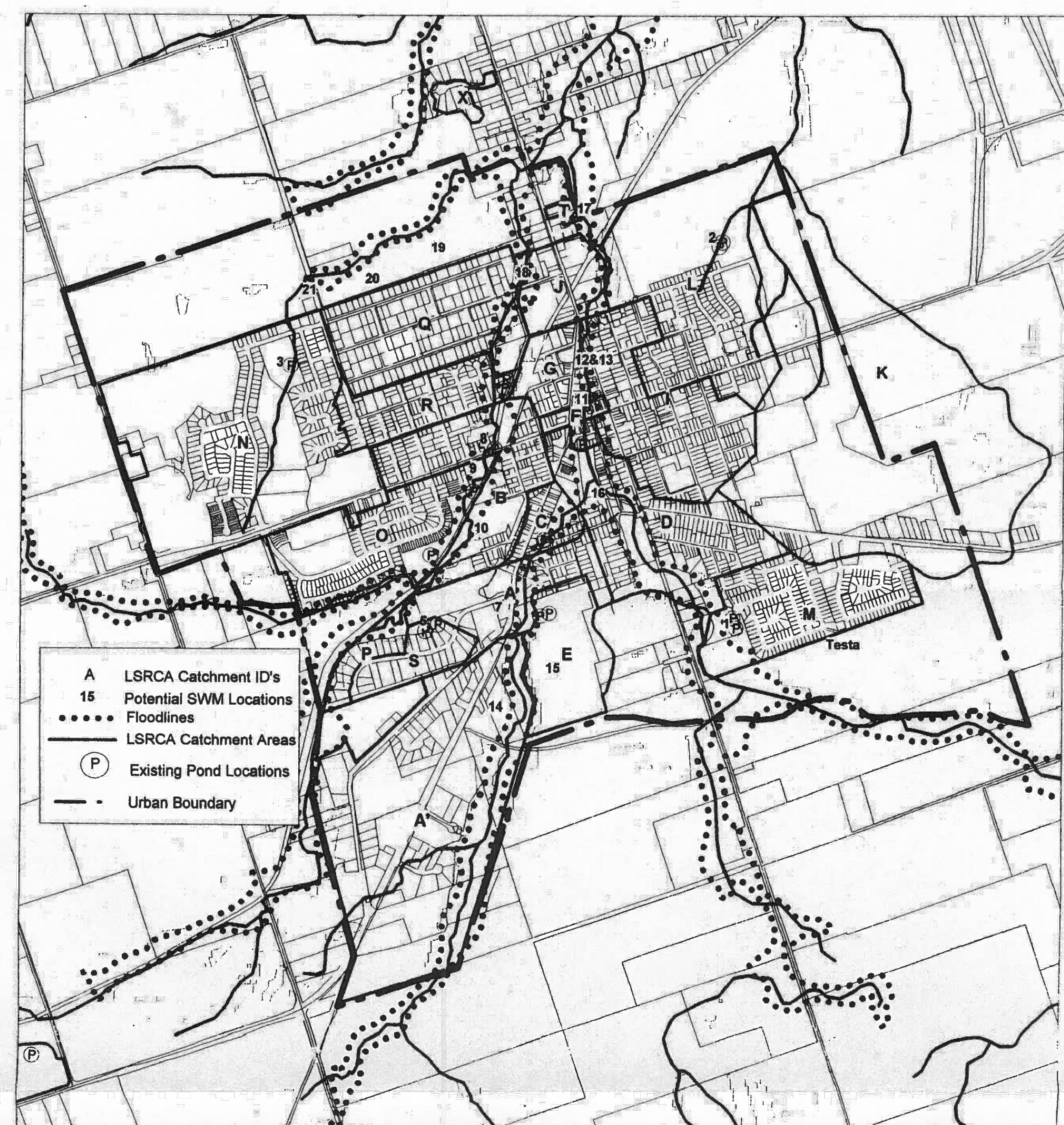

Figure 3.3.1: Potential SWM Retrofit Opportunities

Scale 1:12,500

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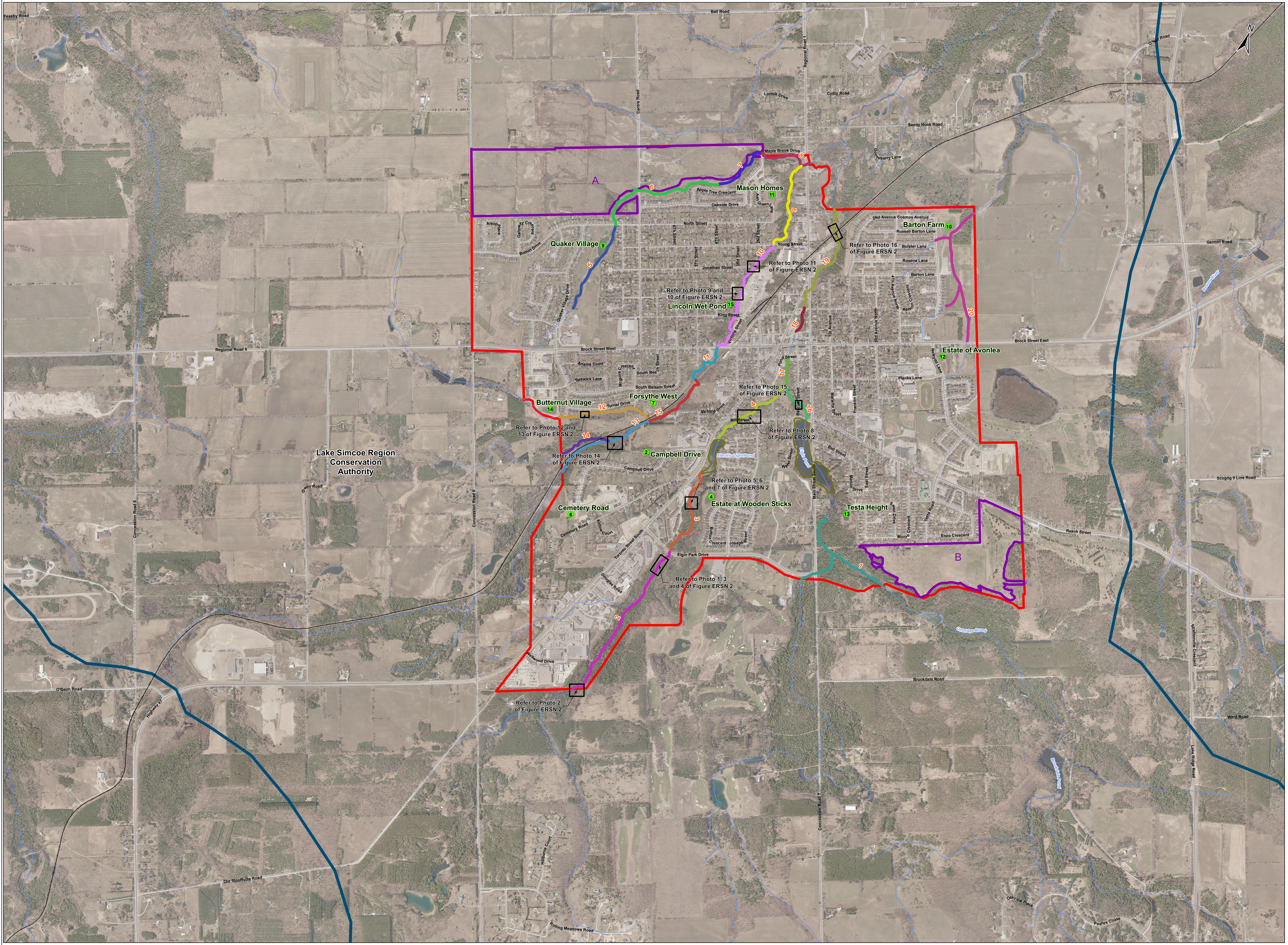
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.

TSH - 1

Title

Uxbridge Urban Area SWM Study
July 2000 (Prepared by TSHi Associates)



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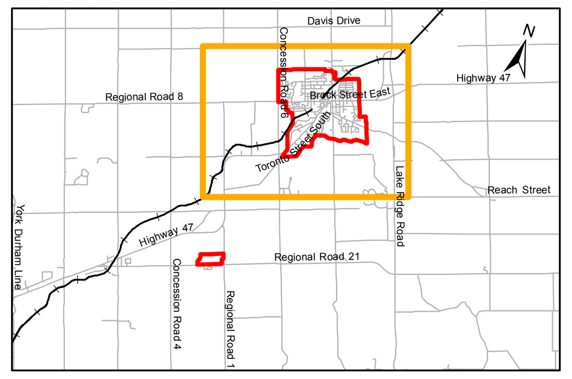
Key Map



Legend

- SWM Pond Location
- Study Areas
- Railway
- Subwatershed
- Watercourse
- Waterbody
- Other Pond (Not SWM Pond)

Future Settlement Area

- Areas A and B: Residential
- Photograph Location

Reach ID

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

Notes

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   Stantec Consulting Ltd., Township of Uxbridge Stormwater Management Facility Assessment 2012. January 2013.
   Stantec Consulting Ltd. Field Survey of Uxbridge Urban Area Erosion Prone Areas Conducted on Oct 29, 2014
4. Orthoimagery © Durham Region, 2014. Imagery taken in 2012.

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TOWNSHIP OF UXBRIDGE

SWM POND MASTER PLAN

Title

Erosion Areas of Concern within Uxbridge Urban Area

Project No.	Scale
160621777	0 175 350 m

Figure No.	Sheet	Revision
ERSN 1	1 of 1	0

Photo 1: Reach 2 – Refer to Figure ERSN 1 for location of shot. Several Undercut banks.

Photo 2: Reach 2 - Refer to Figure ERSN 1 for location of shot. Perched culvert.

Photo 3: Reach 2 - Refer to Figure ERSN 1 for location of shot. Looking downstream towards Elgin Park Drive illustrating some undercut banks

Photo 4: Reach 2 - Refer to Figure ERSN 1 for location of shot. Series of Several headcuts were found

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Township of Uxbridge Stream Assessment

FIGURE NO.

ERSN 2

TITLE

PHOTOGRAPHIC RECORD

PAGE

1 OF 4

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Photo 5: Reach 3 - Refer to Figure ERSN 1 for location of shot. Several undercut banks

Photo 6: Reach 3 - Refer to Figure ERSN 1 for location of shot. Few slightly head cut areas

Photo 7: Reach 3 - There is some active erosion within the channel.

Photo 8: Reach 4 – Refer to Figure ERSN 1 for location of shot. Slumping gabion basket with water flowing underneath it.

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FIGURE NO.

ERSN 2

TITLE

PHOTOGRAPHIC RECORD

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Photo 9: Reach 10 - Refer to Figure ERSN 1 for location of shot. Debris jam within channel (a wheel barrow and several trees)

Photo 10: Reach 10 – Refer to Figure ERSN 1 for location of shot. Some active erosion noticed within channel around debris jam.

Photo 11: Reach 10 – Refer to Figure ERSN 1 for location of shot. Several Perched Culverts.

Photo 12: Reach 12 – Refer to Figure ERSN 1 for location of shot. Large headcut right off of West of Turner St.

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FIGURE NO.
ERSN 2

TITLE
PHOTOGRAPHIC RECORD

Photo 13: Reach 12 – Refer to Figure ERSN 1 for location of shot. Some undercut sections and erosion noticed right off of West Turner St

Photo 14: Reach 13 – Refer to Figure ERSN 1 for location of shot. Head cutting and a series of log jams near the intersection of reach 13 and reach 14.

Photo 15: Reach 16- Refer to Figure ERSN 1 for location of shot. Perched Culvert.

Photo 16: Reach 19 – Refer to Figure ERSN 1 for location of shot. Several debris in channel at the bridge area.

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FIGURE NO.
ERSN 2

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4 OF 4

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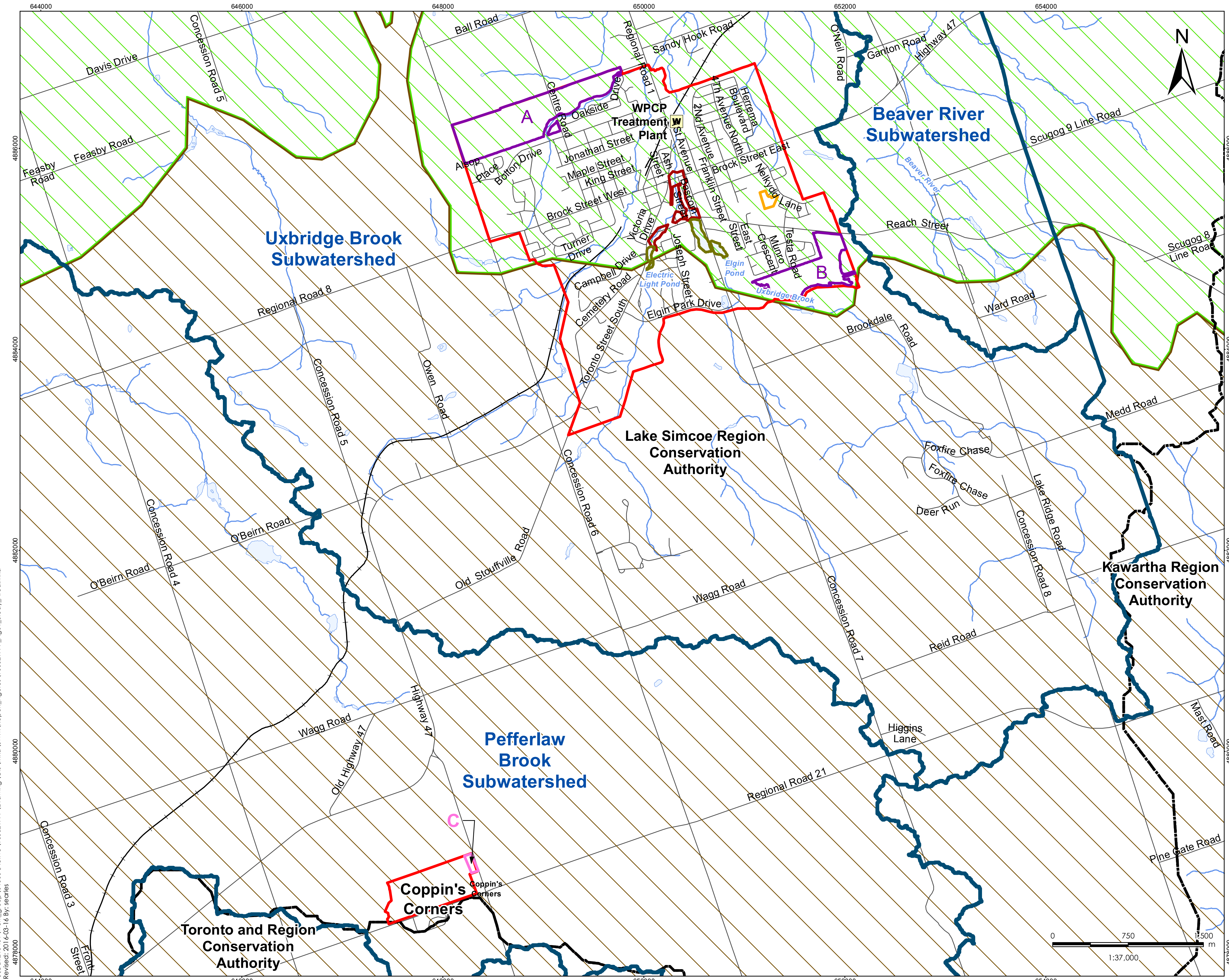

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Legend

- WPCP Treatment Plant
- Study Areas

Future Settlement Area

- Area C: Hamlet Institutional/Commercial
- Areas A and B: Residential
- School

Other

- Deferral

Existing Features

- Roads
- Railway
- Watercourse
- Waterbody
- Other Pond (Not SWM Pond)
- Subwatershed Provided by LSRCA
- Conservation Authority Boundary

Greenbelt Designation Boundary (MMAH)

- Oak Ridges Moraine (ORM)
- Protected Countryside

Notes

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Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.

1

Title

Study Area

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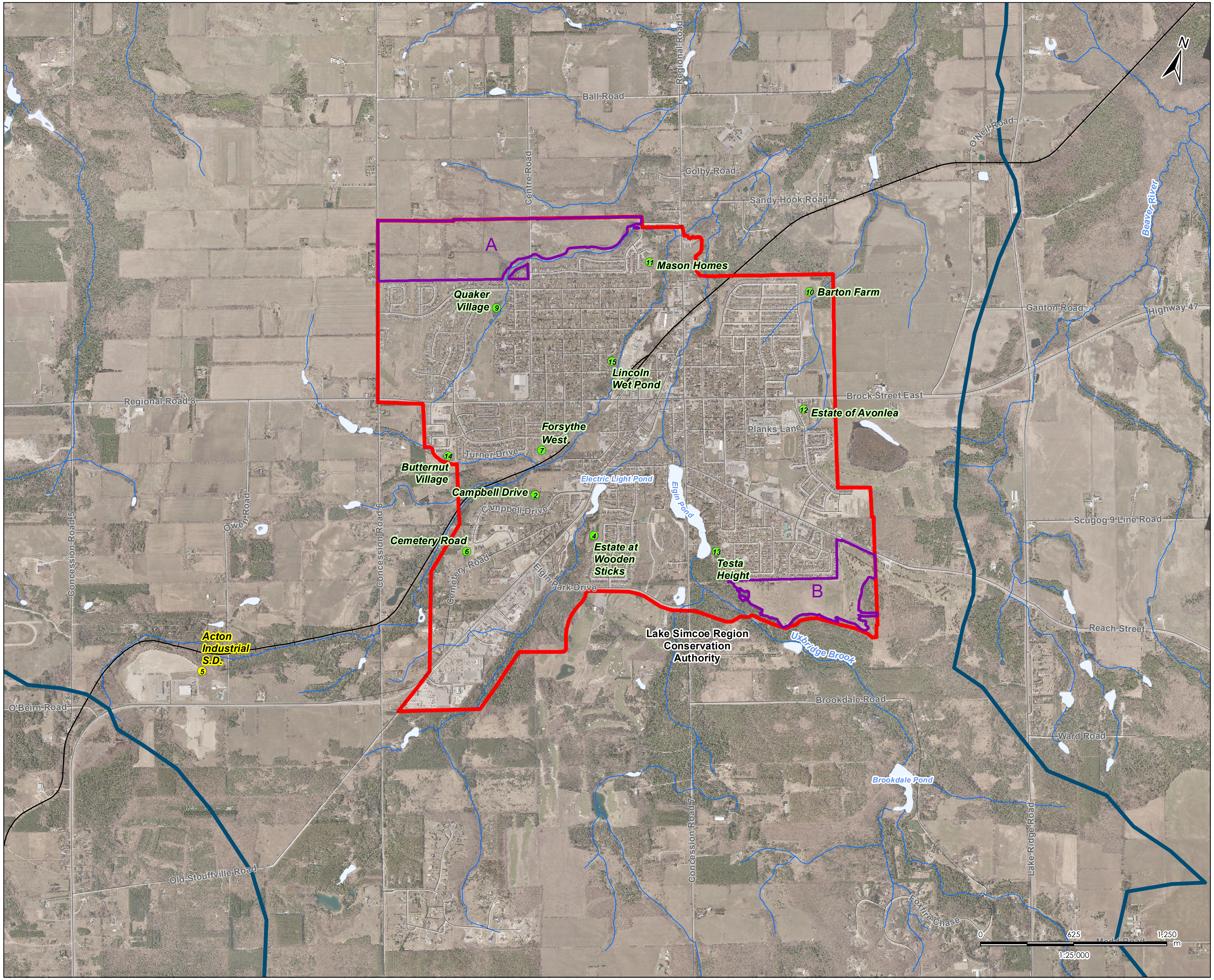

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Legend

- Study Area
- **InStudyArea**
- SWM Pond Location Within Urban Boundary
- SWM Pond Location Outside of Urban Boundary
- Road
- Railway
- Watercourse
- Waterbody
- Conservation Authority Boundary
- Municipal Boundary (Lower Tier)
- Subwatershed
- **Future Settlement Area**
- Areas A and B: Residential

Notes

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Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
2

Title
Uxbridge SWM Pond Locations

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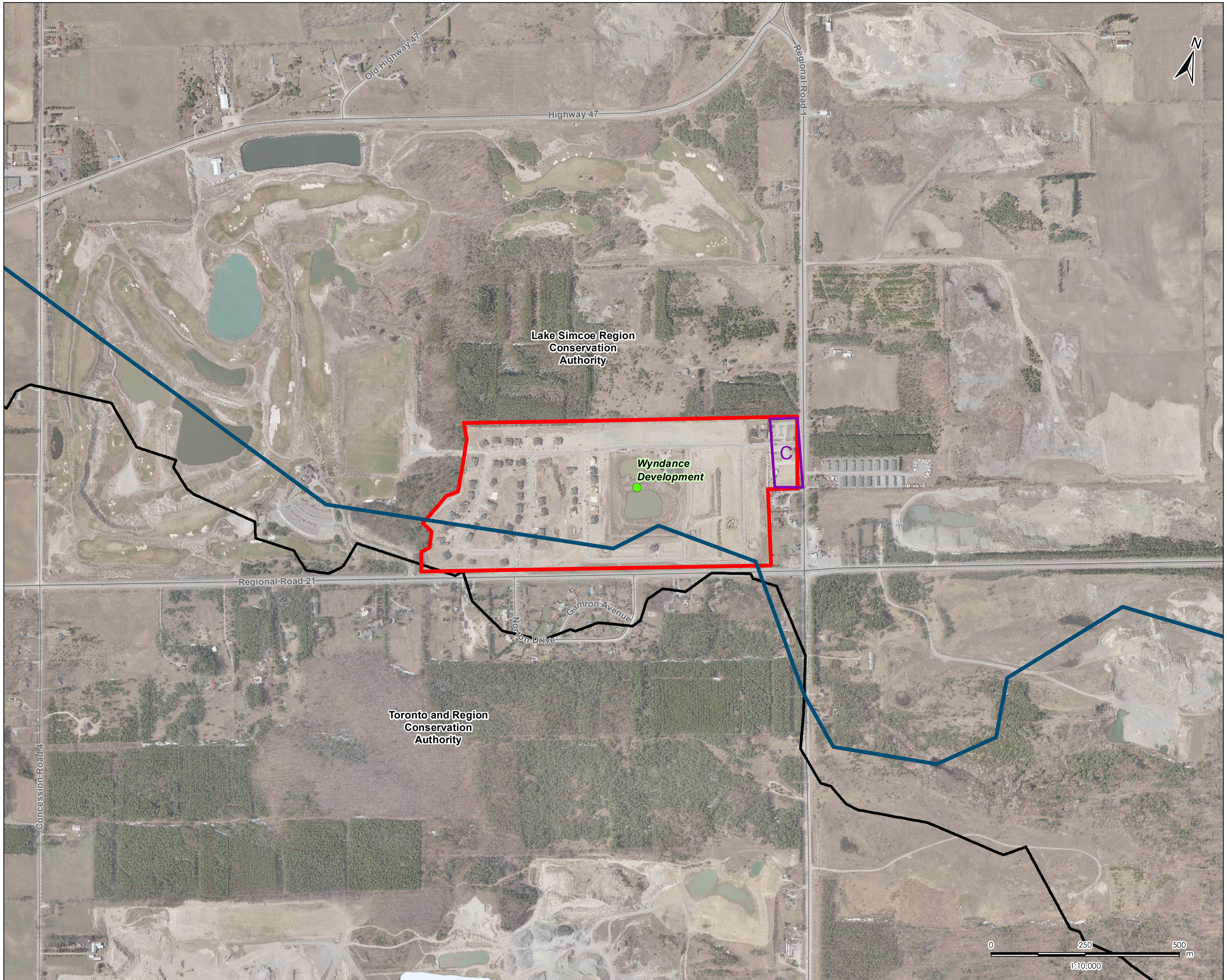

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Legend

- Study Area
- SWM Pond Location
- Road
- Waterbody
- Conservation Authority Boundary
- Subwatershed

Future Settlement Area

- Area C: Hamlet Institutional/Commercial

Notes

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   Stantec Consulting Ltd., Township of Uxbridge Stormwater Management Facility Assessment 2012. January 2013.
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Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.

3

Title

Coppin's Corners SWM Pond Location

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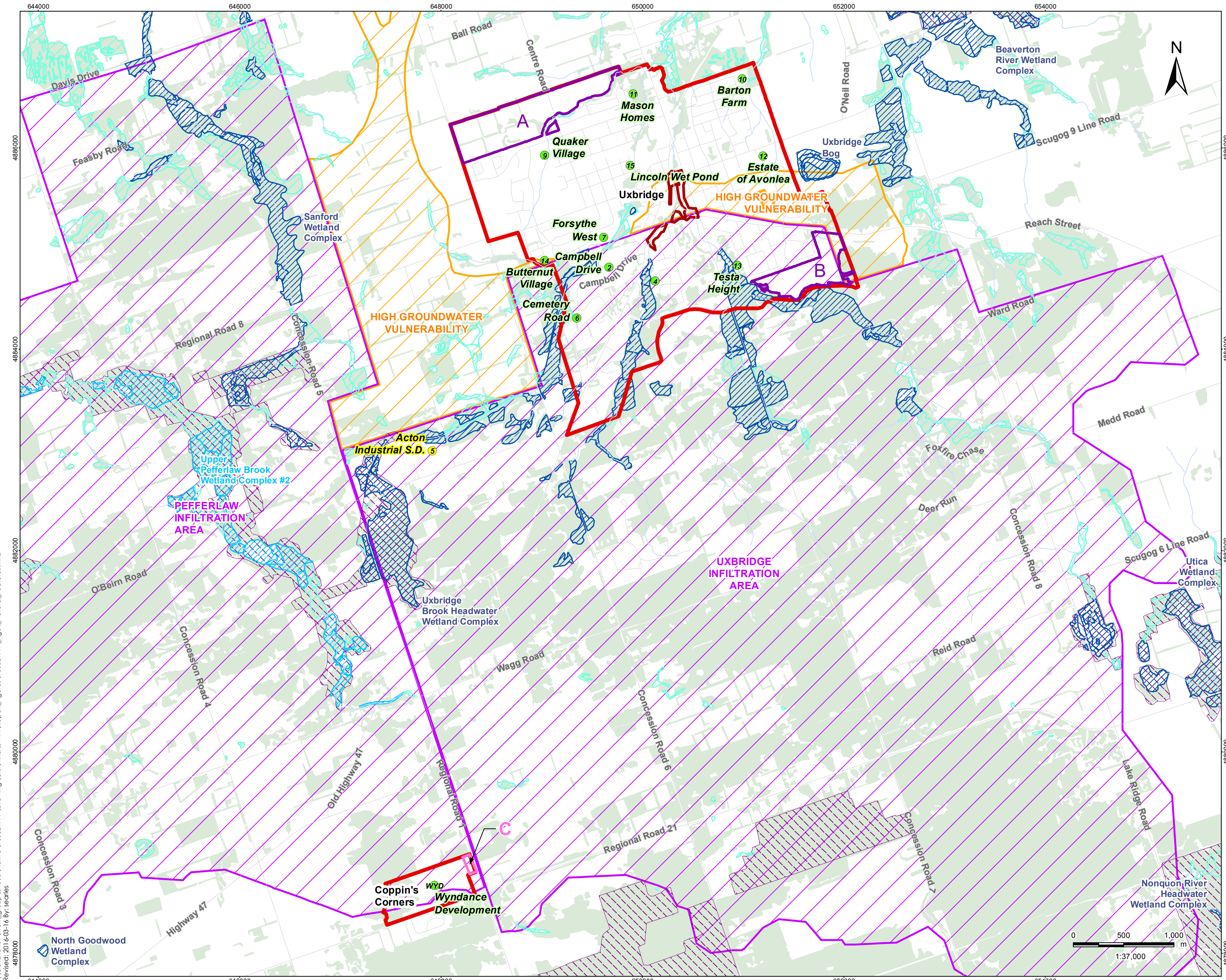

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Stantec

Legend

- Study Area
- SWM Pond Location Within Urban Boundary
- SWM Pond Location Outside of Urban Boundary
- Road
- Watercourse
- Waterbody
- Provincially Significant Wetland
- Other/Locally Significant Wetland
- Unevaluated Wetland
- ANSI, Life Science
- Candidate ANSI, Life Science
- Wooded Area
- High Groundwater Vulnerability
- Infiltration Area

Future Settlement Area

- Hamlet Institutional / Commercial Area
- Residential
- School

Other

- Deferral

Notes

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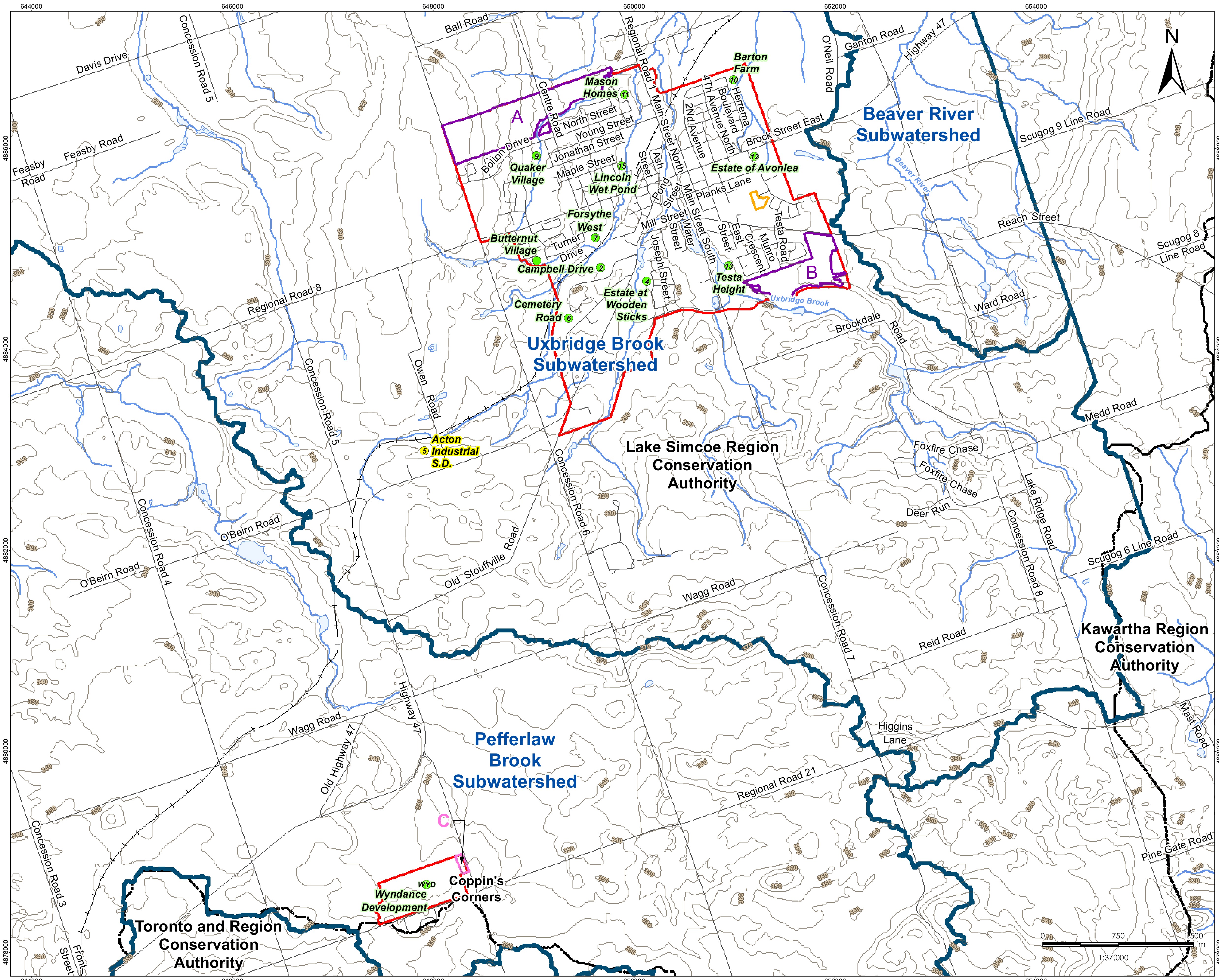
Township of Uxbridge
Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
4

Title
Natural Environment Mapping



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Legend

- <all other values>
- SWM Pond Location Within Urban Boundary
- SWM Pond Location Outside of Urban Boundary
- Study Areas

Future Settlement Area

- Areas A and B: Residential
- Area C: Hamlet Institutional/Commercial
- School

Existing Features

- Roads
- Railway
- Watercourse
- Waterbody
- Topographic Contours (mAMSL)
- Subwatershed Provided by LSRCA

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Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
5

Title
Topographic Map

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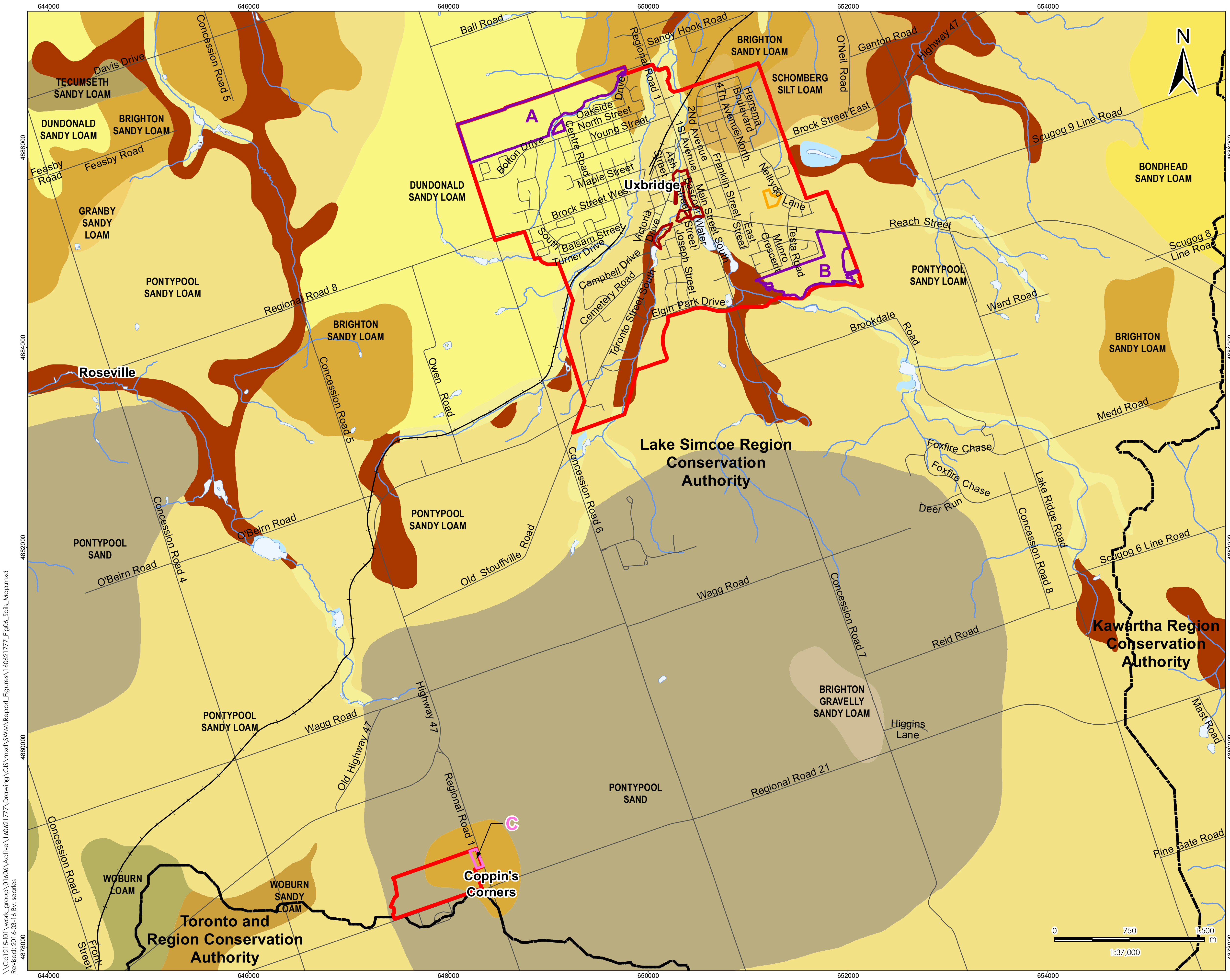

Stantec

Legend

Study Areas

Future Settlement Area

Areas A and B: Residential

Area C: Hamlet Institutional/Commercial

School

Other

Deferral

Existing Features

Roads

Railway

Watercourse

Waterbody

Soil Name

- BONDHEAD SANDY LOAM
- BOTTOM LAND
- BRIGHTON GRAVELLY SANDY LOAM
- BRIGHTON SANDY LOAM
- DUNDONALD SANDY LOAM
- GRANBY SANDY LOAM
- MUCK
- PONTYPOOL SAND
- PONTYPOOL SANDY LOAM
- SCHOMBERG SILT LOAM
- TECUMSETH SANDY LOAM
- WATER
- WOBURN LOAM
- WOBURN SANDY LOAM

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Township of Uxbridge
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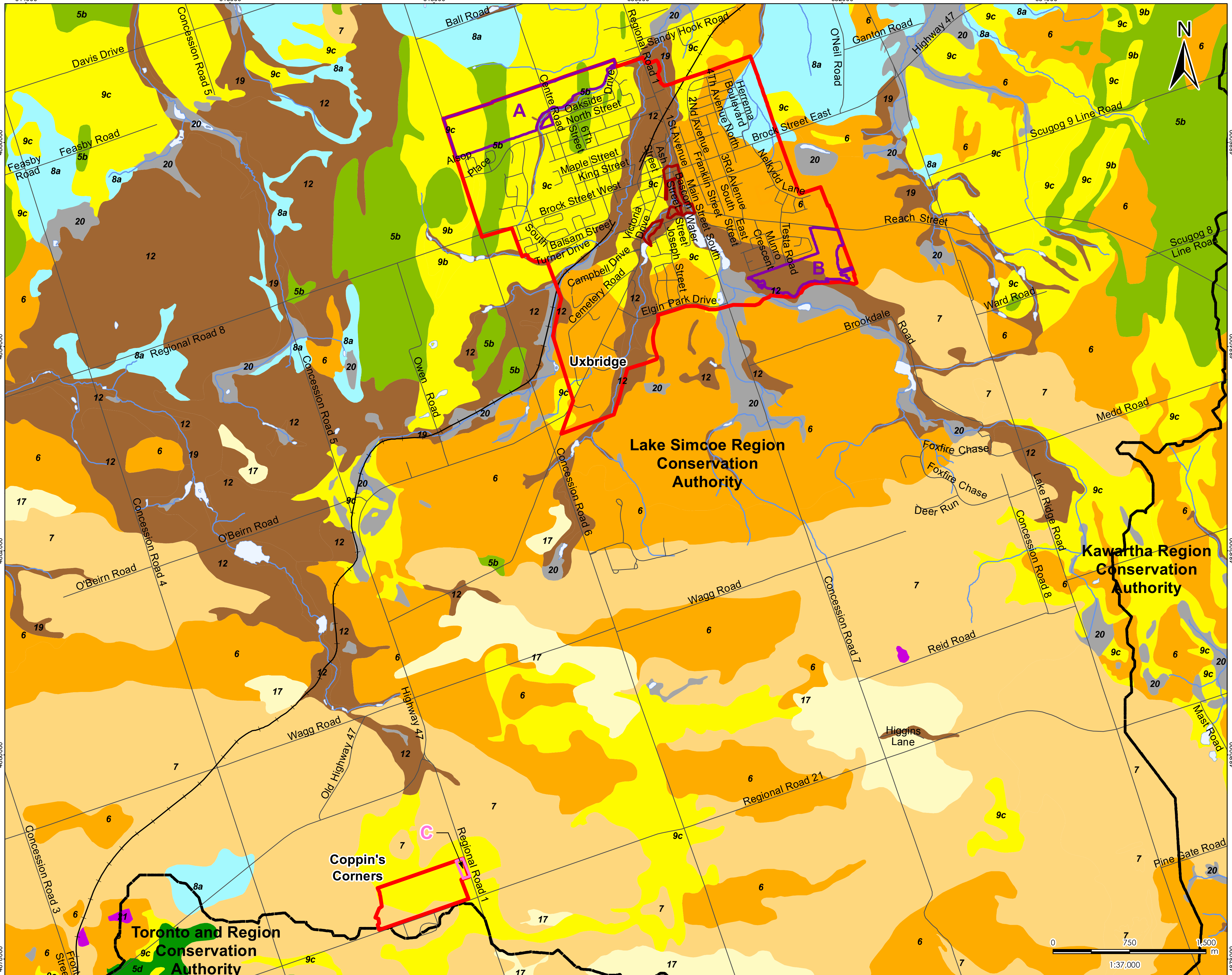
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
6

Title
Soils Map



Stantec

Legend

- Study Areas

Future Settlement Area

- Areas A and B: Residential
- Area C: Hamlet Institutional/Commercial
- School

Other

- Deferral

Existing Features

- Roads
- Railway
- Watercourse
- Waterbody
- Conservation Authority Boundary

Surficial Geology

- 21: Man-made deposits
- 20: Organic deposits
- 19: Modern alluvial deposits
- 17: Eolian deposits
- 12: Older alluvial deposits
- 9b: Coarse-textured glaciolacustrine deposits (Littoral-foreshore deposits)
- 9c: Coarse-textured glaciolacustrine deposits (Foreshore-basinal deposits)
- 8a: Fine-textured glaciolacustrine deposits (Massive-well laminated)
- 7: Glaciofluvial deposits
- 6: Ice-contact stratified deposits
- 5b: Stone-poor, carbonate-derived silty to sandy till
- 5d: Glaciolacustrine-derived silty to clayey till

Notes

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3. Surficial geology produced by the Ontario Geological Survey 2003. Surficial geology of Southern Ontario; Ontario Geological Survey, MRD 128.

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Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
7

Title
Surficial Geology

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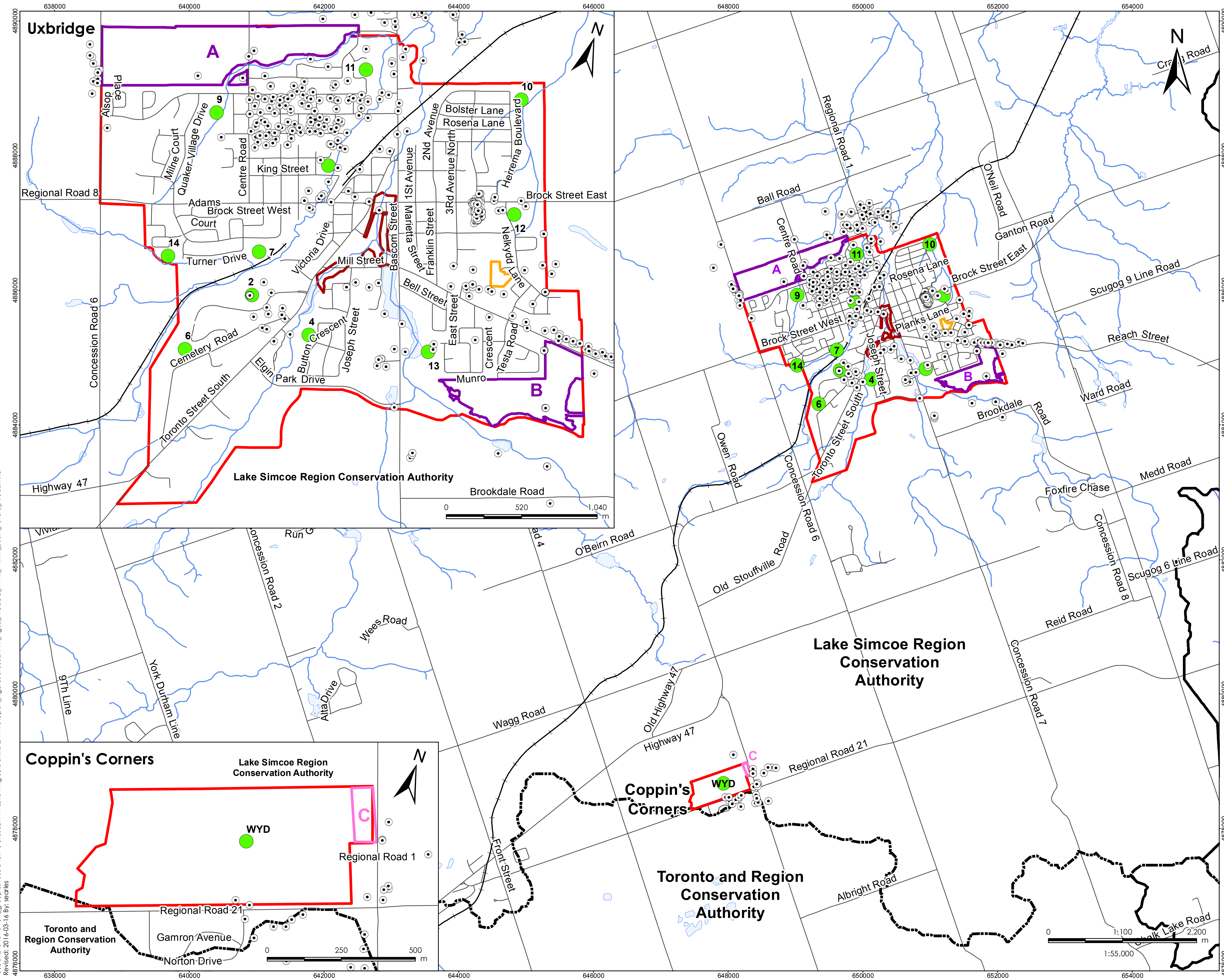

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Legend

- SWM Pond Location
- Study Areas

Future Settlement Area

- Areas A and B: Residential
- Area C: Hamlet Institutional/Commercial
- School

Other

- Deferral

Existing Features

- Roads
- Railway
- Watercourse
- Waterbody
- Conservation Authority Boundary
- MOECC Water Well Within 500 m of SWM Pond

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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3. MOECC Water well locations are approximate and have been positioned based on published UTM coordinates from the MOE Permit to Take Water database. © Queen's Printer for Ontario, 2014.
4. Official Plan and SWM Facility Data: Township of Uxbridge. Official Plan Township of Uxbridge Office Consolidation. August 2007. Stantec Consulting Ltd., Township of Uxbridge Stormwater Management Facility Assessment 2012. January 2013.

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Township of Uxbridge
Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
8

Title

MOECC Water Wells Within 500 metres of Future Development Areas

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Revised: 2016-03-16 By: searles

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Legend

- Study Areas
- SWM Pond Location

Future Settlement Area

- Residential
- School

Other

- Deferral

Existing Features

- Roads
- Railway
- Watercourse
- Waterbody

WHP Capture Zones (Durham Region, 2009)

- 2 Years
- 5 Years
- 25 Years
- Impervious
- WHP 100 m Buffer

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3. MOE Water well locations are approximate and have been positioned based on published UTM coordinates © Queen's Printer for Ontario, 2014.
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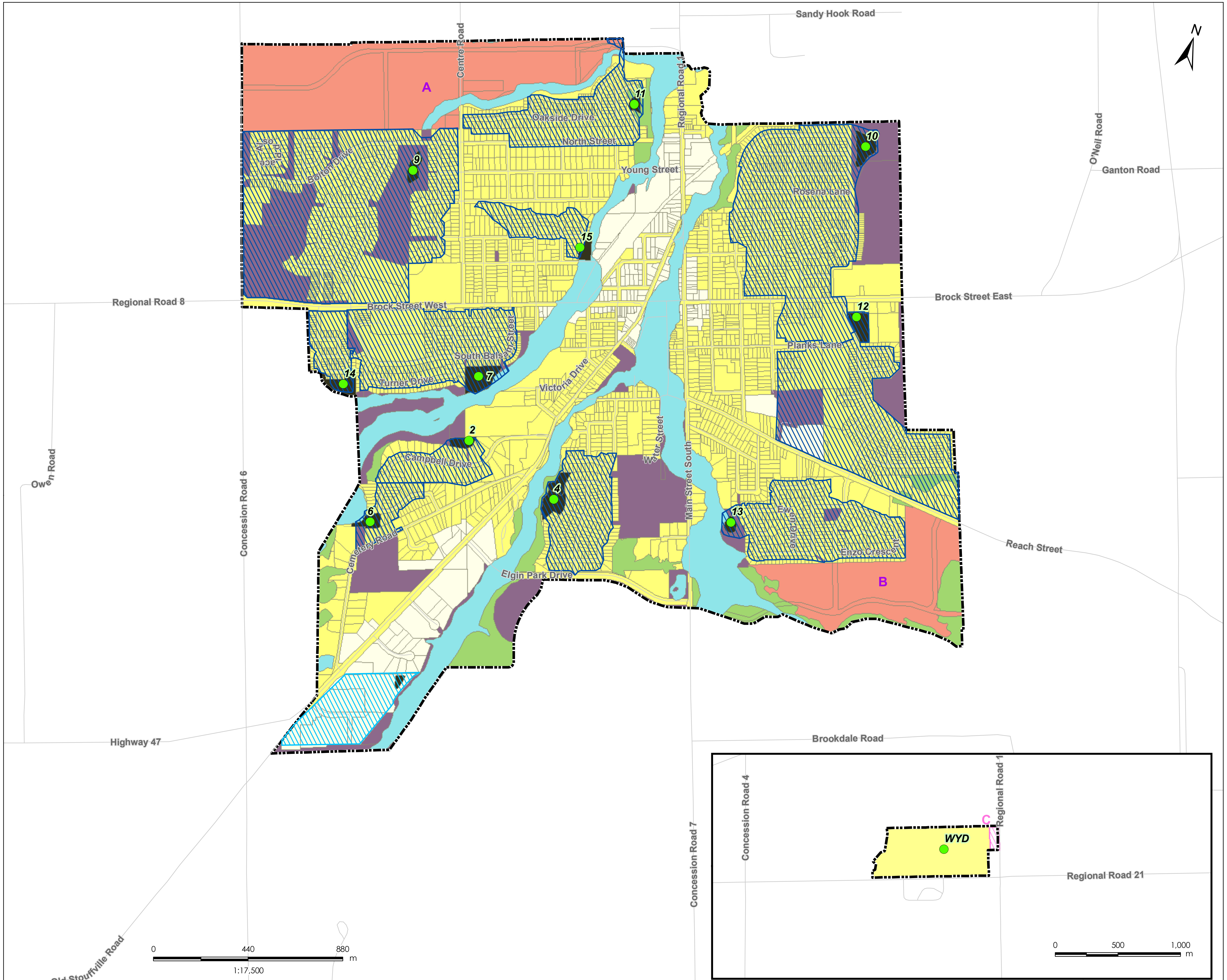
Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
9

Title
Well Head Protection Zones



\\cd1215-f01\work_group\01606\Active\160621777\Drawing\GIS\mxd\SWM\Report_Figures\160621777_Fig10_CANWET_Land_Use.mxd
Revised: 2014-12-18 By: bcowper

Stantec

Legend

- Study Area
- Road
- SWM Pond Location
- Drainage Area to Pond
- Drainage Area to Private Pond

Land Use

- Recreational Mixed Use Area, Cemetery Area, Park and Open Space Area, Private Open Space Area Golf Course, Major Open Space Area, Oak Ridges Moraine
- Environmental Constraint Area
- Forest Area
- Areas A and B: Residential
- Residential Area, Residential Area Higher Density, Proposed School Site
- Commercial, Employment, Central Area, Institutional Area, Brock St. Mixed Use Area
- SWM Pond
- Area C: Hamlet Institutional/Commercial

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2014; © Durham Region, 2014.
3. Official Plan and SWM Facility Data: Township of Uxbridge. Official Plan Township of Uxbridge Office Consolidation. August 2007. Stantec Consulting Ltd., Township of Uxbridge Stormwater Management Facility Assessment 2012. January 2013. The Louis Berger Group, Inc. Estimation of Phosphorus Loadings, 2010. Lake Simcoe Region Conservation Authority. Lake Simcoe Basin Stormwater Management and Retrofit Opportunities, 2007.

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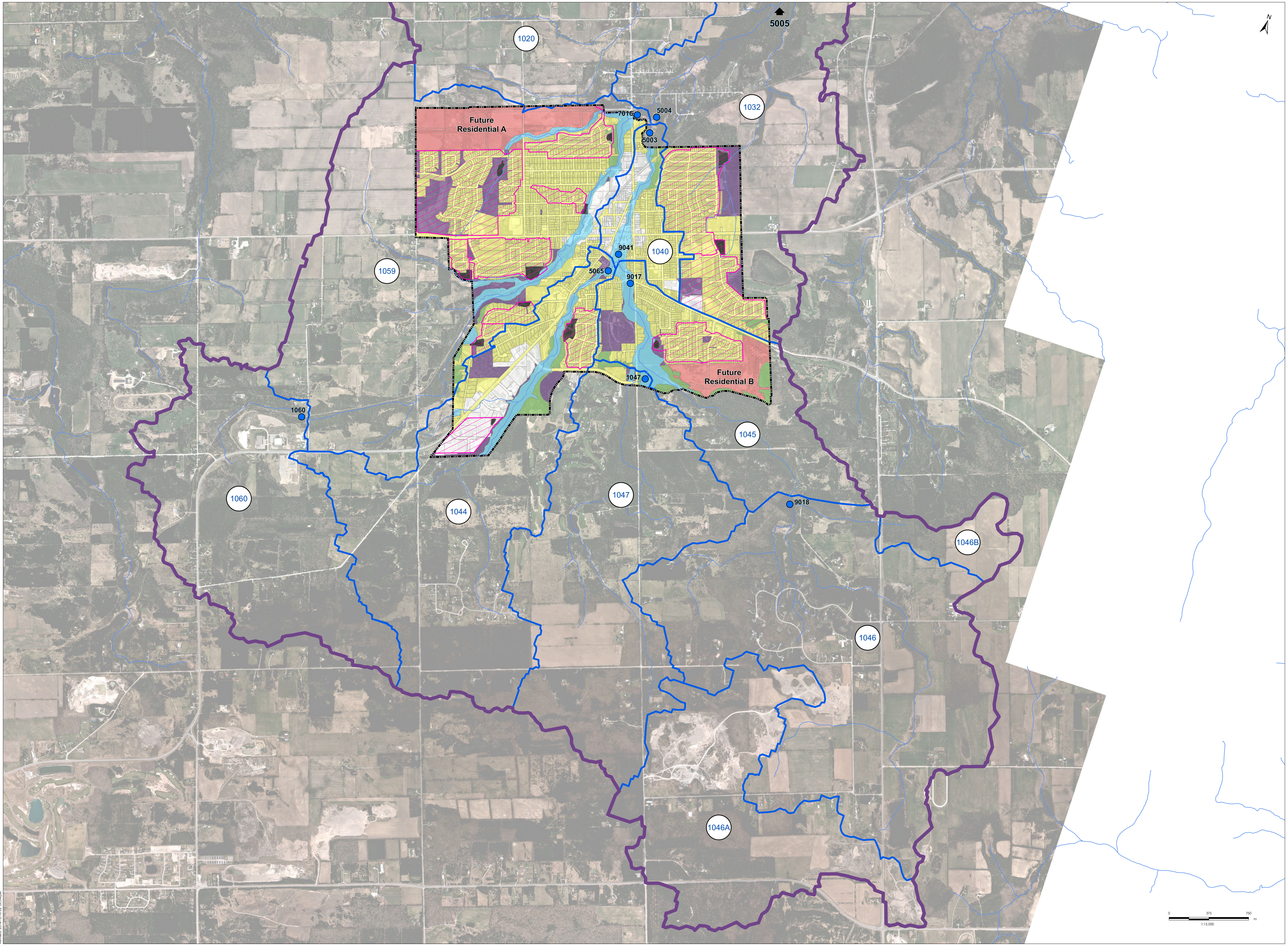
Township of Uxbridge
Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.

10

Title

CANWET Land Use Areas



Legend
Watercourse
Study Area
Watershed Boundary
Subwatershed Boundary
1032 Subwatershed ID
Area Draining to SWM Pond
Flow Node

Land Use
Commercial Employment Central Area
SWM Pond
Residential, Schools, Roads, etc.
Environmental Constraint Area
Forest Area
Future Residential
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2014; © Durham Region, 2014.
3. Orthoimagery © Durham Region, 2014. Imagery taken in 2012.
4. Official Plan and SWM Facility Data: Township of Uxbridge. Official Plan Township of Uxbridge Office Consolidation. August 2007.
Stantec Consulting Ltd., Township of Uxbridge Stormwater Management Facility Assessment 2012. January 2013.

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Uxbridge Urban Area and Hamlet of Coppin's Corners

Figure No.
11

Title
Subwatershed Boundaries and Land Use

Appendix B WILDLIFE RECORDS IN THE STUDY AREA

List of Sensitive Species

The **Snapping Turtle** (*Chelydra serpentina*) is provincially ranked as S3 (vulnerable) and is listed as Special Concern by both COSSARO and COSEWIC. The snapping turtle and their habitat are not protected under the ESA (2007). Snapping Turtles inhabit ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, aquatic vegetation, and soft bottoms. Females show strong nest site fidelity and nest in sand or gravel banks at waterway edges in late May or early June (COSEWIC, 2008).

The **Eastern Ribbonsnake** is provincially ranked vulnerable (S3) and is considered a provincial and federal species of special concern. This species is not provincially regulated under the Endangered Species Act (ESA) (2007). The Eastern Ribbonsnake is restricted to southern Ontario, where it is quite local, and is usually found close to water (Lamond, 1994). They often frequent the edge of shallow ponds, streams, marshes, swamps, or bogs with dense vegetation nearby that provides cover, with abundant exposure to sunlight and upland areas for nesting (COSEWIC, 2002). Ontario ribbonsnakes have been found to hibernate in animal burrows or rock crevices (Lamond, 1994).

The **Eastern Milksnake** (*Lampropeltis triangulum)* is provincially ranked vulnerable (S3) and is considered a provincial and federal species of special concern. This species is not provincially regulated under the ESA (2007). Eastern milksnake occurs throughout southern Ontario and is considered uncommon and local throughout its range (Lamond, 1994).The Milksnake is frequently reported in and around buildings, especially old structures. However, it is found in a variety of habitats, including prairies, pastures, hayfields, rocky hillsides and a wide variety of forest types. Two important features of ideal habitat are proximity to water, and suitable locations for basking and egg-laying, nesting sites may include compost or manure piles, stumps, under boards, or in loose soil (COSEWIC, 2002).

The **Eastern Whip-poor-will** is ranked provincially as S4B (apparently secure breeding status rank) and is designated as a provincially and federally threatened species. This species is afforded general habitat protection under the ESA (2007). Whip-poor-will favour open woodlands with frequent clearings. Its preferred nesting sites contain shaded leaf litter or pine needles and generally occur along wooded edges or in clearings without any herbaceous growth (Cadman et al. 1987). The species is considered to be area-sensitive, preferring 100 hectares of suitable habitat for breeding. Recent survey data suggest a substantial decline in Whip-poor-will numbers and a constriction of range, prompting its recent federal and provincial designation. Reasons for the decline are currently unknown and speculative with habitat loss and degradation, automobile collisions and changes in food supply listed as the leading threats (COSEWIC, 2009). The decline is concurrent with, and likely linked to, noted declines (and associated provincial and federal designations) of a number of aerial-foraging birds.

The **Chimney Swift** is provincially ranked apparently secure (S4) and is designated a provincially and federally threatened species. The species is afforded general habitat protection under the

ESA (2007). Chimney Swift use chimneys for roosting and breeding, as well as walls, rafters, or gables of buildings and, less frequently, natural structures such as hollow trees, tree cavities and cracks in cliffs (Cadman et al., 2007). The main limiting factor contributing to the species' decline is the reduction of suitable breeding and roosting habitat through logging, removal of abandoned buildings and particularly the reduction in use of traditional chimneys; poor weather conditions during breeding season, pesticide use, chimney sweeping during breeding season and intolerance of some building owners are also contributing factors (COSEWIC, 2007).

The **Acadian Flycatcher** is provincially ranked imperiled to vulnerable (S2S3) and is designated a provincially and federally endangered species. This species is afforded general habitat protection under the ESA (2007). Its preferred breeding habitat generally consists of large mature forests and deeply wooded ravines (Friesen and Stabb, 2001). A minimum of thirty hectares of suitable habitat are required. Acadian Flycatchers generally prefer large tracts of undisturbed forest and in Ontario, the species often breeds in black ash swamps (Whitehead and Taylor, 2002). Due to its area sensitive nature, suitable habitat is limited in Ontario as forest cover within its breeding range is low and occurs as small, isolated patches. Other limiting factors include logging practices, invasive species, and encroachment on habitat by agriculture, residential development and utility corridors (COSEWIC, 2010).

The **Barn Swallow** is ranked as S4B provincially (apparently secure breeding status rank) and is designated a provincially and federally threatened species. This species is afforded general habitat protection under the ESA (2007). As their name suggests, Barn Swallows nest on walls or ledges of barns as well as on other human-made structures such as bridges, culverts or other buildings (Cadman et al., 2007). Where suitable nesting structures occur, Barn Swallow often form small colonies, sometimes mixed with Cliff Swallows. Barns Swallows feed on aerial insects while foraging in open habitat (COSEWIC, 2011). Barn Swallows are generally considered grassland species, foraging over meadows, hay, pasture or even mown lawn. They will also frequently forage in woodland clearings, over wetland habitats or open water where insect prey are abundant.

The **Golden-winged Warbler** is ranked as S4B (apparently secure breeding status) and is designated a provincial species of special concern and a federally threatened species. The Golden-winged warbler is confined to southern Ontario with local concentrations along the southern edge of the Canadian Shield, primarily around southeastern Georgian Bay and north of Kingston. This species has experienced a rapid decline in population size over the past decade likely due to natural succession of habitat and hybridization with the Blue-winged warbler. Breeding occurs in successional scrub habitats bordered by forests and nests are constructed on the ground (Cadman et al, 2007). Preference is shown towards early successional scrub (10-30 years into succession) and the species will not persist when the stage of succession has succeeded their requirements. Parasitism by Brown-headed Cowbirds may also be playing a role in population declines (COSEWIC, 2006).

The **Canada Warbler** is ranked as S4B (apparently secure) in Ontario and is designated as a species of Special Concern provincially, although it is designated as a federally threatened species. The Canada Warbler is usually found in moist mixed deciduous-coniferous forests with a well-developed understorey. It may also occur in shrub marshes, red maple stands, coniferous riparian woodlands, ravines and steep brushy slopes, and regenerating forests. It is estimated that about one third of the Canada Warbler population breeds in Ontario. Although relatively abundant in Ontario, this species has been identified at risk due to a steady decline in the breeding population of about 2.4% per year. The main threat to this species appears to be habitat loss on its wintering grounds in South America, where approximately 90% of the cloud rainforest has been lost since the 1970's. Loss of breeding habitat to agriculture and a decline in prey (spruce budworm) may also be contributing factors to the Canada Warbler's decline (COSEWIC 2008; COSSARO 2009).

The **Eastern Meadowlark** is ranked as S4B provincially (apparently secure breeding status rank) and is designated as a provincially and federally threatened species. It is afforded general habitat protection under the ESA (2007). Meadowlarks are ground nesting birds (Harrison, 1975), which are often associated with human-modified habitats where they sing from prominent perches such as roadside wires, trees, and fenceposts. As a grassland species the Eastern Meadowlark typically occurs in meadows, hayfields and pastures. However, it will utilize a wider range of habitat than most grassland species, including mown lawn (e.g. golf course, parks), wooded city ravines, young conifer plantations and orchards (Peck and James 1983). The Eastern Meadowlark is generally tolerant of habitat with early succession of trees or shrubs. As with other grassland species, current threats are primarily the result of expanding urbanization and intensive farming practices (Cadman et al., 2007).

Bobolink is ranked as S4B provincially (apparently secure) and is a provincially and federally threatened species. This species is afforded general habitat protection under the *ESA* (2007). The Bobolink is generally referred to as a "grassland species". It nests primarily in forage crops with a mixture of grasses and broad-leaved forbs, predominantly hayfields and pastures. Preferred ground cover species include grasses such as Timothy and Kentucky bluegrass and forbs such as clover and dandelion (COSEWIC 2010). Bobolink is an area-sensitive species, with reported lower reproductive success in small habitat fragments (Kuehl and Clark 2002; Winter et al. 2004).

The **Little Brown Myotis** (formerly Little Brown Bat; *Myotis lucifugus*) is provincially ranked S5 (Secure) and is designated a provincially and federally endangered species. It is protected under ESA 2007. This species up until recently was considered the most common bat species in Ontario, and most frequently found bat species in North America. The recent change in status is due to significant declines in recent years attributed to a condition referred to as White-nose Syndrome (WNS). A widespread species, the Little Brown Bat is commonly found near waterbodies in buildings, attics, roof crevices and loose bark on trees or under bridges (Eder, 2002).

The **Northern Myotis** is listed as vulnerable (S3?; vulnerable) in Ontario and is designated as endangered federally and provincially. It is protected under *ESA, 2007*. The Northern Myotis (formerly Northern Long-eared Bat; *Myotis septentrionalis*) is a resident bat of upland forests of eastern North America, typically foraging for aerial insects in the forest understory. Maternity roosts are located under bark or in buildings with young born in June and July while hibernating colonies typically reside in cave crevices (Reid, 2006). The precipitous population decline of this species in recent years is attributed to a condition referred to as White-nose Syndrome (WNS).

The **Tri-coloured Bat** (formerly Eastern Pipistrelle; *Perimyotis subflavus*) is provincially ranked vulnerable, rank uncertain (S3?) and is designated a federally endangered species. It is not listed on any schedule federally and thus is not yet afforded protection under SARA or ESA, 2007. The Tri-coloured Bat prefers partly open habitat such as fields with large trees or woodland edges while avoiding both denser and more open areas. It likely roosts in leaves, caves or buildings in the summer, and hibernates in caves and mines where the humidity is high. Maternity colonies are usually found either in tree cavities or man-made structures, but in at least parts of their range they have also been recorded utilizing live and dead foliage as well as squirrel nests. They generally forage at canopy height over open water (NatureServe 2011). Populations have recently declined precipitously due to the rapid spread of White Nose Syndrome (WNS).

Aquatic Species List

Table 1 Aquatic Species List

Species	Scientific Name	Species	Scientific Name
Rainbow trout	*Oncorhynchus mykiss*	Slimy sculpin	*Cottus cognatus*
Brook trout	*Salvelinus fontinalis*	Mottled sculpin	*Cottus bairdi*
Brown trout	*Salmo trutta*	Pearl dace	*Margariscus margarita*
Ciscoe	*Coregonus artedi*	Central stoneroller	*Campostoma anomalum*
Muskellunge	*Esox masquinongy*	Yellow bullhead	*Ameiurus natalis*
White sucker	*Catostomus commersoni*	Brown bullhead	*Ameiurus nebulosus*
Northern hog sucker *	*Hypentelium nigricans*	Stonecat	*Noturus flavus*
Central mudminnow	*Umbra limi*	Brook stickleback	*Culeae inconstans*
Northern redbelly dace	*Phoxinus eos*	Rock bass	*Ambloplites rupestris*
Finescale dace	*Phoxinus neogaeus*	Green sunfish	*Lepomis cyanellus*
Brassy minnow	*Hybognathus hankinsoni*	Pumpkinseed	*Lepomis gibbosus*
Hornyhead chub	*Nocomis biguttatus*	Smallmouth bass	*Micropterus dolomieu*
River chub	*Nocomis micropogon*	Largemouth bass	*Micropterus salmoides*
Golden shiner	*Notemigonus crysoleucas*	White crappie*	*Pomoxis annularis*
Common shiner	*Luxilus cornutus*	Yellow perch	*Perca flavescens*
Blacknose shiner	*Notropis heterolepis*	Walleye	*Sander vitreus*
Rosyface shiner	*Notropis rubellus*	Greenside darter^	*Etheostoma blennioides*
Spotfin shiner	*Cyprinella spiloptera*	Rainbow darter	*Etheostoma caeruleum*
Bluntnose minnow	*Pimephales notatus*	Iowa darter	*Etheostoma exile*
Fathead minnow	*Pimephales promelas*	Johnny darter	*Etheostoma nigrum*
Blacknose dace	*Rhinichthys atratulus*	Blackside darter	*Percina maculata*
Longnose dace	*Rhinichthys cataractae*	Round goby*	*Neogobius melanostomus*
Creek chub	*Semotilus atromaculatus*		

Table 1 Aquatic Species List

Species	Scientific Name	Species	Scientific Name

*= Non-native invasive species

^= Non-native species to the Lake Simcoe watershed. This species is native to Ontario however, and is a species of Special Concern provincially

Wildife Records in the Study Area based on Background Data Sources

COMMON NAME	SCIENTIFIC NAME	ONTARIO STATUS	GLOBAL STATUS	COSSARO	COSEWIC
AMPHIBIANS					
Red-spotted Newt	*Notophthalmus viridescens*	S5	G5T5		
Spotted Salamander	*Ambystoma maculatum*	S4	G5		
Northern Redback Salamander	*Plethodon cinereus*	S5	G5		
American Toad	*Anaxyrus americanus*	S5	G5		
Tetraploid Gray Treefrog	*Hyla versicolor*	S5	G5		
Western Chorus Frog (carolinian)	*Pseudacris triseriata*	S4	G5	NAR	NAR
Spring Peeper	*Pseudacris crucifer*	S5	G5		
Bullfrog	*Lithobates catesbeiana*	S4	G5		
Northern Green Frog	*Lithobates clamitans*	S5	G5		
Pickerel Frog	*Lithobates palustris*	S4	G5	NAR	NAR
Wood Frog	*Lithobates sylvatica*	S5	G5		
Northern Leopard Frog	*Lithobates pipiens*	S5	G5	NAR	NAR
Mink Frog	*Lithobates septentrionalis*	S5	G5		
REPTILES					
Snapping Turtle	*Chelydra serpentina*	S3	G5	SC	SC
Midland Painted Turtle	*Chrysemys picta marginata*	S5	G5T5		
Eastern Gartersnake	*Thamnophis sirtalis*	S5	G5		
Eastern Ribbon Snake	*Thamnophis sauritus*	S3	G5	SC	SC
Northern Watersnake	*Nerodia sipedon sipedon*	S5	G5T5	NAR	NAR
Redbelly Snake	*Storeria occipitomaculata*	S5	G5		
Brown Snake	*Storeria dekayi*	S5	G5		NAR
Ringneck Snake	*Diadophis punctatus*	S4	G5		
Eastern Milksnake	*Lampropeltis triangulum*	S3	G5	SC	SC
BIRDS					
Canada Goose	*Branta canadensis*	S5	G5		
Trumpeter Swan	*Cygnus buccinator*	S4	G4	NAR	NAR
Wood Duck	*Aix sponsa*	S5	G5		
Mallard	*Anas platyrhynchos*	S5	G5		
Hooded Merganser	*Lophodytes cucullatus*	S5B,S5N	G5		
Common Merganser	*Mergus merganser*	S5B,S5N	G5		
Ring-necked Pheasant	*Phasianus colchicus*	SNA	G5		
Ruffed Grouse	*Bonasa umbellus*	S5	G5		
Wild Turkey	*Meleagris gallopava*	S5	G5		
Great Blue Heron	*Ardea herodias*	S5	G5		
Green Heron	*Butorides virescens*	S4B	G5		
Turkey Vulture	*Cathartes aura*	S5B	G5		
Osprey	*Pandion haliaetus*	S5B	G5		
Northern Harrier	*Circus cyaneus*	S4B	G5	NAR	NAR
Sharp-shinned Hawk	*Accipiter striatus*	S5	G5	NAR	NAR
Cooper's Hawk	*Accipiter cooperii*	S4	G5	NAR	NAR
Northern Goshawk	*Accipiter gentilis*	S4	G5	NAR	NAR
Red-shouldered Hawk	*Buteo lineatus*	S4B	G5		NAR
Broad-winged Hawk	*Buteo platypterus*	S5B	G5		
Red-tailed Hawk	*Buteo jamaicensis*	S5	G5	NAR	NAR
American Kestrel	*Falco sparverius*	S5B	G5		
Virginia Rail	*Rallus limicola*	S5B	G5		
Sora	*Porzana carolina*	S4B	G5		
Common Gallinule	*Gallinula chloropus*	S4B	G5		
Killdeer	*Charadrius vociferus*	S5B, S5N	G5		
Spotted Sandpiper	*Actitis macularia*	S5	G5		
American Woodcock	*Scolopax minor*	S4B	G5		
Rock Pigeon	*Columba livia*	SNA	G5		
Mourning Dove	*Zenaida macroura*	S5	G5		
Yellow-billed Cuckoo	*Coccyzus americanus*	S4B	G5		
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S5B	G5		
Eastern Screech-Owl	*Megascops asio*	S5	G5	NAR	NAR
Great Horned Owl	*Bubo virginianus*	S5	G5		
Long-eared Owl	*Asio otus*	S4	G5		
Eastern Whip-poor-will	*Antrostomus vociferus*	S4B	G5	THR	THR
Chimney Swift	*Chaetura pelagica*	S4B, S4N	G5	THR	THR
Ruby-throated Hummingbird	*Archilochus colubris*	S5B	G5		
Belted Kingfisher	*Ceryle alcyon*	S4B	G5		
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S5B	G5		
Downy Woodpecker	*Picoides pubescens*	S5	G5		
Hairy Woodpecker	*Picoides villosus*	S5	G5		
Northern Flicker	*Colaptes auratus*	S4B	G5		
Pileated Woodpecker	*Dryocopus pileatus*	S5	G5		
Eastern Wood-Pewee	*Contopus virens*	S4B	G5		SC-NS
Acadian Flycatcher	*Empidonax virescens*	S2S3B	G5	END	END
Willow Flycatcher	*Empidonax traillii*	S5B	G5		
Least Flycatcher	*Empidonax minimus*	S4B	G5		
Eastern Phoebe	*Sayornis phoebe*	S5B	G5		
Great Crested Flycatcher	*Myiarchus crinitus*	S4B	G5		
Eastern Kingbird	*Tyrannus tyrannus*	S4B	G5		
Yellow-throated Vireo	*Vireo flavifrons*	S4B	G5		
Blue-headed Vireo	*Vireo solitarius*	S5B	G5		
Warbling Vireo	*Vireo gilvus*	S5B	G5		
Red-eyed Vireo	*Vireo olivaceus*	S5B	G5		
Blue Jay	*Cyanocitta cristata*	S5	G5		
American Crow	*Corvus brachyrhynchos*	S5B	G5		

COMMON NAME	**SCIENTIFIC NAME**	ONTARIO STATUS	GLOBAL STATUS	COSSARO	COSEWIC
Purple Martin	*Progne subis*	S4B	G5		
Tree Swallow	*Tachycineta bicolor*	S4B	G5		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B	G5		
Bank Swallow	*Riparia riparia*	S4B	G5		THR-NS
Cliff Swallow	*Petrochelidon pyrrhonota*	S4B	G5		
Barn Swallow	*Hirundo rustica*	S4B	G5	THR	THR-NS
Black-capped Chickadee	*Poecile atricapillus*	S5	G5		
Red-breasted Nuthatch	*Sitta canadensis*	S5	G5		
White-breasted Nuthatch	*Sitta carolinensis*	S5	G5		
Brown Creeper	*Certhia americana*	S5B	G5		
House Wren	*Troglodytes aedon*	S5B	G5		
Winter Wren	*Troglodytes hiemalis*	S5B	G5		
Golden-crowned Kinglet	*Regulus satrapa*	S5B	G5		
Eastern Bluebird	*Sialia sialis*	S5B	G5	NAR	NAR
Veery	*Catharus fuscescens*	S4B	G5		
Hermit Thrush	*Catharus guttatus*	S5B	G5		
Wood Thrush	*Hylocichla mustelina*	S4B	G5		THR-NS
American Robin	*Turdus migratorius*	S5B	G5		
Gray Catbird	*Dumetella carolinensis*	S4B	G5		
Brown Thrasher	*Toxostoma rufum*	S4B	G5		
Northern Mockingbird	*Mimus polyglottos*	S4	G5		
European Starling	*Sturnus vulgaris*	SNA	G5		
Cedar Waxwing	*Bombycilla cedrorum*	S5B	G5		
Ovenbird	*Seiurus aurocapilla*	S4B	G5		
Northern Waterthrush	*Parkesia noveboracensis*	S5B	G5		
Golden-winged Warbler	*Vermivora chrysoptera*	S4B	G4	SC	THR
Blue-winged Warbler	*Vermivora cyanoptera*	S4B	G5		
Black-and-white Warbler	*Mniotilta varia*	S5B	G5		
Nashville Warbler	*Oreothlypis ruficapilla*	S5B	G5		
Mourning Warbler	*Geothlypis philadelphia*	S4B	G5		
Hooded Warbler	*Setophaga citrina*	S3B	G5	NAR	NAR
American Redstart	*Setophaga ruticilla*	S5B	G5		
Magnolia Warbler	*Setophaga magnolia*	S5B	G5		
Yellow Warbler	*Setophaga petechia*	S5B	G5		
Chestnut-sided Warbler	*Setophaga pensylvanica*	S5B	G5		
Pine Warbler	*Setophaga pinus*	S5B	G5		
Yellow-rumped Warbler	*Setophaga coronata*	S5B	G5		
Black-throated Green Warbler	*Setophaga virens*	S5B	G5		
Canada Warbler	*Wilsonia canadensis*	S4B	G5	SC	THR
Wilson's Warbler	*Cardellina pusilla*	S4B	G5		
Eastern Towhee	*Pipilo erythrophthalmus*	S4B	G5		
Chipping Sparrow	*Spizella passerina*	S5B	G5		
Field Sparrow	*Spizella pusilla*	S4B	G5		
Vesper Sparrow	*Pooecetes gramineus*	S4B	G5		
Savannah Sparrow	*Passerculus sandwichensis*	S4B	G5		
Grasshopper Sparrow	*Ammodramus savannarum*	S4B	G5		SC-NS
Song Sparrow	*Melospiza melodia*	S5B	G5		
Swamp Sparrow	*Melospiza georgiana*	S5B	G5		
White-throated Sparrow	*Zonotrichia albicollis*	S5B	G5		
Scarlet Tanager	*Piranga olivacea*	S4B	G5		
Northern Cardinal	*Cardinalis cardinalis*	S5	G5		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S4B	G5		
Indigo Bunting	*Passerina cyanea*	S4B	G5		
Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	THR-NS
Red-winged Blackbird	*Agelaius phoeniceus*	S5	G5		
Eastern Meadowlark	*Sturnella magna*	S4B	G5	THR	THR-NS
Common Grackle	*Quiscalus quiscula*	S5B	G5		
Brown-headed Cowbird	*Molothrus ater*	S4B	G5		
Baltimore Oriole	*Icterus galbula*	S4B	G5		
Purple Finch	*Haemorhouspurpureus*	S4B	G5		
House Finch	*Haemorhous mexicanus*	SNA	G5		
American Goldfinch	*Carduelis tristis*	S5B	G5		
House Sparrow	*Passer domesticus*	SNA	G5		
MAMMALS					
Masked Shrew	*Sorex cinereus*	S5	G5		
Northern Short-tailed Shrew	*Blarina brevicauda*	S5	G5		
Star-nosed Mole	*Condylura cristata*	S5	G5		
Little Brown Myotis	*Myotis lucifugus*	S5	G5	END	END-NS
Northern Myotis	*Myotis septentrionalis*	S3?	G4	END	END-NS
Tri-coloured Bat	*Perimyotis subflavus*	S3?	G5		END-NS
Big Brown Bat	*Eptesicus fuscus*	S5	G5		
Eastern Cottontail	*Sylvilagus floridanus*	S5	G5		
Snowshoe Hare	*Lepus americanus*	S5	G5		
European Hare	*Lepus europaeus*	SNA	G5		
Eastern Chipmunk	*Tamias striatus*	S5	G5		
Woodchuck	*Marmota monax*	S5	G5		
Grey Squirrel	*Sciurus carolinensis*	S5	G5		
Red Squirrel	*Tamiasciurus hudsonicus*	S5	G5		
Beaver	*Castor canadensis*	S5	G5		
White-footed Mouse	*Peromyscus leucopus*	S5	G5		
Muskrat	*Ondatra zibethicus*	S5	G5		
Meadow Vole	*Microtus pennsylvanicus*	S5	G5		
Norway Rat	*Rattus norvegicus*	SNA	G5		

COMMON NAME	SCIENTIFIC NAME	ONTARIO STATUS	GLOBAL STATUS	COSSARO	COSEWIC
House Mouse	*Mus musculus*	SNA	G5		
Porcupine	*Erethizon dorsatum*	S5	G5		
Coyote	*Canis latrans*	S5	G5		
Red Fox	*Vulpes vulpes*	S5	G5		
Raccoon	*Procyon lotor*	S5	G5		
Mink	*Mustela vison*	S4	G5		
Striped Skunk	*Mephitis mephitis*	S5	G5		
River Otter	*Lutra canadensis*	S5	G5		
White-tailed Deer	*Odocoileus virginianus*	S5	G5		

SUMMARY

Total Odonata:
Total Butterflies:
Total Other Arthropods
Total Amphibians:
Total Reptiles:
Total Birds:
Total Breeding Birds:
Total Mammals:

SIGNIFICANT SPECIES

Global:
National:
Provincial:
Regional:
Local:

Explanation of Status and Acronymns

COSSARO: Committee on the Status of Species at Risk in Ontario
COSEWIC: Committee on the Status of Endangered Wildlife in Canada
REGION: Rare in a Site Region
S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)
S2: Imperiled—Imperiled in the province, very few populations (often 20 or fewer),
S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)
S4: Apparently Secure—Uncommon but not rare
S5: Secure—Common, widespread, and abundant in the province
SX: Presumed extirpated
SH: Possibly Extirpated (Historical)
SNR: Unranked
SU: Unrankable—Currently unrankable due to lack of information
SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#: Range Rank—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species
S#B- Breeding status rank
S#N- Non Breeding status rank
?: Indicates uncertainty in the assigned rank
G1: Extremely rare globally; usually fewer than 5 occurrences in the overall range
G1G2: Extremely rare to very rare globally
G2: Very rare globally; usually between 5-10 occurrences in the overall range
G2G3: Very rare to uncommon globally
G3: Rare to uncommon globally; usually between 20-100 occurrences
G3G4: Rare to common globally
G4: Common globally; usually more than 100 occurrences in the overall range
G4G5: Common to very common globally
G5: Very common globally; demonstrably secure
GU: Status uncertain, often because of low search effort or cryptic nature of the species; more data needed.
GNR: Unranked—Global rank not yet assessed.
T: Denotes that the rank applies to a subspecies or variety
Q: Denotes that the taxonomic status of the species, subspecies, or variety is **questionable**.
END: Endangered
THR: Threatened
SC: Special Concern
2, 3 or NS after a COSEWIC ranking indicates the species is either on Schedule 2, Schedule 3 or No Schedule of the Species At Risk Act (SARA)
NAR: Not At Risk
IND: Indeterminant, insufficient information to assign status
DD: Data Deficient
6: Rare in Site Region 6
7: Rare in Site Region 7

Appendix C ARCHEOLOGICAL ASSESSMENT

STAGE 1 ARCHAEOLOGICAL ASSESSMENT, STORMWATER MANAGEMENT MASTER PLAN UXBRIDGE URBAN AREA TOWNSHIP OF UXBRIDGE, ON

Lots 26-34, Concessions 6 - 7, and
Lots 16-18, Concession 4,
Geographic Township of Uxbridge,
Ontario

Prepared for:
The Township of Uxbridge
51 Toronto Street South
P.O. Box 190
Uxbridge, Ontario
L9P 1T1

Prepared by:
Stantec Consulting Ltd.
400-1331 Clyde Ave
Ottawa, ON K2C 3G4

Licensee: Vincent Bourgeois
License Number: P381
PIF Number: P381-0014-2014

Project # 160621777

April 7, 2015

ORIGINAL REPORT

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Project Personnel

Archaeology Project Director:	Jim Wilson, MA, Principal, Regional Discipline Leader, Archaeology (P001)
Overall Project Manager	Colin Varley, MA, RPA, Associate, Senior Archaeologist (P002)
Archaeology Task Manager	Colin Varley, MA (P002)
Licensed Archaeologist	Vincent Bourgeois, MA (P381)
Licensed Field Directors:	Vincent Bourgeois, MA (P381)
Report Writer:	Colin Varley, MA (P002)
Senior Review:	Jim Wilson, MA (P001)
Office Assistants:	Nicole Cruikshank, B.Sc. CertGIS
Ministry of Tourism, Culture and Sport:	Robert von Bitter

Executive Summary

Stantec was retained by the Township of Uxbridge to complete a Stage 1 Archaeological Assessment (AA) as part of an overall Schedule B Class Environmental Assessment for a Stormwater Management Master Plan for the Uxbridge Urban Area. The study area for the Stage 1 AA included Lots 26 to 34 in Concession 6 and 7, and Lots 16 to 18, Concession 4, Geographic Township of Uxbridge. The objectives of the Stage 1 AA were to compile available information about the known and potential archaeological heritage resources within the study area and to provide specific direction for the protection, management and/or recovery of these resources.

The Stage 1 archaeological assessment resulted in the determination that portions of the study areas exhibit high potential for the identification and recovery of archaeological resources. As such, a Stage 2 archaeological assessment will be required for the location of any SWM facilities that are located outside of areas identified as previously disturbed.

The MTCS is asked to review the results presented and accept this report into the Ontario Public Register of Archaeological Reports.

The Executive Summary highlights key points from the report only; for complete information and findings, the reader should examine the complete report.

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1.0 Project Context

1.1 DEVELOPMENT CONTEXT

The Township of Uxbridge (the Town) chose Stantec Consulting Ltd. to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management Master Plan (SWMMP) for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWMMP was prepared in accordance with the *Comprehensive SWM Master Plan Guidelines*, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the *Municipal Class Environmental Assessment Guideline*, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011). As part of the Schedule B Class EA a Stage 1 Archaeological Assessment (AA) was required. The Stage 1 AA was completed by Stantec under Project Information Form (PIF) P381-0014-2014, issued to Vincent Bourgeois under Professional Consultant Licence P381.

The Township of Uxbridge and Coppin's Corners study areas are located south of Lake Simcoe. The Uxbridge study area is generally bounded by Ball Road (north), Concession Road 7 (east), Wagg Road (south), Concession Rd#6 (west). The Coppin's Corners study area is generally bounded by Regional Road HWY 47 (north), Concession Regional Road No. 1 (east), Regional Road No.21 (south) and Concession Road #4 (west). These study areas are the urban areas from the Town's Official Plan and can be seen in Figures 1 and 2. The study area drains to two sub watersheds: Uxbridge Brook and Pefferlaw Brook. There are existing Stormwater Management (SWM) facilities in place that consist of wet ponds. The intent of the SWMMP is to develop the practical and implementable framework which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities.

1.1.1 Objectives

For the purposes of this Stage 1 assessment the Ministry of Tourism, Culture and Sport's (MTCS) 2011 *Standards and Guidelines for Consultant Archaeologists (*Government of Ontario 2011) were followed. The objective of the Stage 1 background study is to document the subject properties' archaeological and land use history and present conditions. This information will be used to support recommendations regarding cultural heritage value or interest as well as assessment and mitigation strategies. The Stage 1 research information was drawn from:

- The MTCS' Archaeological Sites Database (ASDB) for a listing of registered archaeological sites within a one kilometre radius of the study area;
- Reports of previous archaeological assessment within a radius of 50 metres around the property;
- Recent and historical maps of the property area;

- Archaeological management plans or other archaeological potential mapping when available; and
- Commemorative plaques or monuments.

1.2 HISTORICAL CONTEXT

1.2.1 Post-Contact Aboriginal Resources

The post-contact Aboriginal occupation of Southern Ontario was heavily influenced by the dispersal of various Iroquoian-speaking communities by the New York State Iroquois and the subsequent arrival of Algonkian-speaking groups from northern Ontario at the end of the 17th century and beginning of the 18th century (Konrad 1981; Schmalz 1991). By 1690, Algonkian speakers from the north appear to have begun to repopulate Bruce County (Rogers 1978:761). This is the period in which the Mississaugas are known to have moved into southern Ontario and the lower Great Lakes watersheds (Konrad 1981).

At the time of European contact there was a trail that ran from the area of Oshawa Harbour to Lake Scugog known as the Scugog Carrying Place (Frost, 1973). From Lake Scugog the trail connected with the lower Trent River Valley and from there up to Lake Simcoe and Georgian Bay.

1.2.2 Euro-Canadian Settler Resources

The Township of Uxbridge was surveyed in 1804 and 1805 by S.S. Wilmot (Farewell, 1907). Once the land was under survey a number of applicants began patenting lands. In 1804 15 patents of 200 acre lots were made (Johnson, 1973). Despite the patenting of those lands, actual settlement of the township was slow in coming. The earliest settlers (1806) in the Township were Elijah Collins in Lot 21, Concession 5, William Gould in Lot 31, Concession 5 and Dr. Christopher Beswick in what is now the Town of Uxbridge near the present day Elgin Pond. Collins and Gould were both Quakers from Pennsylvania, and several Quaker families followed them to Uxbridge by 1808. Dr. Beswick attempted to build a grist mill and saw mill at his property, but before they could be completed he sold his property to Joseph Collins, who completed the construction of both mills in 1809 (Farewell, 1907; Todd, 1980). The earliest road to Uxbridge cut east from Newmarket and ran north of present day Regional Road 8 (Todd, 1980).

Another significant event of 1808 was the birth of Joseph Gould, who became an important figure in the community for both his industrial and commercial enterprises in the town and his political career at both the municipal and provincial levels (Farewell, 1907: Weaver, 1913).

The War of 1812 stopped the influx of American settlers, and in some cases caused some already settled to return, and after the conclusion of the war immigration into Uxbridge Township was slow to return (Todd, 1980). While most immigration into Ontario County prior to the war had been Americans, after the war the influx was largely of British descent (Johnson, 1973). By the time of the 1826 census, the first to separate out the population of Uxbridge , there were only 228 inhabitants, compared to 891 in Pickering Township, 1098 in Whitby Township and 282 in Brock Township, which had only been opened for eight years (Johnson, 1973; Todd, 1980). It was not until 1840 that the population density of Uxbridge Township exceeded 5 persons per square mile (Johnson, 1973). However, between 1840 and 1850 the population of the township grew rapidly from under 700 to 2,289 (Johnson, 1973).

The increase in population also resulted in a significant increase in the area occupied and under cultivation. In 1840 there were 7,913 acres occupied and 2,456 under cultivation. A decade later those numbers had increased to 25,983 and 8,980, respectively. Cultivated area at both census takings was only in the low 30% range (Johnson, 1973). By 1871 the amount of land occupied had increased by 70% to 43,773 acres. The amount under cultivation, however, had increased three-fold to 28,457 acres (Johnson, 1973).

By the time of the 1877 Historical Atlas of Ontario County all of the lots in the township had been taken up and homesteads built (Figure 3) (Beers, 1877). The Uxbridge Township map shows not only the locations of the residences of each lot occupant but also indicates the locations on important public and commercial buildings, including churches, schools, meeting halls and mills. In particular, within the study area there are three churches and a school shown along Concession 6. A saw mill is shown in the east part of Lot 21, Concession 7. There are also cemeteries shown in Lots 28 and 29, Concession 6.

Much of the Uxbridge Urban Area study area was already developed town site by 1877 (Figure 4). Several mills are noted along Uxbridge Creek and near the still extant mill ponds in Elgin Park and on the east side of Toronto Street (Figure 4), and development along the margins of these mill ponds has been less intensive than other parts of the town area (Figures 6 and 9).

The study area at Coppin's Corners has until recently been agricultural in use. Four of the six parcels incorporated in the Coppin's Corners area as shown on the 1877 map are indicated as containing a family residence (Figure 3). However, two of the parcels, the Gould and Cook properties in the east and south-east part of the study area, are not indicated as having any residence and these properties appear to have been used exclusively at that time for agricultural purposes by landowners who resided elsewhere in the township.

1.2.3 Recent Reports

Previous archaeological assessment reports for the study area include reports by Archaeological Services Inc. (ASI, 1996) and by Kim Slocki (Slocki, 2009).

1.3 ARCHAEOLOGICAL CONTEXT

1.3.1 The Natural Environment

The majority of the study area is located within the Oak Ridges Moraine physiographic region (Chapman and Putnam 1984). The Oak Ridges Moraine is a large region that extends from the Niagara Escarpment in the west to the Trent River in the east and forms the height of land that separates watersheds that drain south into Lake Ontario and north into Georgian Bay and the Trent River. The surface of the moraine is general hilly and comprised of a knob-and-basin relief. Over the whole of the moraine the hills are typically composed of sandy or gravelly material; however in some of the higher elevations around Uxbridge there are till soils that extend above the sand.

The extreme north-eastern corner of the study area is part of the Peterborough Drumlin Field physiographic region, which is a rolling till plain (Chapman and Putnam 1984). In the portions of the plain that border the Oak Ridges Moraine, including the present study area, the till is sandier. Many of the drumlins near the moraine also have coverings of almost stone free fine sand or silt that is likely wind blown off of the moraine (Chapman and Putnam 1984).

The surficial geology of the Uxbridge study area is composed primarily of Pontypool sandy loam, which has good drainage characteristics and is generally rolling to hilly terrain (Olding *et al.*, 1953). Pontypool soils cover almost the entire south half of the study area and a large pocket in the north-west corner. In the north-central and north-west part of the study area the predominant soil type is Dundonald sandy loam, which has good drainage characteristics and is undulating to rolling terrain (Olding *et al.*, 1953). The north-east corner of the study area, the portion in the Peterborough Drumlin Field region, is composed of three soil types: Brighton sandy loam, Schomberg silt loam and Bondhead sandy loam (Olding *et al.*, 1953). All of these soil types also have good drainage characteristics and are nearly level to rolling in terrain. With respect to suitability for farming the Dundonald sandy loam, Schomberg silt loam and Bondhead silt loam are considered to be good to fair crop land (Olding *et al.*, 1953). Brighton sandy loam is considered to be fair crop land and Pontypool sandy loam is a fair to poor crop land (Olding *et al.*, 1953).

The majority of the Coppin's Corners Study Area is Composed of PontyPool sandy loam, with a pocket of Brighton sandy loam at the east end and a pocket of Woburn sandy loam at the west end (Olding *et al.*, 1953). Woburn series soils are well drained and rolling. Of particular note, there have been several aggregate pits located around Coppin's Corners (Olding *et al.*, 1953).

There are relatively few areas of permanently saturated ground in the study area. These are largely restricted to the western boundary of the study area and a few margins along the headwaters of the Uxbridge Brook in the south and west of the study area and the Beaverton River in the east of the study area (Figure 5).

1.3.2 Pre-contact Aboriginal Resources

The following summary of the prehistoric occupation of Southern Ontario (see Table 3-1 for chronological chart) is based on syntheses in ASI (2004), Archaeologix (2008), Bursey *et al.* (n.d.), Ellis and Ferris (1990) and Jacques Whitford (2008).

The first identified human occupation of Ontario begins just after the end of the Wisconsin Glacial period. The first human settlement can be traced back 11,000 years, when this area was settled by Native groups that had been living south of the emerging Great Lakes. This initial occupation is referred to as the "Palaeo-Indian" archaeological culture.

Table 1 Southern Ontario Prehistoric Cultural Chronology, Years Before Present (BP)

ARCHAEOLOGICAL PERIOD	TIME	CHARACTERISTICS
Early Palaeo-Indian	11,000–10,400 BP	caribou and extinct Pleistocene mammal hunters, small camps
Late Palaeo-Indian	10,400–10,000 BP	smaller but more numerous sites
Early Archaic	10,000-8,000 BP	slow population growth, emergence of woodworking industry, development of specialised tools
Middle Archaic	8,000–4,500 BP	environment similar to present, fishing becomes important component of subsistence, wide trade networks for exotic goods
Late Archaic	4,500-3,100 BP	increasing site size, large chipped lithic tools, introduction of bow hunting
Terminal Archaic	3,100-2,950 BP	emergence of true cemeteries with inclusion of exotic trade goods
Early Woodland	2,950-2,400 BP	introduction of pottery, continuation of Terminal Archaic settlement and subsistence patterns
Middle Woodland	2,400-1,400 BP	increased sedentism, larger settlements in spring and summer, dispersed smaller settlement in fall and winter, some elaborate mortuary ceremonialism
Transitional Woodland	1,400-1,100 BP	incipient agriculture in some locations, seasonal hunting & gathering
Late Woodland (Early Iroquoian)	1,100-700 BP	limited agriculture, development of small village settlement, small communal longhouses
Late Woodland (Middle Iroquoian)	700-600 BP	shift to agriculture as major component of subsistence, larger villages with large longhouses, increasing political complexity
Late Woodland (Late Iroquoian)	600- 350 BP	very large villages with smaller houses, politically allied regional populations, increasing trading network

Early Palaeo-Indian (EPI) (11,000-10,400 BP) settlement patterns suggest that small groups, or “bands”, followed a pattern of seasonal mobility extending over large territories. Many (although by no means all) of the EPI sites were located on former beach ridges associated with Lake Algonquin, the post-glacial lake occupying the Lake Huron/Georgian Bay basin, and it is likely that the vegetative cover of these areas would have consisted of open spruce parkland, given the cool climatic conditions. Sites tend to be located on well-drained loamy soils, and on elevations in the landscape, such as knolls. The fact that artifact assemblages of EPI sites are composed exclusively of stone skews our understanding of the general patterns of resource extraction and use. However, the taking of large game, such as caribou, mastodon and mammoth, appears to be of central importance to the sustenance of these early inhabitants. Moreover, EPI sites often appear to be located in areas which would have intersected with migratory caribou herds

The Late Palaeo-Indian (LPI) period (10,400-10,000 BP) is poorly understood compared to the EPI, the result of less research focus than the EPI. As the climate warmed, the spruce parkland was gradually replaced and the vegetation of Southern Ontario began to be dominated by closed coniferous forests. As a result many of the large game species that had been hunted in the EPI period either moved north with the more open vegetation, or became extinct. Like the EPI, LPI peoples covered large territories as they moved around to exploit different resources. Palaeo-Indian site clusters closest to the project area include one at the Holland Marsh between Toronto and Lake Simcoe and at Rice Lake to the east of Uxbridge.

The transition from the Palaeo-Indian period to the Archaic archaeological culture of Ontario prehistory is evidenced in the archaeological record by the development of new tool technologies, the result of utilising an increasing number of resources as compared to peoples from earlier archaeological cultures, and developing a broader based series of tools to more intensively exploit those resources. During the Early Archaic period (10,000-8,000 BP), the jack and red pine forests that characterized the LPI environment were replaced by forests dominated by white pine with some associated deciduous elements. Early Archaic projectile points differ from Palaeo-Indian forms most notably by the presence of side and corner notching on their bases. A ground stone tool industry, including celts and axes, also emerges, indicating that woodworking was an important component of the technological development of Archaic peoples. Although there may have been some reduction in the degree of seasonal movement, it is still likely that population density during the Early Archaic was low, and band territories large.

The development of a more diversified tool technology continued into the Middle Archaic period (8,000-4,500 BP). The presence of grooved stone net-sinkers suggests an increase in the importance of fishing in subsistence activities. Another new tool, the bannerstone, also made its first appearance during this period. Bannerstones are ground stone weights that served as counterbalance for "atlatls" or spear-throwers, again indicating the emergence of a new technology. The increased reliance on local, often poor quality chert resources for chipped stone tools suggests that in the Middle Archaic groups inhabited smaller territories that often did not encompass a source of high quality raw material. In these instances lower quality materials which had been glacially deposited in local tills and river gravels were used.

This reduction in territory size appears to have been the result of gradual region-wide population growth, which forced a reorganization of subsistence practices, as more people had to be supported from the resources of a smaller area. Stone tools especially designed for the preparation of wild plant foods suggest that subsistence catchment was being widened and new resources being more intensively exploited. A major development of the later part of the Middle Archaic period was the initiation of long distance trade. In particular, native copper tools manufactured from sources near Lake Superior were being widely traded.

The trend towards decreased territory size and a broadening subsistence base continued during the Late Archaic (4,500-2,900 BP). Late Archaic sites are far more numerous than either Early or Middle Archaic sites. It appears that the increase in numbers of sites at least partly represents an increase in population. However, around 4,500 BP water levels in the Great Lakes began to take their modern form, rising from lower levels in the Early and Middle Archaic periods. It is likely that the relative paucity of earlier Archaic sites is due to their being inundated under rising lake levels.

The appearance of the first true cemeteries occurs during the Late Archaic. Prior to this period individuals were interred close to the location where they died. However, with the advent of the Late Archaic and local cemeteries, individuals who died at a distance from the cemetery would be returned for final burial at the group cemetery, often resulting in disarticulated skeletons, occasionally missing minor bone elements (e.g. finger bones). The emergence of local group cemeteries has been interpreted as being a response to both increased population densities and competition between local groups for access to resources in that cemeteries would have provided symbolic claims over a local territory and its resources.

Increased territoriality and more limited movement are also consistent with the development of distinct local styles of projectile points. The trade networks which began in the Middle Archaic expand during this period, and begin to include marine shell artifacts (such as beads and gorgets) from as far away as the Mid-Atlantic coast. These marine shell artifacts and native copper implements show up as grave goods, indicating the value of the items. Other artifacts such as polished stone pipes and slate gorgets also appear on Late Archaic sites. One of the more unusual of the Late Archaic artifacts is the "birdstone", small, bird-like effigies usually manufactured from green banded slate.

The Early Woodland period (2,900-2,200 BP) is distinguished from the Late Archaic period primarily by the addition of ceramic technology. While the introduction of pottery provides a useful demarcation point for archaeologists, it may have made less difference in the lives of the Early Woodland peoples. The first pots were very crudely constructed, thick walled, and friable. It has been suggested that they were used in the processing of nut oils by boiling crushed nut fragments in water and skimming off the oil. These vessels were not easily portable, and individual pots must not have enjoyed a long use life. There have also been numerous Early Woodland sites located at which no pottery was found, suggesting that these poorly constructed, undecorated vessels had yet to assume a central position in the day-to-day lives of Early Woodland peoples.

Other than the introduction of this rather limited ceramic technology, the life-ways of Early Woodland peoples show a great deal of continuity with the preceding Late Archaic period. For instance, birdstones continue to be manufactured, although the Early Woodland varieties have "pop-eyes" which protrude from the sides of their heads. Likewise, the thin, well-made projectile points which were produced during the terminal part of the Archaic period continue in use. However, the Early Woodland variants were side-notched rather than corner-notched, giving them a slightly altered and distinctive appearance. The trade networks which were established in the Middle and Late Archaic also continued to function, although there does not appear to have been as much traffic in marine shell during the Early Woodland period. These trade items were included in increasingly sophisticated burial ceremonies, some of which involved construction of burial mounds. Such burial sites from this period have been identified near Grenadier Pond and at Baby Point on the Humber River in Toronto

In terms of settlement and subsistence patterns, the Middle Woodland (2,200 B.C.-1,100 BP) provides a major point of departure from the Archaic and Early Woodland periods. While Middle Woodland peoples still relied on hunting and gathering to meet their subsistence requirements, fish were becoming an even more important part of the diet. Middle Woodland vessels are often heavily decorated with hastily impressed designs covering the entire exterior surface and upper portion of the vessel interior. Consequently, even very small fragments of Middle Woodland vessels are easily identifiable.

It is also at the beginning of the Middle Woodland period that rich, densely occupied sites appear along the margins of major rivers and lakes. While these areas had been utilized by earlier peoples, Middle Woodland sites are significantly different in that the same location was occupied off and on for as long as several hundred years. Because this is the case, rich deposits of artifacts often accumulated. Unlike earlier seasonally utilized locations, these Middle Woodland sites appear to have functioned as base camps, occupied off and on over the course of the year. There are also numerous small upland Middle Woodland sites, many of which can be interpreted as special purpose camps from which localized resource patches were exploited. This shift towards a greater degree of sedentism continues the trend witnessed from at least Middle Archaic times, and provides a prelude to the developments that follow during the Late Woodland period.

Burial ceremonialism appears to reach its zenith in the Middle Woodland period, including the construction of large and elaborate burial mounds, including the Serpent Mound near Rice Lake. Exotic trade goods in large quantities are also associated with Middle Woodland burials.

The relatively brief period of the Transitional Woodland period is marked by the acquisition of cultivar plants species, such as maize and squash, from communities living south of the Great Lakes. The appearance of these plants began a transition to food production, which consequently led to a much reduced need to acquire naturally occurring food resources. Sites were thus occupied for longer periods and by larger numbers of people.

The Late Woodland period in southern Ontario is associated with societies referred to as the Ontario Iroquois Tradition. This period is often divided into three temporal components; Early, Middle and Late Iroquoian (see Table 3.1).

Early Iroquoian peoples continued to practice similar subsistence and settlement patterns as the Transitional Woodland. Villages tended to be small, with small longhouse dwellings that housed either nuclear or, with increasingly, extended families. Smaller camps and hamlets associated with villages served as temporary bases from which wild plant and game resources were acquired. Horticulture appears to have been for the most part a supplement to wild foods, rather than a staple.

The Middle Iroquoian period marks the point at which a fully developed horticultural system (based on corn, bean, and squash) emerged, and at which point cultivars became the staple food source. In this period villages become much larger than in the Early Iroquoian period, and longhouses also become much larger, housing multiple, though related, nuclear families. Food production through horticulture resulted in the abandonment of seasonal mobility that had characterized aboriginal life for millennia. Hunting, fishing, and gathering of wild food activities continued to occur at satellite camps. However, for the most part, most Iroquoian people inhabited large, sometimes fortified villages throughout southern Ontario.

During the Late Iroquoian period longhouses became smaller again, although villages became even larger. Most, if not all, of the Iroquoian communities along the north shore of Lake Ontario had moved by about 1600 either northward, joining with other groups in Simcoe County to form the Petun and Huron, or westward to join other ancestral groups of the Neutral, situated at the west end of Lake Ontario and the Niagara Peninsula. By the 1660s the New York state based Five Nations Iroquois, in particular the Seneca, were using the central north shore of Lake Ontario for hunting, fishing, and participation in the European fur trade. Their main settlements were located near the mouths of the Humber and Rouge Rivers, two branches of the Toronto Carrying Place which linked Lake Ontario to the upper Great Lakes via Lake Simcoe. The main Seneca settlement at the Rouge River was the village of *Ganatsekwyagon*. From here travel routes extended to the east and west along the shoreline of Lake Ontario, which in turn led to trading partners still eager to acquire furs. Toward the end of the 17th century Seneca settlements, whose primary trading partners were English, came under increasing pressure from an alliance between the French at Cataraqui (Kingston) and the Ojibwa, Odawa and Potawatomi nations. By 1695 the Seneca had abandoned their villages on the north shore of Lake Ontario and returned to their ancestral homeland in Western New York State. Aboriginal use and occupation of the north shore of Lake Ontario continued until the late 18th and early 19th centuries.

1.3.3 Previously Identified Archaeological Sites and Surveys

In order that an inventory of archaeological resources could be compiled, the registered archaeological site records kept by the MTCS were consulted. In Ontario, information concerning archaeological sites is stored in the ASDB maintained by the MTCS. This database contains archaeological sites registered according to the Borden system. Under the Borden system, Canada is divided into grid blocks based on latitude and longitude. A Borden Block is approximately 13 kilometres east to west and approximately 18.5 kilometres north to south. Each Borden Block is referenced by a four-letter designator and sites within a block are numbered sequentially as they are found. The study area under review is within Borden Block BaGs.

Information concerning specific site locations is protected by provincial policy, and is not fully subject to the *Freedom of Information and Protection of Privacy Act*. The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to all media capable of conveying location, including maps, drawings, or textual descriptions of a site location. The MTCS will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

An examination of the ASDB has shown that there are at present two registered archaeological sites within a one kilometre radius of the study area (Table 2). Previous archaeological assessment reports for the study area include reports by Archaeological Services Inc. (ASI, 1996) and by Kim Slocki (Slocki, 2009).

Table 2: Registered Archaeological Sites within a One Kilometre Radius of the Study Area

Borden #	Name	Cultural Affiliation
BaGs-25	Gould	19th century Euro-Canadian
BaGs-32	Charlie	19th century Euro-Canadian

2.0 Field Methods

The Stage 1 archaeological assessment compiled available information about the known and potential archaeological heritage resources within the study area. This Stage 1 archaeological assessment was conducted under archaeological consulting license P381 issued to Vincent Bourgeois, MA, of Stantec by the MTCS. No field visit occurred for this overview report.

3.0 Analysis and Conclusions

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Stantec applied archaeological potential criteria commonly used by the Ontario Ministry of Tourism, Culture and Sport (Government of Ontario 2011) to determine areas of archaeological potential within the region under study. These variables include proximity to previously identified archaeological sites, distance to various types of water sources, soil texture and drainage, glacial geomorphology, elevated topography and the general topographic variability of the area.

Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and, considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential. Finally, extensive land disturbance can eradicate archaeological potential (Wilson and Horne, 1995).

Distance to water is an essential factor in archaeological potential modeling. When evaluating distance to water it is important to distinguish between water and shoreline, as well as natural and artificial water sources, as these features affect sites locations and types to varying degrees. The MTCS (Government of Ontario 2011) categorizes water sources in the following manner:

- Primary water sources: lakes, rivers, streams, creeks;
- Secondary water sources: intermittent streams and creeks, springs, marshes and swamps;
- Past water sources: glacial lake shorelines, relic river or stream channels, cobble beaches, shorelines of drained lakes or marshes; and
- Accessible or inaccessible shorelines: high bluffs, swamp or marshy lake edges, sandbars stretching into marsh.

The study area is widely intersected by several small arms of the headwaters of the Uxbridge Creek, and in the north-east part by headwaters of the Beaverton River. While there are several ponds along these headwaters these are the result of damming of the watercourses and in their present form should not be considered to reflect natural hydrogrophy.

Soil texture can be an important determinant of past settlement, usually in combination with other factors such as topography. The study area is characterized by well drained sandy loam or silty loam soils of variable quality for crop production. Any of these soils would have been suitable for pre-contact Aboriginal horticulture, and much of the study area has been used for cultivation over the last 150 years. As such there are no specific areas of greater archaeological potential based on soil texture.

For Euro-Canadian sites, archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; properties listed on the municipal register or designated under the *Ontario Heritage Act*; and property that local histories or informants have identified with possible historical events, activities or occupations. The study area and its environs are located within an area with a record of settlement and growth in the 19th century, and the archaeological potential could be high.

When the above listed criteria are applied to the study area, the archaeological potential for Aboriginal and historic Euro-Canadian sites is deemed to be high for portions of the Uxbridge Urban Area and Hamlet of Coppin's Corner study areas (Figures 5-9). Within much of the Town of Uxbridge itself, some sub-urban areas to the north and south of Uxbridge, and in the Coppin's Corners study area that contains the golf course and developed area in the south-east corner, the archaeological potential is considered low due to extensive and deep modern disturbances. These activities have subjected the study area to extensive and deep land alterations which would have severely damaged the integrity of any archaeological resources, thus removing archaeological potential as per Section 7.7.3 Standard 2 of the *Standards and Guidelines for Consultant Archaeologists*.

4.0 Recommendations

Stantec was retained by the Township of Uxbridge to complete a Stage 1 AA as part of an overall Schedule B Class Environmental Assessment for a Stormwater Management Master Plan for the Uxbridge Urban Area. The study area for the Stage 1 AA included Lots 26 to 34 in Concession 6 and 7, and Lots 16 to18, Concession 4 Geographic Township of Uxbridge.

The Stage 1 archaeological assessment resulted in the determination that portions of the study areas exhibit high potential for the identification and recovery of archaeological resources. As such, a Stage 2 archaeological assessment will be required for the location of any SWM facilities that are located outside of areas identified as previously disturbed.

Figures 5 to 9 identify areas where 300 m buffer zones have been applied to MTCS criteria for determining archaeological potential. In all areas covered by these buffer zones all Stage 2 AA must be carried out at 5 m survey intervals whether by pedestrian survey of open ploughed fields or test pit excavation survey in areas that are wooded and/or inaccessible to ploughing. For areas outside of these buffer zones pedestrian survey must still be carried out at 5 m survey intervals. The interval for test pit excavation survey outside of these buffer zones can be extended to 10 m.

Stage 2 AA by pedestrian survey will include the systematic walking of open ploughed fields at five metre intervals as outlined in Section 2.1.1 of the MTCS' 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). The MTCS standards further require that all agricultural land, both active and inactive, be recently ploughed and sufficiently weathered to improve the visibility of archaeological resources. Ploughing must be deep enough to provide total topsoil exposure, but not deeper than previous ploughing, and must be able to ensure at least 80% ground surface visibility.

For Stage 2 AA conducted by test pit excavation will follow methodologies as outlined in Section 2.1.2 of the MTCS' 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). The MTCS standards require that each test pit be approximately 30 centimetres in diameter, excavated to at least five centimetres in to subsoil, and have all soil screened through six millimetre hardware cloth to facilitate the recovery of any cultural material that may be present. Prior to backfilling, each test pit will be examined for stratigraphy, cultural features, or evidence of fill.

Should any areas of disturbance or features indicating that archaeological potential have been removed (for example, permanently wet areas, existing roads, and previous pipeline land alterations) not previously identified during the Stage 1 assessment be encountered during the Stage 2 archaeological assessment, they will be documented as outlined in Section 2.1.8 of the MTCS' 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011).

The Ministry of Tourism, Culture and Sport is asked to review the results presented and to accept this report into the Ontario Public Register of Archaeological Reports. Additional archaeological assessment is required; hence the study area remains subject to Section 48(1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

5.0 Advice on Compliance with Legislation

This report is submitted to the Ontario Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18 (Government of Ontario 1990c). The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Cemeteries Act*, R.S.O. 1990 c. C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ontario Ministry of Consumer Services.

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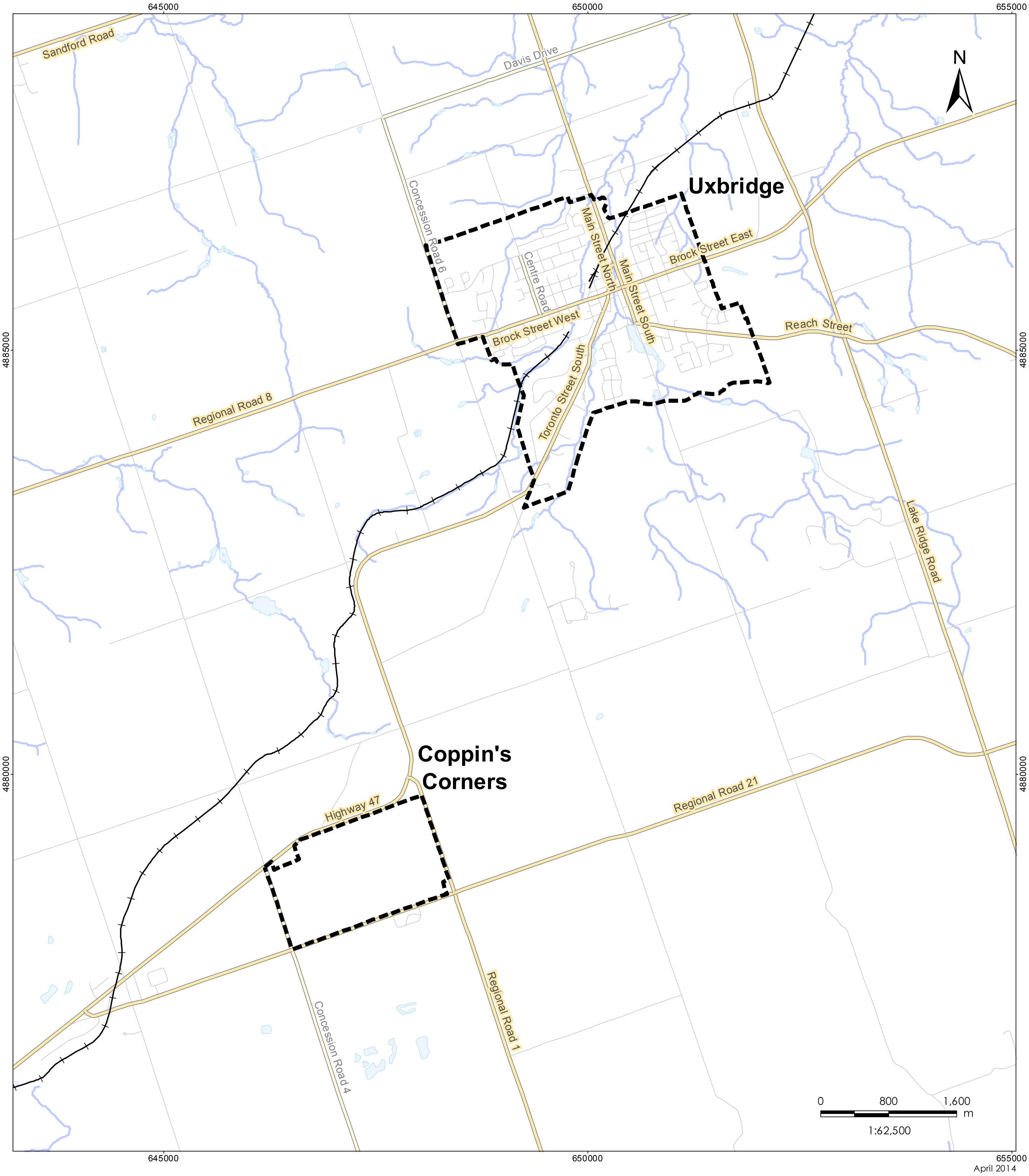
7.0 Maps

All maps will follow on succeeding pages.



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Revised: 2014-04-04 By: ncruikshank

April 2014
Project No. 160621777

Stantec

Legend

Study Area

Client/Project

Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

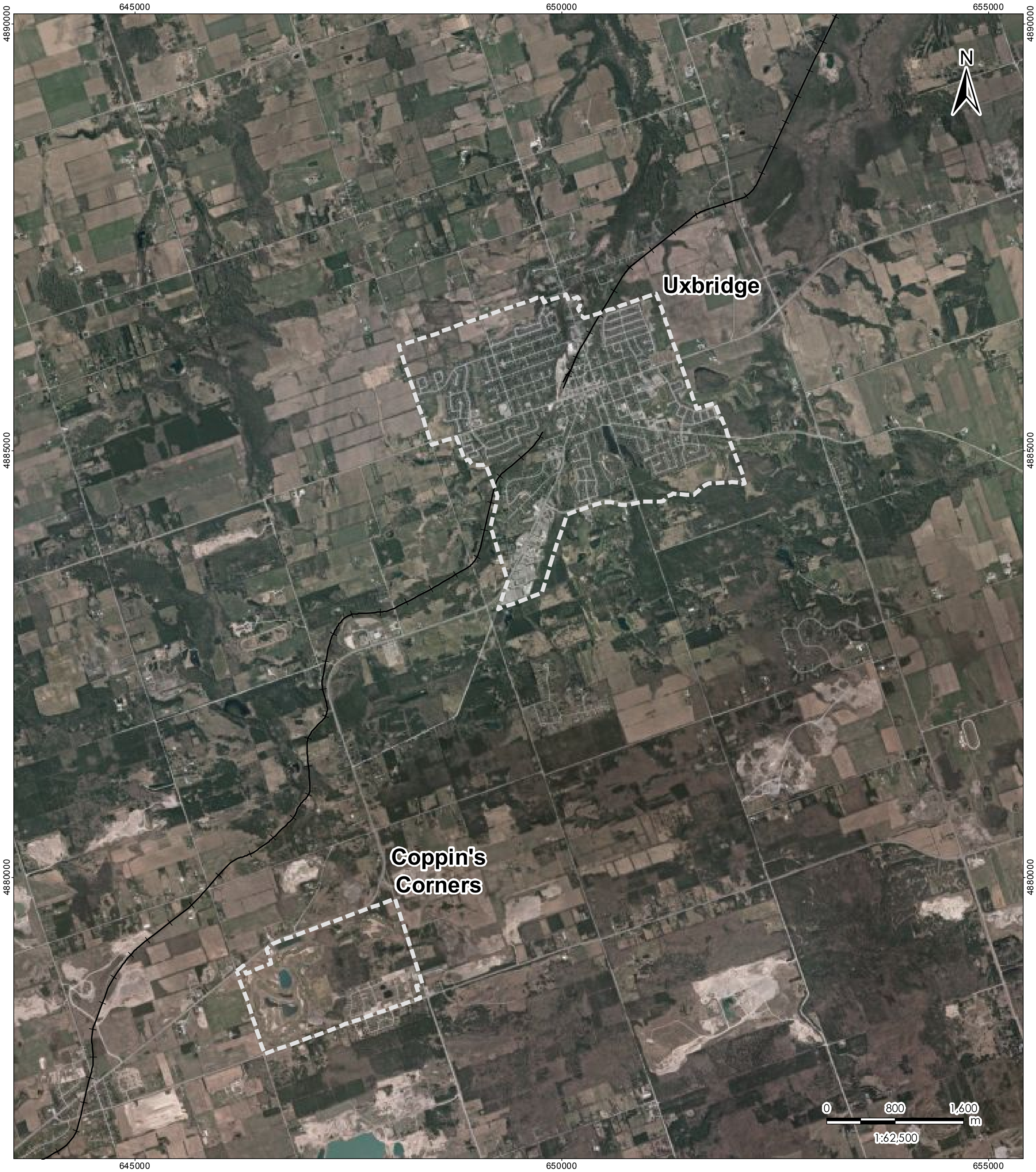
1

Title

Study Area

Notes

1. Coordinate System:
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.



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Stantec

Legend

Study Area

Client/Project

Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

2

Title

Study Area
Current Conditions

Notes

1. Coordinate System:
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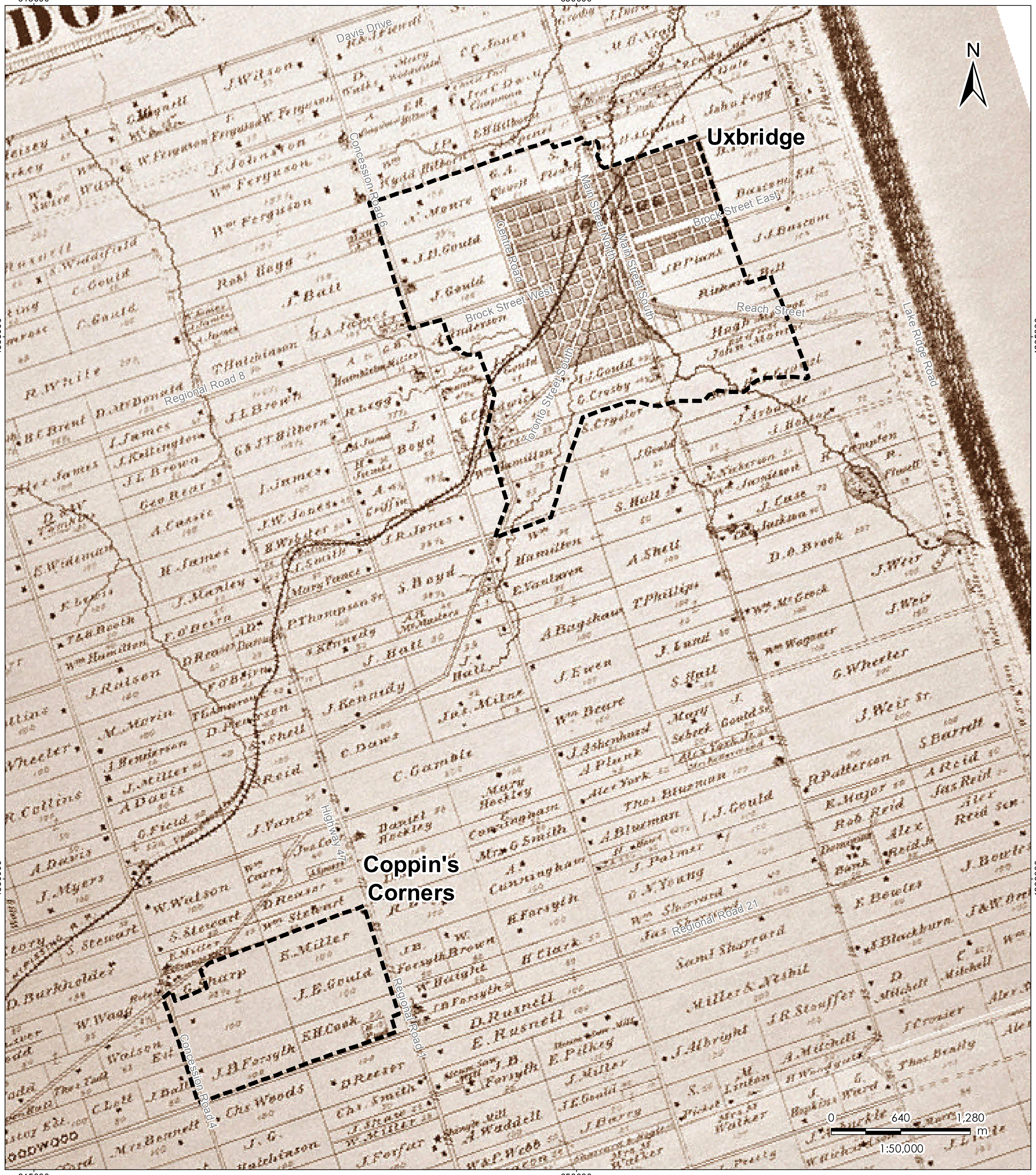
3. Orthoimagery © First Base Solutions, 2012.



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Stantec

Legend

Study Area

Client/Project

Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

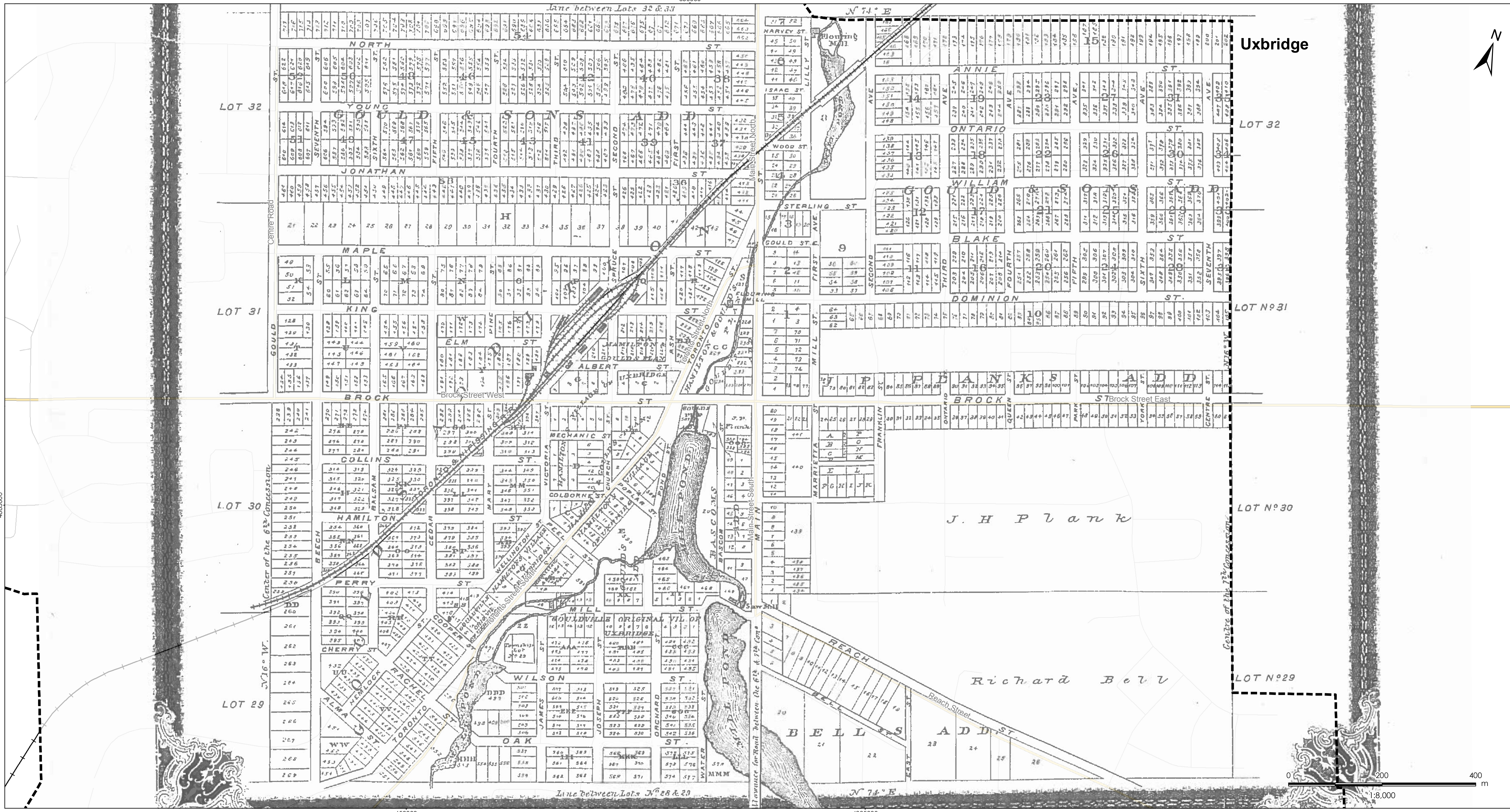
3

Title

Study Area Shown on 1877 Historical Map of Township of Uxbridge

Notes

1. Coordinate System:
2. Map: Illustrated historical atlas of the county of Ontario, Ont. Toronto : J.H. Beers & Co., 1877.



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Project No. 160621777

Stantec

Legend

Study Area

Client/Project

Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

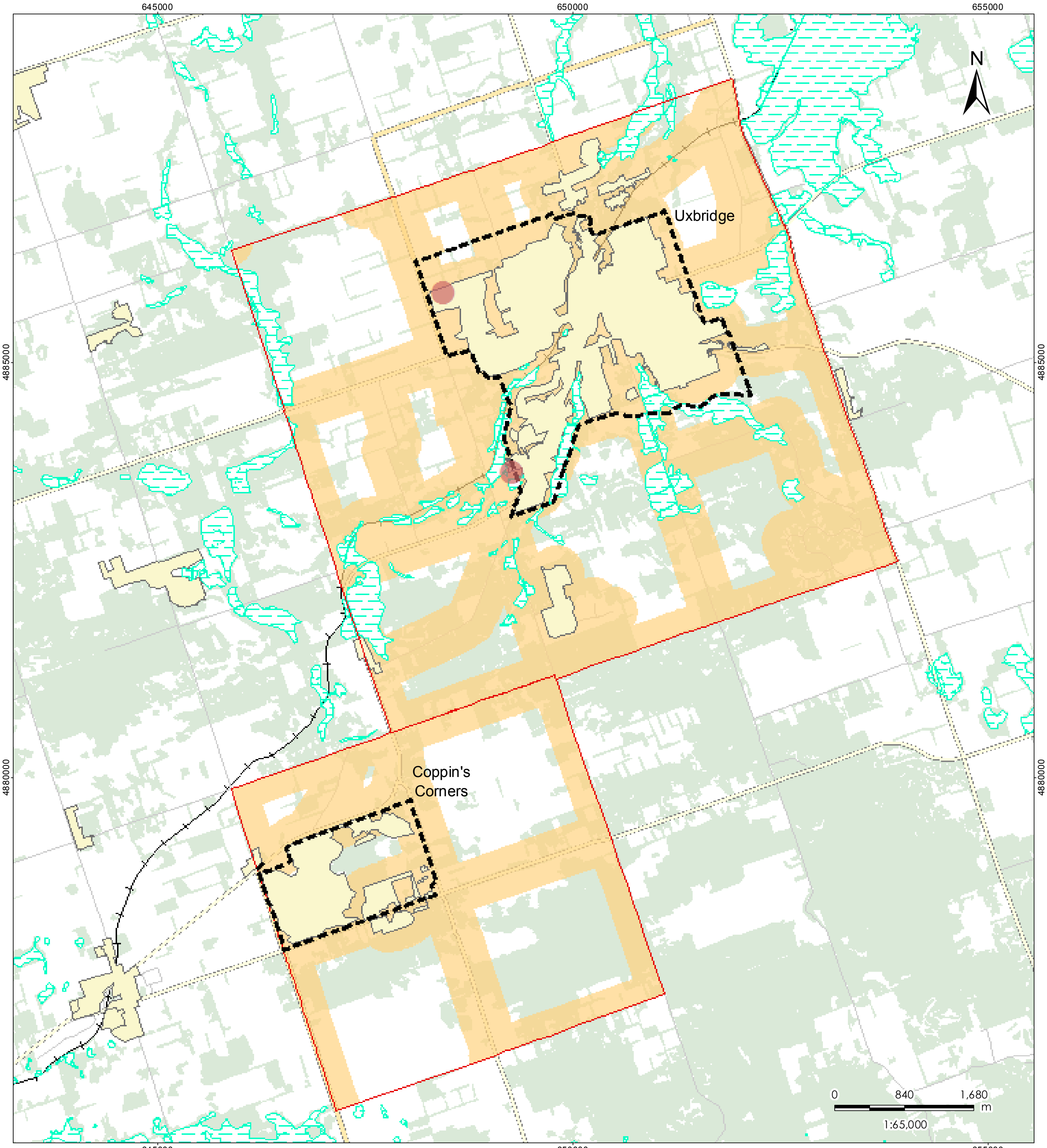
4

Title

Study Area Shown on Detailed Historical Map of Township of Uxbridge

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Map: Illustrated historical atlas of the county of Ontario, Ont. Toronto : J.H. Beers & Co., 1877.



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Project No. 160621777

Stantec

Legend

- Registered Archaeological Site
- Historic Archaeological Potential
- Study Region
- Study Area
- Built up Areas - Previously disturbed
- Permanently Saturated Area
- Wooded Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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Client/Project

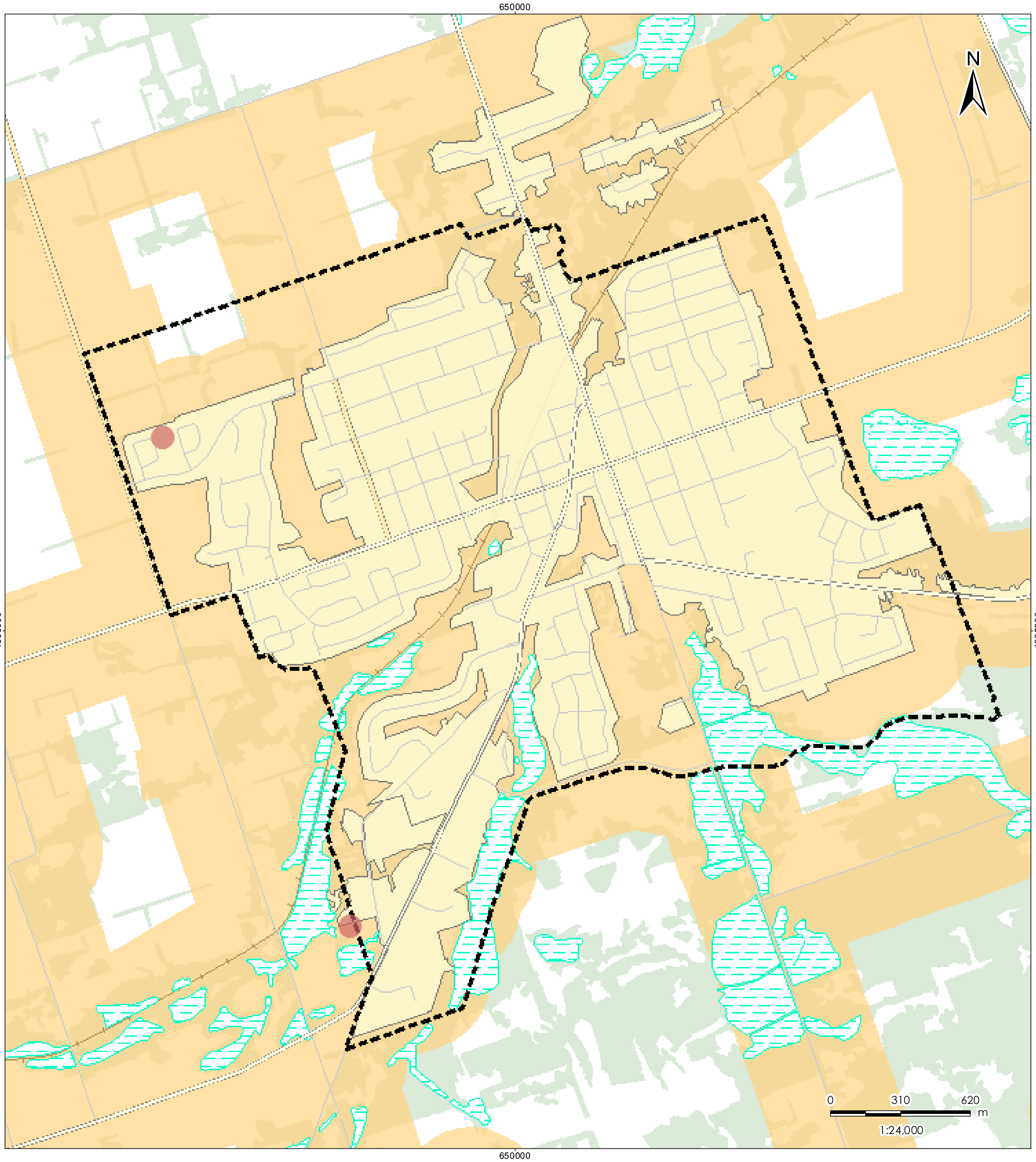
Township of Uxbridge
Archaeological Stage 1 Investigation

Figure No.

5

Title

Township of Uxbridge
300 Meter Buffers Around Features of Historic Archaeological Potential - Overview



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April 2014
Project No. 160621777

Stantec

Legend

- Registered Archaeological Site
- Historic Archaeological Potential
- Study Area
- Built up Areas - Previously disturbed
- Permanently Saturated Area
- Wooded Area

Notes

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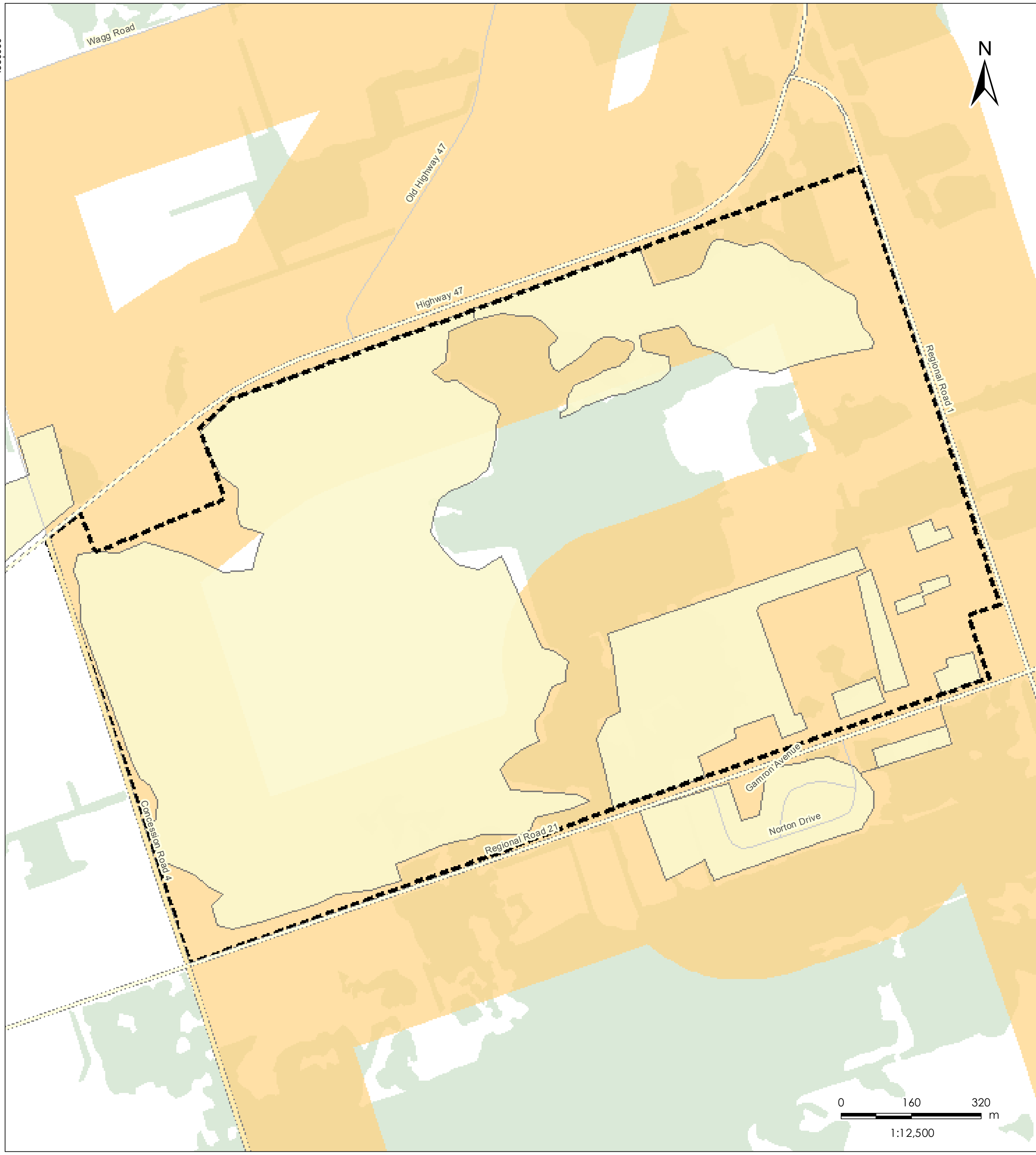
Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

6

Title

Uxbridge Study Area
300 Meter Buffers Around
Features of Historic
Archaeological Potential



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Stantec

Legend

- Registered Archaeological Site
- Historic Archaeological Potential
- Study Area
- Built up Areas - Previously disturbed
- Permanently Saturated Area
- Wooded Area

Notes

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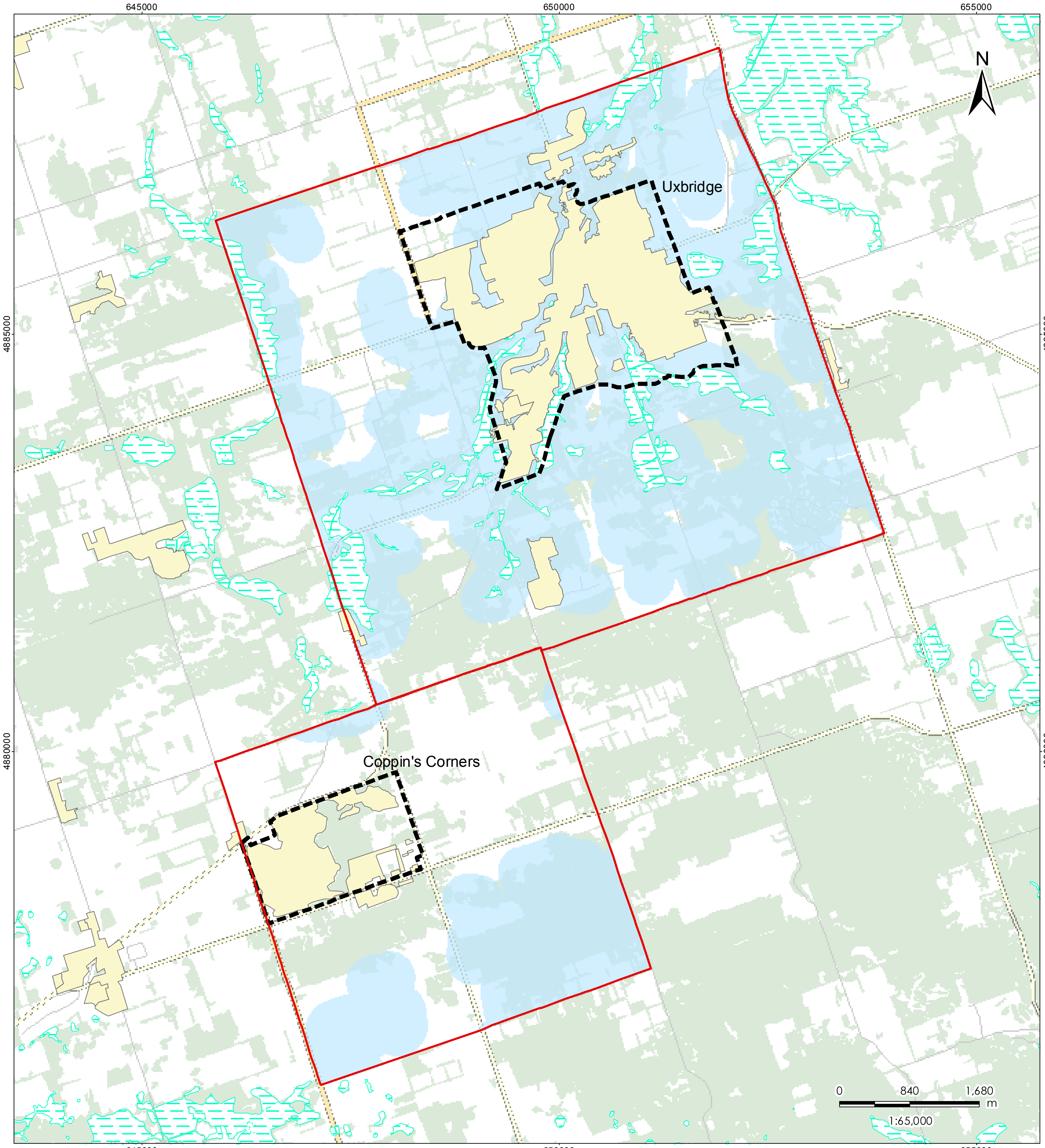
Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

7

Title

Coppin's Corners
300 Meter Buffers Around Features of Historic Archaeological Potential



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Project No. 160621777

Stantec

Legend

- Area of Prehistoric Archaeological Potential
- Study Region
- Study Area
- Built up Areas - Previously disturbed
- Permanently Saturated Area
- Wooded Area

Notes

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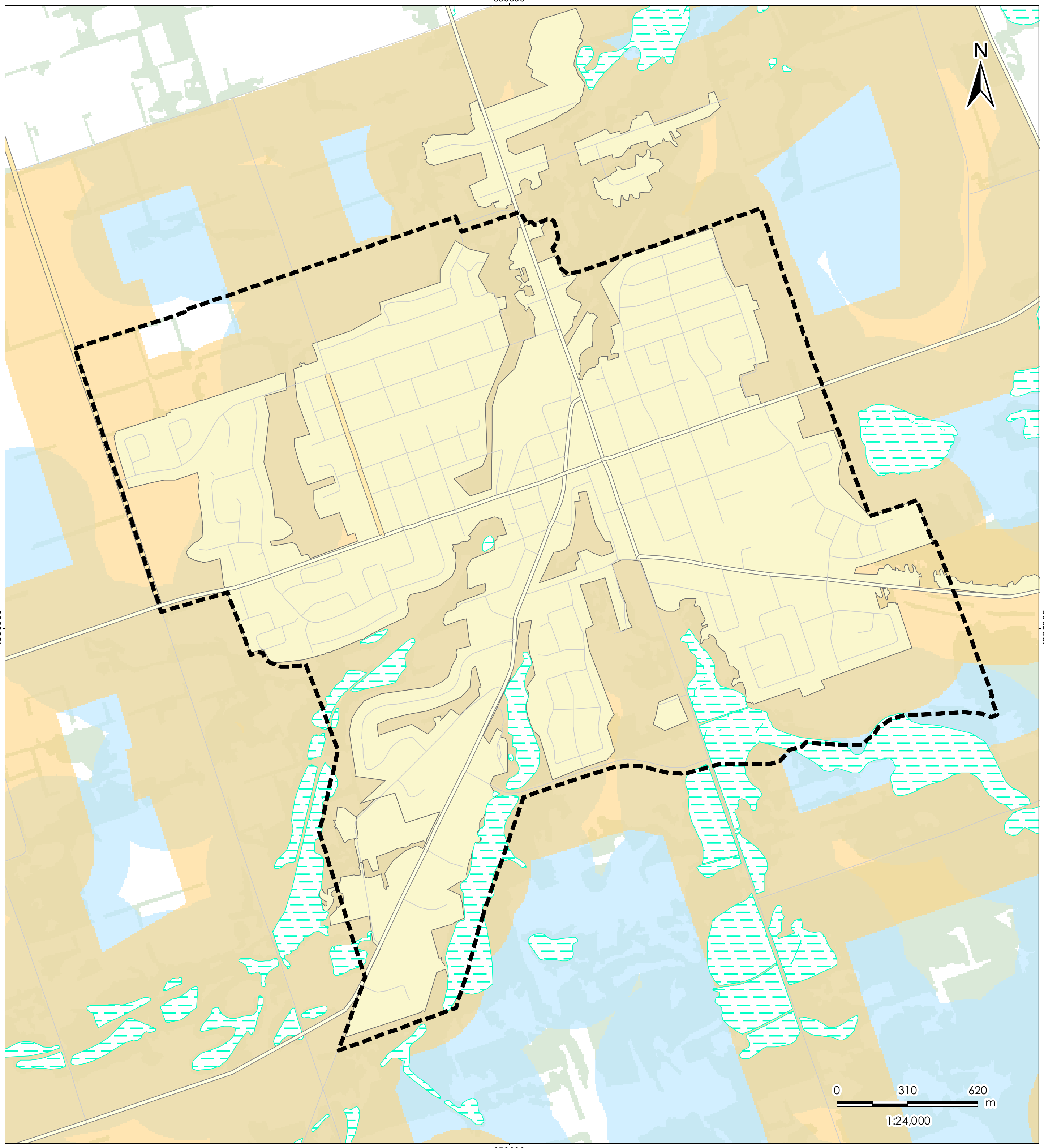
Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

8

Title

**Township of Uxbridge
300 Meter Buffers Around
Features of Prehistoric
Archaeological Potential -
Overview**



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April 2014
Project No. 160621777

Stantec

Legend

- Historic Archaeological Potential
- Area of Prehistoric Archaeological Potential
- Study Area
- Built up Areas - Previously disturbed
- Permanently Saturated Area
- Wooded Area

Notes

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Township of Uxbridge
Archaeological Stage 1
Investigation

Figure No.

9

Title

Uxbridge Study Area 300 Meter Buffers Around Features of Historic and Prehistoric Archaeological Potential

8.0 Closure

This report has been prepared for the sole benefit of the Township of Uxbridge and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and Township of Uxbridge. Any use which a third party makes of this report is the responsibility of such third party.

We trust this report meets your current requirements. Please do not hesitate to contact us should you require further information or have additional questions about any facet of this report.

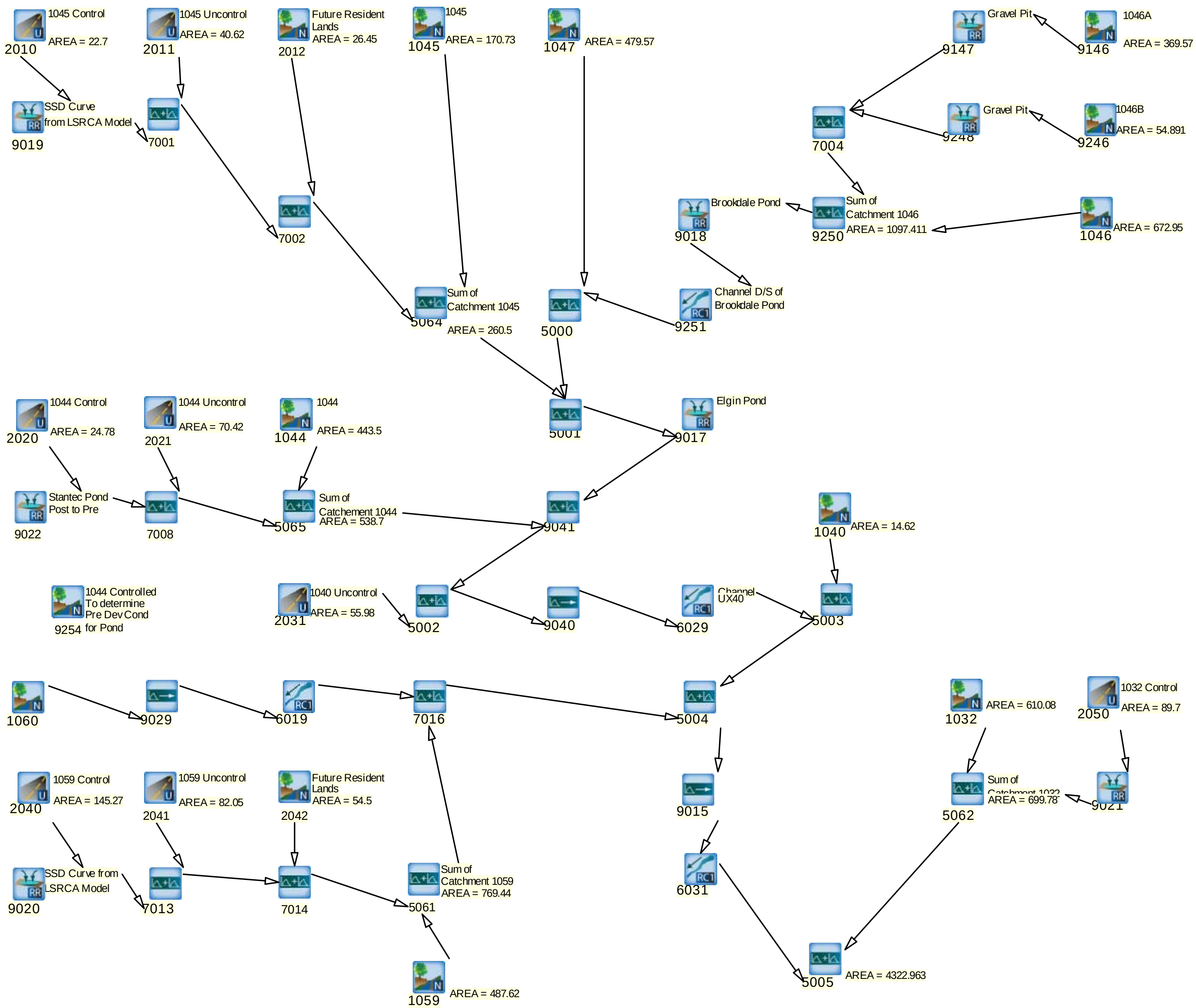
Yours truly,

Colin Varley, MA
Associate,
Senior Archaeologist
Tel: (613) 722-4420
Fax: (613) 722-2799
Colin.Varley@Stantec.com

Jim Wilson, MA
Principle,
Regional Discipline Leader, Archaeology
Tel: (613) 722-4420
Fax: (613) 722-2799
Jim.Wilson@Stantec.com

Appendix D EXISTING CONDITIONS HYDROLOGIC MODELING

Existing Conditions VO2 Schematic



Stormwater Management Master Plan
Uxbridge Urban Area

Hydrologic Modeling Parameters and Revisions

Project No. 160621777
December 2014

Subwatershed	ID	Unit Hydrograph	Area in 2009 LSRCA Model		Stantec Updated Area		Timp	Ximp	CN	Average Slope from 2009 LSRCA model		Stantec Williams Initial Tp[1]	2009 LSRCA TP Multiplier	Stantec Tp Calibrated	Calibrated Tp in 2009 LSRCA Model[2]	Revison to LSRCA Model
			(ha)	($miles^2$)	(ha)	($miles^2$)	(%)	(%)		%	(ft/mile)	(hrs)		(hrs)		
1032	2050	STANHYD	75.60	0.29	89.70	0.35	0.40	0.25	70	-	-		3.75		-	Revised area
	1032	NASHYD	650.21	2.51	610.08	2.36	-	-	70	4.09%	215.95	0.622		2.33	2.49	Revised area
	SUM		725.81	2.80	-		-	-	-	4.09%	215.95	0.665		2.49	-	
			-		699.78	2.70						0.656		2.46		Updated Tp for NASHYD 1032
1040	2031	STANHYD	28.90	0.11	55.98	0.22	0.55	0.35	59	-	-		3.75		-	Revised area, updated Timp and Ximp
	1040	NASHYD	29.98	0.12	14.62	0.06	-	-	59	6.10%	322.08	0.119		0.45	0.76	Revised area
	SUM		58.88	0.23	-		-	-	-	6.10%	322.08	0.205		0.77	-	
			-		70.60	0.27						0.220		0.82		Updated Tp for NASHYD 1040
1044	2020	STANHYD	25.7	0.10	24.78	0.10	0.60	0.40	58	-	-		6.60		-	Revised area, updated Timp and Ximp, catchment now routed through a pond
	2021	STANHYD	519.13	2.00	70.42	0.27	0.55	0.35	58	-	-				-	New catchment to represent uncontrolled urban areas
	1044	NASHYD			443.50	1.71	-	-	58	7.81%	412.37	0.397		2.62	2.84	Revised area
	SUM		544.83	2.10	-		-	-	-	7.81%	412.37	0.430		2.84	-	
			-		538.70	2.08						0.429		2.83		Updated Tp for NASHYD 1044
1045	2010	STANHYD	13.8	0.05	22.70	0.09	0.40	0.25	58	-	-		6.60		-	Revised area
	2011	STANHYD	31	0.12	40.62	0.16	0.40	0.25	58	-	-				-	Revised area
	2012	NASHYD	204.2	0.79	26.45	0.10	-	-	58	1.80%	95.28	0.275		1.82	-	Added for future residential
	1045	NASHYD			170.73	0.66	-	-	58	7.20%	380.16	0.285		1.88	2.17	Revised area
	SUM		249.00	0.96	-		-	-	-	7.20%	380.16	0.330		2.18	-	
			-		260.50	1.01						0.336		2.22		Updated Tp for NASHYD 1045
1046	9146	NASHYD	369.57	1.43	369.57	1.43	-	-	55	8.20%	432.96	0.361	3.50	1.26	1.20	No change
	9246	NASHYD	54.89	0.21	54.89	0.21	-	-	65	8.20%	432.96	0.172	3.50	0.60	0.60	No change
	1046	NASHYD	672.95	2.60	672.95	2.60	-	-	59	8.20%	432.96	0.456	6.15	2.81	2.80	No change
1047	-	NASHYD	479.57	1.85	479.57	1.85	-	-	59	7.54%	398.11	0.417	6.60	2.75	2.73	No change
1059	2040	STANHYD	168.3	0.65	145.27	0.56	0.40	0.25	71	-	-		3.75		-	Revised Area
	2041	STANHYD			82.05	0.32	0.45	0.30	71	-	-				-	New catchment to represent uncontrolled urban areas
	2042	NASHYD	592.7	2.29	54.50	0.21	-	-	71	3.51%	185.37	0.262		0.98	-	Added for future residential
	1059	NASHYD			487.62	1.88	-	-	71	5.68%	299.90	0.483		1.81	2.16	Revised Area
	SUM		761.00	2.94	-		-	-	-	5.68%	299.90	0.575		2.16	-	
			-		769.44	2.97						0.577		2.17		Updated Tp for NASHYD 1059
1060	-	NASHYD	406.96	1.57	406.96	1.57	-	-	60	5.77%	304.66	0.447	2.60	1.16	1.16	No change

Notes:
1. Williams Tp = 6.54 * A ^ 0.39 * S ^ -0.5 Where A = Area in Square Miles and S = Slope in feet / mile.
2. In the 2009 LSRCA model, the Tp was calculated based on the entire area of the subwatershed (both STANDHYD and NASHYD area) not just the NASHYD area. The same modeling approach has been followed in this assessment.

Stormwater Management Master Plan
Uxbridge Urban Area

Weighted Imperviousness

Project No. 160621777
December 2014

Catchment 2020

	% Impervious	Area (ha)	Weighted % Impervious
Residential	40%	15.08	0.24
Commercial	85%	9.70	0.33
Green Space	25%	0.00	0.00
	TOTAL	24.78	58%

Catchment 2021

	% Impervious	Area (ha)	Weighted % Impervious
Residential	40%	48.30	0.27
Commercial	85%	22.12	0.27
Green Space	25%	0.00	0.00
	TOTAL	70.42	54%

Catchment 2031

	% Impervious	Area (ha)	Weighted % Impervious
Residential	40%	39.06	0.28
Commercial	85%	16.92	0.26
Green Space	25%	0.00	0.00
	TOTAL	55.98	54%

Catchment 2040

	% Impervious	Area (ha)	Weighted % Impervious
Residential	40%	124.75	0.34
Commercial	85%	0.00	0.00
Green Space	25%	20.52	0.04
	TOTAL	145.27	38%

Catchment 2041

	% Impervious	Area (ha)	Weighted % Impervious
Residential	40%	73.11	0.36
Commercial	85%	8.94	0.09
Green Space	25%	0.00	0.00
	TOTAL	82.05	45%

```
====================================================================================================
==

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Existing.ou
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Existing.su


DATE: 12/11/2014                           TIME: 1:59:52 PM

USER:


COMMENTS: ____________________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   1 **     2-Year Storm
  ****************************

--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 43.70 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25     .96 |  3.25    1.75 |  6.25    7.87 |  9.25    1.33
                  .50    1.01 |  3.50    1.75 |  6.50    7.87 |  9.50    1.22
                  .75    1.03 |  3.75    1.75 |  6.75    4.16 |  9.75    1.17
                 1.00    1.07 |  4.00    1.75 |  7.00    2.83 | 10.00    1.19
                 1.25    1.12 |  4.25    2.41 |  7.25    2.62 | 10.25    1.15
                 1.50    1.15 |  4.50    2.83 |  7.50    2.62 | 10.50    1.08
                 1.75    1.17 |  4.75    3.16 |  7.75    2.62 | 10.75    1.00
                 2.00    1.22 |  5.00    3.83 |  8.00    2.62 | 11.00     .93
                 2.25    1.22 |  5.25    5.24 |  8.25    2.24 | 11.25     .82
                 2.50    1.22 |  5.50    5.24 |  8.50    1.92 | 11.50     .75
                 2.75    1.31 |  5.75   20.98 |  8.75    1.68 | 11.75     .66
                 3.00    1.49 |  6.00   57.68 |  9.00    1.49 | 12.00     .59

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--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=   2.298 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=   8.387
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        15.59
                over (min)      15.00        30.00
     Storage Coeff.  (min)=      10.86 (ii)   29.14 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.96         1.59         3.942 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20        13.50         20.93
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .31           .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        14.07
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.43 (ii)   28.47 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.70          .68         3.117 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20        10.73         22.09
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .25           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        14.61
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.38 (ii)   26.14 (ii)
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     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                         *TOTALS*
     PEAK FLOW       (cms)=       1.45          .29          1.627 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      33.70        10.73          19.92
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .77          .25            .46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        13.62
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.10 (ii)   29.39 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                         *TOTALS*
     PEAK FLOW       (cms)=       3.32          .82          3.818 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      33.70        10.40          18.56
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .77          .24            .42

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=    .163 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .069 (i)
     TIME TO PEAK    (hrs)=  11.250
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



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-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.19 (ii)   28.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                         *TOTALS*
     PEAK FLOW       (cms)=        .83          .27           .999 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21          17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .21            .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        45.00
     Storage Coeff.  (min)=       8.56 (ii)   30.09 (ii)
     Unit Hyd. Tpeak (min)=      15.00        45.00
     Unit Hyd. peak  (cms)=        .09          .03
                                                         *TOTALS*
     PEAK FLOW       (cms)=       1.43          .44          1.613 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.50           6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21          17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .21            .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (2012) |   Area    (ha)=  26.45   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.82

     Unit Hyd Qpeak  (cms)=    .555

     PEAK FLOW       (cms)=    .011 (i)
     TIME TO PEAK    (hrs)=  10.250
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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 ------------------------------------------------------------------------------
 | CALIB             |
 | NASHYD    (1047)  |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
 |ID= 1 DT=15.0 min  |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=   2.75

     Unit Hyd Qpeak  (cms)=   6.661

     PEAK FLOW       (cms)=    .186 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .987
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .023

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (9146)  |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
 |ID= 1 DT=15.0 min  |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=    .306 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=   1.544
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .035

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (9246)  |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
 |ID= 1 DT=15.0 min  |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .088 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=   2.245
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .051

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (1046)  |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
 |ID= 1 DT=15.0 min  |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=    .259 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .987
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .023

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (1040)  |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
 |ID= 1 DT=15.0 min  |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .083 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   5.698
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .130
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (1059)  |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
 |ID= 1 DT=15.0 min  |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   2.081 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=   8.697
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .199

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | STANDHYD  (2041)  |   Area    (ha)=  82.05
 |ID= 1 DT=15.0 min  |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92         45.13
     Dep. Storage     (mm)=        .50          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     739.60         40.00
     Mannings n          =        .013          .250

     Max.Eff.Inten.(mm/hr)=      57.68         27.85
                over (min)      15.00         30.00
     Storage Coeff.  (min)=      10.58 (ii)    25.07 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .09           .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.27          1.59          4.273 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20         14.58          23.16
     TOTAL RAINFALL   (mm)=      43.70         43.70          43.70
     RUNOFF COEFFICIENT   =        .99           .33            .53

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | STANDHYD  (2040)  |   Area    (ha)= 145.27
 |ID= 1 DT=15.0 min  |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11         87.16
     Dep. Storage     (mm)=        .50          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     984.10         40.00
     Mannings n          =        .013          .250

     Max.Eff.Inten.(mm/hr)=      57.68         26.99
                over (min)      15.00         30.00
     Storage Coeff.  (min)=      12.55 (ii)    27.22 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .08           .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.55          2.85          6.339 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20         14.39          21.59
     TOTAL RAINFALL   (mm)=      43.70         43.70          43.70
     RUNOFF COEFFICIENT   =        .99           .33            .49

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

```
          THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (2042) |   Area    (ha)=  54.50   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .98

     Unit Hyd Qpeak  (cms)=   2.124

     PEAK FLOW      (cms)=    .049 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=   1.598
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .037

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW      (cms)=   1.841 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=   5.901
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .135

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .083     .96 | 3.083    1.75 | 6.083    7.87 |  9.08    1.33
                  .167     .96 | 3.167    1.75 | 6.167    7.87 |  9.17    1.33
                  .250     .96 | 3.250    1.75 | 6.250    7.87 |  9.25    1.33
                  .333    1.01 | 3.333    1.75 | 6.333    7.87 |  9.33    1.22
                  .417    1.01 | 3.417    1.75 | 6.417    7.87 |  9.42    1.22
                  .500    1.01 | 3.500    1.75 | 6.500    7.87 |  9.50    1.22
                  .583    1.03 | 3.583    1.75 | 6.583    4.16 |  9.58    1.17
                  .667    1.03 | 3.667    1.75 | 6.667    4.16 |  9.67    1.17
                  .750    1.03 | 3.750    1.75 | 6.750    4.16 |  9.75    1.17
                  .833    1.07 | 3.833    1.75 | 6.833    2.83 |  9.83    1.19
                  .917    1.07 | 3.917    1.75 | 6.917    2.83 |  9.92    1.19
                 1.000    1.07 | 4.000    1.75 | 7.000    2.83 | 10.00    1.19
                 1.083    1.12 | 4.083    2.41 | 7.083    2.62 | 10.08    1.15
                 1.167    1.12 | 4.167    2.41 | 7.167    2.62 | 10.17    1.15
                 1.250    1.12 | 4.250    2.41 | 7.250    2.62 | 10.25    1.15
                 1.333    1.15 | 4.333    2.83 | 7.333    2.62 | 10.33    1.08
                 1.417    1.15 | 4.417    2.83 | 7.417    2.62 | 10.42    1.08
                 1.500    1.15 | 4.500    2.83 | 7.500    2.62 | 10.50    1.08
                 1.583    1.17 | 4.583    3.16 | 7.583    2.62 | 10.58    1.00
                 1.667    1.17 | 4.667    3.16 | 7.667    2.62 | 10.67    1.00
                 1.750    1.17 | 4.750    3.16 | 7.750    2.62 | 10.75    1.00
                 1.833    1.22 | 4.833    3.83 | 7.833    2.62 | 10.83     .93
                 1.917    1.22 | 4.917    3.83 | 7.917    2.62 | 10.92     .93
                 2.000    1.22 | 5.000    3.83 | 8.000    2.62 | 11.00     .93
                 2.083    1.22 | 5.083    5.24 | 8.083    2.24 | 11.08     .82
                 2.167    1.22 | 5.167    5.24 | 8.167    2.24 | 11.17     .82
                 2.250    1.22 | 5.250    5.24 | 8.250    2.24 | 11.25     .82
                 2.333    1.22 | 5.333    5.24 | 8.333    1.92 | 11.33     .75
                 2.417    1.22 | 5.417    5.24 | 8.417    1.92 | 11.42     .75
                 2.500    1.22 | 5.500    5.24 | 8.500    1.92 | 11.50     .75
                 2.583    1.31 | 5.583   20.98 | 8.583    1.68 | 11.58     .66
                 2.667    1.31 | 5.667   20.98 | 8.667    1.68 | 11.67     .66
                 2.750    1.31 | 5.750   20.98 | 8.750    1.68 | 11.75     .66
```



```
                 2.833    1.49 | 5.833   57.68 | 8.833    1.49 | 11.83     .59
                 2.917    1.49 | 5.917   57.68 | 8.917    1.49 | 11.92     .59
                 3.000    1.49 | 6.000   57.68 | 9.000    1.49 | 12.00     .59

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW      (cms)=    .010 (i)
     TIME TO PEAK    (hrs)=  11.500
     RUNOFF VOLUME    (mm)=    .949
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.2000      .9900
                          .0290      .3700    |   2.7000     1.4200
                          .5000      .6900    |   6.1000     2.1800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      3.942       6.00       20.93
     OUTFLOW: ID= 1 (9021)     89.700      1.121       6.75       20.89

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 28.44
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9644

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .0800      .8375
                          .0100      .4725    |    .1300      .9815
                          .0450      .7030    |    .2380     1.2455

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      1.627       6.00       19.92
     OUTFLOW: ID= 1 (9022)     24.780       .010      12.25       19.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .61
                   TIME SHIFT OF PEAK FLOW        (min)=375.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .4723

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78    .010    12.25    19.43
        + ID2= 2 (2021):    70.42   3.818     6.00    18.56
          ===============================================
          ID = 3 (7008):    95.20   3.821     6.00    18.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20   3.821     6.00    18.79
        + ID2= 2 (1044):   443.50    .163    12.00      .95
          ===============================================
          ID = 3 (5065):   538.70   3.821     6.00     4.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700       .999        6.00       17.71
     OUTFLOW: ID= 1 (9019)     22.700       .130        7.25        6.25

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.98
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .2806

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .130     7.25     6.25
        + ID2= 2 (2011):    40.62   1.613     6.00    17.71
          ===============================================
          ID = 3 (7001):    63.32   1.613     6.00    13.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7001):    63.32   1.613     6.00    13.60
        + ID2= 2 (2012):    26.45    .011    10.25      .95
          ===============================================
          ID = 3 (7002):    89.77   1.613     6.00     9.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570       .306        8.50        1.54
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .5705

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .088        7.00        2.24
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .1232

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000
```



```
                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270      6.339        6.00       21.59
     OUTFLOW: ID= 1 (9020)    145.270       .198       12.00       21.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.12
                   TIME SHIFT OF PEAK FLOW         (min)=360.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.7014

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
         ID= 2 (1060):  406.96     1.84      7.25      5.90
   SHIFT ID= 1 (9029):  406.96     1.84      9.75      5.90

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   2.298     9.00     8.39
        + ID2= 2 (9021):    89.70   1.121     6.75    20.89
          ===============================================
          ID = 3 (5062):   699.78   2.917     8.50     9.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .069    11.25      .95
        + ID2= 2 (7002):    89.77   1.613     6.00     9.87
          ===============================================
          ID = 3 (5064):   260.50   1.613     6.00     4.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   4.273     6.00    23.16
        + ID2= 2 (9020):   145.27    .198    12.00    21.57
          ===============================================
          ID = 3 (7013):   227.32   4.338     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       281.05          .0800
                  34.48       278.78          .0800
                  62.07       280.75          .0800
                  75.86       280.87          .0800
                 110.34       277.13          .0800
```

```
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

       <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
         .20   274.70    .665E+04       .6          .56      172.84
         .39   274.89    .247E+05      4.2         1.00       97.27
         .59   275.09    .478E+05     11.1         1.35       71.58
         .78   275.28    .756E+05     21.4         1.64       58.99
         .98   275.48    .108E+06     35.2         1.89       51.17
        1.17   275.67    .145E+06     52.9         2.12       45.70
        1.37   275.87    .187E+06     74.8         2.33       41.60
        1.56   276.06    .233E+06    101.2         2.53       38.37
        1.76   276.26    .284E+06    132.2         2.71       35.80
        1.95   276.45    .342E+06    160.8         2.73       35.50
        2.17   276.67    .421E+06    204.7         2.83       34.30
        2.38   276.88    .516E+06    258.7         2.91       33.25
        2.60   277.10    .627E+06    323.9         3.00       32.28
        2.82   277.32    .754E+06    402.4         3.11       31.21
        3.03   277.53    .894E+06    517.5         3.37       28.78
        3.25   277.75    .105E+07    645.6         3.58       27.06
        3.47   277.97    .122E+07    787.1         3.76       25.78
        3.68   278.18    .140E+07    942.2         3.91       24.79
        3.90   278.40    .160E+07   1110.1         4.03       24.06

                                   <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (9029)  406.96    1.84    9.75   5.90      .26         .66
     OUTFLOW: ID= 1 (6019)  406.96     .94   11.50   5.90      .21         .58

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95    .259    12.00      .99
          ==============================================
          ID = 3 (9250):  1097.41    .259    12.00      .61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7013):   227.32   4.338     6.00    22.15
        + ID2= 2 (2042):    54.50    .049     8.75     1.60
          ==============================================
          ID = 3 (7014):   281.82   4.338     6.00    18.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   4.8100     1.1900
                           .4200      .6400    |  14.3300     1.2700
                          1.5900      .9400    |  53.8000     1.3300
                          3.2000     1.1100    |    .0000      .0000

                                  AREA      QPEAK       TPEAK        R.V.
                                  (ha)      (cms)       (hrs)        (mm)
     INFLOW : ID= 2 (9250)   1097.411       .259       12.00         .61
     OUTFLOW: ID= 1 (9018)   1097.411       .173       14.50         .60
```


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```
                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 66.98
                   TIME SHIFT OF PEAK FLOW         (min)=150.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .2640

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   2.081     8.50     8.70
        + ID2= 2 (7014):   281.82   4.338     6.00    18.17
          ==============================================
          ID = 3 (5061):   769.44   4.465     6.00    12.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation      Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .28   270.30    .950E+04      3.7          .81       43.21
        .57   270.59    .257E+05     13.9         1.14       30.76
        .85   270.87    .484E+05     32.0         1.39       25.24
       1.13   271.15    .776E+05     59.6         1.61       21.71
       1.42   271.44    .112E+06    100.0         1.87       18.71
       1.70   271.72    .151E+06    157.2         2.18       16.04
       1.99   272.01    .195E+06    225.9         2.44       14.37
       2.27   272.29    .242E+06    305.9         2.65       13.21
       2.55   272.57    .294E+06    398.1         2.84       12.31
       2.84   272.86    .350E+06    501.8         3.01       11.61
       3.12   273.14    .409E+06    617.0         3.17       11.05
       3.40   273.42    .472E+06    744.3         3.31       10.58
       3.69   273.71    .539E+06    882.9         3.44       10.18
       3.97   273.99    .611E+06   1033.6         3.55        9.85
       4.26   274.28    .687E+06   1196.8         3.66        9.57
       4.54   274.56    .768E+06   1370.2         3.75        9.35
       4.82   274.84    .856E+06   1556.4         3.82        9.16
       5.11   275.13    .950E+06   1757.0         3.89        9.01
       5.39   275.41    .105E+07   1967.6         3.93        8.91

                                   <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (9018) 1097.41     .17   14.50    .60      .01         .81
     OUTFLOW: ID= 1 (9251) 1097.41     .17   15.25    .60      .01         .81

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44   4.465     6.00    12.17
        + ID2= 2 (6019):   406.96    .942    11.50     5.90
          ==============================================
          ID = 3 (7016):  1176.40   4.465     6.00    10.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57    .186    12.00      .99
        + ID2= 2 (9251):  1097.41    .170    15.25      .60
          ==================================================
          ID = 3 (5000):  1576.98    .312    13.00      .72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   1.613     6.00     4.02
        + ID2= 2 (5000):  1576.98    .312    13.00      .72
          ==================================================
          ID = 3 (5001):  1837.48   1.613     6.00     1.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min              OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |   (cms)     (ha.m.)
                             .0000      .0000   |   2.8300     3.4900
                             .2800      .2500   |   3.8200     3.9500
                             .7100      .6300   |   4.6700     4.2000
                            1.1300     1.1400   |   7.3600     4.6900
                            1.5600     1.7300   |   8.7800     4.8500
                            1.8400     2.2600   |  35.4000     6.6100
                            2.2700     2.9600   |  *******     8.6500

                                   AREA      QPEAK       TPEAK       R.V.
                                   (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      1.613        6.00        1.19
     OUTFLOW: ID= 1 (9017)   1837.481       .415       12.50        1.19

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.72
                   TIME SHIFT OF PEAK FLOW         (min)=390.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3693

-------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   3.821     6.00     4.10
        + ID2= 2 (9017):  1837.48    .415    12.50     1.19
          ==================================================
          ID = 3 (9041):  2376.18   4.012     6.00     1.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   3.117     6.00    22.09
        + ID2= 2 (9041):  2376.18   4.012     6.00     1.85
          ==================================================
          ID = 3 (5002):  2432.16   7.129     6.00     2.32

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16     7.13      6.00      2.32
    SHIFT ID= 1 (9040): 2432.16     7.13      7.00      2.32
```



```
-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
              <------ DATA FOR SECTION (   1.0) ------>
              Distance      Elevation       Manning
                   .00        274.29         .0800
                 30.80        273.73         .0800
                 51.30        270.17         .0800
                 61.60        266.84         .0800
                 66.80        266.02         .0800
                102.70        265.42         .0350      Main Channel
                123.20        261.00         .0350      Main Channel
                128.40        261.17         .0350      Main Channel
                154.00        264.62         .0350      Main Channel
                174.60        266.82         .0800
                205.40        268.07         .0800
                236.20        268.74         .0800
                282.40        271.31         .0800
                302.90        272.11         .0800
                348.90        274.45         .0800

     <-------------------- TRAVEL TIME TABLE --------------------->
      DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
       (m)      (m)     (cu.m.)      (cms)        (m/s)       (min)
        .63   261.63   .702E+04       5.2          1.14       22.47
       1.26   262.26   .220E+05      24.8          1.74       14.74
       1.89   262.89   .443E+05      64.0          2.22       11.54
       2.53   263.53   .741E+05     127.4          2.65        9.69
       3.16   264.16   .111E+06     219.6          3.04        8.44
       3.79   264.79   .156E+06     343.2          3.39        7.57
       4.42   265.42   .209E+06     501.2          3.70        6.94
       5.16   266.16   .304E+06     766.4          3.88        6.61
       5.90   266.90   .428E+06    1123.8          4.05        6.34
       6.64   267.64   .570E+06    1628.6          4.40        5.84
       7.38   268.38   .738E+06    2225.4          4.65        5.53
       8.12   269.12   .941E+06    2928.9          4.80        5.35
       8.85   269.85   .116E+07    3743.0          4.95        5.18
       9.59   270.59   .141E+07    4656.3          5.10        5.03
      10.33   271.33   .167E+07    5671.9          5.24        4.90
      11.07   272.07   .195E+07    6784.6          5.36        4.80
      11.81   272.81   .226E+07    8029.1          5.47        4.69
      12.55   273.55   .259E+07    9393.0          5.59        4.60
      13.29   274.29   .295E+07   10648.3          5.55        4.62

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    7.13    7.00   2.32       .69      1.18
     OUTFLOW: ID= 1 (6029) 2432.16    4.21    7.25   2.32       .51      1.14


-------------------------------------------------------------------------------

 ADD HYD   (5003)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   4.213     7.25     2.32
        + ID2= 2 (1040):    14.62    .083     6.75     5.70
          ==================================================
          ID = 3 (5003):  2446.78   4.284     7.25     2.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 ADD HYD   (5004)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   4.284     7.25     2.34
        + ID2= 2 (7016):  1176.40   4.465     6.00    10.00
          ==================================================
          ID = 3 (5004):  3623.18   6.621     7.25     4.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
```

```
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
-------------------       (ha)     (cms)     (hrs)      (mm)
         ID= 2 (5004): 3623.18      6.62      7.25      4.82
    SHIFT ID= 1 (9015): 3623.18     6.62      9.25      4.82

-------------------------------------------------------------------------------
-------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
-------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation      Manning
                    .00        260.30         .0800
                  34.10        260.43         .0800
                  62.40        259.79         .0800
                  79.50        255.72         .0800
                 113.50        254.00         .0800
                 153.30        253.33         .0350     Main Channel
                 187.30        253.06         .0350     Main Channel
                 198.70        251.88         .0350     Main Channel
                 204.40        252.61         .0350     Main Channel
                 249.80        254.00         .0800
                 334.90        255.77         .0800
                 351.90        256.37         .0800
                 414.40        260.24         .0800
                 465.50        260.75         .0800
                 514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV     VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)     (cms)       (m/s)       (min)
        .36   252.24    .596E+04       .4          .39      223.90
        .73   252.61    .238E+05      2.8          .61      141.05
       1.09   252.97    .619E+05      8.2          .69      126.14
       1.45   253.33    .151E+06     18.8          .65      134.06
       1.91   253.79    .383E+06     68.4          .93       93.14
       2.38   254.26    .713E+06    157.3         1.15       75.58
       2.84   254.72    .112E+07    287.3         1.33       65.13
       3.31   255.19    .161E+07    454.2         1.47       59.01
       3.77   255.65    .217E+07    659.0         1.58       54.87
       4.24   256.12    .279E+07    908.7         1.69       51.25
       4.70   256.58    .346E+07   1199.1         1.80       48.03
       5.17   257.05    .414E+07   1527.9         1.92       45.17
       5.63   257.51    .485E+07   1892.4         2.03       42.71
       6.10   257.98    .558E+07   2291.8         2.13       40.59
       6.56   258.44    .634E+07   2725.7         2.23       38.74
       7.03   258.91    .711E+07   3193.6         2.33       37.12
       7.49   259.37    .791E+07   3695.3         2.43       35.69
       7.96   259.84    .874E+07   4221.9         2.51       34.48
       8.42   260.30    .961E+07   4697.6         2.54       34.09

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
                            (ha)    (cms)   (hrs)   (mm)     (m)       (m/s)
     INFLOW : ID= 2 (9015) 3623.18    6.62    9.25   4.82      .98        .66
     OUTFLOW: ID= 1 (6031) 3623.18    3.73   12.25   4.82      .79        .62


-------------------------------------------------------------------------------
-------------------
| ADD HYD   (5005) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK      R.V.
-------------------           (ha)    (cms)    (hrs)      (mm)
          ID1= 1 (5062):    699.78    2.917     8.50      9.99
        + ID2= 2 (6031):   3623.18    3.731    12.25      4.82
          ==================================================
          ID = 3 (5005):   4322.96    5.948    10.25      5.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************
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5-Year Storm

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-------------------
| MASS STORM       |     Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 60.45 mm |     Comments: SCS 24 HR MASS CURVE
-------------------
                         Duration of storm    = 12.00 hrs
```



```
                         Mass curve time step = 15.00 min

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                   .25    1.33 |  3.25    2.42 |  6.25   10.88 |  9.25    1.84
                   .50    1.40 |  3.50    2.42 |  6.50   10.88 |  9.50    1.69
                   .75    1.43 |  3.75    2.42 |  6.75    5.75 |  9.75    1.62
                  1.00    1.47 |  4.00    2.42 |  7.00    3.92 | 10.00    1.64
                  1.25    1.55 |  4.25    3.34 |  7.25    3.63 | 10.25    1.60
                  1.50    1.60 |  4.50    3.92 |  7.50    3.63 | 10.50    1.50
                  1.75    1.62 |  4.75    4.38 |  7.75    3.63 | 10.75    1.38
                  2.00    1.69 |  5.00    5.30 |  8.00    3.63 | 11.00    1.28
                  2.25    1.69 |  5.25    7.25 |  8.25    3.10 | 11.25    1.14
                  2.50    1.69 |  5.50    7.25 |  8.50    2.66 | 11.50    1.04
                  2.75    1.81 |  5.75   29.02 |  8.75    2.32 | 11.75     .92
                  3.00    2.06 |  6.00   79.79 |  9.00    2.06 | 12.00     .82

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   4.618 (i)
     TIME TO PEAK   (hrs)=   9.000
     RUNOFF VOLUME   (mm)=  16.513
     TOTAL RAINFALL  (mm)=  60.450
     RUNOFF COEFFICIENT   =    .273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        44.49
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.54 (ii)   21.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       4.26         3.26         6.334 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME   (mm)=      59.95        23.47         32.59
     TOTAL RAINFALL  (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .39           .54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        41.24
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.28 (ii)   20.67 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.86         1.44         4.768 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      59.95        19.06         33.37
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .32           .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        42.78
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.49 (ii)   18.69 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.05          .61         2.442 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      50.45        19.05         31.61
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .83          .32           .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        40.05
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.87 (ii)   21.40 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.77         1.73         5.861 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      50.45        18.53         29.70
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .83          .31           .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=    .721 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .318 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.32 (ii)   20.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.18          .59         1.550 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62         27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .27           .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.52 (ii)   21.41 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                       *TOTALS*
     PEAK FLOW       (cms)=       2.04         1.03        2.687 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62        27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45        60.45
     RUNOFF COEFFICIENT   =        .99          .27          .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2012) |   Area    (ha)=  26.45   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.82

     Unit Hyd Qpeak  (cms)=    .555

     PEAK FLOW       (cms)=    .055 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

| CALIB
| NASHYD    (1047)     Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min     Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.75

     Unit Hyd Qpeak  (cms)=   6.661

     PEAK FLOW       (cms)=    .821 (i)
     TIME TO PEAK    (hrs)=  10.250
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   1.204 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   5.165
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .085

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .398 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   7.283
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .120
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   1.141 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .176 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  11.606
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   4.194 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  17.056
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .282

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        47.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.29 (ii)   20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                       *TOTALS*
     PEAK FLOW       (cms)=       4.71         2.99        6.636 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      59.95        24.95        35.45
     TOTAL RAINFALL   (mm)=      60.45        60.45        60.45
     RUNOFF COEFFICIENT   =        .99          .41          .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
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           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      11.02 (ii)   22.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                           *TOTALS*
     PEAK FLOW       (cms)=       6.59         5.40         10.054 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2042) |   Area    (ha)=  54.50   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .98

     Unit Hyd Qpeak  (cms)=   2.124

     PEAK FLOW       (cms)=    .248 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=   6.907
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .114

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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  CALIB
  NASHYD    (1060)     Area    (ha)= 406.96   Curve Number   (CN)= 60.0
 ID= 1 DT=15.0 min     Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   3.879 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  11.988
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .198

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
```



```
                   .083    1.33 | 3.083    2.42 | 6.083   10.88 |  9.08    1.84
                   .167    1.33 | 3.167    2.42 | 6.167   10.88 |  9.17    1.84
                   .250    1.33 | 3.250    2.42 | 6.250   10.88 |  9.25    1.84
                   .333    1.40 | 3.333    2.42 | 6.333   10.88 |  9.33    1.69
                   .417    1.40 | 3.417    2.42 | 6.417   10.88 |  9.42    1.69
                   .500    1.40 | 3.500    2.42 | 6.500   10.88 |  9.50    1.69
                   .583    1.43 | 3.583    2.42 | 6.583    5.75 |  9.58    1.62
                   .667    1.43 | 3.667    2.42 | 6.667    5.75 |  9.67    1.62
                   .750    1.43 | 3.750    2.42 | 6.750    5.75 |  9.75    1.62
                   .833    1.47 | 3.833    2.42 | 6.833    3.92 |  9.83    1.64
                   .917    1.47 | 3.917    2.42 | 6.917    3.92 |  9.92    1.64
                  1.000    1.47 | 4.000    2.42 | 7.000    3.92 | 10.00    1.64
                  1.083    1.55 | 4.083    3.34 | 7.083    3.63 | 10.08    1.60
                  1.167    1.55 | 4.167    3.34 | 7.167    3.63 | 10.17    1.60
                  1.250    1.55 | 4.250    3.34 | 7.250    3.63 | 10.25    1.60
                  1.333    1.60 | 4.333    3.92 | 7.333    3.63 | 10.33    1.50
                  1.417    1.60 | 4.417    3.92 | 7.417    3.63 | 10.42    1.50
                  1.500    1.60 | 4.500    3.92 | 7.500    3.63 | 10.50    1.50
                  1.583    1.62 | 4.583    4.38 | 7.583    3.63 | 10.58    1.38
                  1.667    1.62 | 4.667    4.38 | 7.667    3.63 | 10.67    1.38
                  1.750    1.62 | 4.750    4.38 | 7.750    3.63 | 10.75    1.38
                  1.833    1.69 | 4.833    5.30 | 7.833    3.63 | 10.83    1.28
                  1.917    1.69 | 4.917    5.30 | 7.917    3.63 | 10.92    1.28
                  2.000    1.69 | 5.000    5.30 | 8.000    3.63 | 11.00    1.28
                  2.083    1.69 | 5.083    7.25 | 8.083    3.10 | 11.08    1.14
                  2.167    1.69 | 5.167    7.25 | 8.167    3.10 | 11.17    1.14
                  2.250    1.69 | 5.250    7.25 | 8.250    3.10 | 11.25    1.14
                  2.333    1.69 | 5.333    7.25 | 8.333    2.66 | 11.33    1.04
                  2.417    1.69 | 5.417    7.25 | 8.417    2.66 | 11.42    1.04
                  2.500    1.69 | 5.500    7.25 | 8.500    2.66 | 11.50    1.04
                  2.583    1.81 | 5.583   29.02 | 8.583    2.32 | 11.58     .92
                  2.667    1.81 | 5.667   29.02 | 8.667    2.32 | 11.67     .92
                  2.750    1.81 | 5.750   29.02 | 8.750    2.32 | 11.75     .92
                  2.833    2.06 | 5.833   79.79 | 8.833    2.06 | 11.83     .82
                  2.917    2.06 | 5.917   79.79 | 8.917    2.06 | 11.92     .82
                  3.000    2.06 | 6.000   79.79 | 9.000    2.06 | 12.00     .82

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .045 (i)
     TIME TO PEAK    (hrs)=   9.833
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000      .9900
                           .0290      .3700   |   2.7000     1.4200
                           .5000      .6900   |   6.1000     2.1800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)       89.700     6.334        6.00       32.59
     OUTFLOW: ID= 1 (9021)       89.700     2.428        6.75       32.56

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.33
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.3607

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800      .8375
                           .0100      .4725   |    .1300      .9815
                           .0450      .7030   |    .2380     1.2455

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)       24.780     2.442        6.00       31.61
     OUTFLOW: ID= 1 (9022)       24.780      .045       12.00       31.04

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.84
                   TIME SHIFT OF PEAK FLOW         (min)=360.00
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                   MAXIMUM  STORAGE   USED       (ha.m.)=   .7023

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .045    12.00    31.04
        + ID2= 2 (2021):    70.42    5.861     6.00    29.70
          ==================================================
          ID = 3 (7008):    95.20    5.866     6.00    30.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ADD HYD   (5065)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    5.866     6.00    30.05
        + ID2= 2 (1044):   443.50     .721    10.50     4.32
          ==================================================
          ID = 3 (5065):   538.70    5.875     6.00     8.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      1.550        6.00       27.45
     OUTFLOW: ID= 1 (9019)     22.700       .476        6.50       15.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.71
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3393

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .476     6.50    15.99
        + ID2= 2 (2011):    40.62    2.687     6.00    27.45
          ==================================================
          ID = 3 (7001):    63.32    2.687     6.00    23.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7001):    63.32    2.687     6.00    23.34
        + ID2= 2 (2012):    26.45     .055     9.00     4.32
          ==================================================
          ID = 3 (7002):    89.77    2.689     6.00    17.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
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                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      1.204        7.50        5.17
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.9089

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .398        6.75        7.28
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3998

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--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     10.054        6.00       33.50
     OUTFLOW: ID= 1 (9020)    145.270       .752        9.00       33.47

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.48
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.7118

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--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     3.88      7.25     11.99
    SHIFT ID= 1 (9029):  406.96     3.88      9.75     11.99

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--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08    4.618     9.00    16.51
        + ID2= 2 (9021):    89.70    2.428     6.75    32.56
          ==================================================
          ID = 3 (5062):   699.78    5.556     8.50    18.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73     .318     9.50     4.32
        + ID2= 2 (7002):    89.77    2.689     6.00    17.74
          ==================================================
          ID = 3 (5064):   260.50    2.696     6.00     8.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
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--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   6.636     6.00    35.45
        + ID2= 2 (9020):   145.27    .752     9.00    33.47
          ==================================================
          ID = 3 (7013):   227.32   6.736     6.00    34.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06

                                   <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     3.88    9.75  11.99       .37       .93
     OUTFLOW: ID= 1 (6019)  406.96     2.12   11.00  11.99       .28       .68

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   1.141    10.50     4.48
          ==================================================
```



```
          ID = 3 (9250):  1097.41   1.141    10.50     2.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7013):   227.32   6.736     6.00    34.19
        + ID2= 2 (2042):    54.50    .248     7.25     6.91
          ==================================================
          ID = 3 (7014):   281.82   6.768     6.00    28.91

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |       OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                             .0000      .0000   |   4.8100      1.1900
                             .4200      .6400   |  14.3300      1.2700
                            1.5900      .9400   |  53.8000      1.3300
                            3.2000     1.1100   |    .0000       .0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      1.141       10.50        2.75
     OUTFLOW: ID= 1 (9018)   1097.411      1.065       11.75        2.75

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 93.36
                  TIME SHIFT OF PEAK FLOW         (min)= 75.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .8056

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   4.194     8.50    17.06
        + ID2= 2 (7014):   281.82   6.768     6.00    28.91
          ==================================================
          ID = 3 (5061):   769.44   7.105     6.00    21.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7           .81      43.21
        .57   270.59    .257E+05      13.9          1.14      30.76
        .85   270.87    .484E+05      32.0          1.39      25.24
       1.13   271.15    .776E+05      59.6          1.61      21.71
       1.42   271.44    .112E+06     100.0          1.87      18.71
       1.70   271.72    .151E+06     157.2          2.18      16.04
       1.99   272.01    .195E+06     225.9          2.44      14.37
```

```
       2.27   272.29    .242E+06     305.9          2.65      13.21
       2.55   272.57    .294E+06     398.1          2.84      12.31
       2.84   272.86    .350E+06     501.8          3.01      11.61
       3.12   273.14    .409E+06     617.0          3.17      11.05
       3.40   273.42    .472E+06     744.3          3.31      10.58
       3.69   273.71    .539E+06     882.9          3.44      10.18
       3.97   273.99    .611E+06    1033.6          3.55       9.85
       4.26   274.28    .687E+06    1196.8          3.66       9.57
       4.54   274.56    .768E+06    1370.2          3.75       9.35
       4.82   274.84    .856E+06    1556.4          3.82       9.16
       5.11   275.13    .950E+06    1757.0          3.89       9.01
       5.39   275.41    .105E+07    1967.6          3.93       8.91

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     1.07   11.75   2.75       .08       .81
     OUTFLOW: ID= 1 (9251) 1097.41     1.02   12.75   2.75       .08       .81

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--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44   7.105     6.00    21.40
        + ID2= 2 (6019):   406.96   2.125    11.00    11.99
          ===============================================
          ID = 3 (7016):  1176.40   7.105     6.00    18.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57    .821    10.25     4.48
        + ID2= 2 (9251):  1097.41   1.018    12.75     2.75
          ===============================================
          ID = 3 (5000):  1576.98   1.726    12.00     3.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   2.696     6.00     8.95
        + ID2= 2 (5000):  1576.98   1.726    12.00     3.27
          ===============================================
          ID = 3 (5001):  1837.48   2.706     6.00     4.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000       .0000   |   2.8300     3.4900
                           .2800       .2500   |   3.8200     3.9500
                           .7100       .6300   |   4.6700     4.2000
                          1.1300      1.1400   |   7.3600     4.6900
                          1.5600      1.7300   |   8.7800     4.8500
                          1.8400      2.2600   |  35.4000     6.6100
                          2.2700      2.9600   |  *******     8.6500

                                  AREA      QPEAK       TPEAK        R.V.
                                  (ha)      (cms)       (hrs)        (mm)
     INFLOW : ID= 2 (5001)   1837.481      2.706        6.00         4.08
     OUTFLOW: ID= 1 (9017)   1837.481      1.633       13.75         4.08

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 60.33
                   TIME SHIFT OF PEAK FLOW         (min)=465.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8687

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   5.875     6.00     8.87
        + ID2= 2 (9017):  1837.48   1.633    13.75     4.08
          ===============================================
          ID = 3 (9041):  2376.18   6.182     6.00     5.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   4.768     6.00    33.37
        + ID2= 2 (9041):  2376.18   6.182     6.00     5.16
          ===============================================
          ID = 3 (5002):  2432.16  10.950     6.00     5.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA      QPEAK      TPEAK      R.V.
--------------------      (ha)      (cms)      (hrs)      (mm)
          ID= 2 (5002): 2432.16     10.95       6.00       5.81
    SHIFT ID= 1 (9040): 2432.16     10.95       7.00       5.81

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--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00         274.29         .0800
                  30.80         273.73         .0800
                  51.30         270.17         .0800
                  61.60         266.84         .0800
                  66.80         266.02         .0800
                 102.70         265.42         .0350     Main Channel
                 123.20         261.00         .0350     Main Channel
                 128.40         261.17         .0350     Main Channel
                 154.00         264.62         .0350     Main Channel
                 174.60         266.82         .0800
                 205.40         268.07         .0800
                 236.20         268.74         .0800
                 282.40         271.31         .0800
                 302.90         272.11         .0800
                 348.90         274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63    .702E+04       5.2          1.14      22.47
       1.26   262.26    .220E+05      24.8          1.74      14.74
       1.89   262.89    .443E+05      64.0          2.22      11.54
       2.53   263.53    .741E+05     127.4          2.65       9.69
       3.16   264.16    .111E+06     219.6          3.04       8.44
       3.79   264.79    .156E+06     343.2          3.39       7.57
       4.42   265.42    .209E+06     501.2          3.70       6.94
       5.16   266.16    .304E+06     766.4          3.88       6.61
       5.90   266.90    .428E+06    1123.8          4.05       6.34
       6.64   267.64    .570E+06    1628.6          4.40       5.84
       7.38   268.38    .738E+06    2225.4          4.65       5.53
       8.12   269.12    .941E+06    2928.9          4.80       5.35
       8.85   269.85    .116E+07    3743.0          4.95       5.18
       9.59   270.59    .141E+07    4656.3          5.10       5.03
      10.33   271.33    .167E+07    5671.9          5.24       4.90
      11.07   272.07    .195E+07    6784.6          5.36       4.80
      11.81   272.81    .226E+07    8029.1          5.47       4.69
      12.55   273.55    .259E+07    9393.0          5.59       4.60
      13.29   274.29    .295E+07   10648.3          5.55       4.62

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
```

```
     INFLOW : ID= 2 (9040) 2432.16    10.95    7.00   5.81      .82      1.27
     OUTFLOW: ID= 1 (6029) 2432.16     6.73    7.25   5.81      .68      1.17

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| ADD HYD   (5003)  |
|  1 +  2 =  3      |          AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  6.727     7.25     5.81
        + ID2= 2 (1040):    14.62   .176     6.75    11.61
          ===================================================
          ID = 3 (5003):  2446.78  6.875     7.25     5.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (5004)  |
|  1 +  2 =  3      |          AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  6.875     7.25     5.85
        + ID2= 2 (7016):  1176.40  7.105     6.00    18.14
          ===================================================
          ID = 3 (5004):  3623.18 11.786     7.25     9.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 -------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
 -------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    11.79      7.25      9.84
    SHIFT ID= 1 (9015): 3623.18    11.79      9.25      9.84

 -------------------------------------------------------------------------------
 -------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 -------------------
               <------ DATA FOR SECTION (    1.0) ------>
               Distance      Elevation       Manning
                    .00         260.30          .0800
                  34.10         260.43          .0800
                  62.40         259.79          .0800
                  79.50         255.72          .0800
                 113.50         254.00          .0800
                 153.30         253.33          .0350      Main Channel
                 187.30         253.06          .0350      Main Channel
                 198.70         251.88          .0350      Main Channel
                 204.40         252.61          .0350      Main Channel
                 249.80         254.00          .0800
                 334.90         255.77          .0800
                 351.90         256.37          .0800
                 414.40         260.24          .0800
                 465.50         260.75          .0800
                 514.40         261.48          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH     ELEV      VOLUME     FLOW RATE     VELOCITY    TRAV.TIME
        (m)       (m)      (cu.m.)      (cms)         (m/s)       (min)
        .36     252.24    .596E+04        .4           .39       223.90
        .73     252.61    .238E+05       2.8           .61       141.05
       1.09     252.97    .619E+05       8.2           .69       126.14
       1.45     253.33    .151E+06      18.8           .65       134.06
       1.91     253.79    .383E+06      68.4           .93        93.14
       2.38     254.26    .713E+06     157.3          1.15        75.58
       2.84     254.72    .112E+07     287.3          1.33        65.13
       3.31     255.19    .161E+07     454.2          1.47        59.01
       3.77     255.65    .217E+07     659.0          1.58        54.87
       4.24     256.12    .279E+07     908.7          1.69        51.25
       4.70     256.58    .346E+07    1199.1          1.80        48.03
       5.17     257.05    .414E+07    1527.9          1.92        45.17
       5.63     257.51    .485E+07    1892.4          2.03        42.71
       6.10     257.98    .558E+07    2291.8          2.13        40.59
       6.56     258.44    .634E+07    2725.7          2.23        38.74
       7.03     258.91    .711E+07    3193.6          2.33        37.12
       7.49     259.37    .791E+07    3695.3          2.43        35.69
       7.96     259.84    .874E+07    4221.9          2.51        34.48
```



```
       8.42     260.30    .961E+07    4697.6          2.54        34.09

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    11.79    9.25   9.84      1.21       .67
     OUTFLOW: ID= 1 (6031) 3623.18     7.93   13.25   9.84      1.07       .68

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| ADD HYD   (5005)  |
|  1 +  2 =  3      |          AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78  5.556     8.50    18.57
        + ID2= 2 (6031):  3623.18  7.925    13.25     9.84
          ===================================================
          ID = 3 (5005):  4322.96 11.108    10.50    11.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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   ****************************
   ** SIMULATION NUMBER:   3 **     10-Year Storm
   ****************************

 --------------------
| MASS STORM         |     Filename: V:\01606\Active\160621777\SWM Master Plans
|                    |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 71.22 mm   |     Comments: SCS 24 HR MASS CURVE
 --------------------
                           Duration of storm    = 12.00 hrs
                           Mass curve time step = 15.00 min

                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .25    1.57 |  3.25    2.85 |  6.25   12.82 |  9.25    2.17
                 .50    1.65 |  3.50    2.85 |  6.50   12.82 |  9.50    1.99
                 .75    1.68 |  3.75    2.85 |  6.75    6.78 |  9.75    1.91
                1.00    1.74 |  4.00    2.85 |  7.00    4.62 | 10.00    1.94
                1.25    1.82 |  4.25    3.93 |  7.25    4.27 | 10.25    1.88
                1.50    1.88 |  4.50    4.62 |  7.50    4.27 | 10.50    1.77
                1.75    1.91 |  4.75    5.16 |  7.75    4.27 | 10.75    1.62
                2.00    1.99 |  5.00    6.24 |  8.00    4.27 | 11.00    1.51
                2.25    1.99 |  5.25    8.55 |  8.25    3.65 | 11.25    1.34
                2.50    1.99 |  5.50    8.55 |  8.50    3.13 | 11.50    1.22
                2.75    2.14 |  5.75   34.19 |  8.75    2.73 | 11.75    1.08
                3.00    2.42 |  6.00   94.01 |  9.00    2.42 | 12.00     .97

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 --------------------
| CALIB              |
| NASHYD    (1032)   |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min   |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=   6.388 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  22.629
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .318

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 --------------------
| CALIB              |
| STANDHYD  (2050)   |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min   |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88         53.82
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     773.30         40.00
     Mannings n           =       .013          .250

     Max.Eff.Inten.(mm/hr)=      94.01         58.25
                over (min)=      15.00         30.00
     Storage Coeff.  (min)=       8.93 (ii)    19.72 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.10         4.45         7.981 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        30.65          40.67
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .43            .57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        54.71
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.76 (ii)   18.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.62         1.99         5.890 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        25.19          41.13
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .35            .58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        56.75
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.07 (ii)   16.97 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.44          .85         2.988 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      61.22        25.17          39.59
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .86          .35            .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        53.21
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.31 (ii)   19.49 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.72         2.40         7.245 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      61.22        24.53          37.37
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .86          .34            .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   1.282 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .572 (i)
     TIME TO PEAK    (hrs)=   9.250
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        41.43
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.92 (ii)   18.28 (ii)
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     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       1.40          .82          1.928 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        22.15          34.29
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .31            .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        41.43
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.04 (ii)   19.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       2.44         1.44          3.351 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        22.15          34.29
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .31            .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (2012) |   Area    (ha)=  26.45   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.82

     Unit Hyd Qpeak  (cms)=    .555

     PEAK FLOW       (cms)=    .099 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB
| NASHYD    (1047)     Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min     Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.75

     Unit Hyd Qpeak  (cms)=   6.661

     PEAK FLOW       (cms)=   1.461 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.804
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .110

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   2.098 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   8.408
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .118

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .705 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  11.652
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .164

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   2.027 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.804
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .110

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .250 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  16.207
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .228

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   5.792 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  23.326
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .328
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        62.41
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.70 (ii)   19.19 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.64         4.05          8.287 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        32.37          43.87
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .45            .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        60.66
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.33 (ii)   20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       7.93         7.33         12.687 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        32.04          41.71
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .45            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (2042) |   Area    (ha)=  54.50   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .98

     Unit Hyd Qpeak  (cms)=   2.124

     PEAK FLOW       (cms)=    .473 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  11.717
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .165
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
 CALIB
 NASHYD    (1060)     Area    (ha)= 406.96   Curve Number   (CN)= 60.0
ID= 1 DT=15.0 min     Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                      U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   5.477 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  16.717
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .235

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                .083    1.57 | 3.083    2.85 | 6.083   12.82 |  9.08    2.17
                .167    1.57 | 3.167    2.85 | 6.167   12.82 |  9.17    2.17
                .250    1.57 | 3.250    2.85 | 6.250   12.82 |  9.25    2.17
                .333    1.65 | 3.333    2.85 | 6.333   12.82 |  9.33    1.99
                .417    1.65 | 3.417    2.85 | 6.417   12.82 |  9.42    1.99
                .500    1.65 | 3.500    2.85 | 6.500   12.82 |  9.50    1.99
                .583    1.68 | 3.583    2.85 | 6.583    6.78 |  9.58    1.91
                .667    1.68 | 3.667    2.85 | 6.667    6.78 |  9.67    1.91
                .750    1.68 | 3.750    2.85 | 6.750    6.78 |  9.75    1.91
                .833    1.74 | 3.833    2.85 | 6.833    4.62 |  9.83    1.94
                .917    1.74 | 3.917    2.85 | 6.917    4.62 |  9.92    1.94
               1.000    1.74 | 4.000    2.85 | 7.000    4.62 | 10.00    1.94
               1.083    1.82 | 4.083    3.93 | 7.083    4.27 | 10.08    1.88
               1.167    1.82 | 4.167    3.93 | 7.167    4.27 | 10.17    1.88
               1.250    1.82 | 4.250    3.93 | 7.250    4.27 | 10.25    1.88
               1.333    1.88 | 4.333    4.62 | 7.333    4.27 | 10.33    1.77
               1.417    1.88 | 4.417    4.62 | 7.417    4.27 | 10.42    1.77
               1.500    1.88 | 4.500    4.62 | 7.500    4.27 | 10.50    1.77
               1.583    1.91 | 4.583    5.16 | 7.583    4.27 | 10.58    1.62
               1.667    1.91 | 4.667    5.16 | 7.667    4.27 | 10.67    1.62
               1.750    1.91 | 4.750    5.16 | 7.750    4.27 | 10.75    1.62
               1.833    1.99 | 4.833    6.24 | 7.833    4.27 | 10.83    1.51
               1.917    1.99 | 4.917    6.24 | 7.917    4.27 | 10.92    1.51
               2.000    1.99 | 5.000    6.24 | 8.000    4.27 | 11.00    1.51
               2.083    1.99 | 5.083    8.55 | 8.083    3.65 | 11.08    1.34
               2.167    1.99 | 5.167    8.55 | 8.167    3.65 | 11.17    1.34
               2.250    1.99 | 5.250    8.55 | 8.250    3.65 | 11.25    1.34
               2.333    1.99 | 5.333    8.55 | 8.333    3.13 | 11.33    1.22
               2.417    1.99 | 5.417    8.55 | 8.417    3.13 | 11.42    1.22
               2.500    1.99 | 5.500    8.55 | 8.500    3.13 | 11.50    1.22
               2.583    2.14 | 5.583   34.19 | 8.583    2.73 | 11.58    1.08
               2.667    2.14 | 5.667   34.19 | 8.667    2.73 | 11.67    1.08
               2.750    2.14 | 5.750   34.19 | 8.750    2.73 | 11.75    1.08
               2.833    2.42 | 5.833   94.01 | 8.833    2.42 | 11.83     .97
               2.917    2.42 | 5.917   94.01 | 8.917    2.42 | 11.92     .97
               3.000    2.42 | 6.000   94.01 | 9.000    2.42 | 12.00     .97

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .080 (i)
     TIME TO PEAK    (hrs)=   9.583
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR (9021) |
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| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      7.981        6.00       40.67
     OUTFLOW: ID= 1 (9021)     89.700      3.472        6.50       40.63

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.51
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.6071

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800       .8375
                           .0100      .4725   |    .1300       .9815
                           .0450      .7030   |    .2380      1.2455

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      2.988        6.00       39.59
     OUTFLOW: ID= 1 (9022)     24.780       .080       11.00       38.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.67
                   TIME SHIFT OF PEAK FLOW         (min)=300.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8370

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .080    11.00    38.99
        + ID2= 2 (2021):    70.42    7.245     6.00    37.37
          ===============================================
          ID = 3 (7008):    95.20    7.252     6.00    37.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

  ADD HYD   (5065)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    7.252     6.00    37.79
        + ID2= 2 (1044):   443.50    1.282    10.00     7.55
          ===============================================
          ID = 3 (5065):   538.70    7.274     6.00    12.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      1.928        6.00       34.29
     OUTFLOW: ID= 1 (9019)     22.700       .712        6.50       22.83

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.93
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3911

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .712     6.50    22.83
        + ID2= 2 (2011):    40.62    3.351     6.00    34.29
          ===============================================
          ID = 3 (7001):    63.32    3.351     6.00    30.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7001):    63.32    3.351     6.00    30.18
        + ID2= 2 (2012):    26.45     .099     8.75     7.55
          ===============================================
          ID = 3 (7002):    89.77    3.356     6.00    23.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      2.098        7.50        8.41
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.1075

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .705        6.50       11.65
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6396

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     12.687        6.00       41.71
     OUTFLOW: ID= 1 (9020)    145.270      1.220        8.25       41.69

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.62
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.3353

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     5.48      7.25     16.72
```

```
   SHIFT ID= 1 (9029):  406.96     5.48      9.75     16.72

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   6.388     8.75    22.63
        + ID2= 2 (9021):    89.70   3.472     6.50    40.63
          =================================================
          ID = 3 (5062):   699.78   7.487     8.50    24.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .572     9.25     7.55
        + ID2= 2 (7002):    89.77   3.356     6.00    23.51
          =================================================
          ID = 3 (5064):   260.50   3.372     6.00    13.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          =================================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   8.287     6.00    43.87
        + ID2= 2 (9020):   145.27   1.220     8.25    41.69
          =================================================
          ID = 3 (7013):   227.32   8.413     6.00    42.48

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04       .6           .56      172.84
        .39   274.89    .247E+05      4.2          1.00       97.27
        .59   275.09    .478E+05     11.1          1.35       71.58
```



```
        .78   275.28    .756E+05     21.4          1.64       58.99
        .98   275.48    .108E+06     35.2          1.89       51.17
       1.17   275.67    .145E+06     52.9          2.12       45.70
       1.37   275.87    .187E+06     74.8          2.33       41.60
       1.56   276.06    .233E+06    101.2          2.53       38.37
       1.76   276.26    .284E+06    132.2          2.71       35.80
       1.95   276.45    .342E+06    160.8          2.73       35.50
       2.17   276.67    .421E+06    204.7          2.83       34.30
       2.38   276.88    .516E+06    258.7          2.91       33.25
       2.60   277.10    .627E+06    323.9          3.00       32.28
       2.82   277.32    .754E+06    402.4          3.11       31.21
       3.03   277.53    .894E+06    517.5          3.37       28.78
       3.25   277.75    .105E+07    645.6          3.58       27.06
       3.47   277.97    .122E+07    787.1          3.76       25.78
       3.68   278.18    .140E+07    942.2          3.91       24.79
       3.90   278.40    .160E+07   1110.1          4.03       24.06

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)   406.96     5.48    9.75  16.72       .43      1.05
     OUTFLOW: ID= 1 (6019)   406.96     3.43   10.75  16.71       .35       .85


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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   2.027    10.00     7.80
          =================================================
          ID = 3 (9250):  1097.41   2.027    10.00     4.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7013):   227.32   8.413     6.00    42.48
        + ID2= 2 (2042):    54.50    .473     7.25    11.72
          =================================================
          ID = 3 (7014):   281.82   8.490     6.00    36.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 RESERVOIR (9018)
 IN= 2---> OUT= 1
 DT= 15.0 min             OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   4.8100     1.1900
                           .4200      .6400    |  14.3300     1.2700
                          1.5900      .9400    |  53.8000     1.3300
                          3.2000     1.1100    |    .0000      .0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      2.027       10.00        4.79
     OUTFLOW: ID= 1 (9018)   1097.411      2.001       10.50        4.78

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 98.74
                  TIME SHIFT OF PEAK FLOW        (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .9837

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--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   5.792     8.50    23.33
        + ID2= 2 (7014):   281.82   8.490     6.00    36.53
          =================================================
          ID = 3 (5061):   769.44   9.019     6.00    28.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

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--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33          .0800
                  46.71       277.77          .0800
                  57.10       277.40          .0800
                  62.29       276.96          .0800
                  67.48       275.94          .0800
                  77.86       273.27          .0800
                  83.05       272.29          .0800
                  93.43       270.99          .0800
                 109.00       270.02          .0350      Main Channel
                 119.38       270.02          .0350      Main Channel
                 150.53       271.36     .0350 / .0800  Main Channel
                 186.86       273.45          .0800
                 207.62       274.37          .0800
                 233.57       275.12          .0800
                 247.79       275.41          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)       (m/s)      (min)
        .28   270.30    .950E+04      3.7          .81       43.21
        .57   270.59    .257E+05     13.9         1.14       30.76
        .85   270.87    .484E+05     32.0         1.39       25.24
       1.13   271.15    .776E+05     59.6         1.61       21.71
       1.42   271.44    .112E+06    100.0         1.87       18.71
       1.70   271.72    .151E+06    157.2         2.18       16.04
       1.99   272.01    .195E+06    225.9         2.44       14.37
       2.27   272.29    .242E+06    305.9         2.65       13.21
       2.55   272.57    .294E+06    398.1         2.84       12.31
       2.84   272.86    .350E+06    501.8         3.01       11.61
       3.12   273.14    .409E+06    617.0         3.17       11.05
       3.40   273.42    .472E+06    744.3         3.31       10.58
       3.69   273.71    .539E+06    882.9         3.44       10.18
       3.97   273.99    .611E+06   1033.6         3.55        9.85
       4.26   274.28    .687E+06   1196.8         3.66        9.57
       4.54   274.56    .768E+06   1370.2         3.75        9.35
       4.82   274.84    .856E+06   1556.4         3.82        9.16
       5.11   275.13    .950E+06   1757.0         3.89        9.01
       5.39   275.41    .105E+07   1967.6         3.93        8.91

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41    2.00   10.50   4.78      .15       .81
     OUTFLOW: ID= 1 (9251) 1097.41    1.89   11.50   4.78      .14       .81

--------------------------------------------------------------------------------

 ADD HYD   (7016)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):    769.44    9.019     6.00    28.16
        + ID2= 2 (6019):    406.96    3.432    10.75    16.71
          ===============================================
          ID = 3 (7016):   1176.40    9.039    10.25    24.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):    479.57    1.461    10.00     7.80
        + ID2= 2 (9251):   1097.41    1.886    11.50     4.78
          ===============================================
          ID = 3 (5000):   1576.98    3.229    11.25     5.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
```



```
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):    260.50    3.372     6.00    13.05
        + ID2= 2 (5000):   1576.98    3.229    11.25     5.70
          ===============================================
          ID = 3 (5001):   1837.48    3.962    11.00     6.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min          OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                        .0000       .0000   |   2.8300     3.4900
                        .2800       .2500   |   3.8200     3.9500
                        .7100       .6300   |   4.6700     4.2000
                       1.1300      1.1400   |   7.3600     4.6900
                       1.5600      1.7300   |   8.7800     4.8500
                       1.8400      2.2600   |  35.4000     6.6100
                       2.2700      2.9600   |  *******     8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)    1837.481     3.962       11.00        6.74
     OUTFLOW: ID= 1 (9017)    1837.481     3.066       13.00        6.74

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 77.38
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.6017

--------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):    538.70    7.274     6.00    12.89
        + ID2= 2 (9017):   1837.48    3.066    13.00     6.74
          ===============================================
          ID = 3 (9041):   2376.18    7.656     6.00     8.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):     55.98    5.890     6.00    41.13
        + ID2= 2 (9041):   2376.18    7.656     6.00     8.14
          ===============================================
          ID = 3 (5002):   2432.16   13.545     6.00     8.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    13.55      6.00      8.90
    SHIFT ID= 1 (9040): 2432.16    13.55      7.00      8.90

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29          .0800
                  30.80       273.73          .0800
                  51.30       270.17          .0800
                  61.60       266.84          .0800
                  66.80       266.02          .0800
                 102.70       265.42          .0350      Main Channel
                 123.20       261.00          .0350      Main Channel
                 128.40       261.17          .0350      Main Channel
                 154.00       264.62          .0350      Main Channel
```

```
                174.60        266.82         .0800
                205.40        268.07         .0800
                236.20        268.74         .0800
                282.40        271.31         .0800
                302.90        272.11         .0800
                348.90        274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63    .702E+04       5.2          1.14      22.47
       1.26   262.26    .220E+05      24.8          1.74      14.74
       1.89   262.89    .443E+05      64.0          2.22      11.54
       2.53   263.53    .741E+05     127.4          2.65       9.69
       3.16   264.16    .111E+06     219.6          3.04       8.44
       3.79   264.79    .156E+06     343.2          3.39       7.57
       4.42   265.42    .209E+06     501.2          3.70       6.94
       5.16   266.16    .304E+06     766.4          3.88       6.61
       5.90   266.90    .428E+06    1123.8          4.05       6.34
       6.64   267.64    .570E+06    1628.6          4.40       5.84
       7.38   268.38    .738E+06    2225.4          4.65       5.53
       8.12   269.12    .941E+06    2928.9          4.80       5.35
       8.85   269.85    .116E+07    3743.0          4.95       5.18
       9.59   270.59    .141E+07    4656.3          5.10       5.03
      10.33   271.33    .167E+07    5671.9          5.24       4.90
      11.07   272.07    .195E+07    6784.6          5.36       4.80
      11.81   272.81    .226E+07    8029.1          5.47       4.69
      12.55   273.55    .259E+07    9393.0          5.59       4.60
      13.29   274.29    .295E+07   10648.3          5.55       4.62

                              <---- hydrograph ---->  <-pipe / channel->
                        AREA    QPEAK   TPEAK   R.V.  MAX DEPTH  MAX VEL
                        (ha)    (cms)   (hrs)   (mm)     (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16   13.55    7.00   8.90      .90     1.34
     OUTFLOW: ID= 1 (6029) 2432.16    8.54    7.25   8.90      .74     1.21

-------------------------------------------------------------------------------

 ADD HYD   (5003)
   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   8.541     7.25     8.90
        + ID2= 2 (1040):    14.62    .250     6.75    16.21
          ==================================================
          ID = 3 (5003):  2446.78   8.749     7.25     8.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 ADD HYD   (5004)
   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   8.749     7.25     8.94
        + ID2= 2 (7016):  1176.40   9.039    10.25    24.20
          ==================================================
          ID = 3 (5004):  3623.18  15.922     7.25    13.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |     AREA     QPEAK     TPEAK     R.V.
--------------------     (ha)     (cms)     (hrs)     (mm)
          ID= 2 (5004): 3623.18    15.92      7.25    13.90
    SHIFT ID= 1 (9015): 3623.18    15.92      9.25    13.90

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
                 Distance     Elevation       Manning
                      .00        260.30         .0800
                    34.10        260.43         .0800
                    62.40        259.79         .0800
                    79.50        255.72         .0800
```



```
                113.50        254.00         .0800
                153.30        253.33         .0350       Main Channel
                187.30        253.06         .0350       Main Channel
                198.70        251.88         .0350       Main Channel
                204.40        252.61         .0350       Main Channel
                249.80        254.00         .0800
                334.90        255.77         .0800
                351.90        256.37         .0800
                414.40        260.24         .0800
                465.50        260.75         .0800
                514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .36   252.24    .596E+04        .4           .39     223.90
        .73   252.61    .238E+05       2.8           .61     141.05
       1.09   252.97    .619E+05       8.2           .69     126.14
       1.45   253.33    .151E+06      18.8           .65     134.06
       1.91   253.79    .383E+06      68.4           .93      93.14
       2.38   254.26    .713E+06     157.3          1.15      75.58
       2.84   254.72    .112E+07     287.3          1.33      65.13
       3.31   255.19    .161E+07     454.2          1.47      59.01
       3.77   255.65    .217E+07     659.0          1.58      54.87
       4.24   256.12    .279E+07     908.7          1.69      51.25
       4.70   256.58    .346E+07    1199.1          1.80      48.03
       5.17   257.05    .414E+07    1527.9          1.92      45.17
       5.63   257.51    .485E+07    1892.4          2.03      42.71
       6.10   257.98    .558E+07    2291.8          2.13      40.59
       6.56   258.44    .634E+07    2725.7          2.23      38.74
       7.03   258.91    .711E+07    3193.6          2.33      37.12
       7.49   259.37    .791E+07    3695.3          2.43      35.69
       7.96   259.84    .874E+07    4221.9          2.51      34.48
       8.42   260.30    .961E+07    4697.6          2.54      34.09

                              <---- hydrograph ---->  <-pipe / channel->
                        AREA    QPEAK   TPEAK   R.V.  MAX DEPTH  MAX VEL
                        (ha)    (cms)   (hrs)   (mm)     (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18   15.92    9.25  13.90     1.35      .66
     OUTFLOW: ID= 1 (6031) 3623.18   11.30   13.50  13.90     1.19      .67

-------------------------------------------------------------------------------

 ADD HYD   (5005)
   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   7.487     8.50    24.94
        + ID2= 2 (6031):  3623.18  11.300    13.50    13.90
          ==================================================
          ID = 3 (5005):  4322.96  14.955    10.50    15.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 ****************************
 ** SIMULATION NUMBER:   4 **      25-Year Storm
 ****************************

--------------------
| MASS STORM       |     Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 83.15 mm |     Comments: SCS 24 HR MASS CURVE
--------------------
                         Duration of storm     = 12.00 hrs
                         Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.83 |  3.25    3.33 |  6.25   14.97 |  9.25    2.53
                  .50    1.93 |  3.50    3.33 |  6.50   14.97 |  9.50    2.33
                  .75    1.96 |  3.75    3.33 |  6.75    7.92 |  9.75    2.23
                 1.00    2.03 |  4.00    3.33 |  7.00    5.39 | 10.00    2.26
                 1.25    2.13 |  4.25    4.59 |  7.25    4.99 | 10.25    2.20
                 1.50    2.20 |  4.50    5.39 |  7.50    4.99 | 10.50    2.06
                 1.75    2.23 |  4.75    6.02 |  7.75    4.99 | 10.75    1.90
                 2.00    2.33 |  5.00    7.28 |  8.00    4.99 | 11.00    1.76
                 2.25    2.33 |  5.25    9.98 |  8.25    4.26 | 11.25    1.56
                 2.50    2.33 |  5.50    9.98 |  8.50    3.66 | 11.50    1.43
                 2.75    2.49 |  5.75   39.91 |  8.75    3.19 | 11.75    1.26
                 3.00    2.83 |  6.00  109.76 |  9.00    2.83 | 12.00    1.13
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-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=   8.546 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  30.044
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .361

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        74.52
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.40 (ii)   18.17 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       6.06         5.90          9.919 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      82.65        39.14          50.02
     TOTAL RAINFALL   (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT   =        .99          .47            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        70.93
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.29 (ii)   17.26 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       5.46         2.68          7.193 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      82.65        32.56          50.09
     TOTAL RAINFALL   (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT   =        .99          .39            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        73.57
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.71 (ii)   15.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       2.88         1.14          3.618 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      73.15        32.53          48.78
     TOTAL RAINFALL   (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT   =        .88          .39            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        69.10
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.81 (ii)   17.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       6.77         3.23          8.855 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      73.15        31.76          46.24
     TOTAL RAINFALL   (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT   =        .88          .38            .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   2.063 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW      (cms)=    .930 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        54.15
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.56 (ii)   16.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       1.65         1.12          2.372 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      82.65        28.85          42.30
     TOTAL RAINFALL   (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT   =        .99          .35            .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        54.15
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.62 (ii)   17.73 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       2.88         1.95          4.134 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      82.65        28.85          42.30
     TOTAL RAINFALL   (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT   =        .99          .35            .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (2012) |   Area    (ha)=  26.45   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.82

     Unit Hyd Qpeak  (cms)=    .555

     PEAK FLOW      (cms)=    .163 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

  CALIB
  NASHYD    (1047)     Area    (ha)= 479.57   Curve Number   (CN)= 59.0
 ID= 1 DT=15.0 min     Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.75

     Unit Hyd Qpeak  (cms)=   6.661

     PEAK FLOW      (cms)=   2.351 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.300
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW      (cms)=   3.332 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  12.712
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .153

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW      (cms)=   1.134 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  17.315
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW      (cms)=   3.258 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.300
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .148
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .342 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  21.923
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .264

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   7.732 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  30.906
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .372

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB              |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        79.39
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       8.18 (ii)   17.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.69         5.34        10.214 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      82.65        41.10         53.56
     TOTAL RAINFALL   (mm)=      83.15        83.15         83.15
     RUNOFF COEFFICIENT   =        .99          .49           .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        77.23
```



```
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.70 (ii)   19.34 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       9.43         9.68        15.788 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      82.65        40.71         51.20
     TOTAL RAINFALL   (mm)=      83.15        83.15         83.15
     RUNOFF COEFFICIENT   =        .99          .49           .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (2042) |   Area    (ha)=  54.50   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .98

     Unit Hyd Qpeak  (cms)=   2.124

     PEAK FLOW       (cms)=    .791 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  18.000
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .216

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
| CALIB              |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   7.472 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  22.578
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .272

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .083    1.83 | 3.083    3.33 | 6.083   14.97 |  9.08    2.53
                 .167    1.83 | 3.167    3.33 | 6.167   14.97 |  9.17    2.53
                 .250    1.83 | 3.250    3.33 | 6.250   14.97 |  9.25    2.53
                 .333    1.93 | 3.333    3.33 | 6.333   14.97 |  9.33    2.33
                 .417    1.93 | 3.417    3.33 | 6.417   14.97 |  9.42    2.33
                 .500    1.93 | 3.500    3.33 | 6.500   14.97 |  9.50    2.33
                 .583    1.96 | 3.583    3.33 | 6.583    7.92 |  9.58    2.23
                 .667    1.96 | 3.667    3.33 | 6.667    7.92 |  9.67    2.23
                 .750    1.96 | 3.750    3.33 | 6.750    7.92 |  9.75    2.23
                 .833    2.03 | 3.833    3.33 | 6.833    5.39 |  9.83    2.26
                 .917    2.03 | 3.917    3.33 | 6.917    5.39 |  9.92    2.26
                1.000    2.03 | 4.000    3.33 | 7.000    5.39 | 10.00    2.26
                1.083    2.13 | 4.083    4.59 | 7.083    4.99 | 10.08    2.20
                1.167    2.13 | 4.167    4.59 | 7.167    4.99 | 10.17    2.20
                1.250    2.13 | 4.250    4.59 | 7.250    4.99 | 10.25    2.20
                1.333    2.20 | 4.333    5.39 | 7.333    4.99 | 10.33    2.06
                1.417    2.20 | 4.417    5.39 | 7.417    4.99 | 10.42    2.06
```

```
                1.500    2.20 | 4.500    5.39 | 7.500    4.99 | 10.50    2.06
                1.583    2.23 | 4.583    6.02 | 7.583    4.99 | 10.58    1.90
                1.667    2.23 | 4.667    6.02 | 7.667    4.99 | 10.67    1.90
                1.750    2.23 | 4.750    6.02 | 7.750    4.99 | 10.75    1.90
                1.833    2.33 | 4.833    7.28 | 7.833    4.99 | 10.83    1.76
                1.917    2.33 | 4.917    7.28 | 7.917    4.99 | 10.92    1.76
                2.000    2.33 | 5.000    7.28 | 8.000    4.99 | 11.00    1.76
                2.083    2.33 | 5.083    9.98 | 8.083    4.26 | 11.08    1.56
                2.167    2.33 | 5.167    9.98 | 8.167    4.26 | 11.17    1.56
                2.250    2.33 | 5.250    9.98 | 8.250    4.26 | 11.25    1.56
                2.333    2.33 | 5.333    9.98 | 8.333    3.66 | 11.33    1.43
                2.417    2.33 | 5.417    9.98 | 8.417    3.66 | 11.42    1.43
                2.500    2.33 | 5.500    9.98 | 8.500    3.66 | 11.50    1.43
                2.583    2.49 | 5.583   39.91 | 8.583    3.19 | 11.58    1.26
                2.667    2.49 | 5.667   39.91 | 8.667    3.19 | 11.67    1.26
                2.750    2.49 | 5.750   39.91 | 8.750    3.19 | 11.75    1.26
                2.833    2.83 | 5.833  109.76 | 8.833    2.83 | 11.83    1.13
                2.917    2.83 | 5.917  109.76 | 8.917    2.83 | 11.92    1.13
                3.000    2.83 | 6.000  109.76 | 9.000    2.83 | 12.00    1.13

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .130 (i)
     TIME TO PEAK    (hrs)=   9.333
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      9.919        6.00       50.02
     OUTFLOW: ID= 1 (9021)     89.700      4.688        6.50       49.98

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.27
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8649

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800       .8375
                           .0100      .4725   |    .1300       .9815
                           .0450      .7030   |    .2380      1.2455

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      3.618        6.00       48.78
     OUTFLOW: ID= 1 (9022)     24.780       .130        9.50       48.16

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.59
                   TIME SHIFT OF PEAK FLOW         (min)=210.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9810

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .130     9.50    48.16
        + ID2= 2 (2021):    70.42    8.855     6.00    46.24
          ==============================================
          ID = 3 (7008):    95.20    8.864     6.00    46.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ADD HYD   (5065)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    8.864     6.00    46.74
        + ID2= 2 (1044):   443.50    2.063     9.75    11.92
          ==============================================
          ID = 3 (5065):   538.70    8.907     6.00    18.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      2.372        6.00       42.30
     OUTFLOW: ID= 1 (9019)     22.700       .929        6.50       30.84

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.15
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .4536

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .929     6.50    30.84
        + ID2= 2 (2011):    40.62    4.134     6.00    42.30
          ==============================================
          ID = 3 (7001):    63.32    4.414     6.00    38.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7001):    63.32    4.414     6.00    38.19
        + ID2= 2 (2012):    26.45     .163     8.50    11.92
          ==============================================
          ID = 3 (7002):    89.77    4.423     6.00    30.45

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      3.332        7.25       12.71
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.6980

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
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```
                               (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      1.134        6.50       17.31
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                  TIME SHIFT OF PEAK FLOW         (min)=******
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .9504

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 --------------------
 | RESERVOIR (9020) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   1.7200      5.0000
                           .2200     3.0000    |   2.5000      7.0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     15.788        6.00       51.20
     OUTFLOW: ID= 1 (9020)    145.270      1.758        7.75       51.17

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.14
                  TIME SHIFT OF PEAK FLOW         (min)=105.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  5.0996

 ------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9029) |
 | IN= 2---> OUT= 1 |
 | SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
 --------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     7.47      7.00     22.58
    SHIFT ID= 1 (9029):  406.96     7.47      9.50     22.58

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 --------------------
 | ADD HYD   (5062) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   8.546     8.75    30.04
        + ID2= 2 (9021):    89.70   4.688     6.50    49.98
          ==================================================
          ID = 3 (5062):   699.78   9.861     8.50    32.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5064) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .930     9.00    11.92
        + ID2= 2 (7002):    89.77   4.423     6.00    30.45
          ==================================================
          ID = 3 (5064):   260.50   4.455     6.00    18.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | ADD HYD   (7004) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | ADD HYD   (7013) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  10.214     6.00    53.56
        + ID2= 2 (9020):   145.27   1.758     7.75    51.17
          ==================================================
```


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```
          ID = 3 (7013):   227.32  10.369     6.00    52.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | ROUTE CHN (6019) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05          .0800
                  34.48        278.78          .0800
                  62.07        280.75          .0800
                  75.86        280.87          .0800
                 110.34        277.13          .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50          .0350     Main Channel
                 151.72        274.76          .0350     Main Channel
                 172.41        276.25          .0350     Main Channel
                 213.79        277.31          .0800
                 255.17        278.25          .0800
                 275.86        278.49          .0800
                 289.66        279.07          .0800
                 303.45        278.41          .0800
                 312.47        278.40          .0800

       <--------------------- TRAVEL TIME TABLE ---------------------->
        DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
         .20   274.70    .665E+04        .6           .56     172.84
         .39   274.89    .247E+05       4.2          1.00      97.27
         .59   275.09    .478E+05      11.1          1.35      71.58
         .78   275.28    .756E+05      21.4          1.64      58.99
         .98   275.48    .108E+06      35.2          1.89      51.17
        1.17   275.67    .145E+06      52.9          2.12      45.70
        1.37   275.87    .187E+06      74.8          2.33      41.60
        1.56   276.06    .233E+06     101.2          2.53      38.37
        1.76   276.26    .284E+06     132.2          2.71      35.80
        1.95   276.45    .342E+06     160.8          2.73      35.50
        2.17   276.67    .421E+06     204.7          2.83      34.30
        2.38   276.88    .516E+06     258.7          2.91      33.25
        2.60   277.10    .627E+06     323.9          3.00      32.28
        2.82   277.32    .754E+06     402.4          3.11      31.21
        3.03   277.53    .894E+06     517.5          3.37      28.78
        3.25   277.75    .105E+07     645.6          3.58      27.06
        3.47   277.97    .122E+07     787.1          3.76      25.78
        3.68   278.18    .140E+07     942.2          3.91      24.79
        3.90   278.40    .160E+07    1110.1          4.03      24.06

                                     <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     7.47    9.50  22.58       .48      1.14
     OUTFLOW: ID= 1 (6019)  406.96     5.03   10.75  22.58       .41      1.03


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 --------------------
 | ADD HYD   (9250) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   3.258     9.75    12.30
          ==================================================
          ID = 3 (9250):  1097.41   3.258     9.75     7.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | ADD HYD   (7014) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7013):   227.32  10.369     6.00    52.04
        + ID2= 2 (2042):    54.50    .791     7.00    18.00
          ==================================================
          ID = 3 (7014):   281.82  10.515     6.00    45.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

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-------------------------------------------------------------------------------
 RESERVOIR (9018)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   4.8100     1.1900
                           .4200      .6400   |  14.3300     1.2700
                          1.5900      .9400   |  53.8000     1.3300
                          3.2000     1.1100   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      3.258        9.75        7.54
     OUTFLOW: ID= 1 (9018)   1097.411      3.253       10.00        7.54

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.83
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.1127

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   7.732     8.50    30.91
        + ID2= 2 (7014):   281.82  10.515     6.00    45.46
          ==================================================
          ID = 3 (5061):   769.44  11.307     6.00    36.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)       (min)
         .28   270.30   .950E+04      3.7           .81       43.21
         .57   270.59   .257E+05     13.9          1.14       30.76
         .85   270.87   .484E+05     32.0          1.39       25.24
        1.13   271.15   .776E+05     59.6          1.61       21.71
        1.42   271.44   .112E+06    100.0          1.87       18.71
        1.70   271.72   .151E+06    157.2          2.18       16.04
        1.99   272.01   .195E+06    225.9          2.44       14.37
        2.27   272.29   .242E+06    305.9          2.65       13.21
        2.55   272.57   .294E+06    398.1          2.84       12.31
        2.84   272.86   .350E+06    501.8          3.01       11.61
        3.12   273.14   .409E+06    617.0          3.17       11.05
        3.40   273.42   .472E+06    744.3          3.31       10.58
        3.69   273.71   .539E+06    882.9          3.44       10.18
        3.97   273.99   .611E+06   1033.6          3.55        9.85
        4.26   274.28   .687E+06   1196.8          3.66        9.57
        4.54   274.56   .768E+06   1370.2          3.75        9.35
        4.82   274.84   .856E+06   1556.4          3.82        9.16
        5.11   275.13   .950E+06   1757.0          3.89        9.01
        5.39   275.41   .105E+07   1967.6          3.93        8.91

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (9018) 1097.41     3.25   10.00   7.54       .25        .81
```



```
     OUTFLOW: ID= 1 (9251) 1097.41     3.08   11.00   7.54       .24        .81

-------------------------------------------------------------------------------

--------------------
 ADD HYD   (7016)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  11.307     6.00    36.24
        + ID2= 2 (6019):   406.96   5.034    10.75    22.58
          ==================================================
          ID = 3 (7016):  1176.40  12.683    10.25    31.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   2.351     9.75    12.30
        + ID2= 2 (9251):  1097.41   3.082    11.00     7.54
          ==================================================
          ID = 3 (5000):  1576.98   5.287    10.75     8.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   4.455     6.00    18.30
        + ID2= 2 (5000):  1576.98   5.287    10.75     8.99
          ==================================================
          ID = 3 (5001):  1837.48   6.467    10.50    10.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.8300     3.4900
                           .2800      .2500   |   3.8200     3.9500
                           .7100      .6300   |   4.6700     4.2000
                          1.1300     1.1400   |   7.3600     4.6900
                          1.5600     1.7300   |   8.7800     4.8500
                          1.8400     2.2600   |  35.4000     6.6100
                          2.2700     2.9600   |  *******     8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      6.467       10.50       10.31
     OUTFLOW: ID= 1 (9017)   1837.481      6.123       11.50       10.31

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.68
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.4676

-------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   8.907     6.00    18.07
        + ID2= 2 (9017):  1837.48   6.123    11.50    10.31
          ==================================================
          ID = 3 (9041):  2376.18   9.391     6.00    12.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   7.193     6.00    50.09
        + ID2= 2 (9041):  2376.18   9.391     6.00    12.07
          ==================================================
          ID = 3 (5002):  2432.16  16.584     6.00    12.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    16.58      6.00     12.94
    SHIFT ID= 1 (9040): 2432.16    16.58      7.00     12.94

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        274.29         .0800
                  30.80        273.73         .0800
                  51.30        270.17         .0800
                  61.60        266.84         .0800
                  66.80        266.02         .0800
                 102.70        265.42         .0350      Main Channel
                 123.20        261.00         .0350      Main Channel
                 128.40        261.17         .0350      Main Channel
                 154.00        264.62         .0350      Main Channel
                 174.60        266.82         .0800
                 205.40        268.07         .0800
                 236.20        268.74         .0800
                 282.40        271.31         .0800
                 302.90        272.11         .0800
                 348.90        274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63    .702E+04       5.2          1.14      22.47
       1.26   262.26    .220E+05      24.8          1.74      14.74
       1.89   262.89    .443E+05      64.0          2.22      11.54
       2.53   263.53    .741E+05     127.4          2.65       9.69
       3.16   264.16    .111E+06     219.6          3.04       8.44
       3.79   264.79    .156E+06     343.2          3.39       7.57
       4.42   265.42    .209E+06     501.2          3.70       6.94
       5.16   266.16    .304E+06     766.4          3.88       6.61
       5.90   266.90    .428E+06    1123.8          4.05       6.34
       6.64   267.64    .570E+06    1628.6          4.40       5.84
       7.38   268.38    .738E+06    2225.4          4.65       5.53
       8.12   269.12    .941E+06    2928.9          4.80       5.35
       8.85   269.85    .116E+07    3743.0          4.95       5.18
       9.59   270.59    .141E+07    4656.3          5.10       5.03
      10.33   271.33    .167E+07    5671.9          5.24       4.90
      11.07   272.07    .195E+07    6784.6          5.36       4.80
      11.81   272.81    .226E+07    8029.1          5.47       4.69
      12.55   273.55    .259E+07    9393.0          5.59       4.60
      13.29   274.29    .295E+07   10648.3          5.55       4.62

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    16.58    7.00  12.94      1.00      1.43
     OUTFLOW: ID= 1 (6029) 2432.16    10.80    7.25  12.94       .81      1.26

-------------------------------------------------------------------------------

| ADD HYD   (5003)
|   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  10.795     7.25    12.94
        + ID2= 2 (1040):    14.62    .342     6.75    21.92
          ==================================================
          ID = 3 (5003):  2446.78  11.077     7.25    13.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```



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-------------------------------------------------------------------------------

| ADD HYD   (5004)
|   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  11.077     7.25    13.00
        + ID2= 2 (7016):  1176.40  12.683    10.25    31.51
          ==================================================
          ID = 3 (5004):  3623.18  20.960     7.25    19.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    20.96      7.25     19.01
    SHIFT ID= 1 (9015): 3623.18    20.96      9.25     19.01

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        260.30         .0800
                  34.10        260.43         .0800
                  62.40        259.79         .0800
                  79.50        255.72         .0800
                 113.50        254.00         .0800
                 153.30        253.33         .0350      Main Channel
                 187.30        253.06         .0350      Main Channel
                 198.70        251.88         .0350      Main Channel
                 204.40        252.61         .0350      Main Channel
                 249.80        254.00         .0800
                 334.90        255.77         .0800
                 351.90        256.37         .0800
                 414.40        260.24         .0800
                 465.50        260.75         .0800
                 514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .36   252.24    .596E+04        .4           .39     223.90
        .73   252.61    .238E+05       2.8           .61     141.05
       1.09   252.97    .619E+05       8.2           .69     126.14
       1.45   253.33    .151E+06      18.8           .65     134.06
       1.91   253.79    .383E+06      68.4           .93      93.14
       2.38   254.26    .713E+06     157.3          1.15      75.58
       2.84   254.72    .112E+07     287.3          1.33      65.13
       3.31   255.19    .161E+07     454.2          1.47      59.01
       3.77   255.65    .217E+07     659.0          1.58      54.87
       4.24   256.12    .279E+07     908.7          1.69      51.25
       4.70   256.58    .346E+07    1199.1          1.80      48.03
       5.17   257.05    .414E+07    1527.9          1.92      45.17
       5.63   257.51    .485E+07    1892.4          2.03      42.71
       6.10   257.98    .558E+07    2291.8          2.13      40.59
       6.56   258.44    .634E+07    2725.7          2.23      38.74
       7.03   258.91    .711E+07    3193.6          2.33      37.12
       7.49   259.37    .791E+07    3695.3          2.43      35.69
       7.96   259.84    .874E+07    4221.9          2.51      34.48
       8.42   260.30    .961E+07    4697.6          2.54      34.09

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    20.96    9.25  19.01      1.47       .65
     OUTFLOW: ID= 1 (6031) 3623.18    16.19   14.50  19.01      1.36       .65

-------------------------------------------------------------------------------

| ADD HYD   (5005)
|   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   9.861     8.50    32.60
        + ID2= 2 (6031):  3623.18  16.195    14.50    19.01
```

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          ==================================================
          ID = 3 (5005):  4322.96  19.436    10.50    21.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************
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100-Year Storm

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--------------------
| MASS STORM        |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                   |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal=104.07 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    2.29 |  3.25    4.16 |  6.25   18.73 |  9.25    3.16
                  .50    2.41 |  3.50    4.16 |  6.50   18.73 |  9.50    2.91
                  .75    2.46 |  3.75    4.16 |  6.75    9.91 |  9.75    2.79
                 1.00    2.54 |  4.00    4.16 |  7.00    6.74 | 10.00    2.83
                 1.25    2.66 |  4.25    5.74 |  7.25    6.24 | 10.25    2.75
                 1.50    2.75 |  4.50    6.74 |  7.50    6.24 | 10.50    2.58
                 1.75    2.79 |  4.75    7.53 |  7.75    6.24 | 10.75    2.37
                 2.00    2.91 |  5.00    9.12 |  8.00    6.24 | 11.00    2.21
                 2.25    2.91 |  5.25   12.49 |  8.25    5.33 | 11.25    1.96
                 2.50    2.91 |  5.50   12.49 |  8.50    4.58 | 11.50    1.79
                 2.75    3.12 |  5.75   49.95 |  8.75    4.00 | 11.75    1.58
                 3.00    3.54 |  6.00  137.37 |  9.00    3.54 | 12.00    1.42

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=  12.719 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  44.321
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.00
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.68 (ii)   16.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       7.74         8.71         13.552 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        55.08          67.20
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .53            .65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



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-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       102.01
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       6.66 (ii)   15.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       6.95         4.03          9.610 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        46.64          66.57
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .45            .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.80
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.22 (ii)   13.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       3.64         2.12          5.761 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      94.07        46.60          65.59
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .45            .63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        99.64
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.14 (ii)   15.84 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
```

```
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       8.63         4.89          11.845 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      94.07        45.60          62.56
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .44            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   3.773 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB             |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=   1.719 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.08 (ii)   14.64 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                            *TOTALS*
     PEAK FLOW       (cms)=       2.09         2.10           4.191 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| CALIB             |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       6.05 (ii)   15.61 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       3.66         2.99           5.609 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (2012) |   Area    (ha)=  26.45   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.82

     Unit Hyd Qpeak  (cms)=    .555

     PEAK FLOW       (cms)=    .305 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  21.264
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.75

     Unit Hyd Qpeak  (cms)=   6.661

     PEAK FLOW       (cms)=   4.294 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   6.047 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  21.790
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .209

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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 | CALIB            |
 | NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   2.047 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  28.911
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .278

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   5.946 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .525 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  33.262
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .320

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=  11.484 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  45.460
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .437

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | STANDHYD  (2041) |   Area    (ha)=  82.05
 |ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
 -------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       111.02
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                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.47 (ii)   15.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       8.54         7.81         13.792 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57        57.41         71.26
     TOTAL RAINFALL   (mm)=     104.07       104.07        104.07
     RUNOFF COEFFICIENT   =       1.00          .55           .68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | STANDHYD  (2040) |   Area    (ha)= 145.27
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 -------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       108.14
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.87 (ii)   17.29 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=      12.10        14.21         21.603 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57        56.93         68.59
     TOTAL RAINFALL   (mm)=     104.07       104.07        104.07
     RUNOFF COEFFICIENT   =       1.00          .55           .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | NASHYD    (2042) |   Area    (ha)=  54.50   Curve Number   (CN)= 71.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=    .98

     Unit Hyd Qpeak  (cms)=   2.124

     PEAK FLOW       (cms)=   1.481 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  30.846
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .296

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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   CALIB
   NASHYD    (1060)     Area    (ha)= 406.96   Curve Number   (CN)= 60.0
  ID= 1 DT=15.0 min     Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                        U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=  11.495 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  34.179
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .328
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .083    2.29 | 3.083    4.16 | 6.083   18.73 |  9.08    3.16
                  .167    2.29 | 3.167    4.16 | 6.167   18.73 |  9.17    3.16
                  .250    2.29 | 3.250    4.16 | 6.250   18.73 |  9.25    3.16
                  .333    2.41 | 3.333    4.16 | 6.333   18.73 |  9.33    2.91
                  .417    2.41 | 3.417    4.16 | 6.417   18.73 |  9.42    2.91
                  .500    2.41 | 3.500    4.16 | 6.500   18.73 |  9.50    2.91
                  .583    2.46 | 3.583    4.16 | 6.583    9.91 |  9.58    2.79
                  .667    2.46 | 3.667    4.16 | 6.667    9.91 |  9.67    2.79
                  .750    2.46 | 3.750    4.16 | 6.750    9.91 |  9.75    2.79
                  .833    2.54 | 3.833    4.16 | 6.833    6.74 |  9.83    2.83
                  .917    2.54 | 3.917    4.16 | 6.917    6.74 |  9.92    2.83
                 1.000    2.54 | 4.000    4.16 | 7.000    6.74 | 10.00    2.83
                 1.083    2.66 | 4.083    5.74 | 7.083    6.24 | 10.08    2.75
                 1.167    2.66 | 4.167    5.74 | 7.167    6.24 | 10.17    2.75
                 1.250    2.66 | 4.250    5.74 | 7.250    6.24 | 10.25    2.75
                 1.333    2.75 | 4.333    6.74 | 7.333    6.24 | 10.33    2.58
                 1.417    2.75 | 4.417    6.74 | 7.417    6.24 | 10.42    2.58
                 1.500    2.75 | 4.500    6.74 | 7.500    6.24 | 10.50    2.58
                 1.583    2.79 | 4.583    7.53 | 7.583    6.24 | 10.58    2.37
                 1.667    2.79 | 4.667    7.53 | 7.667    6.24 | 10.67    2.37
                 1.750    2.79 | 4.750    7.53 | 7.750    6.24 | 10.75    2.37
                 1.833    2.91 | 4.833    9.12 | 7.833    6.24 | 10.83    2.21
                 1.917    2.91 | 4.917    9.12 | 7.917    6.24 | 10.92    2.21
                 2.000    2.91 | 5.000    9.12 | 8.000    6.24 | 11.00    2.21
                 2.083    2.91 | 5.083   12.49 | 8.083    5.33 | 11.08    1.96
                 2.167    2.91 | 5.167   12.49 | 8.167    5.33 | 11.17    1.96
                 2.250    2.91 | 5.250   12.49 | 8.250    5.33 | 11.25    1.96
                 2.333    2.91 | 5.333   12.49 | 8.333    4.58 | 11.33    1.79
                 2.417    2.91 | 5.417   12.49 | 8.417    4.58 | 11.42    1.79
                 2.500    2.91 | 5.500   12.49 | 8.500    4.58 | 11.50    1.79
                 2.583    3.12 | 5.583   49.95 | 8.583    4.00 | 11.58    1.58
                 2.667    3.12 | 5.667   49.95 | 8.667    4.00 | 11.67    1.58
                 2.750    3.12 | 5.750   49.96 | 8.750    4.00 | 11.75    1.58
                 2.833    3.54 | 5.833  137.37 | 8.833    3.54 | 11.83    1.42
                 2.917    3.54 | 5.917  137.37 | 8.917    3.54 | 11.92    1.42
                 3.000    3.54 | 6.000  137.37 | 9.000    3.54 | 12.00    1.42

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .238 (i)
     TIME TO PEAK    (hrs)=   9.167
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     13.552        6.00       67.20
     OUTFLOW: ID= 1 (9021)     89.700      6.901        6.50       67.16

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 50.92
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.3882

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| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800       .8375
                           .0100      .4725   |    .1300       .9815
                           .0450      .7030   |    .2380      1.2455

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      5.761        6.00       65.59
     OUTFLOW: ID= 1 (9022)     24.780       .238        8.75       64.96

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.13
                   TIME SHIFT OF PEAK FLOW         (min)=165.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.2452

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| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .238     8.75    64.96
        + ID2= 2 (2021):    70.42   11.845     6.00    62.56
          ==================================================
          ID = 3 (7008):    95.20   11.880     6.00    63.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ADD HYD   (5065)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20   11.880     6.00    63.19
        + ID2= 2 (1044):   443.50    3.773     9.75    21.26
          ==================================================
          ID = 3 (5065):   538.70   11.982     6.00    28.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      4.191        6.00       57.25
     OUTFLOW: ID= 1 (9019)     22.700      1.116        6.50       45.79

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.63
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6335

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70    1.116     6.50    45.79
        + ID2= 2 (2011):    40.62    5.609     6.00    57.25
          ==================================================
          ID = 3 (7001):    63.32    6.549     6.00    53.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
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```
          ID1= 1 (7001):    63.32   6.549     6.00    53.14
        + ID2= 2 (2012):    26.45    .305     8.25    21.26
          ===============================================
          ID = 3 (7002):    89.77   6.570     6.00    43.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | RESERVOIR (9147) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      6.047        7.25       21.79
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  8.0530

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 --------------------
 | RESERVOIR (9248) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      2.047        6.50       28.91
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.5870

 -------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (9020) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |   1.7200      5.0000
                            .2200     3.0000   |   2.5000      7.0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     21.603        6.00       68.59
     OUTFLOW: ID= 1 (9020)    145.270      2.400        7.50       68.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.11
                   TIME SHIFT OF PEAK FLOW         (min)= 90.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  6.7462

 -------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9029) |
 | IN= 2---> OUT= 1 |
 | SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
 --------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     11.49      7.00     34.18
    SHIFT ID= 1 (9029):  406.96     11.49      9.50     34.18

 -------------------------------------------------------------------------------
 --------------------
 | ADD HYD   (5062) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08  12.719     8.75    44.32
        + ID2= 2 (9021):    89.70   6.901     6.50    67.16
          ===============================================
          ID = 3 (5062):   699.78  14.432     8.50    47.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
```



```
 --------------------
 | ADD HYD   (5064) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73   1.719     8.75    21.26
        + ID2= 2 (7002):    89.77   6.570     6.00    43.75
          ===============================================
          ID = 3 (5064):   260.50   6.647     6.00    29.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | ADD HYD   (7004) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | ADD HYD   (7013) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  13.792     6.00    71.26
        + ID2= 2 (9020):   145.27   2.400     7.50    68.57
          ===============================================
          ID = 3 (7013):   227.32  14.003     6.00    69.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6019) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation      Manning
                     .00       281.05         .0800
                   34.48       278.78         .0800
                   62.07       280.75         .0800
                   75.86       280.87         .0800
                  110.34       277.13         .0800
                  124.14       276.45     .0800 / .0350  Main Channel
                  137.93       274.50         .0350      Main Channel
                  151.72       274.76         .0350      Main Channel
                  172.41       276.25         .0350      Main Channel
                  213.79       277.31         .0800
                  255.17       278.25         .0800
                  275.86       278.49         .0800
                  289.66       279.07         .0800
                  303.45       278.41         .0800
                  312.47       278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06
```

```
                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96    11.49    9.50  34.18       .59      1.36
     OUTFLOW: ID= 1 (6019)  406.96     8.03   10.50  34.18       .50      1.17

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   5.946     9.50    21.89
          ==============================================
          ID = 3 (9250):  1097.41   5.946     9.50    13.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7013):   227.32  14.003     6.00    69.54
        + ID2= 2 (2042):    54.50   1.481     7.00    30.85
          ==============================================
          ID = 3 (7014):   281.82  14.328     6.00    62.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 RESERVOIR (9018)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   4.8100     1.1900
                          .4200      .6400    |  14.3300     1.2700
                         1.5900      .9400    |  53.8000     1.3300
                         3.2000     1.1100    |    .0000      .0000

                              AREA      QPEAK       TPEAK       R.V.
                              (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411     5.946        9.50       13.43
     OUTFLOW: ID= 1 (9018)   1097.411     5.975        9.50       13.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.48
                   TIME SHIFT OF PEAK FLOW         (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.2011

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                     CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62  11.484     8.25    45.46
        + ID2= 2 (7014):   281.82  14.328     6.00    62.06
          ==============================================
          ID = 3 (5061):   769.44  15.963     8.00    51.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
```



```
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)       (m/s)      (min)
        .28   270.30    .950E+04      3.7           .81      43.21
        .57   270.59    .257E+05     13.9          1.14      30.76
        .85   270.87    .484E+05     32.0          1.39      25.24
       1.13   271.15    .776E+05     59.6          1.61      21.71
       1.42   271.44    .112E+06    100.0          1.87      18.71
       1.70   271.72    .151E+06    157.2          2.18      16.04
       1.99   272.01    .195E+06    225.9          2.44      14.37
       2.27   272.29    .242E+06    305.9          2.65      13.21
       2.55   272.57    .294E+06    398.1          2.84      12.31
       2.84   272.86    .350E+06    501.8          3.01      11.61
       3.12   273.14    .409E+06    617.0          3.17      11.05
       3.40   273.42    .472E+06    744.3          3.31      10.58
       3.69   273.71    .539E+06    882.9          3.44      10.18
       3.97   273.99    .611E+06   1033.6          3.55       9.85
       4.26   274.28    .687E+06   1196.8          3.66       9.57
       4.54   274.56    .768E+06   1370.2          3.75       9.35
       4.82   274.84    .856E+06   1556.4          3.82       9.16
       5.11   275.13    .950E+06   1757.0          3.89       9.01
       5.39   275.41    .105E+07   1967.6          3.93       8.91

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     5.98    9.50  13.43       .35       .87
     OUTFLOW: ID= 1 (9251) 1097.41     5.71   10.50  13.43       .34       .86

-------------------------------------------------------------------------------

 ADD HYD   (7016)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  15.963     8.00    51.54
        + ID2= 2 (6019):   406.96   8.029    10.50    34.18
          ==============================================
          ID = 3 (7016):  1176.40  19.459    10.00    45.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   4.294     9.50    21.89
        + ID2= 2 (9251):  1097.41   5.713    10.50    13.43
          ==============================================
          ID = 3 (5000):  1576.98   9.870    10.00    16.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   6.647     6.00    29.01
        + ID2= 2 (5000):  1576.98   9.870    10.00    16.00
          ==============================================
          ID = 3 (5001):  1837.48  12.025     9.75    17.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                         .0000      .0000   |   2.8300      3.4900
                         .2800      .2500   |   3.8200      3.9500
                         .7100      .6300   |   4.6700      4.2000
                        1.1300     1.1400   |   7.3600      4.6900
                        1.5600     1.7300   |   8.7800      4.8500
                        1.8400     2.2600   |  35.4000      6.6100
                        2.2700     2.9600   |  *******      8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     12.025        9.75       17.85
     OUTFLOW: ID= 1 (9017)   1837.481     12.002       10.00       17.85

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.81
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  5.0639

------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70  11.982     6.00    28.67
        + ID2= 2 (9017):  1837.48  12.002    10.00    17.85
          ==================================================
          ID = 3 (9041):  2376.18  16.418    10.00    20.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   9.610     6.00    66.57
        + ID2= 2 (9041):  2376.18  16.418    10.00    20.30
          ==================================================
          ID = 3 (5002):  2432.16  22.279     6.00    21.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    22.28      6.00     21.37
    SHIFT ID= 1 (9040): 2432.16    22.28      7.00     21.37

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                     .00        274.29          .0800
                   30.80        273.73          .0800
                   51.30        270.17          .0800
                   61.60        266.84          .0800
                   66.80        266.02          .0800
                  102.70        265.42          .0350     Main Channel
                  123.20        261.00          .0350     Main Channel
                  128.40        261.17          .0350     Main Channel
                  154.00        264.62          .0350     Main Channel
                  174.60        266.82          .0800
                  205.40        268.07          .0800
                  236.20        268.74          .0800
                  282.40        271.31          .0800
                  302.90        272.11          .0800
                  348.90        274.45          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV       VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)       (cms)        (m/s)      (min)
        .63   261.63     .702E+04        5.2          1.14      22.47
       1.26   262.26     .220E+05       24.8          1.74      14.74
       1.89   262.89     .443E+05       64.0          2.22      11.54
       2.53   263.53     .741E+05      127.4          2.65       9.69
       3.16   264.16     .111E+06      219.6          3.04       8.44
```



```
       3.79   264.79     .156E+06      343.2          3.39       7.57
       4.42   265.42     .209E+06      501.2          3.70       6.94
       5.16   266.16     .304E+06      766.4          3.88       6.61
       5.90   266.90     .428E+06     1123.8          4.05       6.34
       6.64   267.64     .570E+06     1628.6          4.40       5.84
       7.38   268.38     .738E+06     2225.4          4.65       5.53
       8.12   269.12     .941E+06     2928.9          4.80       5.35
       8.85   269.85     .116E+07     3743.0          4.95       5.18
       9.59   270.59     .141E+07     4656.3          5.10       5.03
      10.33   271.33     .167E+07     5671.9          5.24       4.90
      11.07   272.07     .195E+07     6784.6          5.36       4.80
      11.81   272.81     .226E+07     8029.1          5.47       4.69
      12.55   273.55     .259E+07     9393.0          5.59       4.60
      13.29   274.29     .295E+07    10648.3          5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    22.28    7.00  21.37      1.18      1.63
     OUTFLOW: ID= 1 (6029) 2432.16    16.72   11.25  21.37      1.00      1.43

------------------------------------------------------------------------------

 ADD HYD   (5003)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  16.723    11.25    21.37
        + ID2= 2 (1040):    14.62    .525     6.75    33.26
          ==================================================
          ID = 3 (5003):  2446.78  16.784    11.25    21.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

 ADD HYD   (5004)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  16.784    11.25    21.44
        + ID2= 2 (7016):  1176.40  19.459    10.00    45.53
          ==================================================
          ID = 3 (5004):  3623.18  34.821    10.50    29.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    34.82     10.50     29.26
    SHIFT ID= 1 (9015): 3623.18    34.82     12.50     29.26

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                     .00        260.30          .0800
                   34.10        260.43          .0800
                   62.40        259.79          .0800
                   79.50        255.72          .0800
                  113.50        254.00          .0800
                  153.30        253.33          .0350     Main Channel
                  187.30        253.06          .0350     Main Channel
                  198.70        251.88          .0350     Main Channel
                  204.40        252.61          .0350     Main Channel
                  249.80        254.00          .0800
                  334.90        255.77          .0800
                  351.90        256.37          .0800
                  414.40        260.24          .0800
                  465.50        260.75          .0800
                  514.40        261.48          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV       VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)       (cms)        (m/s)      (min)
```

```
        .36   252.24    .596E+04        .4           .39     223.90
        .73   252.61    .238E+05       2.8           .61     141.05
       1.09   252.97    .619E+05       8.2           .69     126.14
       1.45   253.33    .151E+06      18.8           .65     134.06
       1.91   253.79    .383E+06      68.4           .93      93.14
       2.38   254.26    .713E+06     157.3          1.15      75.58
       2.84   254.72    .112E+07     287.3          1.33      65.13
       3.31   255.19    .161E+07     454.2          1.47      59.01
       3.77   255.65    .217E+07     659.0          1.58      54.87
       4.24   256.12    .279E+07     908.7          1.69      51.25
       4.70   256.58    .346E+07    1199.1          1.80      48.03
       5.17   257.05    .414E+07    1527.9          1.92      45.17
       5.63   257.51    .485E+07    1892.4          2.03      42.71
       6.10   257.98    .558E+07    2291.8          2.13      40.59
       6.56   258.44    .634E+07    2725.7          2.23      38.74
       7.03   258.91    .711E+07    3193.6          2.33      37.12
       7.49   259.37    .791E+07    3695.3          2.43      35.69
       7.96   259.84    .874E+07    4221.9          2.51      34.48
       8.42   260.30    .961E+07    4697.6          2.54      34.09

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    34.82   12.50  29.26      1.60       .72
     OUTFLOW: ID= 1 (6031) 3623.18    28.80   14.00  29.26      1.54       .69

-------------------------------------------------------------------------------

  ADD HYD   (5005)
    1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78  14.432     8.50    47.25
        + ID2= 2 (6031):  3623.18  28.797    14.00    29.26
          ==================================================
          ID = 3 (5005):  4322.96  33.085    13.50    32.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 FINISH
=========================================================================================================
==
```

Appendix EPHOSPHORUS LOADING RATE CALCULATIONS

Table C
REGIONAL MUNICIPALITY OF DURHAM
Uxbridge Brook WPCP
2014 Operational Data
Effluent Wastewater Flow and Analyses

Month	Effluent Plant Flow			Effluent Analyses																			
	Total	Avg Day	Max Day	CBOD$_5$		Suspended Solids		Total Phosphorus			Dissolved Phosphorus	TKN	Total Ammonia Nitrogen				Un-ionized Ammonia	Nitrate Nitrogen	Alkalinity CaCO3	pH		Temperature	
													Winter		Summer								
				conc.	load	conc.	load	conc.	load		conc.	conc.	conc.	load	conc.	load	conc.	conc.	conc.				
	m³	m³/d	m³/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	kg/mth	mg/L	mg/L	mg/L N	kg/d N	mg/L N	kg/d N	mg/L	mg/L	mg/L	min	max	min	max
January	105,179	3,393	5,847	1.4	4.8	5	15.6	0.09	0.31	9	0.01	0.96	0.2	0.5	--	--	0.0	22.3	97	6.5	7.2	6.1	12.4
February	95,024	3,394	5,971	1.0	3.4	5	18.3	0.08	0.27	8	0.01	1.14	0.3	1.0	--	--	0.0	23.4	88	6.5	7.0	8.6	15.9
March	111,735	3,604	4,404	0.4	1.4	2	7.6	0.06	0.22	7	0.01	2.64	1.6	5.7	--	--	0.0	20.6	119	6.5	7.3	7.7	13.0
April	158,140	5,271	6,867	0.7	3.7	2	12.1	0.04	0.21	6	0.00	4.11	3.5	18.6	--	--	0.0	14.7	170	6.6	7.6	10.3	13.1
May	140,749	4,540	5,420	1.5	6.8	4	17.7	0.07	0.32	10	0.02	1.95	--	--	1.5	6.9	0.0	20.7	160	6.6	7.4	11.8	16.2
June	119,001	3,967	4,639	0.9	3.6	4	17.5	0.04	0.16	5	0.01	0.93	--	--	0.1	0.2	0.0	21.2	114	6.4	7.3	15.7	18.8
July	114,961	3,708	4,267	1.0	3.7	2	7.0	0.03	0.11	3	0.01	0.78	--	--	0.0	0.1	0.0	19.3	119	6.5	7.5	17.5	19.0
August	113,402	3,658	3,956	1.1	4.0	2	5.5	0.06	0.22	7	0.01	1.02	--	--	0.3	1.1	0.0	18.3	135	6.7	7.7	17.7	19.9
September	122,237	4,076	4,863	1.5	6.1	2	7.3	0.07	0.29	9	0.02	1.87	--	--	1.1	4.6	0.0	15.2	143	6.6	7.5	16.8	19.9
October	131,256	4,234	5,148	1.8	7.6	3	11.4	0.08	0.34	11	0.03	7.48	--	--	5.1	21.5	0.0	12.0	167	6.4	7.4	13.9	18.7
November	118,526	3,951	4,465	1.1	4.3	2	9.1	0.06	0.24	7	0.02	5.93	--	--	2.2	8.7	0.0	18.5	142	6.4	7.4	11.3	16.7
December	124,186	4,006	4,501	0.9	3.6	3	12.4	0.06	0.24	7	0.02	0.77	0.0	0.08	--	--	0.0	28.0	95	6.6	7.2	10.7	13.5
Total	1,454,396									89													
Average	121,200	**3,985**		1.1	**4.4**	3	**12.0**	0.06	**0.25**	7	0.01	2.47	1.1	5.2	1.5	6.2	0.0	19.5	129				
Max	158,140		6,867	**1.8**	7.6	**5**	18.3	**0.09**	0.34	11	0.03	7.48	**3.5**	**18.6**	**5.1**	**21.5**	**0.0**	28.0	170		**7.7**		19.9
Min	95,024			0.4	1.4	2	5.5	0.03	0.11	3	0.00	0.77	0.0	0.1	0.0	0.1	0.0	12.0	88	**6.4**		6.1	

ECA Limit				8.5	30.9	10	36.3	0.15	0.78				6	21.8	3	10.9	0.1			6.0	9.5		
ECA Objective				5		5		0.1					5		2					6.5	9.0		
LSPRS*										286													
Compliant				Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	No	No	Yes			Yes	Yes		

Comments

Objectives for CBOD$_5$, Suspended Solids and Total Ammonia Nitrogen apply to individual samples upon issuance of the new approval (June 28, 2012)

* Lake Simcoe Phosphorus Reduction Strategy

Plant flow metered at the final effluent

Refer to Section 2.1 - Plant Performance Evaluation of the Annual Performance Report for definition used to determine compliance with ECA Effluent limits.

Table E
REGIONAL MUNICIPALITY OF DURHAM
Uxbridge Brook WPCP
Operational Data 2014
Effluent Objective Analyses and Exceedance

Month	Effluent Objective Analyses and Exceedance														
	$CBOD_5$		Suspended Solids		Total Phosphorus		Total Ammonia Nitrogen			pH				E.coli	
	max. conc. mg/L	# of exceedances	max. conc. mg/L	# of exceedances	max. conc. mg/L	# of exceedances	max. conc. Winter	max. conc. Summer	# of exceedances	min. conc. mg/L	# of exceedances	max. conc. mg/L	# of exceedances	monthly conc cfu/100ml	# of exceedances
January	2.2	0	10.0	4	0.24	6	0.7	--	0	6.5	2	7.2	0	0	0
February	1.8	0	10.3	5	0.17	8	0.6	--	0	5.8	9	7.0	0	0.7	0
March	0.8	0	4.2	0	0.13	1	4.8	--	0	6.5	1	7.3	0	0	0
April	1.0	0	4.4	0	0.09	0	6.8	--	9	6.6	0	7.6	0	0	0
May	2.2	0	9.3	3	0.13	6	--	5.0	8	6.6	0	7.4	0	0	0
June	1.0	0	27.0	2	0.09	0	--	0.1	0	6.4	3	7.3	0	0	0
July	1.4	0	4.6	0	0.08	0	--	0.1	0	6.5	1	7.5	0	0	0
August	1.5	0	2.5	0	0.13	2	--	2.4	0	6.7	0	7.7	0	0	0
September	1.8	0	3.4	0	0.12	3	--	3.7	3	6.6	0	7.5	0	0	0
October	3.7	0	4.3	0	0.13	5	--	21.0	13	6.4	4	7.4	0	0	0
November	1.5	0	3.5	0	0.09	0	--	20.1	4	6.4	3	7.4	0	0	0
December	1.3	0	4.4	0	0.13	4	0.1	--	0	6.6	0	7.2	0	0	0
Total		0		14		35			37		23		0		0
Average	1.7		7.3		0.13		2.6	7.5							
Minimum	0.8		2.5		0.08		0.1	0.1		5.8					
Maximum	3.7		27.0		0.24		6.8	21.0				7.7		1	
ECA Objective	5		5		0.1		5	2		6.5		9.0		200	

Note: Concentration objectives apply to any single result.

Uxbridge SWMMP
Phosphorus Calculations

Project Number: 1606 21777
Updated: Nov 2014

The following is a summary of calculations used to calculate phosphorus loadings:

Average Annual Phosphorus Loading/Land Use Area x Mitigation Measure Reduction (if applicable)= Phosphorus Loading (kg/year/ha) for that Land Use Area Type

Average Annual Phosphorus Loading/Land Use Area x Land Use Area x Mitigation Measure Reduction (if applicable)= Phosphorus Loading (kg/year) for that Land Use Area Type

For landuse categories and loading rates, refer to Table 2-3 and 2-4 of *Estimation of the Phosphorus Loadings to Lake Simcoe* , prepared by The Louis Berger Group, Inc. (2010) and refer to the Township of Uxbridge Official Plan Schedule A (April 2008)

*The residential and industrial area categories and rates(Liang 1999) are not Canwet landuse categories. They are from monitoring data from Liang, 1999 that are indicated in the Lake Simcoe Basin Stormwater Management and Retrofit Opportunities. Prepared by the Lake Simcoe Region Conservation Authority (2007)

For a multiple stages of phosphorus removal use equation below :

A+B - A X B/100 = Total % removal,
Where A and B are different removal %'s

Refer to Equation 4-1 from the *New Jersey Stormwater Best Management* Practices Manual Prepared by the State of New Jersey (2004)

Average LID Removal:

Refer to Table 4.4.3 "Low Impact Development Stormwater Management Planning and Design Guide" (2010) by the TRCA

The average LID phosphorus removal is based on the average total phosphorus removal of infiltration trenches, grass swales/perforated pipe systems:
79.5 % Total Phosphporus Removal

Assumed level 1 pond phosphorus removal is 63% based on MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)
Assumed level 3 pond phosphorus removal is 63% based on MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)

Total Phosphorus loadings for each condition = Sum of Phosphorus Loading (kg/year) for the Land Use Areas within the Uxbridge Urban Area

Uxbridge SWMMP
Phosphorus Calculations

Project Number: 1606 21777
Updated: November 2014

CANWET Land Use Category	Existing and Future Condition Land Use	Existing and Future Condition Average Annual Phosphorus Loading Rate (kg/ha)
		Pefferlaw-Uxbridge Brook
Hay-Pasture	General Agricultural Area, Permanent Agricultural Area	0.068
Cropland		
Quarry		
Turf-Sod		
Tile Drainage		
Forest	Forest Area, (Future Residential Area - Currently Forest Area)	0.0300
Wetland	Environmental Constraint Area	0.120
Stream Banks		
Groundwater		
Transition	Recreational Mixed Use Area, Cemetery Area, Park and Open Space Area, Private Open Space Area Golf Course, Major Open Space Area, Oak Ridges Moraine	0.098
Septics		
Polder		
*Residential (Liang 1999)	Residential Area, Residential Area Higher Density, Mixed Use Area, Employment Area, , Proposed School Site	1.320
*Industrial/commerial (Liang 1999)	Corridor commerical Area, Employment Area, Institutional Area, Brock St. Mixed Used Area	1.820

For land use categories and loading rates:
Refer to Table 2-3 and Table 2-4 *of Estimation of the Phosphorus Loadings to Lake Simcoe,* prepared by The Louis Berger Group, Inc. (2010)
and refer to the Township of Uxbridge Official Plan Schedule A (April 2008)
*The residential and industrial (Liang 1999) are not Canwet landuse categories. They are from monitoring data from Liang, 1999 that are indicated in the
Lake Simcoe Basin Stormwater Management and Retrofit Opportunities. Prepared by the Lake Simcoe Region Conservation Authority (2007)

Uxbridge SWMMP
Phosphorus Loadings with SWMF

Project Number: 1606 21777
Updated: November 2014

Assumed wet pond phosphorus removal is 63% based on *MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)*

The following calculations are assuming existing SWM ponds treatment is present and that all high density areas can be affected by an LID approach that has an approximate total phosphorus removal of 79.50%

Additionally, two ponds are implemented treating the future residential areas 81.04 ha
Assumed wet pond phosphorus removal is 63% based on *MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)*

A+B - A X B/100 = Total % removal,
Where A and B are different removal %'s
92.42% Removal using LID and SWMF

Existing Conditions	**Phosphorus Loading (kg/ha)**	**Wet Pond Treatment (ha)**	**Uncontrolled (ha)**	**Phosphorus Loading (kg/year) After Treatment**
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	6.03
Environmental Constraint Area	0.12	0.52	77.86	9.37
Forest Area	0.0300	2.42	106.51	3.21
Residential, Schools, Roads, etc.	1.32	228.64	225.63	409.50
Commercial, Employment Area, Institutional	1.82	12.11	47.98	95.48
			Total Phosphorus Loading	523.58

Future Conditions (no swm measures for future development (Area A and B))	**Phosphorus Loading (kg/ha)**	**Wet Pond Treatment (ha)**	**Uncontrolled (ha)**	**Phosphorus Loading (kg/year) After Treatment**
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	6.03
Environmental Constraint Area	0.12	0.52	77.86	9.37
Forest Area	0.0300	2.19	25.70	0.784
Residential, Schools, Roads, etc.	1.32	228.87	306.44	516.29
Commercial, Employment Area, Institutional	1.82	12.11	47.98	95.48
			Total Phosphorus Loading	627.94

Future Conditions (Wet Ponds for future development (Area A and B))	**Phosphorus Loading (kg/ha)**	**Wet Pond Treatment (ha)**	**Uncontrolled (ha)**	**Phosphorus Loading (kg/year) After Treatment**
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	6.03
Environmental Constraint Area	0.12	0.52	77.86	9.37
Forest Area	0.0300	2.19	25.70	0.784
Residential, Schools, Roads, etc.	1.32	309.68	225.63	449.08
Commercial, Employment Area, Institutional	1.82	12.11	47.98	95.48
			Total Phosphorus Loading	560.74

Future Conditions (LID treatment for future residential (Area A and B) and commercial lands)	**Phosphorus Loading (kg/ha)**	**Wet Pond Treatment (ha)**	**Uncontrolled (ha)**	**Phosphorus Loading (kg/year) After Treatment**
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	6.03
Environmental Constraint Area	0.12	0.52	77.86	9.37
Forest Area	0.0300	2.19	25.70	0.784
Residential, Schools, Roads, etc.	1.32	228.87	306.44	194.70
Commercial, Employment Area, Institutional	1.82	12.11	47.98	26.06
			Total Phosphorus Loading	236.94

Future Conditions (Wet Ponds and LID's for future development (Area A and B)and commercial lands)	**Phosphorus Loading (kg/ha)**	**Wet Pond Treatment (ha)**	**Uncontrolled (ha)**	**Phosphorus Loading (kg/year) After Treatment**
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	6.03
Environmental Constraint Area	0.12	0.52	77.86	9.37
Forest Area	0.0300	2.19	25.70	0.784
Residential, Schools, Roads, etc.	1.32	309.68	225.63	180.92
Commercial, Employment Area, Institutional	1.82	12.11	47.98	26.06
			Total Phosphorus Loading	223.15

Future Conditions (Wet Ponds for future development (Area A and B), LID's for future development and commercial lands and retrofit of existing ponds)	**Phosphorus Loading (kg/ha)**	**Wet Pond Treatment (ha)**	**Uncontrolled (ha)**	**Phosphorus Loading (kg/year) After Treatment**
Cemetery Area, Park & Open Space Area, Private Open Space Area Golf Course	0.10	35.93	48.19	4.99
Environmental Constraint Area	0.12	0.52	77.86	9.35
Forest Area	0.0300	2.19	25.70	0.837
Residential, Schools, Roads, etc.	1.32	309.68	225.63	92.04
Commercial, Employment Area, Institutional	1.82	12.11	47.98	19.57
			Total Phosphorus Loading	126.79

Uxbridge SWMMP
Phosphorus Loadings for Future Development Areas A and B

Project Number: 1606 21777
Updated: November 2014

Assumed wet pond phosphorus removal is 63% based on *MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)*

The following calculations are assuming existing SWM ponds treatment is present and that all high density areas can be affected by an LID approach that has an approximate total phosphorus removal of 79.50%

Additionally, two ponds are implemented treating the future residential areas 81.04 ha
Assumed wet pond phosphorus removal is 63% based on *MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)*

A+B - A X B/100 = Total % removal,
Where A and B are different removal %'s
92.42% Removal using LID and SWMF

Existing Conditions	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Forest Area	0.0300		81.04	2.43
			Total Phosphorus Loading	2.43

Future Conditions (no swm measures for future development (Area A and B))	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Residential, Schools, Roads, etc.	1.32		81.04	106.97
			Total Phosphorus Loading	106.97

Future Conditions (Wet Ponds for future development (Area A and B))	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Residential, Schools, Roads, etc.	1.32	81.04		39.58
			Total Phosphorus Loading	39.58

Future Conditions (LID treatment for future residential (Area A and B) and commercial lands)	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Residential, Schools, Roads, etc.	1.32		81.04	21.93
			Total Phosphorus Loading	21.93

Future Conditions (Wet Ponds and LID's for future development (Area A and B)and commercial lands)	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Residential, Schools, Roads, etc.	1.32	81.04		8.11
			Total Phosphorus Loading	8.11

Future Conditions (Wet Ponds for future development (Area A and B), LID's for future development and commercial lands and retrofit of existing ponds)	Phosphorus Loading (kg/ha)	Wet Pond Treatment (ha)	Uncontrolled (ha)	Phosphorus Loading (kg/year) After Treatment
Residential, Schools, Roads, etc.	1.32	81.04		8.11
			Total Phosphorus Loading	8.11

Uxbridge SWMMP
MOE Phosphorus Tool Phosphorus Loadings Calculation

Assumed wet pond phospohrus removal is 63% based on MOE's Lake Simcoe Phosphorus Loading Development Tool (2012)
The following calculations are assuming existing SWM ponds treatment are present and that all high density areas can be affected by an LID approach that has an approximate total phosphorus removal of 79.5%
Additoinally, two ponds are implemented treating future residential areas 81.04 ha.

A+B-AXB/100= Total % removal,
Wehere A and B are different removal %
92.4% removal using LID and SWMF

Pre- Development Phosphorus Load Based Upon MOE Phosphorus Tool Land Use Phosphorus Loadings Coefficients				
Land Use	Area	Phosphorus Loading Coefficient (kg/ha)	BMP Removal Efficiency	BMP P Load (kg/yr)
Forest	184	0.03	0%	5.52
Forest	2.94	0.03	63%	0.03
High Intensity - Commercial/Industrial	48	1.82	0%	87.36
High Intensity - Commercial/Industrial	12.1	1.82	63%	8.15
High Intensity - Residential	226	1.32	0%	298.32
High Intensity - Residential	229	1.32	63%	111.84
Transition	48.2	0.04	0%	1.93
Transition	35.9	0.04	63%	0.53
			Total	513.68

Post-Devleopment Phosphorus Load Based Upon MOE Phosphorus Tool Land Use Phosphorus Loadings Coefficients				
Land Use	Area	Phosphorus Loading Coefficient (kg/ha)	BMP Removal Efficiency	BMP P Load (kg/yr)
Forest	104	0.03	0%	3.12
Forest	2.71	0.03	92.4%	0.01
High Intensity - Commercial/Industrial	48	1.82	79.5%	17.91
High Intensity - Commercial/Industrial	12.1	1.82	92.4%	1.67
High Intensity - Residential	226	1.32	79.5%	61.16
High Intensity - Residential	310	1.32	92.4%	31.10
Transition	48.2	0.04	0%	1.93
Transition	35.9	0.04	92.4%	0.11
			Total	117.00

Phosphorus Net Reduction **-396.68** kg/year

The Phosphorus Net Reduction is similar to the Phosphorus Loading Assessment Results -396.79 **kg/year**
(refer to Section 4.4.7 of the Stormwater Management Master Plan)

Appendix F CLIMATE CHANGE/ FUTURE CONDITIONS HYDROLOGIC MODELING

F.1 CLIMATE CHANGE HYDROLOGIC MODELING

UXBRDIGE SWM-MP CLIMATE CHANGE ASSESSMENT

MTO Analysis of Station and Assessment of % Increase over Existing

Station G6140954 — MTO Analysis Intensity (mm/hr)

Return Perio	hrs	24	18	12	6	3	2	1	0.5
	mins	1440	1080	720	360	180	120	60	30
2	Current	2.1	2.6	3.5	6.3	11	14.4	23.2	39.2
2	2050s	2.4	2.9	3.9	6.9	12.1	15.9	25.5	43.1
2	2080s	2.6	3.2	4.3	7.6	13.3	17.5	28.1	47.5
5	Current	2.7	3.3	4.5	7.9	13.9	18.3	29.3	49.6
5	2050s	3.3	4	5.4	9.6	16.8	22	35.4	59.8
5	2080s	3.7	4.5	6.1	10.8	18.9	24.9	40	67.5
10	Current	3.1	3.8	5.1	9	15.8	20.8	33.4	56.4
10	2050s	3.9	4.7	6.4	11.4	19.9	26.1	42	70.9
10	2080s	4.4	5.4	7.3	12.9	22.7	29.7	47.8	80.7
20	Current	3.5	4.2	5.7	10.1	17.7	23.2	37.3	63
20	2050s	4.5	5.4	7.3	13	22.9	30	48.3	81.5
20	2080s	5.1	6.2	8.4	15	26.2	34.4	55.3	93.4
50	Current	3.9	4.8	6.4	11.4	20.1	26.3	42.3	71.5
50	2050s	5.2	6.3	8.6	15.2	26.7	35.1	56.4	95.3
50	2080s	6	7.3	9.9	17.6	30.8	40.5	65.1	109.9
100	Current	4.3	5.2	7	12.5	21.9	28.7	46.1	77.9
100	2050s	5.8	7	9.5	16.9	29.6	38.9	62.5	105.5
100	2080s	6.7	8.1	11	19.6	34.3	45	72.3	122.2

MTO Analysis % increase from Current

Return Perio		24	18	12	6	3	2	1	0.5
		1440	1080	720	360	180	120	60	30
2	Current								
2	2050s	1.14286	1.11538	1.11429	1.09524	1.1	1.10417	1.09914	1.09949
2	2080s	1.2381	1.23077	1.22857	1.20635	1.20909	1.21528	1.21121	1.21173
5	Current								
5	2050s	1.26923	1.25	1.25581	1.26316	1.26316	1.25714	1.25979	1.25895
5	2080s	1.42308	1.40625	1.4186	1.42105	1.42105	1.42286	1.42349	1.42105
10	Current								
10	2050s	1.25806	1.23684	1.2549	1.26667	1.25949	1.25481	1.25749	1.25709
10	2080s	1.41935	1.42105	1.43137	1.43333	1.43671	1.42788	1.43114	1.43085
20	Current								
20	2050s	1.28571	1.28571	1.2807	1.28713	1.29379	1.2931	1.29491	1.29365
20	2080s	1.45714	1.47619	1.47368	1.48515	1.48023	1.48276	1.48257	1.48254
50	Current								
50	2050s	1.33333	1.3125	1.34375	1.33333	1.32836	1.3346	1.33333	1.33287
50	2080s	1.53846	1.52083	1.54688	1.54386	1.53234	1.53992	1.53901	1.53706
100	Current								
100	2050s	1.34884	1.34615	1.35714	1.352	1.3516	1.3554	1.35575	1.3543
100	2080s	1.55814	1.55769	1.57143	1.568	1.56621	1.56794	1.56833	1.56868

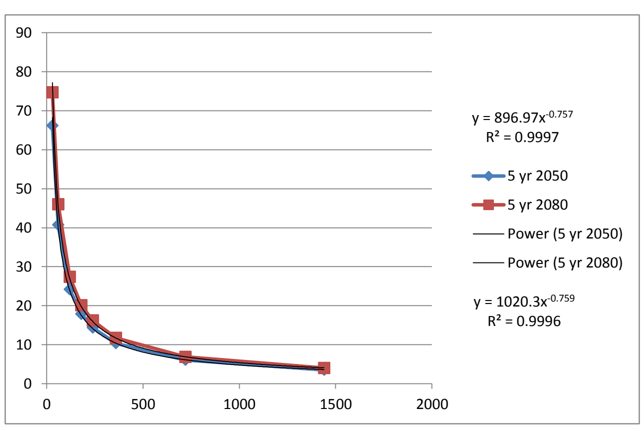
Current Uxbridge IDF Data

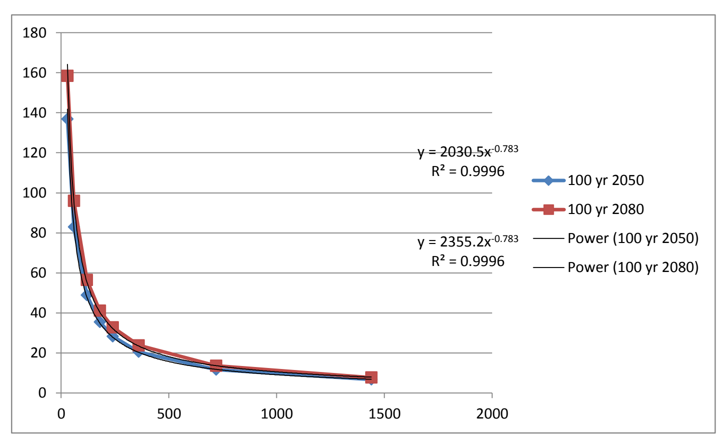
Year\Time (min)	1440	720	360	240	180	120	60	30	15	10	5
2	2.12	3.64	6.25	8.54	10.66	14.50	24.24	39.44	61.23	76.76	105.57
5	2.93	5.04	8.65	11.84	14.78	20.13	33.70	54.88	85.30	107.01	147.29
10	3.45	5.93	10.19	13.95	17.41	23.71	39.70	64.66	100.49	126.06	173.52
25	4.02	6.93	11.90	16.31	20.37	27.78	46.76	76.92	121.60	154.64	218.94
100	4.96	8.67	15.12	20.88	26.22	36.02	61.17	101.00	158.93	200.63	278.63

Increase in Uxbridge Intensities

The current Uxubridge intensity value were increased by same percent the MTO Station analysis

Year\Time (min)	1440	720	360	240	180	120	60	30
5 yr 2050	3.575549071	6.106159336	10.38156672	14.39294606	17.8621	24.1977	40.7126	66.1702
5 yr 2080	4.008948958	6.869429253	11.72732537	16.19206432	20.0948	27.3874	46.0029	74.6904
	1440	720	360	240	180	120	60	30
100 yr 2050	6.691103461	11.67487057	20.52104669	28.23470969	35.438	48.8204	82.9374	136.789
100 yr 2080	7.729378136	13.50949308	23.76121195	32.74558046	41.065	56.4761	95.942	158.442





Q = CiA — Therefore, D2/D1 = √(i2/i1)

I = A/t^C

D α √A

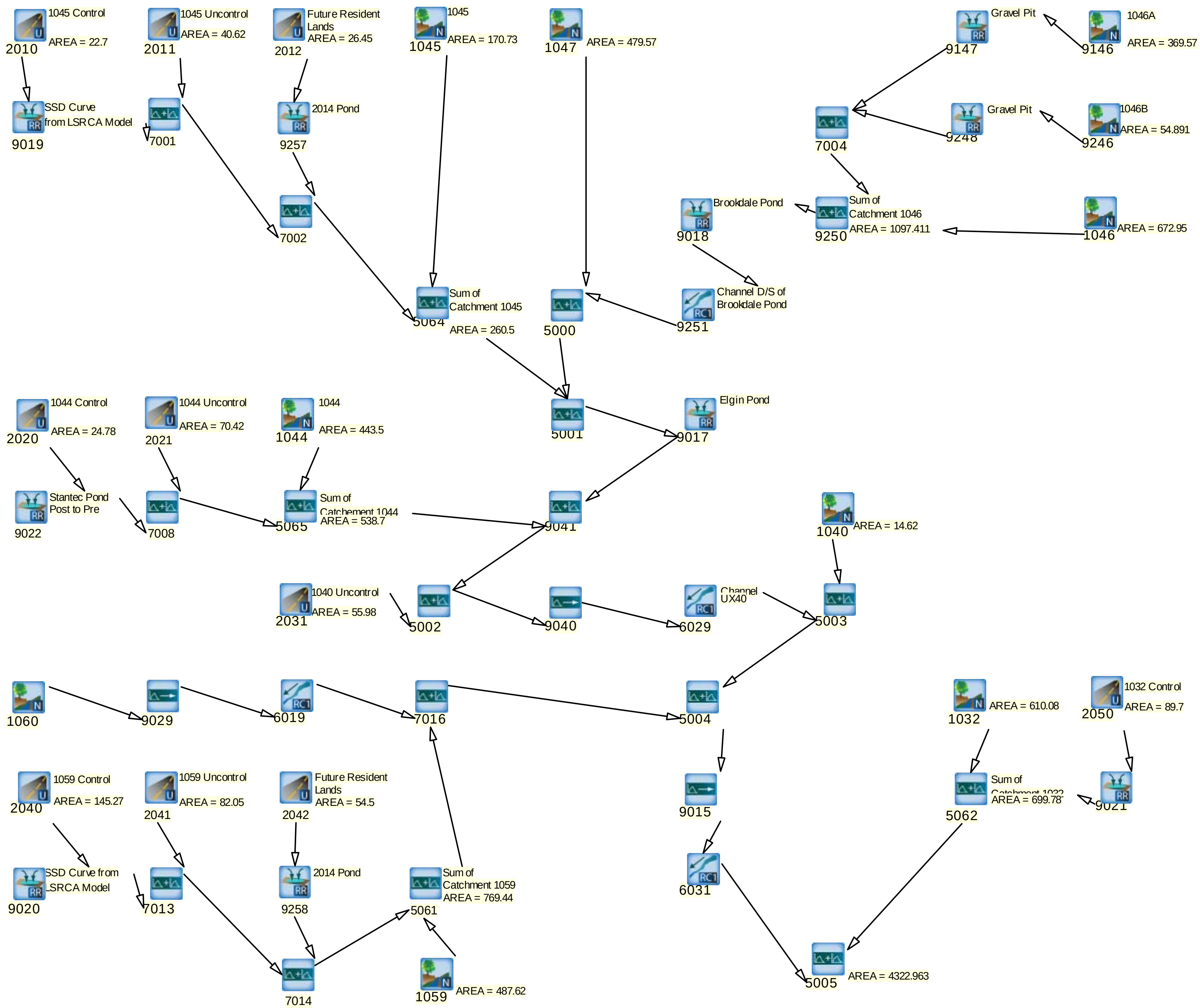
A α Q

5	440.6	0	0.674
10	508.05	0	0.67
25	592.4	0	0.667
50	654.5	0	0.665
100	715.6	0	0.663

Assume tc = 10 minutes, how does diameter change with climate change for 5-year conveyance?

	Old IDF Data	2050	2080
i	93.33	156.96	177.72
D	1.00	1.30	1.38
D	525	681	724
D	1050	1362	1449

Future Conditions VO2 Schematic (with SWM Controls)



```
==================================================================================================
==

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Future With
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Future With


DATE: 12/11/2014                           TIME: 3:31:01 PM

USER:


COMMENTS: ____________________________________________________________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  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************
```

Current 5-Year Storm

```
--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 60.45 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.33 |  3.25    2.42 |  6.25   10.88 |  9.25    1.84
                  .50    1.40 |  3.50    2.42 |  6.50   10.88 |  9.50    1.69
                  .75    1.43 |  3.75    2.42 |  6.75    5.75 |  9.75    1.62
                 1.00    1.47 |  4.00    2.42 |  7.00    3.92 | 10.00    1.64
                 1.25    1.55 |  4.25    3.34 |  7.25    3.63 | 10.25    1.60
                 1.50    1.60 |  4.50    3.92 |  7.50    3.63 | 10.50    1.50
                 1.75    1.62 |  4.75    4.38 |  7.75    3.63 | 10.75    1.38
                 2.00    1.69 |  5.00    5.30 |  8.00    3.63 | 11.00    1.28
                 2.25    1.69 |  5.25    7.25 |  8.25    3.10 | 11.25    1.14
                 2.50    1.69 |  5.50    7.25 |  8.50    2.66 | 11.50    1.04
                 2.75    1.81 |  5.75   29.02 |  8.75    2.32 | 11.75     .92
                 3.00    2.06 |  6.00   79.79 |  9.00    2.06 | 12.00     .82

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   4.618 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=  16.513
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        44.49
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.54 (ii)   21.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       4.26         3.26         6.334 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      59.95        23.47         32.59
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .39           .54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        41.24
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       8.28 (ii)   20.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       3.86         1.44         4.768 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      59.95        19.06         33.37
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .32           .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        42.78
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       6.49 (ii)   18.69 (ii)
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     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.05          .61          2.442 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      50.45        19.05          31.61
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .83          .32            .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        40.05
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.87 (ii)   21.40 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.77         1.73          5.861 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      50.45        18.53          29.70
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .83          .31            .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=    .721 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .318 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.61 (ii)   20.50 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.36          .68          1.792 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.32 (ii)   20.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.18          .59          1.550 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.52 (ii)   21.41 (ii)
```

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     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.04         1.03         2.687 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62         27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .27           .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=    .825 (i)
     TIME TO PEAK    (hrs)=  10.250
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   1.204 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   5.165
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .085

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .398 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   7.283
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .120

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   1.141 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .074
```



```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .176 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  11.606
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   4.194 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  17.056
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .282

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.22 (ii)   20.01 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.69         2.15         4.075 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68         33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45         60.45
     RUNOFF COEFFICIENT   =        .99          .41           .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        47.99
```

```
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.29 (ii)   20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       4.71         2.99          6.636 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.95          35.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      11.02 (ii)   22.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                           *TOTALS*
     PEAK FLOW       (cms)=       6.59         5.40         10.054 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

 CALIB
 NASHYD    (1060)      Area    (ha)= 406.96   Curve Number   (CN)= 60.0
ID= 1 DT=15.0 min      Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   3.879 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  11.988
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .198

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000      .9900
                           .0290      .3700   |   2.7000     1.4200
                           .5000      .6900   |   6.1000     2.1800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     6.334        6.00       32.59
     OUTFLOW: ID= 1 (9021)     89.700     2.428        6.75       32.56
```



```
                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.33
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.3607

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620      .8805
                           .0150      .6000   |    .4710     1.0180
                           .1240      .7875   |    .9610     1.2660

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780     2.442        6.00       31.61
     OUTFLOW: ID= 1 (9022)     24.780      .065       11.00       31.20

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.64
                   TIME SHIFT OF PEAK FLOW         (min)=300.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6853

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .065    11.00    31.20
        + ID2= 2 (2021):    70.42    5.861     6.00    29.70
          ==================================================
          ID = 3 (7008):    95.20    5.867     6.00    30.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

  ADD HYD   (5065)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    5.867     6.00    30.09
        + ID2= 2 (1044):   443.50     .721    10.50     4.32
          ==================================================
          ID = 3 (5065):   538.70    5.876     6.00     8.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990      .7350
                           .0110      .4435   |    .1630      .8595
                           .0550      .6265   |    .3050     1.0800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450     1.792        6.00       27.45
     OUTFLOW: ID= 1 (9257)     26.450      .055       11.25       27.06

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.06
                   TIME SHIFT OF PEAK FLOW         (min)=315.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6262

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800      .5900
                           .0000      .2600   |   1.2200      .7400
                           .5700      .3500   |   1.3500      .9300
                           .9900      .4700   |   2.8300      .9900

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700     1.550        6.00       27.45
```

```
     OUTFLOW: ID= 1 (9019)     22.700       .476        6.50       15.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.71
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3393

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .476     6.50    15.99
        + ID2= 2 (2011):    40.62    2.687     6.00    27.45
          ==================================================
          ID = 3 (7001):    63.32    2.687     6.00    23.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******   |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     1.204        7.50        5.17
     OUTFLOW: ID= 1 (9147)    369.570      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.9089

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******   |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      .398        6.75        7.28
     OUTFLOW: ID= 1 (9248)     54.891      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3998

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--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000   |    .4730     1.6365
                          .0490     1.0690   |    .7910     1.8915
                          .2480     1.4290   |   1.4810     2.3855

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500     4.075        6.00       33.50
     OUTFLOW: ID= 1 (9258)     54.500      .248        9.00       33.39

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.08
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.4289

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--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000   |   1.7200     5.0000
                          .2200     3.0000   |   2.5000     7.0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
```



```
     INFLOW : ID= 2 (2040)    145.270    10.054        6.00       33.50
     OUTFLOW: ID= 1 (9020)    145.270      .752        9.00       33.47

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.48
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.7118

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     3.88      7.25     11.99
    SHIFT ID= 1 (9029):  406.96     3.88      9.75     11.99

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08    4.618     9.00    16.51
        + ID2= 2 (9021):    89.70    2.428     6.75    32.56
          ==================================================
          ID = 3 (5062):   699.78    5.556     8.50    18.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45     .055    11.25    27.06
        + ID2= 2 (7001):    63.32    2.687     6.00    23.34
          ==================================================
          ID = 3 (7002):    89.77    2.693     6.00    24.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57     .000      .00      .00
        + ID2= 2 (9248):    54.89     .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46     .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05    6.636     6.00    35.45
        + ID2= 2 (9020):   145.27     .752     9.00    33.47
          ==================================================
          ID = 3 (7013):   227.32    6.736     6.00    34.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
```

```
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)       (min)
        .20   274.70    .665E+04        .6           .56      172.84
        .39   274.89    .247E+05       4.2          1.00       97.27
        .59   275.09    .478E+05      11.1          1.35       71.58
        .78   275.28    .756E+05      21.4          1.64       58.99
        .98   275.48    .108E+06      35.2          1.89       51.17
       1.17   275.67    .145E+06      52.9          2.12       45.70
       1.37   275.87    .187E+06      74.8          2.33       41.60
       1.56   276.06    .233E+06     101.2          2.53       38.37
       1.76   276.26    .284E+06     132.2          2.71       35.80
       1.95   276.45    .342E+06     160.8          2.73       35.50
       2.17   276.67    .421E+06     204.7          2.83       34.30
       2.38   276.88    .516E+06     258.7          2.91       33.25
       2.60   277.10    .627E+06     323.9          3.00       32.28
       2.82   277.32    .754E+06     402.4          3.11       31.21
       3.03   277.53    .894E+06     517.5          3.37       28.78
       3.25   277.75    .105E+07     645.6          3.58       27.06
       3.47   277.97    .122E+07     787.1          3.76       25.78
       3.68   278.18    .140E+07     942.2          3.91       24.79
       3.90   278.40    .160E+07    1110.1          4.03       24.06

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     3.88    9.75  11.99       .37       .93
     OUTFLOW: ID= 1 (6019)  406.96     2.12   11.00  11.99       .28       .68

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--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .318     9.50      4.32
        + ID2= 2 (7002):    89.77   2.693     6.00     24.44
          ===============================================
          ID = 3 (5064):   260.50   2.700     6.00     11.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00       .00
        + ID2= 2 (1046):   672.95   1.141    10.50      4.48
          ===============================================
          ID = 3 (9250):  1097.41   1.141    10.50      2.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50    .248     9.00     33.39
        + ID2= 2 (7013):   227.32   6.736     6.00     34.19
          ===============================================
          ID = 3 (7014):   281.82   6.761     6.00     34.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |        OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------         (cms)     (ha.m.)   |   (cms)     (ha.m.)
```



```
                              .0000      .0000   |   4.8100      1.1900
                              .4200      .6400   |  14.3300      1.2700
                             1.5900      .9400   |  53.8000      1.3300
                             3.2000     1.1100   |    .0000       .0000

                                    AREA      QPEAK       TPEAK       R.V.
                                    (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      1.141       10.50        2.75
     OUTFLOW: ID= 1 (9018)   1097.411      1.065       11.75        2.75

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 93.36
                 TIME SHIFT OF PEAK FLOW         (min)= 75.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=   .8056

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--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   4.194     8.50     17.06
        + ID2= 2 (7014):   281.82   6.761     6.00     34.03
          ===============================================
          ID = 3 (5061):   769.44   7.098     6.00     23.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)       (min)
        .28   270.30    .950E+04       3.7           .81       43.21
        .57   270.59    .257E+05      13.9          1.14       30.76
        .85   270.87    .484E+05      32.0          1.39       25.24
       1.13   271.15    .776E+05      59.6          1.61       21.71
       1.42   271.44    .112E+06     100.0          1.87       18.71
       1.70   271.72    .151E+06     157.2          2.18       16.04
       1.99   272.01    .195E+06     225.9          2.44       14.37
       2.27   272.29    .242E+06     305.9          2.65       13.21
       2.55   272.57    .294E+06     398.1          2.84       12.31
       2.84   272.86    .350E+06     501.8          3.01       11.61
       3.12   273.14    .409E+06     617.0          3.17       11.05
       3.40   273.42    .472E+06     744.3          3.31       10.58
       3.69   273.71    .539E+06     882.9          3.44       10.18
       3.97   273.99    .611E+06    1033.6          3.55        9.85
       4.26   274.28    .687E+06    1196.8          3.66        9.57
       4.54   274.56    .768E+06    1370.2          3.75        9.35
       4.82   274.84    .856E+06    1556.4          3.82        9.16
       5.11   275.13    .950E+06    1757.0          3.89        9.01
       5.39   275.41    .105E+07    1967.6          3.93        8.91

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     1.07   11.75   2.75       .08       .81
     OUTFLOW: ID= 1 (9251) 1097.41     1.02   12.75   2.75       .08       .81

--------------------------------------------------------------------------------

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```
 ADD HYD   (7016)
   1 +  2 =  3            AREA    QPEAK    TPEAK     R.V.
                          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44   7.098     6.00    23.27
        + ID2= 2 (6019):   406.96   2.125    11.00    11.99
          ===============================================
          ID = 3 (7016):  1176.40   7.098     6.00    19.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57    .825    10.25     4.48
        + ID2= 2 (9251):  1097.41   1.018    12.75     2.75
          ===============================================
          ID = 3 (5000):  1576.98   1.725    12.00     3.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   2.700     6.00    11.26
        + ID2= 2 (5000):  1576.98   1.725    12.00     3.27
          ===============================================
          ID = 3 (5001):  1837.48   2.711     6.00     4.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min           OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000   |   2.8300     3.4900
                          .2800      .2500   |   3.8200     3.9500
                          .7100      .6300   |   4.6700     4.2000
                         1.1300     1.1400   |   7.3600     4.6900
                         1.5600     1.7300   |   8.7800     4.8500
                         1.8400     2.2600   |  35.4000     6.6100
                         2.2700     2.9600   |  *******     8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      2.711        6.00        4.41
     OUTFLOW: ID= 1 (9017)   1837.481      1.643       13.75        4.41

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 60.62
                  TIME SHIFT OF PEAK FLOW         (min)=465.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.8892

-------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3            AREA    QPEAK    TPEAK     R.V.
                          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   5.876     6.00     8.88
        + ID2= 2 (9017):  1837.48   1.643    13.75     4.41
          ===============================================
          ID = 3 (9041):  2376.18   6.184     6.00     5.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   4.768     6.00    33.37
        + ID2= 2 (9041):  2376.18   6.184     6.00     5.42
          ===============================================
          ID = 3 (5002):  2432.16  10.952     6.00     6.06
```



```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    10.95      6.00      6.06
    SHIFT ID= 1 (9040): 2432.16    10.95      7.00      6.06

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00         274.29         .0800
                  30.80         273.73         .0800
                  51.30         270.17         .0800
                  61.60         266.84         .0800
                  66.80         266.02         .0800
                 102.70         265.42         .0350      Main Channel
                 123.20         261.00         .0350      Main Channel
                 128.40         261.17         .0350      Main Channel
                 154.00         264.62         .0350      Main Channel
                 174.60         266.82         .0800
                 205.40         268.07         .0800
                 236.20         268.74         .0800
                 282.40         271.31         .0800
                 302.90         272.11         .0800
                 348.90         274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63    .702E+04       5.2          1.14      22.47
       1.26   262.26    .220E+05      24.8          1.74      14.74
       1.89   262.89    .443E+05      64.0          2.22      11.54
       2.53   263.53    .741E+05     127.4          2.65       9.69
       3.16   264.16    .111E+06     219.6          3.04       8.44
       3.79   264.79    .156E+06     343.2          3.39       7.57
       4.42   265.42    .209E+06     501.2          3.70       6.94
       5.16   266.16    .304E+06     766.4          3.88       6.61
       5.90   266.90    .428E+06    1123.8          4.05       6.34
       6.64   267.64    .570E+06    1628.6          4.40       5.84
       7.38   268.38    .738E+06    2225.4          4.65       5.53
       8.12   269.12    .941E+06    2928.9          4.80       5.35
       8.85   269.85    .116E+07    3743.0          4.95       5.18
       9.59   270.59    .141E+07    4656.3          5.10       5.03
      10.33   271.33    .167E+07    5671.9          5.24       4.90
      11.07   272.07    .195E+07    6784.6          5.36       4.80
      11.81   272.81    .226E+07    8029.1          5.47       4.69
      12.55   273.55    .259E+07    9393.0          5.59       4.60
      13.29   274.29    .295E+07   10648.3          5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    10.95    7.00   6.06       .82      1.27
     OUTFLOW: ID= 1 (6029) 2432.16     6.73    7.25   6.06       .68      1.17


-------------------------------------------------------------------------------

 ADD HYD   (5003)
   1 +  2 =  3            AREA    QPEAK    TPEAK     R.V.
                          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   6.729     7.25     6.06
        + ID2= 2 (1040):    14.62    .176     6.75    11.61
          ===============================================
          ID = 3 (5003):  2446.78   6.877     7.25     6.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 ADD HYD   (5004)
   1 +  2 =  3            AREA    QPEAK    TPEAK     R.V.
                          (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (5003):  2446.78   6.877     7.25     6.10
        + ID2= 2 (7016):  1176.40   7.098     6.00    19.37
          ==================================================
          ID = 3 (5004):  3623.18  11.731     7.25    10.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    11.73      7.25     10.41
    SHIFT ID= 1 (9015): 3623.18    11.73      9.25     10.41

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
             <------ DATA FOR SECTION (   1.0) ------>
             Distance      Elevation       Manning
                  .00        260.30         .0800
                34.10        260.43         .0800
                62.40        259.79         .0800
                79.50        255.72         .0800
               113.50        254.00         .0800
               153.30        253.33         .0350      Main Channel
               187.30        253.06         .0350      Main Channel
               198.70        251.88         .0350      Main Channel
               204.40        252.61         .0350      Main Channel
               249.80        254.00         .0800
               334.90        255.77         .0800
               351.90        256.37         .0800
               414.40        260.24         .0800
               465.50        260.75         .0800
               514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
        (m)      (m)     (cu.m.)     (cms)         (m/s)       (min)
        .36   252.24    .596E+04       .4            .39      223.90
        .73   252.61    .238E+05      2.8            .61      141.05
       1.09   252.97    .619E+05      8.2            .69      126.14
       1.45   253.33    .151E+06     18.8            .65      134.06
       1.91   253.79    .383E+06     68.4            .93       93.14
       2.38   254.26    .713E+06    157.3           1.15       75.58
       2.84   254.72    .112E+07    287.3           1.33       65.13
       3.31   255.19    .161E+07    454.2           1.47       59.01
       3.77   255.65    .217E+07    659.0           1.58       54.87
       4.24   256.12    .279E+07    908.7           1.69       51.25
       4.70   256.58    .346E+07   1199.1           1.80       48.03
       5.17   257.05    .414E+07   1527.9           1.92       45.17
       5.63   257.51    .485E+07   1892.4           2.03       42.71
       6.10   257.98    .558E+07   2291.8           2.13       40.59
       6.56   258.44    .634E+07   2725.7           2.23       38.74
       7.03   258.91    .711E+07   3193.6           2.33       37.12
       7.49   259.37    .791E+07   3695.3           2.43       35.69
       7.96   259.84    .874E+07   4221.9           2.51       34.48
       8.42   260.30    .961E+07   4697.6           2.54       34.09

                                     <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH   MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)       (m/s)
     INFLOW : ID= 2 (9015) 3623.18    11.73    9.25  10.41      1.21        .67
     OUTFLOW: ID= 1 (6031) 3623.18     8.02   13.25  10.41      1.07        .68

-------------------------------------------------------------------------------

  ADD HYD   (5005)
    1 +  2 =  3              AREA     QPEAK     TPEAK      R.V.
                             (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (5062):   699.78   5.556      8.50    18.57
        + ID2= 2 (6031):  3623.18   8.018     13.25    10.41
          ==================================================
          ID = 3 (5005):  4322.96  11.089     10.50    11.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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Current 100-Year Storm

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  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal=104.07 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    2.29 |  3.25    4.16 |  6.25   18.73 |  9.25    3.16
                  .50    2.41 |  3.50    4.16 |  6.50   18.73 |  9.50    2.91
                  .75    2.46 |  3.75    4.16 |  6.75    9.91 |  9.75    2.79
                 1.00    2.54 |  4.00    4.16 |  7.00    6.74 | 10.00    2.83
                 1.25    2.66 |  4.25    5.74 |  7.25    6.24 | 10.25    2.75
                 1.50    2.75 |  4.50    6.74 |  7.50    6.24 | 10.50    2.58
                 1.75    2.79 |  4.75    7.53 |  7.75    6.24 | 10.75    2.37
                 2.00    2.91 |  5.00    9.12 |  8.00    6.24 | 11.00    2.21
                 2.25    2.91 |  5.25   12.49 |  8.25    5.33 | 11.25    1.96
                 2.50    2.91 |  5.50   12.49 |  8.50    4.58 | 11.50    1.79
                 2.75    3.12 |  5.75   49.95 |  8.75    4.00 | 11.75    1.58
                 3.00    3.54 |  6.00  137.37 |  9.00    3.54 | 12.00    1.42

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=  12.719 (i)
     TIME TO PEAK   (hrs)=   8.750
     RUNOFF VOLUME   (mm)=  44.321
     TOTAL RAINFALL  (mm)= 104.070
     RUNOFF COEFFICIENT   =    .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.00
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.68 (ii)   16.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       7.74         8.71         13.552 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME   (mm)=     103.57        55.08          67.20
     TOTAL RAINFALL  (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =      1.00          .53            .65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
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```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       102.01
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       6.66 (ii)   15.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       6.95         4.03          9.610 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        46.64          66.57
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .45            .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.80
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.22 (ii)   13.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       3.64         2.12          5.761 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      94.07        46.60          65.59
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .45            .63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        99.64
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.14 (ii)   15.84 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       8.63         4.89         11.845 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      94.07        45.60          62.56
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
```



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     RUNOFF COEFFICIENT   =        .90          .44            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   3.773 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=   1.719 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.32 (ii)   14.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                            *TOTALS*
     PEAK FLOW       (cms)=       2.42         2.43          4.852 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
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```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.08 (ii)   14.64 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                            *TOTALS*
     PEAK FLOW       (cms)=       2.09         2.10          4.191 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.05 (ii)   15.61 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       3.66         2.99          5.609 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   4.316 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20
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     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   6.047 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  21.790
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .209

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   2.047 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  28.911
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .278

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   5.946 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .525 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  33.262
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .320

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=  11.484 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  45.460
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .437

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB             |
| STANDHYD  (2042) |   Area    (ha)=  54.50
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```
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80       32.70
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     602.80       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      108.14
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       6.61 (ii)   15.03 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       4.84        5.60         8.616 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57       56.93         68.59
     TOTAL RAINFALL   (mm)=     104.07      104.07        104.07
     RUNOFF COEFFICIENT   =       1.00         .55           .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92       45.13
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     739.60       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      111.02
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       7.47 (ii)   15.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       8.54        7.81        13.792 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57       57.41         71.26
     TOTAL RAINFALL   (mm)=     104.07      104.07        104.07
     RUNOFF COEFFICIENT   =       1.00         .55           .68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11       87.16
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     984.10       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      108.14
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       8.87 (ii)   17.29 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=      12.10       14.21        21.603 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
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     RUNOFF VOLUME    (mm)=     103.57       56.93         68.59
     TOTAL RAINFALL   (mm)=     104.07      104.07        104.07
     RUNOFF COEFFICIENT   =       1.00         .55           .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
 CALIB
 NASHYD    (1060)    Area    (ha)= 406.96   Curve Number   (CN)= 60.0
ID= 1 DT=15.0 min    Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                     U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=  11.495 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  34.179
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .328

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000      .9900
                           .0290      .3700   |   2.7000     1.4200
                           .5000      .6900   |   6.1000     2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     13.552        6.00       67.20
     OUTFLOW: ID= 1 (9021)     89.700      6.901        6.50       67.16

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 50.92
                   TIME SHIFT OF PEAK FLOW        (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.3882

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-------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620      .8805
                           .0150      .6000   |    .4710     1.0180
                           .1240      .7875   |    .9610     1.2660

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      5.761        6.00       65.59
     OUTFLOW: ID= 1 (9022)     24.780       .587        6.75       65.18

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.19
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0811

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| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):     24.78     .587     6.75    65.18
        + ID2= 2 (2021):     70.42   11.845     6.00    62.56
          ==================================================
          ID = 3 (7008):     95.20   11.879     6.00    63.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20  11.879     6.00    63.24
        + ID2= 2 (1044):   443.50   3.773     9.75    21.26
          ==================================================
          ID = 3 (5065):   538.70  11.982     6.00    28.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .0990       .7350
                          .0110      .4435    |    .1630       .8595
                          .0550      .6265    |    .3050      1.0800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450     4.852        6.00       57.25
     OUTFLOW: ID= 1 (9257)     26.450      .305        8.25       56.86

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.28
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0799

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-------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.0800       .5900
                          .0000      .2600    |   1.2200       .7400
                          .5700      .3500    |   1.3500       .9300
                          .9900      .4700    |   2.8300       .9900

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700     4.191        6.00       57.25
     OUTFLOW: ID= 1 (9019)     22.700     1.116        6.50       45.79

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.63
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6335

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-------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70   1.116     6.50    45.79
        + ID2= 2 (2011):    40.62   5.609     6.00    57.25
          ==================================================
          ID = 3 (7001):    63.32   6.549     6.00    53.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******    |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     6.047        7.25       21.79
     OUTFLOW: ID= 1 (9147)    369.570      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  8.0530

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-------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
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```
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******    |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891     2.047        6.50       28.91
     OUTFLOW: ID= 1 (9248)     54.891      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.5870

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-------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .4730      1.6365
                          .0490     1.0690    |    .7910      1.8915
                          .2480     1.4290    |   1.4810      2.3855

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500     8.616        6.00       68.59
     OUTFLOW: ID= 1 (9258)     54.500     1.479        7.00       68.49

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.17
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.3855

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-------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.7200      5.0000
                          .2200     3.0000    |   2.5000      7.0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270    21.603        6.00       68.59
     OUTFLOW: ID= 1 (9020)    145.270     2.400        7.50       68.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.11
                   TIME SHIFT OF PEAK FLOW         (min)= 90.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  6.7462

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-------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
-------------------       (ha)     (cms)     (hrs)      (mm)
           ID= 2 (1060):  406.96     11.49      7.00     34.18
     SHIFT ID= 1 (9029):  406.96     11.49      9.50     34.18

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| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08  12.719     8.75    44.32
        + ID2= 2 (9021):    89.70   6.901     6.50    67.16
          ==================================================
          ID = 3 (5062):   699.78  14.432     8.50    47.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45    .305     8.25    56.86
        + ID2= 2 (7001):    63.32   6.549     6.00    53.14
          ==================================================
          ID = 3 (7002):    89.77   6.591     6.00    54.23
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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  13.792     6.00    71.26
        + ID2= 2 (9020):   145.27   2.400     7.50    68.57
          ==================================================
          ID = 3 (7013):   227.32  14.003     6.00    69.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       281.05          .0800
                  34.48       278.78          .0800
                  62.07       280.75          .0800
                  75.86       280.87          .0800
                 110.34       277.13          .0800
                 124.14       276.45     .0800 / .0350  Main Channel
                 137.93       274.50          .0350     Main Channel
                 151.72       274.76          .0350     Main Channel
                 172.41       276.25          .0350     Main Channel
                 213.79       277.31          .0800
                 255.17       278.25          .0800
                 275.86       278.49          .0800
                 289.66       279.07          .0800
                 303.45       278.41          .0800
                 312.47       278.40          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06

                                      <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)   406.96    11.49    9.50  34.18       .59      1.36
     OUTFLOW: ID= 1 (6019)   406.96     8.03   10.50  34.18       .50      1.17


-------------------------------------------------------------------------------
```



```
--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73   1.719     8.75    21.26
        + ID2= 2 (7002):    89.77   6.591     6.00    54.23
          ==================================================
          ID = 3 (5064):   260.50   6.668     6.00    32.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   5.946     9.50    21.89
          ==================================================
          ID = 3 (9250):  1097.41   5.946     9.50    13.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50   1.479     7.00    68.49
        + ID2= 2 (7013):   227.32  14.003     6.00    69.54
          ==================================================
          ID = 3 (7014):   281.82  14.091     6.00    69.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |        OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                              .0000      .0000   |   4.8100     1.1900
                              .4200      .6400   |  14.3300     1.2700
                             1.5900      .9400   |  53.8000     1.3300
                             3.2000     1.1100   |    .0000      .0000

                                      AREA      QPEAK       TPEAK       R.V.
                                      (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      5.946        9.50       13.43
     OUTFLOW: ID= 1 (9018)   1097.411      5.975        9.50       13.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.48
                   TIME SHIFT OF PEAK FLOW         (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.2011

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                     CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62  11.484     8.25    45.46
        + ID2= 2 (7014):   281.82  14.091     6.00    69.34
          ==================================================
          ID = 3 (5061):   769.44  16.196     8.25    54.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33          .0800
                  46.71       277.77          .0800
                  57.10       277.40          .0800
                  62.29       276.96          .0800
```

```
                67.48        275.94         .0800
                77.86        273.27         .0800
                83.05        272.29         .0800
                93.43        270.99         .0800
               109.00        270.02         .0350      Main Channel
               119.38        270.02         .0350      Main Channel
               150.53        271.36     .0350 / .0800  Main Channel
               186.86        273.45         .0800
               207.62        274.37         .0800
               233.57        275.12         .0800
               247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7           .81      43.21
        .57   270.59    .257E+05      13.9          1.14      30.76
        .85   270.87    .484E+05      32.0          1.39      25.24
       1.13   271.15    .776E+05      59.6          1.61      21.71
       1.42   271.44    .112E+06     100.0          1.87      18.71
       1.70   271.72    .151E+06     157.2          2.18      16.04
       1.99   272.01    .195E+06     225.9          2.44      14.37
       2.27   272.29    .242E+06     305.9          2.65      13.21
       2.55   272.57    .294E+06     398.1          2.84      12.31
       2.84   272.86    .350E+06     501.8          3.01      11.61
       3.12   273.14    .409E+06     617.0          3.17      11.05
       3.40   273.42    .472E+06     744.3          3.31      10.58
       3.69   273.71    .539E+06     882.9          3.44      10.18
       3.97   273.99    .611E+06    1033.6          3.55       9.85
       4.26   274.28    .687E+06    1196.8          3.66       9.57
       4.54   274.56    .768E+06    1370.2          3.75       9.35
       4.82   274.84    .856E+06    1556.4          3.82       9.16
       5.11   275.13    .950E+06    1757.0          3.89       9.01
       5.39   275.41    .105E+07    1967.6          3.93       8.91

                               <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     5.98    9.50  13.43       .35       .87
     OUTFLOW: ID= 1 (9251) 1097.41     5.71   10.50  13.43       .34       .86

-------------------------------------------------------------------------------

 ADD HYD   (7016)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (5061):   769.44  16.196     8.25    54.21
      + ID2= 2 (6019):   406.96   8.029    10.50    34.18
        ==================================================
        ID = 3 (7016):  1176.40  19.820    10.00    47.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (1047):   479.57   4.316     9.50    21.89
      + ID2= 2 (9251):  1097.41   5.713    10.50    13.43
        ==================================================
        ID = 3 (5000):  1576.98   9.884    10.00    16.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (5064):   260.50   6.668     6.00    32.63
      + ID2= 2 (5000):  1576.98   9.884    10.00    16.00
        ==================================================
        ID = 3 (5001):  1837.48  12.073    10.00    18.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```


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```
 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min          OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         .0000      .0000   |   2.8300     3.4900
                         .2800      .2500   |   3.8200     3.9500
                         .7100      .6300   |   4.6700     4.2000
                        1.1300     1.1400   |   7.3600     4.6900
                        1.5600     1.7300   |   8.7800     4.8500
                        1.8400     2.2600   |  35.4000     6.6100
                        2.2700     2.9600   |  *******     8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     12.073       10.00      18.36
     OUTFLOW: ID= 1 (9017)   1837.481     12.052       10.00      18.36

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.82
                   TIME SHIFT OF PEAK FLOW         (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  5.0673

-------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (5065):   538.70  11.982     6.00    28.68
      + ID2= 2 (9017):  1837.48  12.052    10.00    18.36
        ==================================================
        ID = 3 (9041):  2376.18  16.532    10.00    20.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (2031):    55.98   9.610     6.00    66.57
      + ID2= 2 (9041):  2376.18  16.532    10.00    20.70
        ==================================================
        ID = 3 (5002):  2432.16  22.282     6.00    21.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    22.28      6.00     21.75
    SHIFT ID= 1 (9040): 2432.16    22.28      7.00     21.75

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        274.29         .0800
                  30.80        273.73         .0800
                  51.30        270.17         .0800
                  61.60        266.84         .0800
                  66.80        266.02         .0800
                 102.70        265.42         .0350      Main Channel
                 123.20        261.00         .0350      Main Channel
                 128.40        261.17         .0350      Main Channel
                 154.00        264.62         .0350      Main Channel
                 174.60        266.82         .0800
                 205.40        268.07         .0800
                 236.20        268.74         .0800
                 282.40        271.31         .0800
                 302.90        272.11         .0800
                 348.90        274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63    .702E+04       5.2          1.14      22.47
```

```
      1.26   262.26    .220E+05      24.8         1.74      14.74
      1.89   262.89    .443E+05      64.0         2.22      11.54
      2.53   263.53    .741E+05     127.4         2.65       9.69
      3.16   264.16    .111E+06     219.6         3.04       8.44
      3.79   264.79    .156E+06     343.2         3.39       7.57
      4.42   265.42    .209E+06     501.2         3.70       6.94
      5.16   266.16    .304E+06     766.4         3.88       6.61
      5.90   266.90    .428E+06    1123.8         4.05       6.34
      6.64   267.64    .570E+06    1628.6         4.40       5.84
      7.38   268.38    .738E+06    2225.4         4.65       5.53
      8.12   269.12    .941E+06    2928.9         4.80       5.35
      8.85   269.85    .116E+07    3743.0         4.95       5.18
      9.59   270.59    .141E+07    4656.3         5.10       5.03
     10.33   271.33    .167E+07    5671.9         5.24       4.90
     11.07   272.07    .195E+07    6784.6         5.36       4.80
     11.81   272.81    .226E+07    8029.1         5.47       4.69
     12.55   273.55    .259E+07    9393.0         5.59       4.60
     13.29   274.29    .295E+07   10648.3         5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    22.28    7.00  21.75      1.18      1.63
     OUTFLOW: ID= 1 (6029) 2432.16    16.84   11.25  21.75      1.00      1.44

--------------------------------------------------------------------------------

 ADD HYD   (5003)
   1 +  2 =  3                 AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  16.837    11.25     21.75
        + ID2= 2 (1040):    14.62    .525     6.75     33.26
          ===============================================
          ID = 3 (5003):  2446.78  16.899    11.25     21.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

 ADD HYD   (5004)
   1 +  2 =  3                 AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  16.899    11.25     21.82
        + ID2= 2 (7016):  1176.40  19.820    10.00     47.28
          ===============================================
          ID = 3 (5004):  3623.18  35.373    10.50     30.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    35.37     10.50     30.09
    SHIFT ID= 1 (9015): 3623.18    35.37     12.50     30.09

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00         260.30         .0800
                  34.10         260.43         .0800
                  62.40         259.79         .0800
                  79.50         255.72         .0800
                 113.50         254.00         .0800
                 153.30         253.33         .0350     Main Channel
                 187.30         253.06         .0350     Main Channel
                 198.70         251.88         .0350     Main Channel
                 204.40         252.61         .0350     Main Channel
                 249.80         254.00         .0800
                 334.90         255.77         .0800
                 351.90         256.37         .0800
                 414.40         260.24         .0800
                 465.50         260.75         .0800
                 514.40         261.48         .0800
```



```
      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
        (m)       (m)      (cu.m.)     (cms)        (m/s)       (min)
        .36    252.24    .596E+04       .4          .39       223.90
        .73    252.61    .238E+05      2.8          .61       141.05
       1.09    252.97    .619E+05      8.2          .69       126.14
       1.45    253.33    .151E+06     18.8          .65       134.06
       1.91    253.79    .383E+06     68.4          .93        93.14
       2.38    254.26    .713E+06    157.3         1.15        75.58
       2.84    254.72    .112E+07    287.3         1.33        65.13
       3.31    255.19    .161E+07    454.2         1.47        59.01
       3.77    255.65    .217E+07    659.0         1.58        54.87
       4.24    256.12    .279E+07    908.7         1.69        51.25
       4.70    256.58    .346E+07   1199.1         1.80        48.03
       5.17    257.05    .414E+07   1527.9         1.92        45.17
       5.63    257.51    .485E+07   1892.4         2.03        42.71
       6.10    257.98    .558E+07   2291.8         2.13        40.59
       6.56    258.44    .634E+07   2725.7         2.23        38.74
       7.03    258.91    .711E+07   3193.6         2.33        37.12
       7.49    259.37    .791E+07   3695.3         2.43        35.69
       7.96    259.84    .874E+07   4221.9         2.51        34.48
       8.42    260.30    .961E+07   4697.6         2.54        34.09

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    35.37   12.50  30.09      1.61       .72
     OUTFLOW: ID= 1 (6031) 3623.18    29.26   14.00  30.09      1.55       .69

--------------------------------------------------------------------------------

 ADD HYD   (5005)
   1 +  2 =  3                 AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78  14.432     8.50     47.25
        + ID2= 2 (6031):  3623.18  29.257    14.00     30.09
          ===============================================
          ID = 3 (5005):  4322.96  33.598    13.50     32.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   6 **      2050 5-Year Storm
  ****************************

--------------------
| MASS STORM       |     Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 73.95 mm |     Comments: SCS 24 HR MASS CURVE
--------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.63 |  3.25    2.96 |  6.25   13.31 |  9.25    2.25
                  .50    1.72 |  3.50    2.96 |  6.50   13.31 |  9.50    2.07
                  .75    1.75 |  3.75    2.96 |  6.75    7.04 |  9.75    1.98
                 1.00    1.80 |  4.00    2.96 |  7.00    4.79 | 10.00    2.01
                 1.25    1.89 |  4.25    4.08 |  7.25    4.44 | 10.25    1.95
                 1.50    1.95 |  4.50    4.79 |  7.50    4.44 | 10.50    1.83
                 1.75    1.98 |  4.75    5.35 |  7.75    4.44 | 10.75    1.69
                 2.00    2.07 |  5.00    6.48 |  8.00    4.44 | 11.00    1.57
                 2.25    2.07 |  5.25    8.87 |  8.25    3.79 | 11.25    1.39
                 2.50    2.07 |  5.50    8.87 |  8.50    3.25 | 11.50    1.27
                 2.75    2.22 |  5.75   35.50 |  8.75    2.84 | 11.75    1.12
                 3.00    2.51 |  6.00   97.61 |  9.00    2.51 | 12.00    1.01

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--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   6.865 (i)
     TIME TO PEAK   (hrs)=   8.750
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```
     RUNOFF VOLUME    (mm)=  24.271
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .328

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        61.88
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.80 (ii)   19.33 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       5.32         4.77          8.415 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45        32.55         42.78
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .99          .44           .58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        58.31
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.64 (ii)   18.42 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       4.81         2.14          6.183 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45        26.83         43.14
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .99          .36           .58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
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     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        60.48
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.98 (ii)   16.61 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       2.54          .91          3.130 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      63.95        26.81         41.66
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .86          .36           .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        56.73
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.19 (ii)   19.09 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       5.96         2.58          7.607 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      63.95        26.14         39.37
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .86          .35           .53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW      (cms)=   1.447 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   8.476
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .115

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW      (cms)=    .647 (i)
     TIME TO PEAK    (hrs)=   9.250
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```
     RUNOFF VOLUME    (mm)=   8.476
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .115

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58       15.87
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     419.90       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=      97.61       44.24
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.10 (ii)   18.14 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       1.69        1.03         2.346 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45       23.63         36.08
     TOTAL RAINFALL   (mm)=      73.95       73.95         73.95
     RUNOFF COEFFICIENT   =        .99         .32           .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08       13.62
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     389.00       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=      97.61       44.24
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       5.83 (ii)   17.87 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       1.46         .89         2.027 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45       23.63         36.08
     TOTAL RAINFALL   (mm)=      73.95       73.95         73.95
     RUNOFF COEFFICIENT   =        .99         .32           .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25       24.37
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     520.40       40.00
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     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=      97.61       44.24
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.94 (ii)   18.98 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       2.54        1.55         3.526 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45       23.63         36.08
     TOTAL RAINFALL   (mm)=      73.95       73.95         73.95
     RUNOFF COEFFICIENT   =        .99         .32           .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW      (cms)=   1.655 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   8.762
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .118

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW      (cms)=   2.356 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   9.331
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .126

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW      (cms)=    .797 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  12.877
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .174

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW      (cms)=   2.287 (i)
```

```
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   8.762
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .118

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .270 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  17.461
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .236

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   6.221 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  25.006
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .338

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        64.37
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.58 (ii)   17.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.35         3.11         5.390 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45        33.98         43.85
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .99          .46           .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
```


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     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        66.21
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.57 (ii)   18.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.88         4.34         8.719 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45        34.32         46.06
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .99          .46           .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      97.61        64.37
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.17 (ii)   20.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       8.27         7.85        13.381 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45        33.98         43.85
     TOTAL RAINFALL   (mm)=      73.95        73.95         73.95
     RUNOFF COEFFICIENT   =        .99          .46           .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   5.913 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  18.003
     TOTAL RAINFALL   (mm)=  73.950
     RUNOFF COEFFICIENT   =    .243

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.2000      .9900
                          .0290      .3700    |   2.7000     1.4200
                          .5000      .6900    |   6.1000     2.1800
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                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     8.415        6.00       42.78
     OUTFLOW: ID= 1 (9021)     89.700     3.748        6.50       42.74

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 44.54
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.6654

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620       .8805
                           .0150      .6000   |    .4710      1.0180
                           .1240      .7875   |    .9610      1.2660

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780     3.130        6.00       41.66
     OUTFLOW: ID= 1 (9022)     24.780      .156        8.75       41.25

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.97
                   TIME SHIFT OF PEAK FLOW         (min)=165.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8091

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .156     8.75    41.25
        + ID2= 2 (2021):    70.42    7.607     6.00    39.37
          ==================================================
          ID = 3 (7008):    95.20    7.615     6.00    39.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------


  ADD HYD   (5065)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    7.615     6.00    39.86
        + ID2= 2 (1044):   443.50    1.447    10.00     8.48
          ==================================================
          ID = 3 (5065):   538.70    7.641     6.00    14.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990       .7350
                           .0110      .4435   |    .1630       .8595
                           .0550      .6265   |    .3050      1.0800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450     2.346        6.00       36.08
     OUTFLOW: ID= 1 (9257)     26.450      .113        9.50       35.70

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.83
                   TIME SHIFT OF PEAK FLOW         (min)=210.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .7631

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
```



```
                           .9900      .4700   |   2.8300       .9900

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700     2.027        6.00       36.08
     OUTFLOW: ID= 1 (9019)     22.700      .761        6.50       24.63

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 37.52
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .4046

------------------------------------------------------------------------------

--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .761     6.50    24.63
        + ID2= 2 (2011):    40.62    3.526     6.00    36.08
          ==================================================
          ID = 3 (7001):    63.32    3.587     6.00    31.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     2.356        7.50        9.33
     OUTFLOW: ID= 1 (9147)    369.570      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.4483

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      .797        6.50       12.88
     OUTFLOW: ID= 1 (9248)     54.891      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .7068

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730      1.6365
                           .0490     1.0690   |    .7910      1.8915
                           .2480     1.4290   |   1.4810      2.3855

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500     5.390        6.00       43.85
     OUTFLOW: ID= 1 (9258)     54.500      .538        7.75       43.75

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.98
                   TIME SHIFT OF PEAK FLOW         (min)=105.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.6891

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                         .0000      .0000   |   1.7200      5.0000
                         .2200     3.0000   |   2.5000      7.0000

                               AREA      QPEAK       TPEAK       R.V.
                               (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270    13.381        6.00       43.85
     OUTFLOW: ID= 1 (9020)    145.270     1.346        8.25       43.82

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.06
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.5029

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     5.91      7.25     18.00
    SHIFT ID= 1 (9029):  406.96     5.91      9.75     18.00

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   6.865     8.75    24.27
        + ID2= 2 (9021):    89.70   3.748     6.50    42.74
          ==============================================
          ID = 3 (5062):   699.78   8.006     8.25    26.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45    .113     9.50    35.70
        + ID2= 2 (7001):    63.32   3.587     6.00    31.98
          ==============================================
          ID = 3 (7002):    89.77   3.594     6.00    33.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ==============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   8.719     6.00    46.06
        + ID2= 2 (9020):   145.27   1.346     8.25    43.82
          ==============================================
          ID = 3 (7013):   227.32   8.852     6.00    44.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05          .0800
                  34.48        278.78          .0800
                  62.07        280.75          .0800
```



```
                  75.86        280.87          .0800
                 110.34        277.13          .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50          .0350     Main Channel
                 151.72        274.76          .0350     Main Channel
                 172.41        276.25          .0350     Main Channel
                 213.79        277.31          .0800
                 255.17        278.25          .0800
                 275.86        278.49          .0800
                 289.66        279.07          .0800
                 303.45        278.41          .0800
                 312.47        278.40          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
        .20   274.70    .665E+04        .6          .56     172.84
        .39   274.89    .247E+05       4.2         1.00      97.27
        .59   275.09    .478E+05      11.1         1.35      71.58
        .78   275.28    .756E+05      21.4         1.64      58.99
        .98   275.48    .108E+06      35.2         1.89      51.17
       1.17   275.67    .145E+06      52.9         2.12      45.70
       1.37   275.87    .187E+06      74.8         2.33      41.60
       1.56   276.06    .233E+06     101.2         2.53      38.37
       1.76   276.26    .284E+06     132.2         2.71      35.80
       1.95   276.45    .342E+06     160.8         2.73      35.50
       2.17   276.67    .421E+06     204.7         2.83      34.30
       2.38   276.88    .516E+06     258.7         2.91      33.25
       2.60   277.10    .627E+06     323.9         3.00      32.28
       2.82   277.32    .754E+06     402.4         3.11      31.21
       3.03   277.53    .894E+06     517.5         3.37      28.78
       3.25   277.75    .105E+07     645.6         3.58      27.06
       3.47   277.97    .122E+07     787.1         3.76      25.78
       3.68   278.18    .140E+07     942.2         3.91      24.79
       3.90   278.40    .160E+07    1110.1         4.03      24.06

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     5.91    9.75  18.00       .44      1.07
     OUTFLOW: ID= 1 (6019)  406.96     3.85   10.75  18.00       .37       .92


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--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .647     9.25     8.48
        + ID2= 2 (7002):    89.77   3.594     6.00    33.07
          ==============================================
          ID = 3 (5064):   260.50   3.614     6.00    16.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   2.287    10.00     8.76
          ==============================================
          ID = 3 (9250):  1097.41   2.287    10.00     5.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50    .538     7.75    43.75
        + ID2= 2 (7013):   227.32   8.852     6.00    44.63
          ==============================================
          ID = 3 (7014):   281.82   8.885     6.00    44.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```

```
 RESERVOIR (9018)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   4.8100     1.1900
                           .4200      .6400   |  14.3300     1.2700
                          1.5900      .9400   |  53.8000     1.3300
                          3.2000     1.1100   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (9250)   1097.411      2.287       10.00        5.37
    OUTFLOW: ID= 1 (9018)   1097.411      2.266       10.50        5.37

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.07
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0118

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--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   6.221     8.50    25.01
        + ID2= 2 (7014):   281.82   8.885     6.00    44.46
          ==============================================
          ID = 3 (5061):   769.44   9.470     6.00    32.13

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7           .81      43.21
        .57   270.59    .257E+05      13.9          1.14      30.76
        .85   270.87    .484E+05      32.0          1.39      25.24
       1.13   271.15    .776E+05      59.6          1.61      21.71
       1.42   271.44    .112E+06     100.0          1.87      18.71
       1.70   271.72    .151E+06     157.2          2.18      16.04
       1.99   272.01    .195E+06     225.9          2.44      14.37
       2.27   272.29    .242E+06     305.9          2.65      13.21
       2.55   272.57    .294E+06     398.1          2.84      12.31
       2.84   272.86    .350E+06     501.8          3.01      11.61
       3.12   273.14    .409E+06     617.0          3.17      11.05
       3.40   273.42    .472E+06     744.3          3.31      10.58
       3.69   273.71    .539E+06     882.9          3.44      10.18
       3.97   273.99    .611E+06    1033.6          3.55       9.85
       4.26   274.28    .687E+06    1196.8          3.66       9.57
       4.54   274.56    .768E+06    1370.2          3.75       9.35
       4.82   274.84    .856E+06    1556.4          3.82       9.16
       5.11   275.13    .950E+06    1757.0          3.89       9.01
       5.39   275.41    .105E+07    1967.6          3.93       8.91

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (9018) 1097.41      2.27   10.50   5.37       .18        .81
    OUTFLOW: ID= 1 (9251) 1097.41      2.14   11.50   5.37       .17        .81
```



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 ADD HYD   (7016)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44   9.470     6.00    32.13
        + ID2= 2 (6019):   406.96   3.854    10.75    18.00
          ==============================================
          ID = 3 (7016):  1176.40  10.022    10.25    27.24

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   1.655    10.00     8.76
        + ID2= 2 (9251):  1097.41   2.144    11.50     5.37
          ==============================================
          ID = 3 (5000):  1576.98   3.673    11.00     6.40

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   3.614     6.00    16.95
        + ID2= 2 (5000):  1576.98   3.673    11.00     6.40
          ==============================================
          ID = 3 (5001):  1837.48   4.537    10.75     7.90

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.8300     3.4900
                           .2800      .2500   |   3.8200     3.9500
                           .7100      .6300   |   4.6700     4.2000
                          1.1300     1.1400   |   7.3600     4.6900
                          1.5600     1.7300   |   8.7800     4.8500
                          1.8400     2.2600   |  35.4000     6.6100
                          2.2700     2.9600   |  *******     8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (5001)   1837.481      4.537       10.75        7.90
    OUTFLOW: ID= 1 (9017)   1837.481      3.732       12.75        7.90

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 82.26
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.9117

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 ADD HYD   (9041)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   7.641     6.00    14.02
        + ID2= 2 (9017):  1837.48   3.732    12.75     7.90
          ==============================================
          ID = 3 (9041):  2376.18   8.048     6.00     9.29

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (2031):    55.98   6.183     6.00    43.14
        + ID2= 2 (9041):  2376.18   8.048     6.00     9.29
          ==================================================
          ID = 3 (5002):  2432.16  14.230     6.00    10.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    14.23      6.00     10.07
    SHIFT ID= 1 (9040): 2432.16    14.23      7.00     10.07

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29          .0800
                  30.80       273.73          .0800
                  51.30       270.17          .0800
                  61.60       266.84          .0800
                  66.80       266.02          .0800
                 102.70       265.42          .0350      Main Channel
                 123.20       261.00          .0350      Main Channel
                 128.40       261.17          .0350      Main Channel
                 154.00       264.62          .0350      Main Channel
                 174.60       266.82          .0800
                 205.40       268.07          .0800
                 236.20       268.74          .0800
                 282.40       271.31          .0800
                 302.90       272.11          .0800
                 348.90       274.45          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
         .63   261.63    .702E+04      5.2          1.14      22.47
        1.26   262.26    .220E+05     24.8          1.74      14.74
        1.89   262.89    .443E+05     64.0          2.22      11.54
        2.53   263.53    .741E+05    127.4          2.65       9.69
        3.16   264.16    .111E+06    219.6          3.04       8.44
        3.79   264.79    .156E+06    343.2          3.39       7.57
        4.42   265.42    .209E+06    501.2          3.70       6.94
        5.16   266.16    .304E+06    766.4          3.88       6.61
        5.90   266.90    .428E+06   1123.8          4.05       6.34
        6.64   267.64    .570E+06   1628.6          4.40       5.84
        7.38   268.38    .738E+06   2225.4          4.65       5.53
        8.12   269.12    .941E+06   2928.9          4.80       5.35
        8.85   269.85    .116E+07   3743.0          4.95       5.18
        9.59   270.59    .141E+07   4656.3          5.10       5.03
       10.33   271.33    .167E+07   5671.9          5.24       4.90
       11.07   272.07    .195E+07   6784.6          5.36       4.80
       11.81   272.81    .226E+07   8029.1          5.47       4.69
       12.55   273.55    .259E+07   9393.0          5.59       4.60
       13.29   274.29    .295E+07  10648.3          5.55       4.62

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    14.23    7.00  10.07       .92      1.36
     OUTFLOW: ID= 1 (6029) 2432.16     9.04    7.25  10.07       .75      1.22


-------------------------------------------------------------------------------

| ADD HYD   (5003)
|   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   9.038     7.25    10.07
        + ID2= 2 (1040):    14.62    .270     6.75    17.46
          ==================================================
          ID = 3 (5003):  2446.78   9.263     7.25    10.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```
 ADD HYD   (5004)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   9.263     7.25    10.11
        + ID2= 2 (7016):  1176.40  10.022    10.25    27.24
          ==================================================
          ID = 3 (5004):  3623.18  17.022     7.25    15.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    17.02      7.25     15.67
    SHIFT ID= 1 (9015): 3623.18    17.02      9.25     15.67

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       260.30          .0800
                  34.10       260.43          .0800
                  62.40       259.79          .0800
                  79.50       255.72          .0800
                 113.50       254.00          .0800
                 153.30       253.33          .0350      Main Channel
                 187.30       253.06          .0350      Main Channel
                 198.70       251.88          .0350      Main Channel
                 204.40       252.61          .0350      Main Channel
                 249.80       254.00          .0800
                 334.90       255.77          .0800
                 351.90       256.37          .0800
                 414.40       260.24          .0800
                 465.50       260.75          .0800
                 514.40       261.48          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
         .36   252.24    .596E+04       .4           .39     223.90
         .73   252.61    .238E+05      2.8           .61     141.05
        1.09   252.97    .619E+05      8.2           .69     126.14
        1.45   253.33    .151E+06     18.8           .65     134.06
        1.91   253.79    .383E+06     68.4           .93      93.14
        2.38   254.26    .713E+06    157.3          1.15      75.58
        2.84   254.72    .112E+07    287.3          1.33      65.13
        3.31   255.19    .161E+07    454.2          1.47      59.01
        3.77   255.65    .217E+07    659.0          1.58      54.87
        4.24   256.12    .279E+07    908.7          1.69      51.25
        4.70   256.58    .346E+07   1199.1          1.80      48.03
        5.17   257.05    .414E+07   1527.9          1.92      45.17
        5.63   257.51    .485E+07   1892.4          2.03      42.71
        6.10   257.98    .558E+07   2291.8          2.13      40.59
        6.56   258.44    .634E+07   2725.7          2.23      38.74
        7.03   258.91    .711E+07   3193.6          2.33      37.12
        7.49   259.37    .791E+07   3695.3          2.43      35.69
        7.96   259.84    .874E+07   4221.9          2.51      34.48
        8.42   260.30    .961E+07   4697.6          2.54      34.09

                                     <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    17.02    9.25  15.67      1.39       .65
     OUTFLOW: ID= 1 (6031) 3623.18    12.44   13.50  15.67      1.23       .67


-------------------------------------------------------------------------------

 ADD HYD   (5005)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   8.006     8.25    26.64
        + ID2= 2 (6031):  3623.18  12.437    13.50    15.67
          ==================================================
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          ID = 3 (5005):  4322.96  15.980    10.50    17.45

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************
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2050 100-Year Storm

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--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal=141.08 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    3.10 |  3.25    5.64 |  6.25   25.39 |  9.25    4.29
                  .50    3.27 |  3.50    5.64 |  6.50   25.39 |  9.50    3.95
                  .75    3.33 |  3.75    5.64 |  6.75   13.43 |  9.75    3.78
                 1.00    3.44 |  4.00    5.64 |  7.00    9.14 | 10.00    3.84
                 1.25    3.61 |  4.25    7.79 |  7.25    8.46 | 10.25    3.72
                 1.50    3.72 |  4.50    9.14 |  7.50    8.46 | 10.50    3.50
                 1.75    3.78 |  4.75   10.21 |  7.75    8.46 | 10.75    3.22
                 2.00    3.95 |  5.00   12.36 |  8.00    8.46 | 11.00    2.99
                 2.25    3.95 |  5.25   16.93 |  8.25    7.22 | 11.25    2.65
                 2.50    3.95 |  5.50   16.93 |  8.50    6.21 | 11.50    2.43
                 2.75    4.23 |  5.75   67.72 |  8.75    5.42 | 11.75    2.14
                 3.00    4.80 |  6.00  186.23 |  9.00    4.80 | 12.00    1.92

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=  20.956 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  72.405
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .513

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       162.83
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       6.80 (ii)   13.95 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .07
                                                           *TOTALS*
     PEAK FLOW       (cms)=      10.75        17.73         28.484 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     140.58        85.53          99.29
     TOTAL RAINFALL   (mm)=     141.08       141.08         141.08
     RUNOFF COEFFICIENT   =       1.00          .61            .70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       162.88
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.90 (ii)   13.05 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=       9.61         8.50         18.115 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     140.58        74.24          97.46
     TOTAL RAINFALL   (mm)=     141.08       141.08         141.08
     RUNOFF COEFFICIENT   =       1.00          .53            .69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       168.94
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       4.62 (ii)   11.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=       5.00         3.63          8.631 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     131.08        74.17          96.94
     TOTAL RAINFALL   (mm)=     141.08       141.08         141.08
     RUNOFF COEFFICIENT   =        .93          .53            .69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       159.66
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       6.32 (ii)   13.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .08
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                                                            *TOTALS*
     PEAK FLOW      (cms)=     11.96        10.32        22.282 (iii)
     TIME TO PEAK   (hrs)=      6.00         6.00          6.00
     RUNOFF VOLUME   (mm)=    131.08        72.81         93.21
     TOTAL RAINFALL  (mm)=    141.08       141.08        141.08
     RUNOFF COEFFICIENT  =       .93          .52           .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW      (cms)=   7.624 (i)
     TIME TO PEAK   (hrs)=   9.500
     RUNOFF VOLUME   (mm)=  41.825
     TOTAL RAINFALL  (mm)= 141.080
     RUNOFF COEFFICIENT  =    .296

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW      (cms)=   3.503 (i)
     TIME TO PEAK   (hrs)=   8.750
     RUNOFF VOLUME   (mm)=  41.824
     TOTAL RAINFALL  (mm)= 141.080
     RUNOFF COEFFICIENT  =    .296

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=      10.58        15.87
     Dep. Storage    (mm)=        .50         2.50
     Average Slope    (%)=       1.00         1.00
     Length           (m)=     419.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       128.07
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       4.71 (ii)   12.58 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                            *TOTALS*
     PEAK FLOW      (cms)=       3.33         4.27         7.595 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME   (mm)=     140.58        67.58         85.83
     TOTAL RAINFALL  (mm)=     141.08       141.08        141.08
     RUNOFF COEFFICIENT  =       1.00          .48           .61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=       9.08        13.62
     Dep. Storage    (mm)=        .50         2.50
     Average Slope    (%)=       1.00         1.00
     Length           (m)=     389.00        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       128.07
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       4.50 (ii)   12.37 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                            *TOTALS*
     PEAK FLOW      (cms)=       2.87         3.69         6.555 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME   (mm)=     140.58        67.58         85.83
     TOTAL RAINFALL  (mm)=     141.08       141.08        141.08
     RUNOFF COEFFICIENT  =       1.00          .48           .61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area    (ha)=      16.25        24.37
     Dep. Storage    (mm)=        .50         2.50
     Average Slope    (%)=       1.00         1.00
     Length           (m)=     520.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       128.07
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.36 (ii)   13.23 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                            *TOTALS*
     PEAK FLOW      (cms)=       5.04         6.41        11.458 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME   (mm)=     140.58        67.58         85.83
     TOTAL RAINFALL  (mm)=     141.08       141.08        141.08
     RUNOFF COEFFICIENT  =       1.00          .48           .61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW      (cms)=   8.696 (i)
     TIME TO PEAK   (hrs)=   9.250
     RUNOFF VOLUME   (mm)=  42.904
     TOTAL RAINFALL  (mm)= 141.080
     RUNOFF COEFFICIENT  =    .304

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=  12.134 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  41.596
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .295

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   4.003 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  53.190
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .377

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=  11.966 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  42.904
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .304

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .904 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  56.500
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .400

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=  18.905 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  73.974
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .524

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



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-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       166.50
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.85 (ii)   12.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       6.69        11.39          18.084 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00            6.00
     RUNOFF VOLUME    (mm)=     140.58        87.79          100.99
     TOTAL RAINFALL   (mm)=     141.08       141.08          141.08
     RUNOFF COEFFICIENT   =       1.00          .62             .72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       170.66
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       6.62 (ii)   13.63 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .08
                                                            *TOTALS*
     PEAK FLOW       (cms)=      11.86        15.77          27.623 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00            6.00
     RUNOFF VOLUME    (mm)=     140.58        88.40          104.05
     TOTAL RAINFALL   (mm)=     141.08       141.08          141.08
     RUNOFF COEFFICIENT   =       1.00          .63             .74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     186.23       166.50
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       7.86 (ii)   14.94 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .07
                                                         *TOTALS*
     PEAK FLOW       (cms)=      16.90        28.51        45.416 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     140.58        87.79        100.99
     TOTAL RAINFALL   (mm)=     141.08       141.08        141.08
     RUNOFF COEFFICIENT   =       1.00          .62           .72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
 CALIB
 NASHYD    (1060)     Area    (ha)= 406.96   Curve Number   (CN)= 60.0
ID= 1 DT=15.0 min     Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
                      U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=  19.800 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  57.870
     TOTAL RAINFALL   (mm)= 141.080
     RUNOFF COEFFICIENT   =    .410

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     28.484        6.00       99.29
     OUTFLOW: ID= 1 (9021)     89.700     11.711        6.25       99.25

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.12
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.4623

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620       .8805
                           .0150      .6000   |    .4710      1.0180
                           .1240      .7875   |    .9610      1.2660

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      8.631        6.00       96.94
     OUTFLOW: ID= 1 (9022)     24.780      1.340        6.50       96.53

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.52
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.4727

------------------------------------------------------------------------------
--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78   1.340     6.50    96.53
        + ID2= 2 (2021):    70.42  22.282     6.00    93.21
          ==================================================
          ID = 3 (7008):    95.20  22.672     6.00    94.07
```



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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

 ADD HYD   (5065)
|  1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20  22.672     6.00    94.07
        + ID2= 2 (1044):   443.50   7.624     9.50    41.82
          ==================================================
          ID = 3 (5065):   538.70  22.954     6.00    51.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990       .7350
                           .0110      .4435   |    .1630       .8595
                           .0550      .6265   |    .3050      1.0800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      7.595        6.00       85.83
     OUTFLOW: ID= 1 (9257)     26.450       .599        7.00       85.44

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.88
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.5375

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      6.555        6.00       85.83
     OUTFLOW: ID= 1 (9019)     22.700      1.809        6.50       74.38

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 27.59
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9647

------------------------------------------------------------------------------

--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70   1.809     6.50    74.38
        + ID2= 2 (2011):    40.62  11.458     6.00    85.83
          ==================================================
          ID = 3 (7001):    63.32  12.603     6.00    81.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     12.134        7.25       41.60
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)= 15.3728
```

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      4.003        6.50      53.19
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00        .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.9197

-----------------------------------------------------------------------------
--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000   |    .4730      1.6365
                          .0490     1.0690   |    .7910      1.8915
                          .2480     1.4290   |   1.4810      2.3855

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500     18.084        6.00     100.99
     OUTFLOW: ID= 1 (9258)     54.500      2.816        6.75     100.89

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 15.57
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.3593

-----------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000   |   1.7200      5.0000
                          .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     45.416        6.00     100.99
     OUTFLOW: ID= 1 (9020)    145.270      3.637        7.25     100.96

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.01
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  9.9216

-----------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     19.80      7.00     57.87
    SHIFT ID= 1 (9029):  406.96     19.80      9.50     57.87

-----------------------------------------------------------------------------
--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08  20.956     8.75    72.40
        + ID2= 2 (9021):    89.70  11.711     6.25    99.25
          ==================================================
          ID = 3 (5062):   699.78  23.217     8.50    75.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
```



```
          ID1= 1 (9257):    26.45    .599     7.00    85.44
        + ID2= 2 (7001):    63.32  12.603     6.00    81.72
          ==================================================
          ID = 3 (7002):    89.77  12.776     6.00    82.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  27.623     6.00   104.05
        + ID2= 2 (9020):   145.27   3.637     7.25   100.96
          ==================================================
          ID = 3 (7013):   227.32  29.473     6.00   102.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6          .56     172.84
        .39   274.89    .247E+05       4.2         1.00      97.27
        .59   275.09    .478E+05      11.1         1.35      71.58
        .78   275.28    .756E+05      21.4         1.64      58.99
        .98   275.48    .108E+06      35.2         1.89      51.17
       1.17   275.67    .145E+06      52.9         2.12      45.70
       1.37   275.87    .187E+06      74.8         2.33      41.60
       1.56   276.06    .233E+06     101.2         2.53      38.37
       1.76   276.26    .284E+06     132.2         2.71      35.80
       1.95   276.45    .342E+06     160.8         2.73      35.50
       2.17   276.67    .421E+06     204.7         2.83      34.30
       2.38   276.88    .516E+06     258.7         2.91      33.25
       2.60   277.10    .627E+06     323.9         3.00      32.28
       2.82   277.32    .754E+06     402.4         3.11      31.21
       3.03   277.53    .894E+06     517.5         3.37      28.78
       3.25   277.75    .105E+07     645.6         3.58      27.06
       3.47   277.97    .122E+07     787.1         3.76      25.78
       3.68   278.18    .140E+07     942.2         3.91      24.79
       3.90   278.40    .160E+07    1110.1         4.03      24.06

                              <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96   19.80    9.50  57.87       .75      1.59
```

```
     OUTFLOW: ID= 1 (6019)  406.96    14.91   10.50  57.87       .66      1.45

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 -------------------
 | ADD HYD   (5064) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73   3.503     8.75    41.82
        + ID2= 2 (7002):    89.77  12.776     6.00    82.82
          ==================================================
          ID = 3 (5064):   260.50  12.987     6.00    55.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 -------------------
 | ADD HYD   (9250) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95  11.966     9.50    42.90
          ==================================================
          ID = 3 (9250):  1097.41  11.966     9.50    26.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 -------------------
 | ADD HYD   (7014) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50   2.816     6.75   100.89
        + ID2= 2 (7013):   227.32  29.473     6.00   102.08
          ==================================================
          ID = 3 (7014):   281.82  30.538     6.00   101.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 -------------------
 | RESERVOIR (9018) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 -------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   4.8100     1.1900
                           .4200      .6400    |  14.3300     1.2700
                          1.5900      .9400    |  53.8000     1.3300
                          3.2000     1.1100    |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411     11.966        9.50       26.31
     OUTFLOW: ID= 1 (9018)   1097.411     12.026        9.50       26.31

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.50
                   TIME SHIFT OF PEAK FLOW        (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.2720

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                     CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
 -----------------------------------------------------------------------------

 -------------------
 | ADD HYD   (5061) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62  18.905     8.25    73.97
        + ID2= 2 (7014):   281.82  30.538     6.00   101.85
          ==================================================
          ID = 3 (5061):   769.44  33.183     6.00    84.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -----------------------------------------------------------------------------
 -------------------
 | ROUTE CHN (9251) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 -------------------
                &lt;------ DATA FOR SECTION (   1.0) ------&gt;
```



```
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      &lt;-------------------- TRAVEL TIME TABLE ---------------------&gt;
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)      (cms)       (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81      43.21
        .57   270.59    .257E+05      13.9         1.14      30.76
        .85   270.87    .484E+05      32.0         1.39      25.24
       1.13   271.15    .776E+05      59.6         1.61      21.71
       1.42   271.44    .112E+06     100.0         1.87      18.71
       1.70   271.72    .151E+06     157.2         2.18      16.04
       1.99   272.01    .195E+06     225.9         2.44      14.37
       2.27   272.29    .242E+06     305.9         2.65      13.21
       2.55   272.57    .294E+06     398.1         2.84      12.31
       2.84   272.86    .350E+06     501.8         3.01      11.61
       3.12   273.14    .409E+06     617.0         3.17      11.05
       3.40   273.42    .472E+06     744.3         3.31      10.58
       3.69   273.71    .539E+06     882.9         3.44      10.18
       3.97   273.99    .611E+06    1033.6         3.55       9.85
       4.26   274.28    .687E+06    1196.8         3.66       9.57
       4.54   274.56    .768E+06    1370.2         3.75       9.35
       4.82   274.84    .856E+06    1556.4         3.82       9.16
       5.11   275.13    .950E+06    1757.0         3.89       9.01
       5.39   275.41    .105E+07    1967.6         3.93       8.91

                               &lt;---- hydrograph ----&gt;   &lt;-pipe / channel-&gt;
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41    12.03    9.50  26.31       .52      1.06
     OUTFLOW: ID= 1 (9251) 1097.41    11.79    9.75  26.31       .51      1.05


 -----------------------------------------------------------------------------

 -------------------
 | ADD HYD   (7016) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  33.183     6.00    84.18
        + ID2= 2 (6019):   406.96  14.914    10.50    57.87
          ==================================================
          ID = 3 (7016):  1176.40  33.843    10.00    75.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -----------------------------------------------------------------------------

 -------------------
 | ADD HYD   (5000) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   8.696     9.25    42.90
        + ID2= 2 (9251):  1097.41  11.790     9.75    26.31
          ==================================================
          ID = 3 (5000):  1576.98  20.360     9.75    31.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -----------------------------------------------------------------------------

 -------------------
 | ADD HYD   (5001) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 -------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50  12.987     6.00    55.95
        + ID2= 2 (5000):  1576.98  20.360     9.75    31.36
          ==================================================
          ID = 3 (5001):  1837.48  24.868     9.25    34.84
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min            OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.8300     3.4900
                           .2800      .2500   |   3.8200     3.9500
                           .7100      .6300   |   4.6700     4.2000
                          1.1300     1.1400   |   7.3600     4.6900
                          1.5600     1.7300   |   8.7800     4.8500
                          1.8400     2.2600   |  35.4000     6.6100
                          2.2700     2.9600   |  *******     8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     24.868        9.25       34.84
     OUTFLOW: ID= 1 (9017)   1837.481     24.804        9.50       34.84

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.74
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  5.9113

--------------------------------------------------------------------------------

 ADD HYD   (9041)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70  22.954     6.00    51.06
        + ID2= 2 (9017):  1837.48  24.804     9.50    34.84
          ==================================================
          ID = 3 (9041):  2376.18  33.610     9.50    38.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98  18.115     6.00    97.46
        + ID2= 2 (9041):  2376.18  33.610     9.50    38.52
          ==================================================
          ID = 3 (5002):  2432.16  42.238     6.00    39.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    42.24      6.00     39.88
    SHIFT ID= 1 (9040): 2432.16    42.24      7.00     39.88

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29          .0800
                  30.80       273.73          .0800
                  51.30       270.17          .0800
                  61.60       266.84          .0800
                  66.80       266.02          .0800
                 102.70       265.42          .0350      Main Channel
                 123.20       261.00          .0350      Main Channel
                 128.40       261.17          .0350      Main Channel
                 154.00       264.62          .0350      Main Channel
                 174.60       266.82          .0800
                 205.40       268.07          .0800
                 236.20       268.74          .0800
                 282.40       271.31          .0800
                 302.90       272.11          .0800
                 348.90       274.45          .0800
```



```
      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)       (min)
         .63   261.63    .702E+04       5.2         1.14       22.47
        1.26   262.26    .220E+05      24.8         1.74       14.74
        1.89   262.89    .443E+05      64.0         2.22       11.54
        2.53   263.53    .741E+05     127.4         2.65        9.69
        3.16   264.16    .111E+06     219.6         3.04        8.44
        3.79   264.79    .156E+06     343.2         3.39        7.57
        4.42   265.42    .209E+06     501.2         3.70        6.94
        5.16   266.16    .304E+06     766.4         3.88        6.61
        5.90   266.90    .428E+06    1123.8         4.05        6.34
        6.64   267.64    .570E+06    1628.6         4.40        5.84
        7.38   268.38    .738E+06    2225.4         4.65        5.53
        8.12   269.12    .941E+06    2928.9         4.80        5.35
        8.85   269.85    .116E+07    3743.0         4.95        5.18
        9.59   270.59    .141E+07    4656.3         5.10        5.03
       10.33   271.33    .167E+07    5671.9         5.24        4.90
       11.07   272.07    .195E+07    6784.6         5.36        4.80
       11.81   272.81    .226E+07    8029.1         5.47        4.69
       12.55   273.55    .259E+07    9393.0         5.59        4.60
       13.29   274.29    .295E+07   10648.3         5.55        4.62

                              <---- hydrograph ---->  <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    42.24    7.00  39.88      1.54      1.93
     OUTFLOW: ID= 1 (6029) 2432.16    34.04   10.75  39.88      1.41      1.84

--------------------------------------------------------------------------------

 ADD HYD   (5003)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  34.038    10.75    39.88
        + ID2= 2 (1040):    14.62    .904     6.75    56.50
          ==================================================
          ID = 3 (5003):  2446.78  34.150    10.75    39.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

 ADD HYD   (5004)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  34.150    10.75    39.97
        + ID2= 2 (7016):  1176.40  33.843    10.00    75.08
          ==================================================
          ID = 3 (5004):  3623.18  67.198    10.25    51.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    67.20     10.25     51.37
    SHIFT ID= 1 (9015): 3623.18    67.20     12.25     51.37

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       260.30          .0800
                  34.10       260.43          .0800
                  62.40       259.79          .0800
                  79.50       255.72          .0800
                 113.50       254.00          .0800
                 153.30       253.33          .0350      Main Channel
                 187.30       253.06          .0350      Main Channel
                 198.70       251.88          .0350      Main Channel
                 204.40       252.61          .0350      Main Channel
                 249.80       254.00          .0800
```

```
                 334.90        255.77         .0800
                 351.90        256.37         .0800
                 414.40        260.24         .0800
                 465.50        260.75         .0800
                 514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)       (m/s)       (min)
        .36   252.24    .596E+04       .4          .39      223.90
        .73   252.61    .238E+05      2.8          .61      141.05
       1.09   252.97    .619E+05      8.2          .69      126.14
       1.45   253.33    .151E+06     18.8          .65      134.06
       1.91   253.79    .383E+06     68.4          .93       93.14
       2.38   254.26    .713E+06    157.3         1.15       75.58
       2.84   254.72    .112E+07    287.3         1.33       65.13
       3.31   255.19    .161E+07    454.2         1.47       59.01
       3.77   255.65    .217E+07    659.0         1.58       54.87
       4.24   256.12    .279E+07    908.7         1.69       51.25
       4.70   256.58    .346E+07   1199.1         1.80       48.03
       5.17   257.05    .414E+07   1527.9         1.92       45.17
       5.63   257.51    .485E+07   1892.4         2.03       42.71
       6.10   257.98    .558E+07   2291.8         2.13       40.59
       6.56   258.44    .634E+07   2725.7         2.23       38.74
       7.03   258.91    .711E+07   3193.6         2.33       37.12
       7.49   259.37    .791E+07   3695.3         2.43       35.69
       7.96   259.84    .874E+07   4221.9         2.51       34.48
       8.42   260.30    .961E+07   4697.6         2.54       34.09

                                  <---- hydrograph ---->   <-pipe / channel->
                           AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                           (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18   67.20   12.25  51.37      1.90       .92
     OUTFLOW: ID= 1 (6031) 3623.18   58.12   13.25  51.37      1.82       .85

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 -------------------
 ADD HYD   (5005)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):    699.78  23.217     8.50    75.85
        + ID2= 2 (6031):   3623.18  58.118    13.25    51.37
          ===============================================
          ID = 3 (5005):   4322.96  66.515    13.00    55.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   8 **
  ****************************
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2080 5-Year Storm

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--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 83.02 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.83 |  3.25    3.32 |  6.25   14.94 |  9.25    2.52
                  .50    1.93 |  3.50    3.32 |  6.50   14.94 |  9.50    2.32
                  .75    1.96 |  3.75    3.32 |  6.75    7.90 |  9.75    2.22
                 1.00    2.03 |  4.00    3.32 |  7.00    5.38 | 10.00    2.26
                 1.25    2.13 |  4.25    4.58 |  7.25    4.98 | 10.25    2.19
                 1.50    2.19 |  4.50    5.38 |  7.50    4.98 | 10.50    2.06
                 1.75    2.22 |  4.75    6.01 |  7.75    4.98 | 10.75    1.89
                 2.00    2.32 |  5.00    7.27 |  8.00    4.98 | 11.00    1.76
                 2.25    2.32 |  5.25    9.96 |  8.25    4.25 | 11.25    1.56
                 2.50    2.32 |  5.50    9.96 |  8.50    3.65 | 11.50    1.43
                 2.75    2.49 |  5.75   39.85 |  8.75    3.19 | 11.75    1.26
                 3.00    2.82 |  6.00  109.59 |  9.00    2.82 | 12.00    1.13

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46
```



```
     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   8.521 (i)
     TIME TO PEAK   (hrs)=   8.750
     RUNOFF VOLUME   (mm)=  29.960
     TOTAL RAINFALL  (mm)=  83.020
     RUNOFF COEFFICIENT  =    .361

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88         53.82
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     773.30         40.00
     Mannings n          =       .013          .250

     Max.Eff.Inten.(mm/hr)=     109.59         74.34
                over (min)      15.00         30.00
     Storage Coeff.  (min)=       8.40 (ii)    18.19 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .09           .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       6.04          5.89          9.897 (iii)
     TIME TO PEAK   (hrs)=       6.00          6.25           6.00
     RUNOFF VOLUME   (mm)=      82.52         39.05          49.92
     TOTAL RAINFALL  (mm)=      83.02         83.02          83.02
     RUNOFF COEFFICIENT  =        .99           .47            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79         25.19
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     610.90         40.00
     Mannings n          =       .013          .250

     Max.Eff.Inten.(mm/hr)=     109.59         70.74
                over (min)      15.00         30.00
     Storage Coeff.  (min)=       7.29 (ii)    17.27 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .10           .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       5.45          2.67          7.179 (iii)
     TIME TO PEAK   (hrs)=       6.00          6.25           6.00
     RUNOFF VOLUME   (mm)=      82.52         32.47          49.99
     TOTAL RAINFALL  (mm)=      83.02         83.02          83.02
     RUNOFF COEFFICIENT  =        .99           .39            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.59        73.38
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.71 (ii)   15.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=       2.87         1.13          3.611 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      73.02        32.45          48.68
     TOTAL RAINFALL   (mm)=      83.02        83.02          83.02
     RUNOFF COEFFICIENT   =        .88          .39            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.59        68.92
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.81 (ii)   17.90 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=       6.76         3.22          8.837 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      73.02        31.67          46.14
     TOTAL RAINFALL   (mm)=      83.02        83.02          83.02
     RUNOFF COEFFICIENT   =        .88          .38            .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW      (cms)=   2.054 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  11.864
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22
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```
     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW      (cms)=    .926 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=  11.864
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.59        54.01
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.83 (ii)   16.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=       1.91         1.29          2.741 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      82.52        28.77          42.21
     TOTAL RAINFALL   (mm)=      83.02        83.02          83.02
     RUNOFF COEFFICIENT   =        .99          .35            .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.59        54.01
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.56 (ii)   16.68 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=       1.65         1.11          2.367 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      82.52        28.77          42.21
     TOTAL RAINFALL   (mm)=      83.02        83.02          83.02
     RUNOFF COEFFICIENT   =        .99          .35            .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
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                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25       24.37
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     520.40       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     109.59       54.01
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.63 (ii)  17.74 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       2.88        1.95         4.125 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      82.52       28.77         42.21
     TOTAL RAINFALL   (mm)=      83.02       83.02         83.02
     RUNOFF COEFFICIENT   =        .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   2.351 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.247
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   3.317 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  12.661
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .153

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   1.129 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  17.249
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
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```
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   3.244 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.247
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .341 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  21.857
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .263

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   7.710 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  30.821
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .371

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80       32.70
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     602.80       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     109.59       77.04
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.24 (ii)  16.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       3.80        3.82         6.324 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      82.52       40.62         51.09
     TOTAL RAINFALL   (mm)=      83.02       83.02         83.02
     RUNOFF COEFFICIENT   =        .99         .49           .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
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|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.59        79.20
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       8.18 (ii)   17.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       6.68         5.32        10.192 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      82.52        41.00         53.46
     TOTAL RAINFALL   (mm)=      83.02        83.02         83.02
     RUNOFF COEFFICIENT   =        .99          .49           .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     109.59        77.04
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.71 (ii)   19.36 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       9.42         9.65        15.753 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      82.52        40.62         51.09
     TOTAL RAINFALL   (mm)=      83.02        83.02         83.02
     RUNOFF COEFFICIENT   =        .99          .49           .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW      (cms)=   7.449 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  22.511
     TOTAL RAINFALL   (mm)=  83.020
     RUNOFF COEFFICIENT   =    .271

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
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| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      9.897        6.00       49.92
     OUTFLOW: ID= 1 (9021)     89.700      4.675        6.50       49.88

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.23
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8617

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620       .8805
                           .0150      .6000   |    .4710      1.0180
                           .1240      .7875   |    .9610      1.2660

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      3.611        6.00       48.68
     OUTFLOW: ID= 1 (9022)     24.780       .253        8.00       48.27

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.02
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8752

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):     24.78     .253     8.00    48.27
        + ID2= 2 (2021):     70.42    8.837     6.00    46.14
          ==================================================
          ID = 3 (7008):     95.20    8.847     6.00    46.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (5065) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):     95.20    8.847     6.00    46.70
        + ID2= 2 (1044):    443.50    2.054     9.75    11.86
          ==================================================
          ID = 3 (5065):    538.70    8.890     6.00    18.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990       .7350
                           .0110      .4435   |    .1630       .8595
                           .0550      .6265   |    .3050      1.0800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      2.741        6.00       42.21
     OUTFLOW: ID= 1 (9257)     26.450       .162        9.00       41.82

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.91
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8579

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
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```
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      2.367        6.00       42.21
     OUTFLOW: ID= 1 (9019)     22.700       .926        6.50       30.75

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.13
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .4529

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .926     6.50    30.75
        + ID2= 2 (2011):    40.62    4.125     6.00    42.21
          ================================================
          ID = 3 (7001):    63.32    4.402     6.00    38.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      3.317        7.25       12.66
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.6793

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      1.129        6.50       17.25
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9468

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--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730      1.6365
                           .0490     1.0690   |    .7910      1.8915
                           .2480     1.4290   |   1.4810      2.3855

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500      6.324        6.00       51.09
     OUTFLOW: ID= 1 (9258)     54.500       .786        7.25       50.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.42
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8885

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| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     15.753        6.00       51.09
     OUTFLOW: ID= 1 (9020)    145.270      1.755        7.75       51.07

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.14
                   TIME SHIFT OF PEAK FLOW         (min)=105.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  5.0902

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--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     7.45      7.00     22.51
    SHIFT ID= 1 (9029):  406.96     7.45      9.50     22.51

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08    8.521     8.75    29.96
        + ID2= 2 (9021):    89.70    4.675     6.50    49.88
          ================================================
          ID = 3 (5062):   699.78    9.834     8.50    32.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45     .162     9.00    41.82
        + ID2= 2 (7001):    63.32    4.402     6.00    38.10
          ================================================
          ID = 3 (7002):    89.77    4.411     6.00    39.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57     .000      .00      .00
        + ID2= 2 (9248):    54.89     .000      .00      .00
          ================================================
          ID = 3 (7004):   424.46     .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   10.192     6.00    53.46
        + ID2= 2 (9020):   145.27    1.755     7.75    51.07
          ================================================
          ID = 3 (7013):   227.32   10.347     6.00    51.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
```

```
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       281.05          .0800
                  34.48       278.78          .0800
                  62.07       280.75          .0800
                  75.86       280.87          .0800
                 110.34       277.13          .0800
                 124.14       276.45      .0800 / .0350  Main Channel
                 137.93       274.50          .0350      Main Channel
                 151.72       274.76          .0350      Main Channel
                 172.41       276.25          .0350      Main Channel
                 213.79       277.31          .0800
                 255.17       278.25          .0800
                 275.86       278.49          .0800
                 289.66       279.07          .0800
                 303.45       278.41          .0800
                 312.47       278.40          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)     (m)      (cu.m.)      (cms)       (m/s)      (min)
        .20   274.70    .665E+04        .6          .56     172.84
        .39   274.89    .247E+05       4.2         1.00      97.27
        .59   275.09    .478E+05      11.1         1.35      71.58
        .78   275.28    .756E+05      21.4         1.64      58.99
        .98   275.48    .108E+06      35.2         1.89      51.17
       1.17   275.67    .145E+06      52.9         2.12      45.70
       1.37   275.87    .187E+06      74.8         2.33      41.60
       1.56   276.06    .233E+06     101.2         2.53      38.37
       1.76   276.26    .284E+06     132.2         2.71      35.80
       1.95   276.45    .342E+06     160.8         2.73      35.50
       2.17   276.67    .421E+06     204.7         2.83      34.30
       2.38   276.88    .516E+06     258.7         2.91      33.25
       2.60   277.10    .627E+06     323.9         3.00      32.28
       2.82   277.32    .754E+06     402.4         3.11      31.21
       3.03   277.53    .894E+06     517.5         3.37      28.78
       3.25   277.75    .105E+07     645.6         3.58      27.06
       3.47   277.97    .122E+07     787.1         3.76      25.78
       3.68   278.18    .140E+07     942.2         3.91      24.79
       3.90   278.40    .160E+07    1110.1         4.03      24.06

                              <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.  MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)     (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96    7.45    9.50  22.51      .48      1.14
     OUTFLOW: ID= 1 (6019)  406.96    5.02   10.75  22.51      .41      1.03

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .926     9.00    11.86
        + ID2= 2 (7002):    89.77   4.411     6.00    39.20
          ==================================================
          ID = 3 (5064):   260.50   4.443     6.00    21.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   3.244     9.75    12.25
          ==================================================
          ID = 3 (9250):  1097.41   3.244     9.75     7.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50    .786     7.25    50.99
        + ID2= 2 (7013):   227.32  10.347     6.00    51.93
          ==================================================
```



```
          ID = 3 (7014):   281.82  10.386     6.00    51.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   4.8100     1.1900
                           .4200      .6400   |  14.3300     1.2700
                          1.5900      .9400   |  53.8000     1.3300
                          3.2000     1.1100   |    .0000      .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      3.244        9.75        7.51
     OUTFLOW: ID= 1 (9018)   1097.411      3.231       10.00        7.51

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.61
                TIME SHIFT OF PEAK FLOW         (min)= 15.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  1.1118

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   7.710     8.50    30.82
        + ID2= 2 (7014):   281.82  10.386     6.00    51.75
          ==================================================
          ID = 3 (5061):   769.44  11.175     6.00    38.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33          .0800
                  46.71       277.77          .0800
                  57.10       277.40          .0800
                  62.29       276.96          .0800
                  67.48       275.94          .0800
                  77.86       273.27          .0800
                  83.05       272.29          .0800
                  93.43       270.99          .0800
                 109.00       270.02          .0350      Main Channel
                 119.38       270.02          .0350      Main Channel
                 150.53       271.36      .0350 / .0800  Main Channel
                 186.86       273.45          .0800
                 207.62       274.37          .0800
                 233.57       275.12          .0800
                 247.79       275.41          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)     (m)      (cu.m.)      (cms)       (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81      43.21
        .57   270.59    .257E+05      13.9         1.14      30.76
        .85   270.87    .484E+05      32.0         1.39      25.24
       1.13   271.15    .776E+05      59.6         1.61      21.71
       1.42   271.44    .112E+06     100.0         1.87      18.71
       1.70   271.72    .151E+06     157.2         2.18      16.04
       1.99   272.01    .195E+06     225.9         2.44      14.37
       2.27   272.29    .242E+06     305.9         2.65      13.21
       2.55   272.57    .294E+06     398.1         2.84      12.31
       2.84   272.86    .350E+06     501.8         3.01      11.61
       3.12   273.14    .409E+06     617.0         3.17      11.05
       3.40   273.42    .472E+06     744.3         3.31      10.58
       3.69   273.71    .539E+06     882.9         3.44      10.18
       3.97   273.99    .611E+06    1033.6         3.55       9.85
       4.26   274.28    .687E+06    1196.8         3.66       9.57
       4.54   274.56    .768E+06    1370.2         3.75       9.35
       4.82   274.84    .856E+06    1556.4         3.82       9.16
       5.11   275.13    .950E+06    1757.0         3.89       9.01
       5.39   275.41    .105E+07    1967.6         3.93       8.91
```

```
                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     3.23   10.00   7.51       .25       .81
     OUTFLOW: ID= 1 (9251) 1097.41     3.07   11.25   7.51       .24       .81

 ------------------------------------------------------------------------------

  ADD HYD   (7016)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5061):   769.44  11.175     6.00    38.49
         + ID2= 2 (6019):   406.96   5.018    10.75    22.51
           ==================================================
           ID = 3 (7016):  1176.40  12.898    10.25    32.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5000) |
 |   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (1047):   479.57   2.351     9.75    12.25
         + ID2= 2 (9251):  1097.41   3.068    11.25     7.51
           ==================================================
           ID = 3 (5000):  1576.98   5.267    10.75     8.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5001) |
 |   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5064):   260.50   4.443     6.00    21.28
         + ID2= 2 (5000):  1576.98   5.267    10.75     8.95
           ==================================================
           ID = 3 (5001):  1837.48   6.478    10.50    10.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

  RESERVOIR (9017)
  IN= 2---> OUT= 1
  DT= 15.0 min          OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000   |   2.8300     3.4900
                          .2800      .2500   |   3.8200     3.9500
                          .7100      .6300   |   4.6700     4.2000
                         1.1300     1.1400   |   7.3600     4.6900
                         1.5600     1.7300   |   8.7800     4.8500
                         1.8400     2.2600   |  35.4000     6.6100
                         2.2700     2.9600   |  *******     8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      6.478       10.50       10.70
     OUTFLOW: ID= 1 (9017)   1837.481      6.142       11.50       10.70

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.82
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.4708

 ------------------------------------------------------------------------------

  ADD HYD   (9041)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5065):   538.70   8.890     6.00    18.02
         + ID2= 2 (9017):  1837.48   6.142    11.50    10.70
           ==================================================
           ID = 3 (9041):  2376.18   9.375     6.00    12.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```



```
 --------------------
 | ADD HYD   (5002) |
 |   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (2031):    55.98   7.179     6.00    49.99
         + ID2= 2 (9041):  2376.18   9.375     6.00    12.36
           ==================================================
           ID = 3 (5002):  2432.16  16.554     6.00    13.22

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9040) |
 | IN= 2---> OUT= 1 |
 | SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
 --------------------      (ha)     (cms)     (hrs)      (mm)
           ID= 2 (5002): 2432.16     16.55      6.00     13.22
     SHIFT ID= 1 (9040): 2432.16     16.55      7.00     13.22

 ------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6029) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation       Manning
                     .00        274.29          .0800
                   30.80        273.73          .0800
                   51.30        270.17          .0800
                   61.60        266.84          .0800
                   66.80        266.02          .0800
                  102.70        265.42          .0350      Main Channel
                  123.20        261.00          .0350      Main Channel
                  128.40        261.17          .0350      Main Channel
                  154.00        264.62          .0350      Main Channel
                  174.60        266.82          .0800
                  205.40        268.07          .0800
                  236.20        268.74          .0800
                  282.40        271.31          .0800
                  302.90        272.11          .0800
                  348.90        274.45          .0800

       <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH     ELEV       VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)       (cu.m.)       (cms)       (m/s)       (min)
         .63    261.63     .702E+04        5.2          1.14       22.47
        1.26    262.26     .220E+05       24.8          1.74       14.74
        1.89    262.89     .443E+05       64.0          2.22       11.54
        2.53    263.53     .741E+05      127.4          2.65        9.69
        3.16    264.16     .111E+06      219.6          3.04        8.44
        3.79    264.79     .156E+06      343.2          3.39        7.57
        4.42    265.42     .209E+06      501.2          3.70        6.94
        5.16    266.16     .304E+06      766.4          3.88        6.61
        5.90    266.90     .428E+06     1123.8          4.05        6.34
        6.64    267.64     .570E+06     1628.6          4.40        5.84
        7.38    268.38     .738E+06     2225.4          4.65        5.53
        8.12    269.12     .941E+06     2928.9          4.80        5.35
        8.85    269.85     .116E+07     3743.0          4.95        5.18
        9.59    270.59     .141E+07     4656.3          5.10        5.03
       10.33    271.33     .167E+07     5671.9          5.24        4.90
       11.07    272.07     .195E+07     6784.6          5.36        4.80
       11.81    272.81     .226E+07     8029.1          5.47        4.69
       12.55    273.55     .259E+07     9393.0          5.59        4.60
       13.29    274.29     .295E+07    10648.3          5.55        4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    16.55    7.00  13.22      1.00      1.43
     OUTFLOW: ID= 1 (6029) 2432.16    10.77    7.25  13.22       .81      1.26

 ------------------------------------------------------------------------------

  ADD HYD   (5003)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (6029):  2432.16  10.774     7.25    13.22
         + ID2= 2 (1040):    14.62    .341     6.75    21.86
           ==================================================
```

```
          ID = 3 (5003):  2446.78  11.054     7.25    13.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------

  ADD HYD   (5004)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  11.054     7.25    13.28
        + ID2= 2 (7016):  1176.40  12.898    10.25    32.96
          ==================================================
          ID = 3 (5004):  3623.18  20.917     7.25    19.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9015) |
 | IN= 2---> OUT= 1 |
 | SHIFT=120.0 min  |       AREA     QPEAK     TPEAK      R.V.
 --------------------       (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    20.92      7.25     19.67
    SHIFT ID= 1 (9015): 3623.18    20.92      9.25     19.67

 -------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6031) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                     .00        260.30         .0800
                   34.10        260.43         .0800
                   62.40        259.79         .0800
                   79.50        255.72         .0800
                  113.50        254.00         .0800
                  153.30        253.33         .0350     Main Channel
                  187.30        253.06         .0350     Main Channel
                  198.70        251.88         .0350     Main Channel
                  204.40        252.61         .0350     Main Channel
                  249.80        254.00         .0800
                  334.90        255.77         .0800
                  351.90        256.37         .0800
                  414.40        260.24         .0800
                  465.50        260.75         .0800
                  514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .36   252.24    .596E+04        .4          .39      223.90
        .73   252.61    .238E+05       2.8          .61      141.05
       1.09   252.97    .619E+05       8.2          .69      126.14
       1.45   253.33    .151E+06      18.8          .65      134.06
       1.91   253.79    .383E+06      68.4          .93       93.14
       2.38   254.26    .713E+06     157.3         1.15       75.58
       2.84   254.72    .112E+07     287.3         1.33       65.13
       3.31   255.19    .161E+07     454.2         1.47       59.01
       3.77   255.65    .217E+07     659.0         1.58       54.87
       4.24   256.12    .279E+07     908.7         1.69       51.25
       4.70   256.58    .346E+07    1199.1         1.80       48.03
       5.17   257.05    .414E+07    1527.9         1.92       45.17
       5.63   257.51    .485E+07    1892.4         2.03       42.71
       6.10   257.98    .558E+07    2291.8         2.13       40.59
       6.56   258.44    .634E+07    2725.7         2.23       38.74
       7.03   258.91    .711E+07    3193.6         2.33       37.12
       7.49   259.37    .791E+07    3695.3         2.43       35.69
       7.96   259.84    .874E+07    4221.9         2.51       34.48
       8.42   260.30    .961E+07    4697.6         2.54       34.09

                                 <---- hydrograph ---->   <-pipe / channel->
                           AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                           (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
    INFLOW : ID= 2 (9015) 3623.18   20.92    9.25  19.67      1.47       .65
    OUTFLOW: ID= 1 (6031) 3623.18   16.42   14.50  19.67      1.37       .65

 -------------------------------------------------------------------------------

  ADD HYD   (5005)
```


5005

```
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   9.834     8.50    32.51
        + ID2= 2 (6031):  3623.18  16.417    14.50    19.67
          ==================================================
          ID = 3 (5005):  4322.96  19.508    12.50    21.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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   ****************************
   ** SIMULATION NUMBER:   9 **
   ****************************
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2080 100-Year Storm

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 --------------------
 | MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
 |                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal=163.64 mm |    Comments: SCS 24 HR MASS CURVE
 --------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .25    3.60 |  3.25    6.55 |  6.25   29.46 |  9.25    4.97
                 .50    3.80 |  3.50    6.55 |  6.50   29.46 |  9.50    4.58
                 .75    3.86 |  3.75    6.55 |  6.75   15.58 |  9.75    4.39
                1.00    3.99 |  4.00    6.55 |  7.00   10.60 | 10.00    4.45
                1.25    4.19 |  4.25    9.03 |  7.25    9.82 | 10.25    4.32
                1.50    4.32 |  4.50   10.60 |  7.50    9.82 | 10.50    4.06
                1.75    4.39 |  4.75   11.85 |  7.75    9.82 | 10.75    3.73
                2.00    4.58 |  5.00   14.33 |  8.00    9.82 | 11.00    3.47
                2.25    4.58 |  5.25   19.64 |  8.25    8.38 | 11.25    3.08
                2.50    4.58 |  5.50   19.64 |  8.50    7.20 | 11.50    2.81
                2.75    4.91 |  5.75   78.55 |  8.75    6.28 | 11.75    2.49
                3.00    5.56 |  6.00  216.00 |  9.00    5.56 | 12.00    2.23

 -------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=  26.345 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  90.754
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .555

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 --------------------
 | CALIB            |
 | STANDHYD  (2050) |   Area    (ha)=  89.70
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88         53.82
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     773.30         40.00
     Mannings n           =       .013          .250

     Max.Eff.Inten.(mm/hr)=     216.00        199.57
                over (min)      15.00         15.00
     Storage Coeff.  (min)=       6.41 (ii)   13.00 (ii)
     Unit Hyd. Tpeak (min)=      15.00         15.00
     Unit Hyd. peak  (cms)=        .10           .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=      12.60         22.46         35.058 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.00           6.00
     RUNOFF VOLUME    (mm)=     163.14        105.05         119.57
     TOTAL RAINFALL   (mm)=     163.64        163.64         163.64
     RUNOFF COEFFICIENT   =       1.00           .64            .73

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
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      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79       25.19
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     610.90       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     216.00      202.49
                over (min)      15.00       15.00
     Storage Coeff.  (min)=       5.56 (ii)   12.11 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=        .11         .08
                                                             *TOTALS*
     PEAK FLOW       (cms)=      11.24       10.93         22.163 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.00           6.00
     RUNOFF VOLUME    (mm)=     163.14       92.27         117.07
     TOTAL RAINFALL   (mm)=     163.64      163.64         163.64
     RUNOFF COEFFICIENT   =       1.00         .56            .72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87        9.91
     Dep. Storage     (mm)=      10.00        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     406.40       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     216.00      210.03
                over (min)      15.00       15.00
     Storage Coeff.  (min)=       4.35 (ii)   10.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=        .11         .08
                                                             *TOTALS*
     PEAK FLOW       (cms)=       5.82        4.66         10.480 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.00           6.00
     RUNOFF VOLUME    (mm)=     153.64       92.19         116.77
     TOTAL RAINFALL   (mm)=     163.64      163.64         163.64
     RUNOFF COEFFICIENT   =        .94         .56            .71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73       31.69
     Dep. Storage     (mm)=      10.00        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     685.20       40.00
     Mannings n          =       .013        .250
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     Max.Eff.Inten.(mm/hr)=     216.00      198.84
                over (min)      15.00       15.00
     Storage Coeff.  (min)=       5.96 (ii)   12.56 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=        .10         .08
                                                             *TOTALS*
     PEAK FLOW       (cms)=      14.00       13.29         27.297 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.00           6.00
     RUNOFF VOLUME    (mm)=     153.64       90.63         112.68
     TOTAL RAINFALL   (mm)=     163.64      163.64         163.64
     RUNOFF COEFFICIENT   =        .94         .55            .69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=  10.352 (i)
     TIME TO PEAK    (hrs)=   9.250
     RUNOFF VOLUME    (mm)=  56.238
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .344

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=   4.780 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  56.238
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .344

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58       15.87
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     419.90       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     216.00      160.56
                over (min)      15.00       15.00
     Storage Coeff.  (min)=       4.44 (ii)   11.63 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=        .11         .08
                                                             *TOTALS*
     PEAK FLOW       (cms)=       3.88        5.53          9.412 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.00           6.00
     RUNOFF VOLUME    (mm)=     163.14       84.61         104.25
     TOTAL RAINFALL   (mm)=     163.64      163.64         163.64
     RUNOFF COEFFICIENT   =       1.00         .52            .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
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      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     216.00       160.56
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       4.24 (ii)   11.43 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=       3.34         4.78          8.121 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     163.14        84.61        104.25
     TOTAL RAINFALL   (mm)=     163.64       163.64        163.64
     RUNOFF COEFFICIENT   =       1.00          .52           .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     216.00       160.56
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.05 (ii)   12.24 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                           *TOTALS*
     PEAK FLOW       (cms)=       5.89         8.33         14.215 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     163.14        84.61        104.25
     TOTAL RAINFALL   (mm)=     163.64       163.64        163.64
     RUNOFF COEFFICIENT   =       1.00          .52           .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB
| NASHYD    (1047)     Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min     Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=  11.800 (i)
     TIME TO PEAK    (hrs)=   9.250
     RUNOFF VOLUME    (mm)=  57.584
     TOTAL RAINFALL   (mm)= 163.640
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     RUNOFF COEFFICIENT   =    .352

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=  16.452 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  55.472
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .339

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   5.334 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  69.658
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=  16.241 (i)
     TIME TO PEAK    (hrs)=   9.250
     RUNOFF VOLUME    (mm)=  57.584
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .352

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=   1.161 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  72.173
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .441

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=  23.751 (i)
     TIME TO PEAK    (hrs)=   8.250
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```
     RUNOFF VOLUME    (mm)=  92.548
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .566

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     216.00       203.46
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.52 (ii)   12.06 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       7.82        14.35         22.177 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     163.14       107.51        121.42
     TOTAL RAINFALL   (mm)=     163.64       163.64        163.64
     RUNOFF COEFFICIENT   =       1.00          .66           .74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     216.00       208.38
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       6.24 (ii)   12.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .08
                                                          *TOTALS*
     PEAK FLOW       (cms)=      13.89        19.87         33.759 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     163.14       108.18        124.67
     TOTAL RAINFALL   (mm)=     163.64       163.64        163.64
     RUNOFF COEFFICIENT   =       1.00          .66           .76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
```



```
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     216.00       203.46
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       7.40 (ii)   13.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .10          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=      19.86        36.03         55.894 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.00
     RUNOFF VOLUME    (mm)=     163.14       107.51        121.42
     TOTAL RAINFALL   (mm)=     163.64       163.64        163.64
     RUNOFF COEFFICIENT   =       1.00          .66           .74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
  CALIB
  NASHYD    (1060)     Area    (ha)= 406.96   Curve Number   (CN)= 60.0
 ID= 1 DT=15.0 min     Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=  25.427 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  73.803
     TOTAL RAINFALL   (mm)= 163.640
     RUNOFF COEFFICIENT   =    .451

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000      .9900
                           .0290      .3700   |   2.7000     1.4200
                           .5000      .6900   |   6.1000     2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     35.058        6.00     119.57
     OUTFLOW: ID= 1 (9021)     89.700     14.535        6.25     119.53

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.46
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.1333

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620      .8805
                           .0150      .6000   |    .4710     1.0180
                           .1240      .7875   |    .9610     1.2660

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780     10.480        6.00     116.77
     OUTFLOW: ID= 1 (9022)     24.780      1.840        6.50     116.36

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.55
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.7162

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (9022):    24.78   1.840     6.50   116.36
        + ID2= 2 (2021):    70.42  27.297     6.00   112.68
          ===============================================
          ID = 3 (7008):    95.20  28.072     6.00   113.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

 ADD HYD   (5065) |
   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20  28.072     6.00   113.64
        + ID2= 2 (1044):   443.50  10.352     9.25    56.24
          ===============================================
          ID = 3 (5065):   538.70  28.519     6.00    66.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990      .7350
                           .0110      .4435   |    .1630      .8595
                           .0550      .6265   |    .3050     1.0800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      9.412        6.00      104.25
     OUTFLOW: ID= 1 (9257)     26.450       .795        7.00      103.86

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.45
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8435

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800      .5900
                           .0000      .2600   |   1.2200      .7400
                           .5700      .3500   |   1.3500      .9300
                           .9900      .4700   |   2.8300      .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      8.121        6.00      104.25
     OUTFLOW: ID= 1 (9019)     22.700      3.917        6.25       92.79

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 48.24
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0963

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70   3.917     6.25    92.79
        + ID2= 2 (2011):    40.62  14.215     6.00   104.25
          ===============================================
          ID = 3 (7001):    63.32  15.467     6.00   100.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     16.452        7.25       55.47
```



```
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)= 20.5009

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      5.334        6.50       69.66
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.8236

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730     1.6365
                           .0490     1.0690   |    .7910     1.8915
                           .2480     1.4290   |   1.4810     2.3855

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500     22.177        6.00      121.42
     OUTFLOW: ID= 1 (9258)     54.500      3.645        6.75      121.32

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.43
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.9736

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200     5.0000
                           .2200     3.0000   |   2.5000     7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     55.894        6.00      121.42
     OUTFLOW: ID= 1 (9020)    145.270      4.424        7.25      121.39

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.91
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)= 11.9496

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK       R.V.
--------------------      (ha)     (cms)     (hrs)       (mm)
           ID= 2 (1060):  406.96    25.43      7.00     73.80
     SHIFT ID= 1 (9029):  406.96    25.43      9.50     73.80

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--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08  26.345     8.75    90.75
        + ID2= 2 (9021):    89.70  14.535     6.25   119.53
          ===============================================
          ID = 3 (5062):   699.78  28.987     8.25    94.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45     .795     7.00   103.86
        + ID2= 2 (7001):    63.32   15.467     6.00   100.14
          ==================================================
          ID = 3 (7002):    89.77   15.769     6.00   101.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57     .000      .00      .00
        + ID2= 2 (9248):    54.89     .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46     .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   33.759     6.00   124.67
        + ID2= 2 (9020):   145.27    4.424     7.25   121.39
          ==================================================
          ID = 3 (7013):   227.32   36.085     6.00   122.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation      Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)       (min)
        .20   274.70    .665E+04        .6           .56      172.84
        .39   274.89    .247E+05       4.2          1.00       97.27
        .59   275.09    .478E+05      11.1          1.35       71.58
        .78   275.28    .756E+05      21.4          1.64       58.99
        .98   275.48    .108E+06      35.2          1.89       51.17
       1.17   275.67    .145E+06      52.9          2.12       45.70
       1.37   275.87    .187E+06      74.8          2.33       41.60
       1.56   276.06    .233E+06     101.2          2.53       38.37
       1.76   276.26    .284E+06     132.2          2.71       35.80
       1.95   276.45    .342E+06     160.8          2.73       35.50
       2.17   276.67    .421E+06     204.7          2.83       34.30
       2.38   276.88    .516E+06     258.7          2.91       33.25
       2.60   277.10    .627E+06     323.9          3.00       32.28
       2.82   277.32    .754E+06     402.4          3.11       31.21
       3.03   277.53    .894E+06     517.5          3.37       28.78
       3.25   277.75    .105E+07     645.6          3.58       27.06
       3.47   277.97    .122E+07     787.1          3.76       25.78
       3.68   278.18    .140E+07     942.2          3.91       24.79
       3.90   278.40    .160E+07    1110.1          4.03       24.06
```



```
                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96    25.43    9.50  73.80       .84      1.71
     OUTFLOW: ID= 1 (6019)  406.96    19.83   10.25  73.80       .75      1.59

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--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    4.780     8.50    56.24
        + ID2= 2 (7002):    89.77   15.769     6.00   101.23
          ==================================================
          ID = 3 (5064):   260.50   16.099     6.00    71.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46     .000      .00      .00
        + ID2= 2 (1046):   672.95   16.241     9.25    57.58
          ==================================================
          ID = 3 (9250):  1097.41   16.241     9.25    35.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50    3.645     6.75   121.32
        + ID2= 2 (7013):   227.32   36.085     6.00   122.58
          ==================================================
          ID = 3 (7014):   281.82   37.782     6.00   122.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |        OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------         (cms)     (ha.m.)   |   (cms)     (ha.m.)
                              .0000      .0000   |   4.8100     1.1900
                              .4200      .6400   |  14.3300     1.2700
                             1.5900      .9400   |  53.8000     1.3300
                             3.2000     1.1100   |    .0000      .0000

                                   AREA      QPEAK       TPEAK       R.V.
                                   (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)    1097.411     16.241        9.25       35.31
     OUTFLOW: ID= 1 (9018)    1097.411     16.528        9.25       35.31

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=101.77
                  TIME SHIFT OF PEAK FLOW         (min)=   .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.3075

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                    CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   23.751     8.25    92.55
        + ID2= 2 (7014):   281.82   37.782     6.00   122.33
          ==================================================
          ID = 3 (5061):   769.44   41.349     6.00   103.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33         .0800
                  46.71       277.77         .0800
                  57.10       277.40         .0800
                  62.29       276.96         .0800
                  67.48       275.94         .0800
                  77.86       273.27         .0800
                  83.05       272.29         .0800
                  93.43       270.99         .0800
                 109.00       270.02         .0350      Main Channel
                 119.38       270.02         .0350      Main Channel
                 150.53       271.36     .0350 / .0800  Main Channel
                 186.86       273.45         .0800
                 207.62       274.37         .0800
                 233.57       275.12         .0800
                 247.79       275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28    270.30    .950E+04      3.7          .81       43.21
        .57    270.59    .257E+05     13.9         1.14       30.76
        .85    270.87    .484E+05     32.0         1.39       25.24
       1.13    271.15    .776E+05     59.6         1.61       21.71
       1.42    271.44    .112E+06    100.0         1.87       18.71
       1.70    271.72    .151E+06    157.2         2.18       16.04
       1.99    272.01    .195E+06    225.9         2.44       14.37
       2.27    272.29    .242E+06    305.9         2.65       13.21
       2.55    272.57    .294E+06    398.1         2.84       12.31
       2.84    272.86    .350E+06    501.8         3.01       11.61
       3.12    273.14    .409E+06    617.0         3.17       11.05
       3.40    273.42    .472E+06    744.3         3.31       10.58
       3.69    273.71    .539E+06    882.9         3.44       10.18
       3.97    273.99    .611E+06   1033.6         3.55        9.85
       4.26    274.28    .687E+06   1196.8         3.66        9.57
       4.54    274.56    .768E+06   1370.2         3.75        9.35
       4.82    274.84    .856E+06   1556.4         3.82        9.16
       5.11    275.13    .950E+06   1757.0         3.89        9.01
       5.39    275.41    .105E+07   1967.6         3.93        8.91

                             <---- hydrograph ---->   <-pipe / channel->
                       AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                       (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41    16.53    9.25  35.31       .61      1.17
     OUTFLOW: ID= 1 (9251) 1097.41    15.98    9.75  35.31       .60      1.16

-------------------------------------------------------------------------------

 ADD HYD   (7016)
   1 +  2 =  3             AREA    QPEAK    TPEAK     R.V.
                           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  41.349    6.00   103.46
        + ID2= 2 (6019):   406.96  19.830   10.25    73.80
          ==================================================
          ID = 3 (7016):  1176.40  43.235   10.00    93.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57  11.800    9.25    57.58
        + ID2= 2 (9251):  1097.41  15.985    9.75    35.31
          ==================================================
          ID = 3 (5000):  1576.98  27.637    9.50    42.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
```



```
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50  16.099    6.00    71.74
        + ID2= 2 (5000):  1576.98  27.637    9.50    42.08
          ==================================================
          ID = 3 (5001):  1837.48  33.811    9.25    46.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 RESERVOIR (9017)
 IN= 2---> OUT= 1
 DT= 15.0 min              OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000    |   2.8300     3.4900
                            .2800      .2500    |   3.8200     3.9500
                            .7100      .6300    |   4.6700     4.2000
                           1.1300     1.1400    |   7.3600     4.6900
                           1.5600     1.7300    |   8.7800     4.8500
                           1.8400     2.2600    |  35.4000     6.6100
                           2.2700     2.9600    |  *******     8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)    1837.481     33.811        9.25       46.29
     OUTFLOW: ID= 1 (9017)    1837.481     33.714        9.50       46.29

                  PEAK    FLOW   REDUCTION [Qout/Qin](%)= 99.71
                  TIME SHIFT OF PEAK FLOW        (min)= 15.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  6.5013

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 ADD HYD   (9041)
   1 +  2 =  3             AREA    QPEAK    TPEAK     R.V.
                           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70  28.519    6.00    66.38
        + ID2= 2 (9017):  1837.48  33.714    9.50    46.29
          ==================================================
          ID = 3 (9041):  2376.18  45.563    9.25    50.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98  22.163    6.00   117.07
        + ID2= 2 (9041):  2376.18  45.563    9.25    50.84
          ==================================================
          ID = 3 (5002):  2432.16  52.090    6.00    52.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16     52.09      6.00     52.37
    SHIFT ID= 1 (9040): 2432.16     52.09      7.00     52.37

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29         .0800
                  30.80       273.73         .0800
                  51.30       270.17         .0800
                  61.60       266.84         .0800
                  66.80       266.02         .0800
                 102.70       265.42         .0350      Main Channel
                 123.20       261.00         .0350      Main Channel
                 128.40       261.17         .0350      Main Channel
                 154.00       264.62         .0350      Main Channel
                 174.60       266.82         .0800
```

```
                 205.40         268.07          .0800
                 236.20         268.74          .0800
                 282.40         271.31          .0800
                 302.90         272.11          .0800
                 348.90         274.45          .0800

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV       VOLUME     FLOW RATE    VELOCITY    TRAV.TIME
        (m)       (m)      (cu.m.)       (cms)        (m/s)       (min)
         .63    261.63    .702E+04        5.2          1.14       22.47
        1.26    262.26    .220E+05       24.8          1.74       14.74
        1.89    262.89    .443E+05       64.0          2.22       11.54
        2.53    263.53    .741E+05      127.4          2.65        9.69
        3.16    264.16    .111E+06      219.6          3.04        8.44
        3.79    264.79    .156E+06      343.2          3.39        7.57
        4.42    265.42    .209E+06      501.2          3.70        6.94
        5.16    266.16    .304E+06      766.4          3.88        6.61
        5.90    266.90    .428E+06     1123.8          4.05        6.34
        6.64    267.64    .570E+06     1628.6          4.40        5.84
        7.38    268.38    .738E+06     2225.4          4.65        5.53
        8.12    269.12    .941E+06     2928.9          4.80        5.35
        8.85    269.85    .116E+07     3743.0          4.95        5.18
        9.59    270.59    .141E+07     4656.3          5.10        5.03
       10.33    271.33    .167E+07     5671.9          5.24        4.90
       11.07    272.07    .195E+07     6784.6          5.36        4.80
       11.81    272.81    .226E+07     8029.1          5.47        4.69
       12.55    273.55    .259E+07     9393.0          5.59        4.60
       13.29    274.29    .295E+07    10648.3          5.55        4.62

                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    52.09    7.00  52.37      1.70      2.05
     OUTFLOW: ID= 1 (6029) 2432.16    46.19   10.50  52.37      1.60      1.97

-------------------------------------------------------------------------------

 | ADD HYD   (5003) |
 |   1 +  2 =  3    |           AREA    QPEAK    TPEAK     R.V.
 --------------------           (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (6029):  2432.16  46.186    10.50    52.37
         + ID2= 2 (1040):    14.62   1.161     6.75    72.17
           ==================================================
           ID = 3 (5003):  2446.78  46.334    10.50    52.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 | ADD HYD   (5004) |
 |   1 +  2 =  3    |           AREA    QPEAK    TPEAK     R.V.
 --------------------           (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5003):  2446.78  46.334    10.50    52.49
         + ID2= 2 (7016):  1176.40  43.235    10.00    93.20
           ==================================================
           ID = 3 (5004):  3623.18  88.924    10.25    65.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |       AREA     QPEAK     TPEAK      R.V.
--------------------       (ha)     (cms)     (hrs)      (mm)
           ID= 2 (5004): 3623.18    88.92     10.25     65.71
     SHIFT ID= 1 (9015): 3623.18    88.92     12.25     65.71

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00         260.30          .0800
                  34.10         260.43          .0800
                  62.40         259.79          .0800
                  79.50         255.72          .0800
                 113.50         254.00          .0800
```



```
                 153.30         253.33          .0350      Main Channel
                 187.30         253.06          .0350      Main Channel
                 198.70         251.88          .0350      Main Channel
                 204.40         252.61          .0350      Main Channel
                 249.80         254.00          .0800
                 334.90         255.77          .0800
                 351.90         256.37          .0800
                 414.40         260.24          .0800
                 465.50         260.75          .0800
                 514.40         261.48          .0800

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV       VOLUME     FLOW RATE    VELOCITY    TRAV.TIME
        (m)       (m)      (cu.m.)       (cms)        (m/s)       (min)
         .36    252.24    .596E+04         .4           .39      223.90
         .73    252.61    .238E+05        2.8           .61      141.05
        1.09    252.97    .619E+05        8.2           .69      126.14
        1.45    253.33    .151E+06       18.8           .65      134.06
        1.91    253.79    .383E+06       68.4           .93       93.14
        2.38    254.26    .713E+06      157.3          1.15       75.58
        2.84    254.72    .112E+07      287.3          1.33       65.13
        3.31    255.19    .161E+07      454.2          1.47       59.01
        3.77    255.65    .217E+07      659.0          1.58       54.87
        4.24    256.12    .279E+07      908.7          1.69       51.25
        4.70    256.58    .346E+07     1199.1          1.80       48.03
        5.17    257.05    .414E+07     1527.9          1.92       45.17
        5.63    257.51    .485E+07     1892.4          2.03       42.71
        6.10    257.98    .558E+07     2291.8          2.13       40.59
        6.56    258.44    .634E+07     2725.7          2.23       38.74
        7.03    258.91    .711E+07     3193.6          2.33       37.12
        7.49    259.37    .791E+07     3695.3          2.43       35.69
        7.96    259.84    .874E+07     4221.9          2.51       34.48
        8.42    260.30    .961E+07     4697.6          2.54       34.09

                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    88.92   12.25  65.71      2.02       .97
     OUTFLOW: ID= 1 (6031) 3623.18    78.05   13.25  65.71      1.96       .95

-------------------------------------------------------------------------------

 | ADD HYD   (5005) |
 |   1 +  2 =  3    |           AREA    QPEAK    TPEAK     R.V.
 --------------------           (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5062):   699.78  28.987     8.25    94.44
         + ID2= 2 (6031):  3623.18  78.046    13.25    65.71
           ==================================================
           ID = 3 (5005):  4322.96  88.506    12.75    70.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

 FINISH
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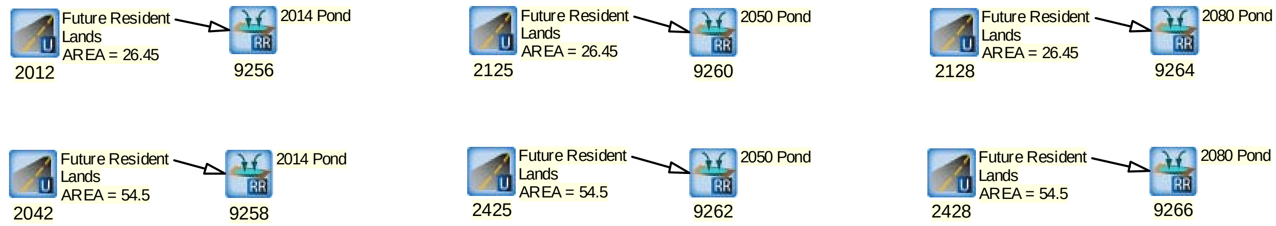
```

SWM Pond Storage Requirements VO2 Schematic



```
==================================================================================================
==
       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Pond Evalua
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Pond Evalua


DATE: 12/12/2014                           TIME: 10:35:21 AM

USER:


COMMENTS: ____________________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************
```

Current 5-Year Storm

```
--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 60.45 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.33 |  3.25    2.42 |  6.25   10.88 |  9.25    1.84
                  .50    1.40 |  3.50    2.42 |  6.50   10.88 |  9.50    1.69
                  .75    1.43 |  3.75    2.42 |  6.75    5.75 |  9.75    1.62
                 1.00    1.47 |  4.00    2.42 |  7.00    3.92 | 10.00    1.64
                 1.25    1.55 |  4.25    3.34 |  7.25    3.63 | 10.25    1.60
                 1.50    1.60 |  4.50    3.92 |  7.50    3.63 | 10.50    1.50
                 1.75    1.62 |  4.75    4.38 |  7.75    3.63 | 10.75    1.38
                 2.00    1.69 |  5.00    5.30 |  8.00    3.63 | 11.00    1.28
                 2.25    1.69 |  5.25    7.25 |  8.25    3.10 | 11.25    1.14
                 2.50    1.69 |  5.50    7.25 |  8.50    2.66 | 11.50    1.04
                 2.75    1.81 |  5.75   29.02 |  8.75    2.32 | 11.75     .92
                 3.00    2.06 |  6.00   79.79 |  9.00    2.06 | 12.00     .82

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.61 (ii)   20.50 (ii)
```



```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.36          .68          1.792 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.22 (ii)   20.01 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.69         2.15          4.075 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9256) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .0990      .7350
                          .0110      .4435    |    .1630      .8595
                          .0550      .6265    |    .3050     1.0800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)      26.450      1.792        6.00      27.45
     OUTFLOW: ID= 1 (9256)      26.450       .055       11.25      27.06

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.06
                   TIME SHIFT OF PEAK FLOW         (min)=315.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6262

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .4730     1.6365
                          .0490     1.0690    |    .7910     1.8915
                          .2480     1.4290    |   1.4810     2.3855

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)      54.500      4.075        6.00      33.50
     OUTFLOW: ID= 1 (9258)      54.500       .248        9.00      33.39
```

```
                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.08
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.4289

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   ****************************
   ** SIMULATION NUMBER:   5 **
   ****************************
```

Current 100-Year Storm

```
 --------------------
 | MASS STORM        |    Filename: V:\01606\Active\160621777\SWM Master Plans
 |                   |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal=104.07 mm  |    Comments: SCS 24 HR MASS CURVE
 --------------------
                          Duration of storm    = 12.00 hrs
                          Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    2.29 |  3.25    4.16 |  6.25   18.73 |  9.25    3.16
                  .50    2.41 |  3.50    4.16 |  6.50   18.73 |  9.50    2.91
                  .75    2.46 |  3.75    4.16 |  6.75    9.91 |  9.75    2.79
                 1.00    2.54 |  4.00    4.16 |  7.00    6.74 | 10.00    2.83
                 1.25    2.66 |  4.25    5.74 |  7.25    6.24 | 10.25    2.75
                 1.50    2.75 |  4.50    6.74 |  7.50    6.24 | 10.50    2.58
                 1.75    2.79 |  4.75    7.53 |  7.75    6.24 | 10.75    2.37
                 2.00    2.91 |  5.00    9.12 |  8.00    6.24 | 11.00    2.21
                 2.25    2.91 |  5.25   12.49 |  8.25    5.33 | 11.25    1.96
                 2.50    2.91 |  5.50   12.49 |  8.50    4.58 | 11.50    1.79
                 2.75    3.12 |  5.75   49.95 |  8.75    4.00 | 11.75    1.58
                 3.00    3.54 |  6.00  137.37 |  9.00    3.54 | 12.00    1.42

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | STANDHYD  (2012)  |   Area    (ha)=  26.45
 |ID= 1 DT=15.0 min  |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)      15.00        15.00
     Storage Coeff.  (min)=       5.32 (ii)   14.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.42         2.43          4.852 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  58.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | STANDHYD  (2042)  |   Area    (ha)=  54.50
 |ID= 1 DT=15.0 min  |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       108.14
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       6.61 (ii)   15.03 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
```



```
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.84         5.60          8.616 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        56.93          68.59
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .55            .66

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  71.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (9256) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |    .0990      .7350
                           .0110      .4435    |    .1630      .8595
                           .0550      .6265    |    .3050     1.0800

                                 AREA      QPEAK       TPEAK        R.V.
                                 (ha)      (cms)       (hrs)        (mm)
     INFLOW : ID= 2 (2012)     26.450      4.852        6.00       57.25
     OUTFLOW: ID= 1 (9256)     26.450       .305        8.25       56.86

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.28
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0799

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (9258) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |    .4730     1.6365
                           .0490     1.0690    |    .7910     1.8915
                           .2480     1.4290    |   1.4810     2.3855

                                 AREA      QPEAK       TPEAK        R.V.
                                 (ha)      (cms)       (hrs)        (mm)
     INFLOW : ID= 2 (2042)     54.500      8.616        6.00       68.59
     OUTFLOW: ID= 1 (9258)     54.500      1.479        7.00       68.49

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.17
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.3855

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  FINISH
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==
       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Pond Evalua
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Pond Evalua


DATE: 12/12/2014                           TIME: 10:43:22 AM

USER:


COMMENTS: ____________________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************
```

2050 5-Year Storm

```
--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 73.95 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.63 |  3.25    2.96 |  6.25   13.31 |  9.25    2.25
                  .50    1.72 |  3.50    2.96 |  6.50   13.31 |  9.50    2.07
                  .75    1.75 |  3.75    2.96 |  6.75    7.04 |  9.75    1.98
                 1.00    1.80 |  4.00    2.96 |  7.00    4.79 | 10.00    2.01
                 1.25    1.89 |  4.25    4.08 |  7.25    4.44 | 10.25    1.95
                 1.50    1.95 |  4.50    4.79 |  7.50    4.44 | 10.50    1.83
                 1.75    1.98 |  4.75    5.35 |  7.75    4.44 | 10.75    1.69
                 2.00    2.07 |  5.00    6.48 |  8.00    4.44 | 11.00    1.57
                 2.25    2.07 |  5.25    8.87 |  8.25    3.79 | 11.25    1.39
                 2.50    2.07 |  5.50    8.87 |  8.50    3.25 | 11.50    1.27
                 2.75    2.22 |  5.75   35.50 |  8.75    2.84 | 11.75    1.12
                 3.00    2.51 |  6.00   97.61 |  9.00    2.51 | 12.00    1.01

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2425) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80       32.70
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     602.80       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=      97.61       64.37
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       7.58 (ii)   17.94 (ii)
```


V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update Dec 2014\Uxbridge\

```
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       3.35        3.11         5.390 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45       33.98         43.85
     TOTAL RAINFALL   (mm)=      73.95       73.95         73.95
     RUNOFF COEFFICIENT   =        .99         .46           .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2125) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58       15.87
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     419.90       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=      97.61       44.24
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       6.10 (ii)   18.14 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.69        1.03         2.346 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.45       23.63         36.08
     TOTAL RAINFALL   (mm)=      73.95       73.95         73.95
     RUNOFF COEFFICIENT   =        .99         .32           .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9262) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.4810     3.7149
                           .2480     1.8790   |    .0000      .0000

                                     AREA      QPEAK       TPEAK       R.V.
                                     (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2425)      54.500      5.390        6.00       43.85
     OUTFLOW: ID= 1 (9262)      54.500       .248        9.75       43.81

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.60
                   TIME SHIFT OF PEAK FLOW         (min)=225.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8789

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9260) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .3050     1.7410
                           .0550      .8335   |    .0000      .0000

                                     AREA      QPEAK       TPEAK       R.V.
                                     (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2125)      26.450      2.346        6.00       36.08
     OUTFLOW: ID= 1 (9260)      26.450       .055       12.00       35.94

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.34
```

```
                   TIME SHIFT OF PEAK FLOW         (min)=360.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8335

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  ***************************
  ** SIMULATION NUMBER:   7 **
  ***************************
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2050 100-Year Storm

```
 -------------------
 | MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
 |                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal=141.08 mm |    Comments: SCS 24 HR MASS CURVE
 -------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                    TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                     .25    3.10 |  3.25    5.64 |  6.25   25.39 |  9.25    4.29
                     .50    3.27 |  3.50    5.64 |  6.50   25.39 |  9.50    3.95
                     .75    3.33 |  3.75    5.64 |  6.75   13.43 |  9.75    3.78
                    1.00    3.44 |  4.00    5.64 |  7.00    9.14 | 10.00    3.84
                    1.25    3.61 |  4.25    7.79 |  7.25    8.46 | 10.25    3.72
                    1.50    3.72 |  4.50    9.14 |  7.50    8.46 | 10.50    3.50
                    1.75    3.78 |  4.75   10.21 |  7.75    8.46 | 10.75    3.22
                    2.00    3.95 |  5.00   12.36 |  8.00    8.46 | 11.00    2.99
                    2.25    3.95 |  5.25   16.93 |  8.25    7.22 | 11.25    2.65
                    2.50    3.95 |  5.50   16.93 |  8.50    6.21 | 11.50    2.43
                    2.75    4.23 |  5.75   67.72 |  8.75    5.42 | 11.75    2.14
                    3.00    4.80 |  6.00  186.23 |  9.00    4.80 | 12.00    1.92

 ------------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | STANDHYD  (2425) |   Area    (ha)=  54.50
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 -------------------
                             IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=      21.80       32.70
      Dep. Storage     (mm)=        .50        1.50
      Average Slope     (%)=       1.00        1.00
      Length            (m)=     602.80       40.00
      Mannings n          =        .013        .250

      Max.Eff.Inten.(mm/hr)=     186.23      166.50
                 over (min)       15.00       15.00
      Storage Coeff.  (min)=       5.85 (ii)   12.94 (ii)
      Unit Hyd. Tpeak (min)=      15.00       15.00
      Unit Hyd. peak  (cms)=        .10         .08
                                                           *TOTALS*
      PEAK FLOW       (cms)=       6.69       11.39         18.084 (iii)
      TIME TO PEAK    (hrs)=       6.00        6.00           6.00
      RUNOFF VOLUME    (mm)=     140.58       87.79         100.99
      TOTAL RAINFALL   (mm)=     141.08      141.08         141.08
      RUNOFF COEFFICIENT   =       1.00         .62            .72

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  71.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | STANDHYD  (2125) |   Area    (ha)=  26.45
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 -------------------
                             IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=      10.58       15.87
      Dep. Storage     (mm)=        .50        2.50
      Average Slope     (%)=       1.00        1.00
      Length            (m)=     419.90       40.00
      Mannings n          =        .013        .250

      Max.Eff.Inten.(mm/hr)=     186.23      128.07
                 over (min)       15.00       15.00
      Storage Coeff.  (min)=       4.71 (ii)   12.58 (ii)
      Unit Hyd. Tpeak (min)=      15.00       15.00
      Unit Hyd. peak  (cms)=        .11         .08
                                                           *TOTALS*
```



```
      PEAK FLOW       (cms)=       3.33        4.27          7.595 (iii)
      TIME TO PEAK    (hrs)=       6.00        6.00           6.00
      RUNOFF VOLUME    (mm)=     140.58       67.58          85.83
      TOTAL RAINFALL   (mm)=     141.08      141.08         141.08
      RUNOFF COEFFICIENT   =       1.00         .48            .61

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  58.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 -------------------
 | RESERVOIR (9262) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 -------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |  1.4810     3.7149
                            .2480     1.8790   |   .0000      .0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
      INFLOW : ID= 2 (2425)     54.500     18.084        6.00     100.99
      OUTFLOW: ID= 1 (9262)     54.500      1.479        7.00     100.95

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.18
                    TIME SHIFT OF PEAK FLOW         (min)= 60.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.7149

 ------------------------------------------------------------------------------
 -------------------
 | RESERVOIR (9260) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 -------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |   .3050     1.7410
                            .0550      .8335   |   .0000      .0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
      INFLOW : ID= 2 (2125)     26.450      7.595        6.00      85.83
      OUTFLOW: ID= 1 (9260)     26.450       .305        9.00      85.69

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.01
                    TIME SHIFT OF PEAK FLOW         (min)=180.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.7409

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  FINISH
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=====================================================================================================
==
       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Pond Evalua
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Pond Evalua


DATE: 12/12/2014                           TIME: 10:44:22 AM

USER:


COMMENTS: ____________________________________________________________

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  ****************************
  ** SIMULATION NUMBER:   8 **
  ****************************
```

2080 5-Year Storm

```
--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 83.02 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.83 |  3.25    3.32 |  6.25   14.94 |  9.25    2.52
                  .50    1.93 |  3.50    3.32 |  6.50   14.94 |  9.50    2.32
                  .75    1.96 |  3.75    3.32 |  6.75    7.90 |  9.75    2.22
                 1.00    2.03 |  4.00    3.32 |  7.00    5.38 | 10.00    2.26
                 1.25    2.13 |  4.25    4.58 |  7.25    4.98 | 10.25    2.19
                 1.50    2.19 |  4.50    5.38 |  7.50    4.98 | 10.50    2.06
                 1.75    2.22 |  4.75    6.01 |  7.75    4.98 | 10.75    1.89
                 2.00    2.32 |  5.00    7.27 |  8.00    4.98 | 11.00    1.76
                 2.25    2.32 |  5.25    9.96 |  8.25    4.25 | 11.25    1.56
                 2.50    2.32 |  5.50    9.96 |  8.50    3.65 | 11.50    1.43
                 2.75    2.49 |  5.75   39.85 |  8.75    3.19 | 11.75    1.26
                 3.00    2.82 |  6.00  109.59 |  9.00    2.82 | 12.00    1.13

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2428) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80         32.70
     Dep. Storage     (mm)=        .50          1.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     602.80         40.00
     Mannings n          =        .013          .250

     Max.Eff.Inten.(mm/hr)=     109.59         77.04
                over (min)      15.00          30.00
     Storage Coeff.  (min)=       7.24 (ii)    16.88 (ii)
```



```
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .10           .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.80          3.82         6.324 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.25          6.00
     RUNOFF VOLUME    (mm)=      82.52         40.62         51.09
     TOTAL RAINFALL   (mm)=      83.02         83.02         83.02
     RUNOFF COEFFICIENT   =        .99           .49           .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2128) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58         15.87
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     419.90         40.00
     Mannings n          =        .013          .250

     Max.Eff.Inten.(mm/hr)=     109.59         54.01
                over (min)      15.00          30.00
     Storage Coeff.  (min)=       5.83 (ii)    16.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .10           .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.91          1.29         2.741 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.25          6.00
     RUNOFF VOLUME    (mm)=      82.52         28.77         42.21
     TOTAL RAINFALL   (mm)=      83.02         83.02         83.02
     RUNOFF COEFFICIENT   =        .99           .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9266) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.4810     4.6110
                          .2480     2.2595    |    .0000      .0000

                                   AREA      QPEAK       TPEAK       R.V.
                                   (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2428)       54.500      6.324        6.00      51.09
     OUTFLOW: ID= 1 (9266)       54.500       .248       10.75      51.05

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.92
                   TIME SHIFT OF PEAK FLOW         (min)=285.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.2591

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9264) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .3050     2.1895
                          .0550      .9965    |    .0000      .0000

                                   AREA      QPEAK       TPEAK       R.V.
                                   (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2128)       26.450      2.741        6.00      42.21
     OUTFLOW: ID= 1 (9264)       26.450       .055       12.00      42.03

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.01
```

```
                   TIME SHIFT OF PEAK FLOW         (min)=360.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9961

 -------------------------------------------------------------------------------
   ****************************
   ** SIMULATION NUMBER:   9 **
   ****************************
```

2080 100-Year Storm

```
 --------------------
 | MASS STORM        |     Filename: V:\01606\Active\160621777\SWM Master Plans
 |                   |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal=163.64 mm  |     Comments: SCS 24 HR MASS CURVE
 --------------------
                           Duration of storm    = 12.00 hrs
                           Mass curve time step = 15.00 min

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                   .25    3.60 |  3.25    6.55 |  6.25   29.46 |  9.25    4.97
                   .50    3.80 |  3.50    6.55 |  6.50   29.46 |  9.50    4.58
                   .75    3.86 |  3.75    6.55 |  6.75   15.58 |  9.75    4.39
                  1.00    3.99 |  4.00    6.55 |  7.00   10.60 | 10.00    4.45
                  1.25    4.19 |  4.25    9.03 |  7.25    9.82 | 10.25    4.32
                  1.50    4.32 |  4.50   10.60 |  7.50    9.82 | 10.50    4.06
                  1.75    4.39 |  4.75   11.85 |  7.75    9.82 | 10.75    3.73
                  2.00    4.58 |  5.00   14.33 |  8.00    9.82 | 11.00    3.47
                  2.25    4.58 |  5.25   19.64 |  8.25    8.38 | 11.25    3.08
                  2.50    4.58 |  5.50   19.64 |  8.50    7.20 | 11.50    2.81
                  2.75    4.91 |  5.75   78.55 |  8.75    6.28 | 11.75    2.49
                  3.00    5.56 |  6.00  216.00 |  9.00    5.56 | 12.00    2.23

 -------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | STANDHYD  (2428)  |    Area    (ha)=  54.50
 |ID= 1 DT=15.0 min  |    Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=      21.80        32.70
      Dep. Storage     (mm)=        .50         1.50
      Average Slope     (%)=       1.00         1.00
      Length            (m)=     602.80        40.00
      Mannings n          =        .013         .250

      Max.Eff.Inten.(mm/hr)=     216.00       203.46
                 over (min)       15.00        15.00
      Storage Coeff.  (min)=       5.52 (ii)   12.06 (ii)
      Unit Hyd. Tpeak (min)=      15.00        15.00
      Unit Hyd. peak  (cms)=        .11          .08
                                                             *TOTALS*
      PEAK FLOW       (cms)=       7.82        14.35          22.177 (iii)
      TIME TO PEAK    (hrs)=       6.00         6.00            6.00
      RUNOFF VOLUME    (mm)=     163.14       107.51          121.42
      TOTAL RAINFALL   (mm)=     163.64       163.64          163.64
      RUNOFF COEFFICIENT   =       1.00          .66             .74

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  71.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | STANDHYD  (2128)  |    Area    (ha)=  26.45
 |ID= 1 DT=15.0 min  |    Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=      10.58        15.87
      Dep. Storage     (mm)=        .50         2.50
      Average Slope     (%)=       1.00         1.00
      Length            (m)=     419.90        40.00
      Mannings n          =        .013         .250

      Max.Eff.Inten.(mm/hr)=     216.00       160.56
                 over (min)       15.00        15.00
      Storage Coeff.  (min)=       4.44 (ii)   11.63 (ii)
      Unit Hyd. Tpeak (min)=      15.00        15.00
      Unit Hyd. peak  (cms)=        .11          .08
                                                             *TOTALS*
```



```
      PEAK FLOW       (cms)=       3.88         5.53           9.412 (iii)
      TIME TO PEAK    (hrs)=       6.00         6.00            6.00
      RUNOFF VOLUME    (mm)=     163.14        84.61          104.25
      TOTAL RAINFALL   (mm)=     163.64       163.64          163.64
      RUNOFF COEFFICIENT   =       1.00          .52             .64

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  58.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (9266)  |
 | IN= 2---> OUT= 1  |
 | DT= 15.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                              .0000      .0000   |  1.4810     4.6110
                              .2480     2.2595   |   .0000      .0000

                                    AREA      QPEAK       TPEAK       R.V.
                                    (ha)      (cms)       (hrs)       (mm)
      INFLOW : ID= 2 (2428)       54.500     22.177        6.00     121.42
      OUTFLOW: ID= 1 (9266)       54.500      1.480        7.25     121.37

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.67
                    TIME SHIFT OF PEAK FLOW         (min)= 75.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  4.6108

 -------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (9264)  |
 | IN= 2---> OUT= 1  |
 | DT= 15.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                              .0000      .0000   |   .3050     2.1895
                              .0550      .9965   |   .0000      .0000

                                    AREA      QPEAK       TPEAK       R.V.
                                    (ha)      (cms)       (hrs)       (mm)
      INFLOW : ID= 2 (2128)       26.450      9.412        6.00     104.25
      OUTFLOW: ID= 1 (9264)       26.450       .305        9.25     104.07

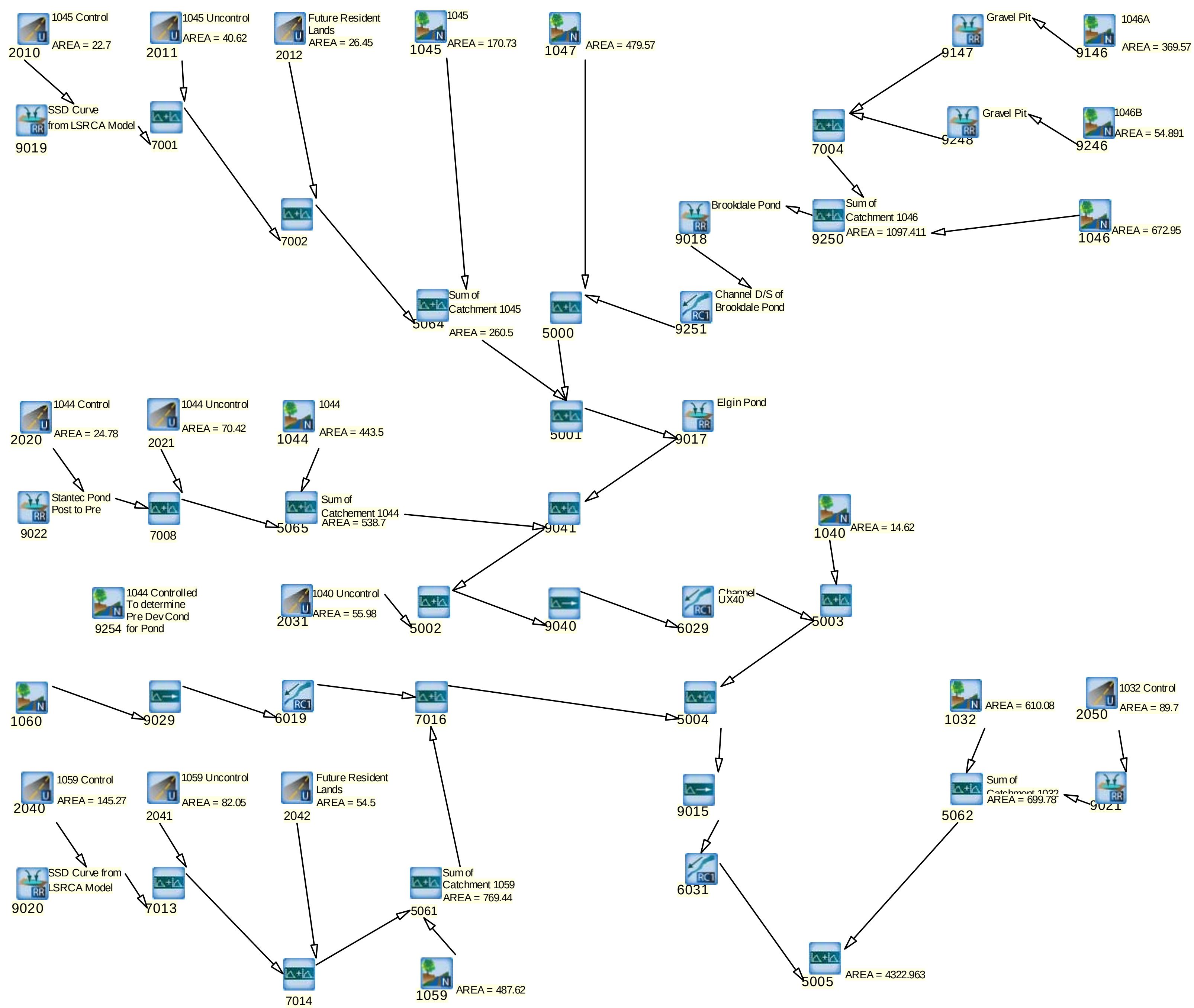
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.24
                    TIME SHIFT OF PEAK FLOW         (min)=195.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.1893

 -------------------------------------------------------------------------------

  FINISH
 =====================================================================================================
 ==
```

F.2 FUTURE CONDITIONS HYDROLOGIC MODELING

Future Conditions VO2 Schematic (Do Nothing)



```
=========================================================================================================
==

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Future No S
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Future No S


DATE: 12/12/2014                           TIME: 11:01:21 AM

USER:


COMMENTS: ____________________________________________________________

---------------------------------------------------------------------------------------------------------
--
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************
```

2-Year Storm

```
--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 43.70 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.96	3.25	1.75	6.25	7.87	9.25	1.33
.50	1.01	3.50	1.75	6.50	7.87	9.50	1.22
.75	1.03	3.75	1.75	6.75	4.16	9.75	1.17
1.00	1.07	4.00	1.75	7.00	2.83	10.00	1.19
1.25	1.12	4.25	2.41	7.25	2.62	10.25	1.15
1.50	1.15	4.50	2.83	7.50	2.62	10.50	1.08
1.75	1.17	4.75	3.16	7.75	2.62	10.75	1.00
2.00	1.22	5.00	3.83	8.00	2.62	11.00	.93
2.25	1.22	5.25	5.24	8.25	2.24	11.25	.82
2.50	1.22	5.50	5.24	8.50	1.92	11.50	.75
2.75	1.31	5.75	20.98	8.75	1.68	11.75	.66
3.00	1.49	6.00	57.68	9.00	1.49	12.00	.59

```
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=   2.298 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=   8.387
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        15.59
                over (min)      15.00        30.00
     Storage Coeff.  (min)=      10.86 (ii)   29.14 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.96         1.59         3.942 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20        13.50         20.93
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .31           .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        14.07
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.43 (ii)   28.47 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.70          .68         3.117 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20        10.73         22.09
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .25           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        14.61
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.38 (ii)   26.14 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                       *TOTALS*
     PEAK FLOW       (cms)=       1.45          .29         1.627 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      33.70        10.73         19.92
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .77          .25           .46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        13.62
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.10 (ii)   29.39 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                       *TOTALS*
     PEAK FLOW       (cms)=       3.32          .82         3.818 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      33.70        10.40         18.56
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .77          .24           .42

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=    .163 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .069 (i)
     TIME TO PEAK    (hrs)=  11.250
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.53 (ii)   29.06 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .96          .31         1.153 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21         17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .21           .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.19 (ii)   28.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .83          .27          .999 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21         17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .21           .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        45.00
     Storage Coeff.  (min)=       8.56 (ii)   30.09 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        45.00
     Unit Hyd. peak  (cms)=        .09          .03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.43          .44         1.613 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.50          6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21         17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .21           .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=    .186 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .987
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .023

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=    .306 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=   1.544
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .035

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .088 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=   2.245
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .051

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=    .259 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .987
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .023
```



```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .083 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   5.698
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .130

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   2.081 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=   8.697
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .199

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        26.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.35 (ii)   24.03 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.88         1.14         2.597 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      43.20        14.39         21.59
     TOTAL RAINFALL   (mm)=      43.70        43.70         43.70
     RUNOFF COEFFICIENT   =        .99          .33           .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        27.85
```

```
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.58 (ii)   25.07 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       3.27         1.59          4.273 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        14.58          23.16
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .33            .53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        26.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      12.55 (ii)   27.22 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       4.55         2.85          6.339 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        14.39          21.59
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .33            .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   1.841 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=   5.901
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .135

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .083     .96 | 3.083    1.75 | 6.083    7.87 |  9.08    1.33
```



```
                  .167     .96 | 3.167    1.75 | 6.167    7.87 |  9.17    1.33
                  .250     .96 | 3.250    1.75 | 6.250    7.87 |  9.25    1.33
                  .333    1.01 | 3.333    1.75 | 6.333    7.87 |  9.33    1.22
                  .417    1.01 | 3.417    1.75 | 6.417    7.87 |  9.42    1.22
                  .500    1.01 | 3.500    1.75 | 6.500    7.87 |  9.50    1.22
                  .583    1.03 | 3.583    1.75 | 6.583    4.16 |  9.58    1.17
                  .667    1.03 | 3.667    1.75 | 6.667    4.16 |  9.67    1.17
                  .750    1.03 | 3.750    1.75 | 6.750    4.16 |  9.75    1.17
                  .833    1.07 | 3.833    1.75 | 6.833    2.83 |  9.83    1.19
                  .917    1.07 | 3.917    1.75 | 6.917    2.83 |  9.92    1.19
                 1.000    1.07 | 4.000    1.75 | 7.000    2.83 | 10.00    1.19
                 1.083    1.12 | 4.083    2.41 | 7.083    2.62 | 10.08    1.15
                 1.167    1.12 | 4.167    2.41 | 7.167    2.62 | 10.17    1.15
                 1.250    1.12 | 4.250    2.41 | 7.250    2.62 | 10.25    1.15
                 1.333    1.15 | 4.333    2.83 | 7.333    2.62 | 10.33    1.08
                 1.417    1.15 | 4.417    2.83 | 7.417    2.62 | 10.42    1.08
                 1.500    1.15 | 4.500    2.83 | 7.500    2.62 | 10.50    1.08
                 1.583    1.17 | 4.583    3.16 | 7.583    2.62 | 10.58    1.00
                 1.667    1.17 | 4.667    3.16 | 7.667    2.62 | 10.67    1.00
                 1.750    1.17 | 4.750    3.16 | 7.750    2.62 | 10.75    1.00
                 1.833    1.22 | 4.833    3.83 | 7.833    2.62 | 10.83     .93
                 1.917    1.22 | 4.917    3.83 | 7.917    2.62 | 10.92     .93
                 2.000    1.22 | 5.000    3.83 | 8.000    2.62 | 11.00     .93
                 2.083    1.22 | 5.083    5.24 | 8.083    2.24 | 11.08     .82
                 2.167    1.22 | 5.167    5.24 | 8.167    2.24 | 11.17     .82
                 2.250    1.22 | 5.250    5.24 | 8.250    2.24 | 11.25     .82
                 2.333    1.22 | 5.333    5.24 | 8.333    1.92 | 11.33     .75
                 2.417    1.22 | 5.417    5.24 | 8.417    1.92 | 11.42     .75
                 2.500    1.22 | 5.500    5.24 | 8.500    1.92 | 11.50     .75
                 2.583    1.31 | 5.583   20.98 | 8.583    1.68 | 11.58     .66
                 2.667    1.31 | 5.667   20.98 | 8.667    1.68 | 11.67     .66
                 2.750    1.31 | 5.750   20.98 | 8.750    1.68 | 11.75     .66
                 2.833    1.49 | 5.833   57.68 | 8.833    1.49 | 11.83     .59
                 2.917    1.49 | 5.917   57.68 | 8.917    1.49 | 11.92     .59
                 3.000    1.49 | 6.000   57.68 | 9.000    1.49 | 12.00     .59

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .010 (i)
     TIME TO PEAK    (hrs)=  11.500
     RUNOFF VOLUME    (mm)=    .949
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000      .9900
                           .0290      .3700   |   2.7000     1.4200
                           .5000      .6900   |   6.1000     2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      3.942        6.00       20.93
     OUTFLOW: ID= 1 (9021)     89.700      1.121        6.75       20.89

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 28.44
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9644

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800      .8375
                           .0100      .4725   |    .1300      .9815
                           .0450      .7030   |    .2380     1.2455

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      1.627        6.00       19.92
     OUTFLOW: ID= 1 (9022)     24.780       .010       12.25       19.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .61
                   TIME SHIFT OF PEAK FLOW         (min)=375.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .4723
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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78    .010    12.25    19.43
        + ID2= 2 (2021):    70.42   3.818     6.00    18.56
          ==================================================
          ID = 3 (7008):    95.20   3.821     6.00    18.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20   3.821     6.00    18.79
        + ID2= 2 (1044):   443.50    .163    12.00      .95
          ==================================================
          ID = 3 (5065):   538.70   3.821     6.00     4.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700       .999        6.00       17.71
     OUTFLOW: ID= 1 (9019)     22.700       .130        7.25        6.25

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.98
                   TIME SHIFT OF PEAK FLOW        (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .2806

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70    .130     7.25     6.25
        + ID2= 2 (2011):    40.62   1.613     6.00    17.71
          ==================================================
          ID = 3 (7001):    63.32   1.613     6.00    13.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570       .306        8.50        1.54
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW        (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .5705

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```



```
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .088        7.00        2.24
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW        (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .1232

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--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270      6.339        6.00       21.59
     OUTFLOW: ID= 1 (9020)    145.270       .198       12.00       21.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.12
                   TIME SHIFT OF PEAK FLOW        (min)=360.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.7014

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--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     1.84      7.25      5.90
    SHIFT ID= 1 (9029):  406.96     1.84      9.75      5.90

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--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   2.298     9.00     8.39
        + ID2= 2 (9021):    89.70   1.121     6.75    20.89
          ==================================================
          ID = 3 (5062):   699.78   2.917     8.50     9.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2012):    26.45   1.153     6.00    17.71
        + ID2= 2 (7001):    63.32   1.613     6.00    13.60
          ==================================================
          ID = 3 (7002):    89.77   2.767     6.00    14.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (2041):    82.05   4.273     6.00    23.16
        + ID2= 2 (9020):   145.27    .198    12.00    21.57
          ==================================================
          ID = 3 (7013):   227.32   4.338     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06

                                   <---- hydrograph ---->  <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.  MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)     (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96    1.84    9.75   5.90      .26       .66
     OUTFLOW: ID= 1 (6019)  406.96     .94   11.50   5.90      .21       .58

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 ADD HYD   (5064)
   1 +  2 =  3                 AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .069    11.25      .95
        + ID2= 2 (7002):    89.77   2.767     6.00    14.81
          ==================================================
          ID = 3 (5064):   260.50   2.767     6.00     5.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |           AREA    QPEAK    TPEAK     R.V.
--------------------           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95    .259    12.00      .99
          ==================================================
          ID = 3 (9250):  1097.41    .259    12.00      .61
```



```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |           AREA    QPEAK    TPEAK     R.V.
--------------------           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2042):    54.50   2.597     6.00    21.59
        + ID2= 2 (7013):   227.32   4.338     6.00    22.15
          ==================================================
          ID = 3 (7014):   281.82   6.935     6.00    22.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   4.8100     1.1900
                           .4200      .6400    |  14.3300     1.2700
                          1.5900      .9400    |  53.8000     1.3300
                          3.2000     1.1100    |    .0000      .0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411       .259       12.00         .61
     OUTFLOW: ID= 1 (9018)   1097.411       .173       14.50         .60

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 66.98
                  TIME SHIFT OF PEAK FLOW         (min)=150.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .2640

------------------------------------------------------------------------------

 ADD HYD   (5061)
   1 +  2 =  3                 AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   2.081     8.50     8.70
        + ID2= 2 (7014):   281.82   6.935     6.00    22.04
          ==================================================
          ID = 3 (5061):   769.44   7.062     6.00    13.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7           .81      43.21
        .57   270.59    .257E+05      13.9          1.14      30.76
        .85   270.87    .484E+05      32.0          1.39      25.24
       1.13   271.15    .776E+05      59.6          1.61      21.71
       1.42   271.44    .112E+06     100.0          1.87      18.71
       1.70   271.72    .151E+06     157.2          2.18      16.04
       1.99   272.01    .195E+06     225.9          2.44      14.37
       2.27   272.29    .242E+06     305.9          2.65      13.21
```

```
       2.55   272.57    .294E+06     398.1          2.84      12.31
       2.84   272.86    .350E+06     501.8          3.01      11.61
       3.12   273.14    .409E+06     617.0          3.17      11.05
       3.40   273.42    .472E+06     744.3          3.31      10.58
       3.69   273.71    .539E+06     882.9          3.44      10.18
       3.97   273.99    .611E+06    1033.6          3.55       9.85
       4.26   274.28    .687E+06    1196.8          3.66       9.57
       4.54   274.56    .768E+06    1370.2          3.75       9.35
       4.82   274.84    .856E+06    1556.4          3.82       9.16
       5.11   275.13    .950E+06    1757.0          3.89       9.01
       5.39   275.41    .105E+07    1967.6          3.93       8.91

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41      .17   14.50    .60       .01       .81
     OUTFLOW: ID= 1 (9251) 1097.41      .17   15.25    .60       .01       .81

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (7016) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5061):   769.44   7.062     6.00    13.58
         + ID2= 2 (6019):   406.96    .942    11.50     5.90
           ==============================================
           ID = 3 (7016):  1176.40   7.062     6.00    10.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5000) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (1047):   479.57    .186    12.00      .99
         + ID2= 2 (9251):  1097.41    .170    15.25      .60
           ==============================================
           ID = 3 (5000):  1576.98    .312    13.00      .72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5001) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5064):   260.50   2.767     6.00     5.73
         + ID2= 2 (5000):  1576.98    .312    13.00      .72
           ==============================================
           ID = 3 (5001):  1837.48   2.767     6.00     1.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | RESERVOIR (9017) |
 | IN= 2---> OUT= 1 |
 | DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |   2.8300     3.4900
                            .2800      .2500   |   3.8200     3.9500
                            .7100      .6300   |   4.6700     4.2000
                           1.1300     1.1400   |   7.3600     4.6900
                           1.5600     1.7300   |   8.7800     4.8500
                           1.8400     2.2600   |  35.4000     6.6100
                           2.2700     2.9600   |  *******     8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      2.767        6.00        1.43
     OUTFLOW: ID= 1 (9017)   1837.481       .617        7.25        1.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.29
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .5485

 -------------------------------------------------------------------------------
```



```
 --------------------
 | ADD HYD   (9041) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5065):   538.70   3.821     6.00     4.10
         + ID2= 2 (9017):  1837.48    .617     7.25     1.43
           ==============================================
           ID = 3 (9041):  2376.18   4.146     6.00     2.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5002) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (2031):    55.98   3.117     6.00    22.09
         + ID2= 2 (9041):  2376.18   4.146     6.00     2.04
           ==============================================
           ID = 3 (5002):  2432.16   7.262     6.00     2.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9040) |
 | IN= 2---> OUT= 1 |
 | SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
 --------------------      (ha)     (cms)     (hrs)      (mm)
           ID= 2 (5002): 2432.16     7.26      6.00      2.50
     SHIFT ID= 1 (9040): 2432.16     7.26      7.00      2.50

 -------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6029) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation      Manning
                     .00       274.29         .0800
                   30.80       273.73         .0800
                   51.30       270.17         .0800
                   61.60       266.84         .0800
                   66.80       266.02         .0800
                  102.70       265.42         .0350      Main Channel
                  123.20       261.00         .0350      Main Channel
                  128.40       261.17         .0350      Main Channel
                  154.00       264.62         .0350      Main Channel
                  174.60       266.82         .0800
                  205.40       268.07         .0800
                  236.20       268.74         .0800
                  282.40       271.31         .0800
                  302.90       272.11         .0800
                  348.90       274.45         .0800

         <-------------------- TRAVEL TIME TABLE --------------------->
          DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
           (m)     (m)      (cu.m.)      (cms)        (m/s)      (min)
            .63   261.63    .702E+04       5.2         1.14      22.47
           1.26   262.26    .220E+05      24.8         1.74      14.74
           1.89   262.89    .443E+05      64.0         2.22      11.54
           2.53   263.53    .741E+05     127.4         2.65       9.69
           3.16   264.16    .111E+06     219.6         3.04       8.44
           3.79   264.79    .156E+06     343.2         3.39       7.57
           4.42   265.42    .209E+06     501.2         3.70       6.94
           5.16   266.16    .304E+06     766.4         3.88       6.61
           5.90   266.90    .428E+06    1123.8         4.05       6.34
           6.64   267.64    .570E+06    1628.6         4.40       5.84
           7.38   268.38    .738E+06    2225.4         4.65       5.53
           8.12   269.12    .941E+06    2928.9         4.80       5.35
           8.85   269.85    .116E+07    3743.0         4.95       5.18
           9.59   270.59    .141E+07    4656.3         5.10       5.03
          10.33   271.33    .167E+07    5671.9         5.24       4.90
          11.07   272.07    .195E+07    6784.6         5.36       4.80
          11.81   272.81    .226E+07    8029.1         5.47       4.69
          12.55   273.55    .259E+07    9393.0         5.59       4.60
          13.29   274.29    .295E+07   10648.3         5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16     7.26    7.00   2.50       .70      1.19
```

```
     OUTFLOW: ID= 1 (6029) 2432.16     4.34    7.25   2.50       .53      1.14

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5003) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   4.336     7.25     2.50
        + ID2= 2 (1040):    14.62    .083     6.75     5.70
          ================================================
          ID = 3 (5003):  2446.78   4.408     7.25     2.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5004) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   4.408     7.25     2.52
        + ID2= 2 (7016):  1176.40   7.062     6.00    10.93
          ================================================
          ID = 3 (5004):  3623.18   7.351     6.00     5.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9015) |
 | IN= 2---> OUT= 1 |
 | SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
 --------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18      7.35      6.00      5.25
    SHIFT ID= 1 (9015): 3623.18      7.35      8.00      5.25

 -------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6031) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation       Manning
                     .00        260.30         .0800
                   34.10        260.43         .0800
                   62.40        259.79         .0800
                   79.50        255.72         .0800
                  113.50        254.00         .0800
                  153.30        253.33         .0350     Main Channel
                  187.30        253.06         .0350     Main Channel
                  198.70        251.88         .0350     Main Channel
                  204.40        252.61         .0350     Main Channel
                  249.80        254.00         .0800
                  334.90        255.77         .0800
                  351.90        256.37         .0800
                  414.40        260.24         .0800
                  465.50        260.75         .0800
                  514.40        261.48         .0800

       <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
         .36    252.24    .596E+04       .4           .39      223.90
         .73    252.61    .238E+05      2.8           .61      141.05
        1.09    252.97    .619E+05      8.2           .69      126.14
        1.45    253.33    .151E+06     18.8           .65      134.06
        1.91    253.79    .383E+06     68.4           .93       93.14
        2.38    254.26    .713E+06    157.3          1.15       75.58
        2.84    254.72    .112E+07    287.3          1.33       65.13
        3.31    255.19    .161E+07    454.2          1.47       59.01
        3.77    255.65    .217E+07    659.0          1.58       54.87
        4.24    256.12    .279E+07    908.7          1.69       51.25
        4.70    256.58    .346E+07   1199.1          1.80       48.03
        5.17    257.05    .414E+07   1527.9          1.92       45.17
        5.63    257.51    .485E+07   1892.4          2.03       42.71
        6.10    257.98    .558E+07   2291.8          2.13       40.59
        6.56    258.44    .634E+07   2725.7          2.23       38.74
        7.03    258.91    .711E+07   3193.6          2.33       37.12
        7.49    259.37    .791E+07   3695.3          2.43       35.69
        7.96    259.84    .874E+07   4221.9          2.51       34.48
        8.42    260.30    .961E+07   4697.6          2.54       34.09
```



```
                              <---- hydrograph ---->   <-pipe / channel->
                        AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                        (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18     7.35    8.00   5.25      1.03       .67
     OUTFLOW: ID= 1 (6031) 3623.18     4.18   11.25   5.25       .81       .63

 -------------------------------------------------------------------------------

 | ADD HYD   (5005) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   2.917     8.50     9.99
        + ID2= 2 (6031):  3623.18   4.180    11.25     5.25
          ================================================
          ID = 3 (5005):  4322.96   6.538    10.25     6.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
   ****************************
   ** SIMULATION NUMBER:   2 **        5-Year Storm
   ****************************

 --------------------
 | MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
 |                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal= 60.45 mm |    Comments: SCS 24 HR MASS CURVE
 --------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                   .25    1.33 |  3.25    2.42 |  6.25   10.88 |  9.25    1.84
                   .50    1.40 |  3.50    2.42 |  6.50   10.88 |  9.50    1.69
                   .75    1.43 |  3.75    2.42 |  6.75    5.75 |  9.75    1.62
                  1.00    1.47 |  4.00    2.42 |  7.00    3.92 | 10.00    1.64
                  1.25    1.55 |  4.25    3.34 |  7.25    3.63 | 10.25    1.60
                  1.50    1.60 |  4.50    3.92 |  7.50    3.63 | 10.50    1.50
                  1.75    1.62 |  4.75    4.38 |  7.75    3.63 | 10.75    1.38
                  2.00    1.69 |  5.00    5.30 |  8.00    3.63 | 11.00    1.28
                  2.25    1.69 |  5.25    7.25 |  8.25    3.10 | 11.25    1.14
                  2.50    1.69 |  5.50    7.25 |  8.50    2.66 | 11.50    1.04
                  2.75    1.81 |  5.75   29.02 |  8.75    2.32 | 11.75     .92
                  3.00    2.06 |  6.00   79.79 |  9.00    2.06 | 12.00     .82

 -------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   4.618 (i)
     TIME TO PEAK   (hrs)=   9.000
     RUNOFF VOLUME   (mm)=  16.513
     TOTAL RAINFALL  (mm)=  60.450
     RUNOFF COEFFICIENT   =    .273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | STANDHYD  (2050) |   Area    (ha)=  89.70
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 --------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        44.49
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.54 (ii)   21.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
```

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     Unit Hyd. peak  (cms)=        .09          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       4.26         3.26          6.334 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        23.47          32.59
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .39            .54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        41.24
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.28 (ii)   20.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       3.86         1.44          4.768 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        19.06          33.37
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .32            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        42.78
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.49 (ii)   18.69 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       2.05          .61          2.442 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      50.45        19.05          31.61
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .83          .32            .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        40.05
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.87 (ii)   21.40 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       4.77         1.73          5.861 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      50.45        18.53          29.70
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .83          .31            .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=    .721 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .318 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.61 (ii)   20.50 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
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     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.36          .68          1.792 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.32 (ii)   20.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.18          .59          1.550 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.52 (ii)   21.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                            *TOTALS*
     PEAK FLOW       (cms)=       2.04         1.03          2.687 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=    .825 (i)
     TIME TO PEAK    (hrs)=  10.250
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   1.204 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   5.165
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .085

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .398 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   7.283
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .120

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   1.141 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .176 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  11.606
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   4.194 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  17.056
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .282

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.22 (ii)   20.01 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       2.69         2.15          4.075 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        47.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.29 (ii)   20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       4.71         2.99          6.636 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.95          35.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      11.02 (ii)   22.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                           *TOTALS*
     PEAK FLOW       (cms)=       6.59         5.40         10.054 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   3.879 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  11.988
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .198

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .083    1.33 | 3.083    2.42 | 6.083   10.88 |  9.08    1.84
                  .167    1.33 | 3.167    2.42 | 6.167   10.88 |  9.17    1.84
                  .250    1.33 | 3.250    2.42 | 6.250   10.88 |  9.25    1.84
                  .333    1.40 | 3.333    2.42 | 6.333   10.88 |  9.33    1.69
                  .417    1.40 | 3.417    2.42 | 6.417   10.88 |  9.42    1.69
                  .500    1.40 | 3.500    2.42 | 6.500   10.88 |  9.50    1.69
                  .583    1.43 | 3.583    2.42 | 6.583    5.75 |  9.58    1.62
                  .667    1.43 | 3.667    2.42 | 6.667    5.75 |  9.67    1.62
                  .750    1.43 | 3.750    2.42 | 6.750    5.75 |  9.75    1.62
                  .833    1.47 | 3.833    2.42 | 6.833    3.92 |  9.83    1.64
                  .917    1.47 | 3.917    2.42 | 6.917    3.92 |  9.92    1.64
                 1.000    1.47 | 4.000    2.42 | 7.000    3.92 | 10.00    1.64
                 1.083    1.55 | 4.083    3.34 | 7.083    3.63 | 10.08    1.60
                 1.167    1.55 | 4.167    3.34 | 7.167    3.63 | 10.17    1.60
                 1.250    1.55 | 4.250    3.34 | 7.250    3.63 | 10.25    1.60
                 1.333    1.60 | 4.333    3.92 | 7.333    3.63 | 10.33    1.50
                 1.417    1.60 | 4.417    3.92 | 7.417    3.63 | 10.42    1.50
                 1.500    1.60 | 4.500    3.92 | 7.500    3.63 | 10.50    1.50
                 1.583    1.62 | 4.583    4.38 | 7.583    3.63 | 10.58    1.38
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               1.667    1.62 | 4.667    4.38 | 7.667    3.63 | 10.67    1.38
               1.750    1.62 | 4.750    4.38 | 7.750    3.63 | 10.75    1.38
               1.833    1.69 | 4.833    5.30 | 7.833    3.63 | 10.83    1.28
               1.917    1.69 | 4.917    5.30 | 7.917    3.63 | 10.92    1.28
               2.000    1.69 | 5.000    5.30 | 8.000    3.63 | 11.00    1.28
               2.083    1.69 | 5.083    7.25 | 8.083    3.10 | 11.08    1.14
               2.167    1.69 | 5.167    7.25 | 8.167    3.10 | 11.17    1.14
               2.250    1.69 | 5.250    7.25 | 8.250    3.10 | 11.25    1.14
               2.333    1.69 | 5.333    7.25 | 8.333    2.66 | 11.33    1.04
               2.417    1.69 | 5.417    7.25 | 8.417    2.66 | 11.42    1.04
               2.500    1.69 | 5.500    7.25 | 8.500    2.66 | 11.50    1.04
               2.583    1.81 | 5.583   29.02 | 8.583    2.32 | 11.58     .92
               2.667    1.81 | 5.667   29.02 | 8.667    2.32 | 11.67     .92
               2.750    1.81 | 5.750   29.02 | 8.750    2.32 | 11.75     .92
               2.833    2.06 | 5.833   79.79 | 8.833    2.06 | 11.83     .82
               2.917    2.06 | 5.917   79.79 | 8.917    2.06 | 11.92     .82
               3.000    2.06 | 6.000   79.79 | 9.000    2.06 | 12.00     .82

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .045 (i)
     TIME TO PEAK    (hrs)=   9.833
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      6.334        6.00       32.59
     OUTFLOW: ID= 1 (9021)     89.700      2.428        6.75       32.56

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.33
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.3607

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800       .8375
                           .0100      .4725   |    .1300       .9815
                           .0450      .7030   |    .2380      1.2455

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      2.442        6.00       31.61
     OUTFLOW: ID= 1 (9022)     24.780       .045       12.00       31.04

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.84
                   TIME SHIFT OF PEAK FLOW         (min)=360.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .7023

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| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .045    12.00    31.04
        + ID2= 2 (2021):    70.42    5.861     6.00    29.70
          ==================================================
          ID = 3 (7008):    95.20    5.866     6.00    30.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
```



```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    5.866     6.00    30.05
        + ID2= 2 (1044):   443.50     .721    10.50     4.32
          ==================================================
          ID = 3 (5065):   538.70    5.875     6.00     8.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      1.550        6.00       27.45
     OUTFLOW: ID= 1 (9019)     22.700       .476        6.50       15.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.71
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3393

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .476     6.50    15.99
        + ID2= 2 (2011):    40.62    2.687     6.00    27.45
          ==================================================
          ID = 3 (7001):    63.32    2.687     6.00    23.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      1.204        7.50        5.17
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.9089

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .398        6.75        7.28
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3998

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--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
```

```
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     10.054        6.00      33.50
     OUTFLOW: ID= 1 (9020)    145.270       .752        9.00      33.47

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.48
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.7118

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     3.88      7.25     11.99
    SHIFT ID= 1 (9029):  406.96     3.88      9.75     11.99

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--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   4.618     9.00    16.51
        + ID2= 2 (9021):    89.70   2.428     6.75    32.56
          ===============================================
          ID = 3 (5062):   699.78   5.556     8.50    18.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2012):    26.45   1.792     6.00    27.45
        + ID2= 2 (7001):    63.32   2.687     6.00    23.34
          ===============================================
          ID = 3 (7002):    89.77   4.479     6.00    24.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   6.636     6.00    35.45
        + ID2= 2 (9020):   145.27    .752     9.00    33.47
          ===============================================
          ID = 3 (7013):   227.32   6.736     6.00    34.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       281.05          .0800
                  34.48       278.78          .0800
                  62.07       280.75          .0800
                  75.86       280.87          .0800
```



```
                 110.34        277.13          .0800
                 124.14        276.45      .0800 / .0350  Main Channel
                 137.93        274.50          .0350      Main Channel
                 151.72        274.76          .0350      Main Channel
                 172.41        276.25          .0350      Main Channel
                 213.79        277.31          .0800
                 255.17        278.25          .0800
                 275.86        278.49          .0800
                 289.66        279.07          .0800
                 303.45        278.41          .0800
                 312.47        278.40          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70   .665E+04        .6            .56     172.84
        .39   274.89   .247E+05        4.2          1.00      97.27
        .59   275.09   .478E+05       11.1          1.35      71.58
        .78   275.28   .756E+05       21.4          1.64      58.99
        .98   275.48   .108E+06       35.2          1.89      51.17
       1.17   275.67   .145E+06       52.9          2.12      45.70
       1.37   275.87   .187E+06       74.8          2.33      41.60
       1.56   276.06   .233E+06      101.2          2.53      38.37
       1.76   276.26   .284E+06      132.2          2.71      35.80
       1.95   276.45   .342E+06      160.8          2.73      35.50
       2.17   276.67   .421E+06      204.7          2.83      34.30
       2.38   276.88   .516E+06      258.7          2.91      33.25
       2.60   277.10   .627E+06      323.9          3.00      32.28
       2.82   277.32   .754E+06      402.4          3.11      31.21
       3.03   277.53   .894E+06      517.5          3.37      28.78
       3.25   277.75   .105E+07      645.6          3.58      27.06
       3.47   277.97   .122E+07      787.1          3.76      25.78
       3.68   278.18   .140E+07      942.2          3.91      24.79
       3.90   278.40   .160E+07     1110.1          4.03      24.06

                                   <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     3.88    9.75  11.99       .37       .93
     OUTFLOW: ID= 1 (6019)  406.96     2.12   11.00  11.99       .28       .68

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| ADD HYD   (5064) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .318     9.50     4.32
        + ID2= 2 (7002):    89.77   4.479     6.00    24.55
          ===============================================
          ID = 3 (5064):   260.50   4.486     6.00    11.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   1.141    10.50     4.48
          ===============================================
          ID = 3 (9250):  1097.41   1.141    10.50     2.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2042):    54.50   4.075     6.00    33.50
        + ID2= 2 (7013):   227.32   6.736     6.00    34.19
          ===============================================
          ID = 3 (7014):   281.82  10.811     6.00    34.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```

```
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   4.8100      1.1900
                          .4200      .6400    |  14.3300      1.2700
                         1.5900      .9400    |  53.8000      1.3300
                         3.2000     1.1100    |    .0000       .0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      1.141       10.50        2.75
     OUTFLOW: ID= 1 (9018)   1097.411      1.065       11.75        2.75

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 93.36
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8056

--------------------------------------------------------------------------------

  ADD HYD   (5061)
    1 +  2 =  3                 AREA    QPEAK    TPEAK     R.V.
--------------------            (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   4.194     8.50    17.06
        + ID2= 2 (7014):   281.82  10.811     6.00    34.05
          ==================================================
          ID = 3 (5061):   769.44  11.148     6.00    23.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                     .00       278.33         .0800
                   46.71       277.77         .0800
                   57.10       277.40         .0800
                   62.29       276.96         .0800
                   67.48       275.94         .0800
                   77.86       273.27         .0800
                   83.05       272.29         .0800
                   93.43       270.99         .0800
                  109.00       270.02         .0350      Main Channel
                  119.38       270.02         .0350      Main Channel
                  150.53       271.36     .0350 / .0800  Main Channel
                  186.86       273.45         .0800
                  207.62       274.37         .0800
                  233.57       275.12         .0800
                  247.79       275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81       43.21
        .57   270.59    .257E+05      13.9         1.14       30.76
        .85   270.87    .484E+05      32.0         1.39       25.24
       1.13   271.15    .776E+05      59.6         1.61       21.71
       1.42   271.44    .112E+06     100.0         1.87       18.71
       1.70   271.72    .151E+06     157.2         2.18       16.04
       1.99   272.01    .195E+06     225.9         2.44       14.37
       2.27   272.29    .242E+06     305.9         2.65       13.21
       2.55   272.57    .294E+06     398.1         2.84       12.31
       2.84   272.86    .350E+06     501.8         3.01       11.61
       3.12   273.14    .409E+06     617.0         3.17       11.05
       3.40   273.42    .472E+06     744.3         3.31       10.58
       3.69   273.71    .539E+06     882.9         3.44       10.18
       3.97   273.99    .611E+06    1033.6         3.55        9.85
       4.26   274.28    .687E+06    1196.8         3.66        9.57
       4.54   274.56    .768E+06    1370.2         3.75        9.35
       4.82   274.84    .856E+06    1556.4         3.82        9.16
       5.11   275.13    .950E+06    1757.0         3.89        9.01
       5.39   275.41    .105E+07    1967.6         3.93        8.91

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     1.07   11.75   2.75       .08       .81
     OUTFLOW: ID= 1 (9251) 1097.41     1.02   12.75   2.75       .08       .81
```



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--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  11.148     6.00    23.28
        + ID2= 2 (6019):   406.96   2.125    11.00    11.99
          ==================================================
          ID = 3 (7016):  1176.40  11.148     6.00    19.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57    .825    10.25     4.48
        + ID2= 2 (9251):  1097.41   1.018    12.75     2.75
          ==================================================
          ID = 3 (5000):  1576.98   1.725    12.00     3.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   4.486     6.00    11.30
        + ID2= 2 (5000):  1576.98   1.725    12.00     3.27
          ==================================================
          ID = 3 (5001):  1837.48   4.497     6.00     4.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   2.8300      3.4900
                          .2800      .2500    |   3.8200      3.9500
                          .7100      .6300    |   4.6700      4.2000
                         1.1300     1.1400    |   7.3600      4.6900
                         1.5600     1.7300    |   8.7800      4.8500
                         1.8400     2.2600    |  35.4000      6.6100
                         2.2700     2.9600    |  *******      8.6500

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      4.497        6.00        4.41
     OUTFLOW: ID= 1 (9017)   1837.481      1.680       13.50        4.41

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 37.35
                   TIME SHIFT OF PEAK FLOW         (min)=450.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.9577

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   5.875     6.00     8.87
        + ID2= 2 (9017):  1837.48   1.680    13.50     4.41
          ==================================================
          ID = 3 (9041):  2376.18   6.386     6.00     5.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   4.768     6.00    33.37
```

```
        + ID2= 2 (9041):  2376.18   6.386     6.00     5.42
          ===============================================
          ID = 3 (5002):  2432.16  11.155     6.00     6.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    11.15      6.00      6.07
    SHIFT ID= 1 (9040): 2432.16    11.15      7.00      6.07

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                   .00        274.29          .0800
                 30.80        273.73          .0800
                 51.30        270.17          .0800
                 61.60        266.84          .0800
                 66.80        266.02          .0800
                102.70        265.42          .0350      Main Channel
                123.20        261.00          .0350      Main Channel
                128.40        261.17          .0350      Main Channel
                154.00        264.62          .0350      Main Channel
                174.60        266.82          .0800
                205.40        268.07          .0800
                236.20        268.74          .0800
                282.40        271.31          .0800
                302.90        272.11          .0800
                348.90        274.45          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)       (m/s)      (min)
        .63   261.63    .702E+04      5.2         1.14      22.47
       1.26   262.26    .220E+05     24.8         1.74      14.74
       1.89   262.89    .443E+05     64.0         2.22      11.54
       2.53   263.53    .741E+05    127.4         2.65       9.69
       3.16   264.16    .111E+06    219.6         3.04       8.44
       3.79   264.79    .156E+06    343.2         3.39       7.57
       4.42   265.42    .209E+06    501.2         3.70       6.94
       5.16   266.16    .304E+06    766.4         3.88       6.61
       5.90   266.90    .428E+06   1123.8         4.05       6.34
       6.64   267.64    .570E+06   1628.6         4.40       5.84
       7.38   268.38    .738E+06   2225.4         4.65       5.53
       8.12   269.12    .941E+06   2928.9         4.80       5.35
       8.85   269.85    .116E+07   3743.0         4.95       5.18
       9.59   270.59    .141E+07   4656.3         5.10       5.03
      10.33   271.33    .167E+07   5671.9         5.24       4.90
      11.07   272.07    .195E+07   6784.6         5.36       4.80
      11.81   272.81    .226E+07   8029.1         5.47       4.69
      12.55   273.55    .259E+07   9393.0         5.59       4.60
      13.29   274.29    .295E+07  10648.3         5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    11.15    7.00   6.07       .82      1.28
     OUTFLOW: ID= 1 (6029) 2432.16     6.92    7.25   6.07       .69      1.18


--------------------------------------------------------------------------------
--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   6.923     7.25     6.07
        + ID2= 2 (1040):    14.62    .176     6.75    11.61
          ===============================================
          ID = 3 (5003):  2446.78   7.072     7.25     6.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```



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--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   7.072     7.25     6.10
        + ID2= 2 (7016):  1176.40  11.148     6.00    19.37
          ===============================================
          ID = 3 (5004):  3623.18  12.315     7.25    10.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    12.31      7.25     10.41
    SHIFT ID= 1 (9015): 3623.18    12.31      9.25     10.41

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                   .00        260.30          .0800
                 34.10        260.43          .0800
                 62.40        259.79          .0800
                 79.50        255.72          .0800
                113.50        254.00          .0800
                153.30        253.33          .0350      Main Channel
                187.30        253.06          .0350      Main Channel
                198.70        251.88          .0350      Main Channel
                204.40        252.61          .0350      Main Channel
                249.80        254.00          .0800
                334.90        255.77          .0800
                351.90        256.37          .0800
                414.40        260.24          .0800
                465.50        260.75          .0800
                514.40        261.48          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)       (m/s)      (min)
        .36   252.24    .596E+04       .4          .39     223.90
        .73   252.61    .238E+05      2.8          .61     141.05
       1.09   252.97    .619E+05      8.2          .69     126.14
       1.45   253.33    .151E+06     18.8          .65     134.06
       1.91   253.79    .383E+06     68.4          .93      93.14
       2.38   254.26    .713E+06    157.3         1.15      75.58
       2.84   254.72    .112E+07    287.3         1.33      65.13
       3.31   255.19    .161E+07    454.2         1.47      59.01
       3.77   255.65    .217E+07    659.0         1.58      54.87
       4.24   256.12    .279E+07    908.7         1.69      51.25
       4.70   256.58    .346E+07   1199.1         1.80      48.03
       5.17   257.05    .414E+07   1527.9         1.92      45.17
       5.63   257.51    .485E+07   1892.4         2.03      42.71
       6.10   257.98    .558E+07   2291.8         2.13      40.59
       6.56   258.44    .634E+07   2725.7         2.23      38.74
       7.03   258.91    .711E+07   3193.6         2.33      37.12
       7.49   259.37    .791E+07   3695.3         2.43      35.69
       7.96   259.84    .874E+07   4221.9         2.51      34.48
       8.42   260.30    .961E+07   4697.6         2.54      34.09

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    12.31    9.25  10.41      1.23       .67
     OUTFLOW: ID= 1 (6031) 3623.18     8.34   13.00  10.41      1.09       .69


--------------------------------------------------------------------------------

  ADD HYD   (5005)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   5.556     8.50    18.57
        + ID2= 2 (6031):  3623.18   8.344    13.00    10.41
          ===============================================
          ID = 3 (5005):  4322.96  11.881    10.50    11.73
```

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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************
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10-Year Storm

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--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 71.22 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.57 |  3.25    2.85 |  6.25   12.82 |  9.25    2.17
                  .50    1.65 |  3.50    2.85 |  6.50   12.82 |  9.50    1.99
                  .75    1.68 |  3.75    2.85 |  6.75    6.78 |  9.75    1.91
                 1.00    1.74 |  4.00    2.85 |  7.00    4.62 | 10.00    1.94
                 1.25    1.82 |  4.25    3.93 |  7.25    4.27 | 10.25    1.88
                 1.50    1.88 |  4.50    4.62 |  7.50    4.27 | 10.50    1.77
                 1.75    1.91 |  4.75    5.16 |  7.75    4.27 | 10.75    1.62
                 2.00    1.99 |  5.00    6.24 |  8.00    4.27 | 11.00    1.51
                 2.25    1.99 |  5.25    8.55 |  8.25    3.65 | 11.25    1.34
                 2.50    1.99 |  5.50    8.55 |  8.50    3.13 | 11.50    1.22
                 2.75    2.14 |  5.75   34.19 |  8.75    2.73 | 11.75    1.08
                 3.00    2.42 |  6.00   94.01 |  9.00    2.42 | 12.00     .97

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area     (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia       (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=   6.388 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  22.629
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .318

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        58.25
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.93 (ii)   19.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.10         4.45         7.981 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      70.72        30.65         40.67
     TOTAL RAINFALL   (mm)=      71.22        71.22         71.22
     RUNOFF COEFFICIENT   =        .99          .43           .57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        54.71
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.76 (ii)   18.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.62         1.99         5.890 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      70.72        25.19         41.13
     TOTAL RAINFALL   (mm)=      71.22        71.22         71.22
     RUNOFF COEFFICIENT   =        .99          .35           .58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        56.75
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.07 (ii)   16.97 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.44          .85         2.988 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25          6.00
     RUNOFF VOLUME    (mm)=      61.22        25.17         39.59
     TOTAL RAINFALL   (mm)=      71.22        71.22         71.22
     RUNOFF COEFFICIENT   =        .86          .35           .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        53.21
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.31 (ii)   19.49 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
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```
     PEAK FLOW       (cms)=       5.72         2.40          7.245 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      61.22        24.53          37.37
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .86          .34            .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   1.282 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .572 (i)
     TIME TO PEAK    (hrs)=   9.250
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        41.43
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.19 (ii)   18.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       1.63          .95          2.231 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        22.15          34.29
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .31            .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB             |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        41.43
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       5.92 (ii)   18.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       1.40          .82          1.928 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        22.15          34.29
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .31            .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        41.43
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.04 (ii)   19.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       2.44         1.44          3.351 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        22.15          34.29
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .31            .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   1.467 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.804
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .110

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB             |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   2.098 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   8.408
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .118

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .705 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  11.652
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .164

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   2.027 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.804
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .110

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .250 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  16.207
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .228

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   5.792 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  23.326
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .328

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB             |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80       32.70
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     602.80       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       60.66
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.69 (ii)  18.31 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       3.22        2.91          5.116 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72       32.04          41.71
     TOTAL RAINFALL   (mm)=      71.22       71.22          71.22
     RUNOFF COEFFICIENT   =        .99         .45            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92       45.13
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     739.60       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       62.41
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       8.70 (ii)  19.19 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       5.64        4.05          8.287 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72       32.37          43.87
     TOTAL RAINFALL   (mm)=      71.22       71.22          71.22
     RUNOFF COEFFICIENT   =        .99         .45            .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11       87.16
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     984.10       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       60.66
                over (min)       15.00       30.00
     Storage Coeff.  (min)=      10.33 (ii)  20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
```

```
     Unit Hyd. peak  (cms)=        .09          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       7.93         7.33         12.687 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        32.04          41.71
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .45            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   5.477 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  16.717
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .235

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	1.57	3.083	2.85	6.083	12.82	9.08	2.17
.167	1.57	3.167	2.85	6.167	12.82	9.17	2.17
.250	1.57	3.250	2.85	6.250	12.82	9.25	2.17
.333	1.65	3.333	2.85	6.333	12.82	9.33	1.99
.417	1.65	3.417	2.85	6.417	12.82	9.42	1.99
.500	1.65	3.500	2.85	6.500	12.82	9.50	1.99
.583	1.68	3.583	2.85	6.583	6.78	9.58	1.91
.667	1.68	3.667	2.85	6.667	6.78	9.67	1.91
.750	1.68	3.750	2.85	6.750	6.78	9.75	1.91
.833	1.74	3.833	2.85	6.833	4.62	9.83	1.94
.917	1.74	3.917	2.85	6.917	4.62	9.92	1.94
1.000	1.74	4.000	2.85	7.000	4.62	10.00	1.94
1.083	1.82	4.083	3.93	7.083	4.27	10.08	1.88
1.167	1.82	4.167	3.93	7.167	4.27	10.17	1.88
1.250	1.82	4.250	3.93	7.250	4.27	10.25	1.88
1.333	1.88	4.333	4.62	7.333	4.27	10.33	1.77
1.417	1.88	4.417	4.62	7.417	4.27	10.42	1.77
1.500	1.88	4.500	4.62	7.500	4.27	10.50	1.77
1.583	1.91	4.583	5.16	7.583	4.27	10.58	1.62
1.667	1.91	4.667	5.16	7.667	4.27	10.67	1.62
1.750	1.91	4.750	5.16	7.750	4.27	10.75	1.62
1.833	1.99	4.833	6.24	7.833	4.27	10.83	1.51
1.917	1.99	4.917	6.24	7.917	4.27	10.92	1.51
2.000	1.99	5.000	6.24	8.000	4.27	11.00	1.51
2.083	1.99	5.083	8.55	8.083	3.65	11.08	1.34
2.167	1.99	5.167	8.55	8.167	3.65	11.17	1.34
2.250	1.99	5.250	8.55	8.250	3.65	11.25	1.34
2.333	1.99	5.333	8.55	8.333	3.13	11.33	1.22
2.417	1.99	5.417	8.55	8.417	3.13	11.42	1.22
2.500	1.99	5.500	8.55	8.500	3.13	11.50	1.22
2.583	2.14	5.583	34.19	8.583	2.73	11.58	1.08
2.667	2.14	5.667	34.19	8.667	2.73	11.67	1.08
2.750	2.14	5.750	34.19	8.750	2.73	11.75	1.08
2.833	2.42	5.833	94.01	8.833	2.42	11.83	.97
2.917	2.42	5.917	94.01	8.917	2.42	11.92	.97
3.000	2.42	6.000	94.01	9.000	2.42	12.00	.97


```
     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW       (cms)=    .080 (i)
     TIME TO PEAK    (hrs)=   9.583
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.2000       .9900
                          .0290      .3700    |   2.7000      1.4200
                          .5000      .6900    |   6.1000      2.1800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      7.981        6.00       40.67
     OUTFLOW: ID= 1 (9021)     89.700      3.472        6.50       40.63

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.51
                   TIME SHIFT OF PEAK FLOW        (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.6071

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .0800       .8375
                          .0100      .4725    |    .1300       .9815
                          .0450      .7030    |    .2380      1.2455

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      2.988        6.00       39.59
     OUTFLOW: ID= 1 (9022)     24.780       .080       11.00       38.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.67
                   TIME SHIFT OF PEAK FLOW        (min)=300.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8370

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):     24.78     .080    11.00    38.99
        + ID2= 2 (2021):     70.42    7.245     6.00    37.37
          ==================================================
          ID = 3 (7008):     95.20    7.252     6.00    37.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):     95.20    7.252     6.00    37.79
        + ID2= 2 (1044):    443.50    1.282    10.00     7.55
          ==================================================
          ID = 3 (5065):    538.70    7.274     6.00    12.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.0800       .5900
                          .0000      .2600    |   1.2200       .7400
                          .5700      .3500    |   1.3500       .9300
```

```
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      1.928        6.00       34.29
     OUTFLOW: ID= 1 (9019)     22.700       .712        6.50       22.83

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.93
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3911

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70    .712     6.50    22.83
        + ID2= 2 (2011):    40.62   3.351     6.00    34.29
          ===============================================
          ID = 3 (7001):    63.32   3.351     6.00    30.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      2.098        7.50        8.41
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.1075

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .705        6.50       11.65
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6396

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--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     12.687        6.00       41.71
     OUTFLOW: ID= 1 (9020)    145.270      1.220        8.25       41.69

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.62
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.3353

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     5.48      7.25     16.72
```



```
    SHIFT ID= 1 (9029):  406.96     5.48      9.75     16.72

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--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   6.388     8.75    22.63
        + ID2= 2 (9021):    89.70   3.472     6.50    40.63
          ===============================================
          ID = 3 (5062):   699.78   7.487     8.50    24.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2012):    26.45   2.231     6.00    34.29
        + ID2= 2 (7001):    63.32   3.351     6.00    30.18
          ===============================================
          ID = 3 (7002):    89.77   5.582     6.00    31.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   8.287     6.00    43.87
        + ID2= 2 (9020):   145.27   1.220     8.25    41.69
          ===============================================
          ID = 3 (7013):   227.32   8.413     6.00    42.48

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       281.05         .0800
                  34.48       278.78         .0800
                  62.07       280.75         .0800
                  75.86       280.87         .0800
                 110.34       277.13         .0800
                 124.14       276.45     .0800 / .0350  Main Channel
                 137.93       274.50         .0350      Main Channel
                 151.72       274.76         .0350      Main Channel
                 172.41       276.25         .0350      Main Channel
                 213.79       277.31         .0800
                 255.17       278.25         .0800
                 275.86       278.49         .0800
                 289.66       279.07         .0800
                 303.45       278.41         .0800
                 312.47       278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
```

```
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     5.48    9.75  16.72       .43      1.05
     OUTFLOW: ID= 1 (6019)  406.96     3.43   10.75  16.71       .35       .85


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 ADD HYD   (5064)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):    170.73     .572     9.25     7.55
        + ID2= 2 (7002):     89.77    5.582     6.00    31.39
          ===============================================
          ID = 3 (5064):    260.50    5.599     6.00    15.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):    424.46     .000      .00      .00
        + ID2= 2 (1046):    672.95    2.027    10.00     7.80
          ===============================================
          ID = 3 (9250):   1097.41    2.027    10.00     4.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2042):     54.50    5.116     6.00    41.71
        + ID2= 2 (7013):    227.32    8.413     6.00    42.48
          ===============================================
          ID = 3 (7014):    281.82   13.529     6.00    42.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000       .0000   |   4.8100     1.1900
                           .4200       .6400   |  14.3300     1.2700
                          1.5900       .9400   |  53.8000     1.3300
                          3.2000      1.1100   |    .0000      .0000

                                   AREA      QPEAK       TPEAK       R.V.
                                   (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      2.027       10.00        4.79
     OUTFLOW: ID= 1 (9018)   1097.411      2.001       10.50        4.78

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 98.74
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9837
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 ADD HYD   (5061)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):    487.62    5.792     8.50    23.33
        + ID2= 2 (7014):    281.82   13.529     6.00    42.33
          ===============================================
          ID = 3 (5061):    769.44   14.059     6.00    30.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation      Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81      43.21
        .57   270.59    .257E+05      13.9         1.14      30.76
        .85   270.87    .484E+05      32.0         1.39      25.24
       1.13   271.15    .776E+05      59.6         1.61      21.71
       1.42   271.44    .112E+06     100.0         1.87      18.71
       1.70   271.72    .151E+06     157.2         2.18      16.04
       1.99   272.01    .195E+06     225.9         2.44      14.37
       2.27   272.29    .242E+06     305.9         2.65      13.21
       2.55   272.57    .294E+06     398.1         2.84      12.31
       2.84   272.86    .350E+06     501.8         3.01      11.61
       3.12   273.14    .409E+06     617.0         3.17      11.05
       3.40   273.42    .472E+06     744.3         3.31      10.58
       3.69   273.71    .539E+06     882.9         3.44      10.18
       3.97   273.99    .611E+06    1033.6         3.55       9.85
       4.26   274.28    .687E+06    1196.8         3.66       9.57
       4.54   274.56    .768E+06    1370.2         3.75       9.35
       4.82   274.84    .856E+06    1556.4         3.82       9.16
       5.11   275.13    .950E+06    1757.0         3.89       9.01
       5.39   275.41    .105E+07    1967.6         3.93       8.91

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     2.00   10.50   4.78       .15       .81
     OUTFLOW: ID= 1 (9251) 1097.41     1.89   11.50   4.78       .14       .81


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--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):    769.44   14.059     6.00    30.29
        + ID2= 2 (6019):    406.96    3.432    10.75    16.71
          ===============================================
          ID = 3 (7016):   1176.40   14.059     6.00    25.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
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```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   1.467    10.00     7.80
        + ID2= 2 (9251):  1097.41   1.886    11.50     4.78
          ===============================================
          ID = 3 (5000):  1576.98   3.230    11.25     5.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   5.599     6.00    15.76
        + ID2= 2 (5000):  1576.98   3.230    11.25     5.70
          ===============================================
          ID = 3 (5001):  1837.48   5.626     6.00     7.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   2.8300     3.4900
                           .2800      .2500    |   3.8200     3.9500
                           .7100      .6300    |   4.6700     4.2000
                          1.1300     1.1400    |   7.3600     4.6900
                          1.5600     1.7300    |   8.7800     4.8500
                          1.8400     2.2600    |  35.4000     6.6100
                          2.2700     2.9600    |  *******     8.6500

                              AREA      QPEAK       TPEAK       R.V.
                              (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      5.626        6.00        7.13
     OUTFLOW: ID= 1 (9017)   1837.481      3.210       12.75        7.13

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 57.05
                   TIME SHIFT OF PEAK FLOW         (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.6668

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   7.274     6.00    12.89
        + ID2= 2 (9017):  1837.48   3.210    12.75     7.13
          ===============================================
          ID = 3 (9041):  2376.18   7.909     6.00     8.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   5.890     6.00    41.13
        + ID2= 2 (9041):  2376.18   7.909     6.00     8.44
          ===============================================
          ID = 3 (5002):  2432.16  13.798     6.00     9.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    13.80      6.00      9.19
    SHIFT ID= 1 (9040): 2432.16    13.80      7.00      9.19

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
```



```
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29          .0800
                  30.80       273.73          .0800
                  51.30       270.17          .0800
                  61.60       266.84          .0800
                  66.80       266.02          .0800
                 102.70       265.42          .0350     Main Channel
                 123.20       261.00          .0350     Main Channel
                 128.40       261.17          .0350     Main Channel
                 154.00       264.62          .0350     Main Channel
                 174.60       266.82          .0800
                 205.40       268.07          .0800
                 236.20       268.74          .0800
                 282.40       271.31          .0800
                 302.90       272.11          .0800
                 348.90       274.45          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)      (cms)       (m/s)      (min)
         .63   261.63    .702E+04       5.2         1.14      22.47
        1.26   262.26    .220E+05      24.8         1.74      14.74
        1.89   262.89    .443E+05      64.0         2.22      11.54
        2.53   263.53    .741E+05     127.4         2.65       9.69
        3.16   264.16    .111E+06     219.6         3.04       8.44
        3.79   264.79    .156E+06     343.2         3.39       7.57
        4.42   265.42    .209E+06     501.2         3.70       6.94
        5.16   266.16    .304E+06     766.4         3.88       6.61
        5.90   266.90    .428E+06    1123.8         4.05       6.34
        6.64   267.64    .570E+06    1628.6         4.40       5.84
        7.38   268.38    .738E+06    2225.4         4.65       5.53
        8.12   269.12    .941E+06    2928.9         4.80       5.35
        8.85   269.85    .116E+07    3743.0         4.95       5.18
        9.59   270.59    .141E+07    4656.3         5.10       5.03
       10.33   271.33    .167E+07    5671.9         5.24       4.90
       11.07   272.07    .195E+07    6784.6         5.36       4.80
       11.81   272.81    .226E+07    8029.1         5.47       4.69
       12.55   273.55    .259E+07    9393.0         5.59       4.60
       13.29   274.29    .295E+07   10648.3         5.55       4.62

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16   13.80    7.00   9.19       .91      1.35
     OUTFLOW: ID= 1 (6029) 2432.16    8.78    7.25   9.19       .74      1.22


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--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   8.784     7.25     9.19
        + ID2= 2 (1040):    14.62    .250     6.75    16.21
          ===============================================
          ID = 3 (5003):  2446.78   8.992     7.25     9.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   8.992     7.25     9.23
        + ID2= 2 (7016):  1176.40  14.059     6.00    25.59
          ===============================================
          ID = 3 (5004):  3623.18  16.385     7.25    14.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    16.38      7.25     14.54
```

```
    SHIFT ID= 1 (9015): 3623.18    16.38      9.25     14.54

 ----------------------------------------------------------------------------
 -------------------
 | ROUTE CHN (6031) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 -------------------
                <------ DATA FOR SECTION (   1.0) ------>
                Distance      Elevation       Manning
                      .00        260.30         .0800
                    34.10        260.43         .0800
                    62.40        259.79         .0800
                    79.50        255.72         .0800
                   113.50        254.00         .0800
                   153.30        253.33         .0350     Main Channel
                   187.30        253.06         .0350     Main Channel
                   198.70        251.88         .0350     Main Channel
                   204.40        252.61         .0350     Main Channel
                   249.80        254.00         .0800
                   334.90        255.77         .0800
                   351.90        256.37         .0800
                   414.40        260.24         .0800
                   465.50        260.75         .0800
                   514.40        261.48         .0800

       <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
         .36   252.24   .596E+04        .4          .39      223.90
         .73   252.61   .238E+05       2.8          .61      141.05
        1.09   252.97   .619E+05       8.2          .69      126.14
        1.45   253.33   .151E+06      18.8          .65      134.06
        1.91   253.79   .383E+06      68.4          .93       93.14
        2.38   254.26   .713E+06     157.3         1.15       75.58
        2.84   254.72   .112E+07     287.3         1.33       65.13
        3.31   255.19   .161E+07     454.2         1.47       59.01
        3.77   255.65   .217E+07     659.0         1.58       54.87
        4.24   256.12   .279E+07     908.7         1.69       51.25
        4.70   256.58   .346E+07    1199.1         1.80       48.03
        5.17   257.05   .414E+07    1527.9         1.92       45.17
        5.63   257.51   .485E+07    1892.4         2.03       42.71
        6.10   257.98   .558E+07    2291.8         2.13       40.59
        6.56   258.44   .634E+07    2725.7         2.23       38.74
        7.03   258.91   .711E+07    3193.6         2.33       37.12
        7.49   259.37   .791E+07    3695.3         2.43       35.69
        7.96   259.84   .874E+07    4221.9         2.51       34.48
        8.42   260.30   .961E+07    4697.6         2.54       34.09

                                 <---- hydrograph ---->   <-pipe / channel->
                           AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                           (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    16.38    9.25  14.54      1.37       .65
     OUTFLOW: ID= 1 (6031) 3623.18    11.69   13.50  14.54      1.21       .67

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 -------------------
 | ADD HYD   (5005) |
 |   1 +  2 =  3    |            AREA    QPEAK    TPEAK     R.V.
 -------------------             (ha)    (cms)    (hrs)     (mm)
           ID1= 1 (5062):   699.78   7.487     8.50    24.94
         + ID2= 2 (6031):  3623.18  11.693    13.50    14.54
           ===============================================
           ID = 3 (5005):  4322.96  15.772    10.25    16.22

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************
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25-Year Storm

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 -------------------
 | MASS STORM       |     Filename: V:\01606\Active\160621777\SWM Master Plans
 |                  |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal= 83.15 mm |     Comments: SCS 24 HR MASS CURVE
 -------------------
                          Duration of storm    = 12.00 hrs
                          Mass curve time step = 15.00 min

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
```



```
                   .25    1.83 |  3.25    3.33 |  6.25   14.97 |  9.25    2.53
                   .50    1.93 |  3.50    3.33 |  6.50   14.97 |  9.50    2.33
                   .75    1.96 |  3.75    3.33 |  6.75    7.92 |  9.75    2.23
                  1.00    2.03 |  4.00    3.33 |  7.00    5.39 | 10.00    2.26
                  1.25    2.13 |  4.25    4.59 |  7.25    4.99 | 10.25    2.20
                  1.50    2.20 |  4.50    5.39 |  7.50    4.99 | 10.50    2.06
                  1.75    2.23 |  4.75    6.02 |  7.75    4.99 | 10.75    1.90
                  2.00    2.33 |  5.00    7.28 |  8.00    4.99 | 11.00    1.76
                  2.25    2.33 |  5.25    9.98 |  8.25    4.26 | 11.25    1.56
                  2.50    2.33 |  5.50    9.98 |  8.50    3.66 | 11.50    1.43
                  2.75    2.49 |  5.75   39.91 |  8.75    3.19 | 11.75    1.26
                  3.00    2.83 |  6.00  109.76 |  9.00    2.83 | 12.00    1.13

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 -------------------
 | CALIB            |
 | NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 -------------------    U.H. Tp(hrs)=   2.46

      Unit Hyd Qpeak  (cms)=   9.472

      PEAK FLOW      (cms)=   8.546 (i)
      TIME TO PEAK   (hrs)=   8.750
      RUNOFF VOLUME   (mm)=  30.044
      TOTAL RAINFALL  (mm)=  83.150
      RUNOFF COEFFICIENT   =    .361

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ----------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | STANDHYD  (2050) |   Area    (ha)=  89.70
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=     35.88        53.82
      Dep. Storage     (mm)=       .50         2.50
      Average Slope     (%)=      1.00         1.00
      Length            (m)=    773.30        40.00
      Mannings n          =       .013         .250

      Max.Eff.Inten.(mm/hr)=    109.76        74.52
                 over (min)      15.00        30.00
      Storage Coeff.  (min)=      8.40 (ii)   18.17 (ii)
      Unit Hyd. Tpeak (min)=     15.00        30.00
      Unit Hyd. peak  (cms)=       .09          .05
                                                            *TOTALS*
      PEAK FLOW      (cms)=      6.06         5.90            9.919 (iii)
      TIME TO PEAK   (hrs)=      6.00         6.25            6.00
      RUNOFF VOLUME   (mm)=     82.65        39.14           50.02
      TOTAL RAINFALL  (mm)=     83.15        83.15           83.15
      RUNOFF COEFFICIENT   =       .99          .47             .60

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  70.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ----------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | STANDHYD  (2031) |   Area    (ha)=  55.98
 |ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=     30.79        25.19
      Dep. Storage     (mm)=       .50         2.50
      Average Slope     (%)=      1.00         1.00
      Length            (m)=    610.90        40.00
      Mannings n          =       .013         .250

      Max.Eff.Inten.(mm/hr)=    109.76        70.93
                 over (min)      15.00        30.00
      Storage Coeff.  (min)=      7.29 (ii)   17.26 (ii)
      Unit Hyd. Tpeak (min)=     15.00        30.00
      Unit Hyd. peak  (cms)=       .10          .05
                                                            *TOTALS*
      PEAK FLOW      (cms)=      5.46         2.68            7.193 (iii)
```

```
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      82.65       32.56         50.09
     TOTAL RAINFALL   (mm)=      83.15       83.15         83.15
     RUNOFF COEFFICIENT   =        .99         .39           .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87        9.91
     Dep. Storage     (mm)=      10.00        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     406.40       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       73.57
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       5.71 (ii)   15.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .11         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.88        1.14          3.618 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.15       32.53         48.78
     TOTAL RAINFALL   (mm)=      83.15       83.15         83.15
     RUNOFF COEFFICIENT   =        .88         .39           .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73       31.69
     Dep. Storage     (mm)=      10.00        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     685.20       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       69.10
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.81 (ii)   17.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.77        3.23          8.855 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      73.15       31.76         46.24
     TOTAL RAINFALL   (mm)=      83.15       83.15         83.15
     RUNOFF COEFFICIENT   =        .88         .38           .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
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```
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   2.063 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .930 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58       15.87
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     419.90       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       54.15
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       5.82 (ii)   16.93 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.92        1.29          2.747 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      82.65       28.85         42.30
     TOTAL RAINFALL   (mm)=      83.15       83.15         83.15
     RUNOFF COEFFICIENT   =        .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08       13.62
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     389.00       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       54.15
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       5.56 (ii)   16.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .11         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.65        1.12          2.372 (iii)
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```
     TIME TO PEAK    (hrs)=      6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     82.65       28.85         42.30
     TOTAL RAINFALL   (mm)=     83.15       83.15         83.15
     RUNOFF COEFFICIENT   =       .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2011)  |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min  |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     16.25       24.37
     Dep. Storage     (mm)=       .50        2.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=    520.40       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=    109.76       54.15
                over (min)      15.00       30.00
     Storage Coeff.  (min)=      6.62 (ii)  17.73 (ii)
     Unit Hyd. Tpeak (min)=     15.00       30.00
     Unit Hyd. peak  (cms)=       .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=      2.88        1.95          4.134 (iii)
     TIME TO PEAK    (hrs)=      6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     82.65       28.85         42.30
     TOTAL RAINFALL   (mm)=     83.15       83.15         83.15
     RUNOFF COEFFICIENT   =       .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1047)  |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   2.362 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.300
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (9146)  |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   3.332 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  12.712
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .153

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB             |
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| NASHYD    (9246)  |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   1.134 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  17.315
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1046)  |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   3.258 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.300
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1040)  |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .342 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  21.923
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .264

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1059)  |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   7.732 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  30.906
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .372

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2042)  |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min  |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     21.80       32.70
     Dep. Storage     (mm)=       .50        1.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=    602.80       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=    109.76       77.23
                over (min)      15.00       30.00
     Storage Coeff.  (min)=      7.23 (ii)  16.87 (ii)
     Unit Hyd. Tpeak (min)=     15.00       30.00
     Unit Hyd. peak  (cms)=       .10         .05
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                                                            *TOTALS*
     PEAK FLOW      (cms)=      3.80         3.83          6.337 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     82.65        40.71          51.20
     TOTAL RAINFALL   (mm)=     83.15        83.15          83.15
     RUNOFF COEFFICIENT   =       .99          .49            .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     36.92        45.13
     Dep. Storage     (mm)=       .50         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    739.60        40.00
     Mannings n          =      .013         .250

     Max.Eff.Inten.(mm/hr)=    109.76        79.39
                over (min)      15.00        30.00
     Storage Coeff.  (min)=      8.18 (ii)   17.71 (ii)
     Unit Hyd. Tpeak (min)=     15.00        30.00
     Unit Hyd. peak  (cms)=       .10          .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=      6.69         5.34          10.214 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     82.65        41.10          53.56
     TOTAL RAINFALL   (mm)=     83.15        83.15          83.15
     RUNOFF COEFFICIENT   =       .99          .49            .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     58.11        87.16
     Dep. Storage     (mm)=       .50         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    984.10        40.00
     Mannings n          =      .013         .250

     Max.Eff.Inten.(mm/hr)=    109.76        77.23
                over (min)      15.00        30.00
     Storage Coeff.  (min)=      9.70 (ii)   19.34 (ii)
     Unit Hyd. Tpeak (min)=     15.00        30.00
     Unit Hyd. peak  (cms)=       .09          .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=      9.43         9.68          15.788 (iii)
     TIME TO PEAK    (hrs)=      6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     82.65        40.71          51.20
     TOTAL RAINFALL   (mm)=     83.15        83.15          83.15
     RUNOFF COEFFICIENT   =       .99          .49            .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB             |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW      (cms)=   7.472 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  22.578
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .272

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                             ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                .083    1.83 | 3.083    3.33 | 6.083   14.97 |  9.08    2.53
                .167    1.83 | 3.167    3.33 | 6.167   14.97 |  9.17    2.53
                .250    1.83 | 3.250    3.33 | 6.250   14.97 |  9.25    2.53
                .333    1.93 | 3.333    3.33 | 6.333   14.97 |  9.33    2.33
                .417    1.93 | 3.417    3.33 | 6.417   14.97 |  9.42    2.33
                .500    1.93 | 3.500    3.33 | 6.500   14.97 |  9.50    2.33
                .583    1.96 | 3.583    3.33 | 6.583    7.92 |  9.58    2.23
                .667    1.96 | 3.667    3.33 | 6.667    7.92 |  9.67    2.23
                .750    1.96 | 3.750    3.33 | 6.750    7.92 |  9.75    2.23
                .833    2.03 | 3.833    3.33 | 6.833    5.39 |  9.83    2.26
                .917    2.03 | 3.917    3.33 | 6.917    5.39 |  9.92    2.26
               1.000    2.03 | 4.000    3.33 | 7.000    5.39 | 10.00    2.26
               1.083    2.13 | 4.083    4.59 | 7.083    4.99 | 10.08    2.20
               1.167    2.13 | 4.167    4.59 | 7.167    4.99 | 10.17    2.20
               1.250    2.13 | 4.250    4.59 | 7.250    4.99 | 10.25    2.20
               1.333    2.20 | 4.333    5.39 | 7.333    4.99 | 10.33    2.06
               1.417    2.20 | 4.417    5.39 | 7.417    4.99 | 10.42    2.06
               1.500    2.20 | 4.500    5.39 | 7.500    4.99 | 10.50    2.06
               1.583    2.23 | 4.583    6.02 | 7.583    4.99 | 10.58    1.90
               1.667    2.23 | 4.667    6.02 | 7.667    4.99 | 10.67    1.90
               1.750    2.23 | 4.750    6.02 | 7.750    4.99 | 10.75    1.90
               1.833    2.33 | 4.833    7.28 | 7.833    4.99 | 10.83    1.76
               1.917    2.33 | 4.917    7.28 | 7.917    4.99 | 10.92    1.76
               2.000    2.33 | 5.000    7.28 | 8.000    4.99 | 11.00    1.76
               2.083    2.33 | 5.083    9.98 | 8.083    4.26 | 11.08    1.56
               2.167    2.33 | 5.167    9.98 | 8.167    4.26 | 11.17    1.56
               2.250    2.33 | 5.250    9.98 | 8.250    4.26 | 11.25    1.56
               2.333    2.33 | 5.333    9.98 | 8.333    3.66 | 11.33    1.43
               2.417    2.33 | 5.417    9.98 | 8.417    3.66 | 11.42    1.43
               2.500    2.33 | 5.500    9.98 | 8.500    3.66 | 11.50    1.43
               2.583    2.49 | 5.583   39.91 | 8.583    3.19 | 11.58    1.26
               2.667    2.49 | 5.667   39.91 | 8.667    3.19 | 11.67    1.26
               2.750    2.49 | 5.750   39.91 | 8.750    3.19 | 11.75    1.26
               2.833    2.83 | 5.833  109.76 | 8.833    2.83 | 11.83    1.13
               2.917    2.83 | 5.917  109.76 | 8.917    2.83 | 11.92    1.13
               3.000    2.83 | 6.000  109.76 | 9.000    2.83 | 12.00    1.13

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW      (cms)=    .130 (i)
     TIME TO PEAK    (hrs)=   9.333
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |   1.2000      .9900
                            .0290      .3700   |   2.7000     1.4200
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                           .5000      .6900   |   6.1000      2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      9.919        6.00       50.02
     OUTFLOW: ID= 1 (9021)     89.700      4.688        6.50       49.98

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.27
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.8649

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800       .8375
                           .0100      .4725   |    .1300       .9815
                           .0450      .7030   |    .2380      1.2455

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      3.618        6.00       48.78
     OUTFLOW: ID= 1 (9022)     24.780       .130        9.50       48.16

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.59
                  TIME SHIFT OF PEAK FLOW         (min)=210.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .9810

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .130     9.50    48.16
        + ID2= 2 (2021):    70.42    8.855     6.00    46.24
          ================================================
          ID = 3 (7008):    95.20    8.864     6.00    46.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    8.864     6.00    46.74
        + ID2= 2 (1044):   443.50    2.063     9.75    11.92
          ================================================
          ID = 3 (5065):   538.70    8.907     6.00    18.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      2.372        6.00       42.30
     OUTFLOW: ID= 1 (9019)     22.700       .929        6.50       30.84

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.15
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .4536

------------------------------------------------------------------------------

--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .929     6.50    30.84
```



```
        + ID2= 2 (2011):    40.62   4.134     6.00    42.30
          ==================================================
          ID = 3 (7001):    63.32   4.414     6.00    38.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      3.332        7.25       12.71
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                  TIME SHIFT OF PEAK FLOW         (min)=******
                  MAXIMUM  STORAGE   USED       (ha.m.)=  4.6980

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      1.134        6.50       17.31
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                  TIME SHIFT OF PEAK FLOW         (min)=******
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .9504

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     15.788        6.00       51.20
     OUTFLOW: ID= 1 (9020)    145.270      1.758        7.75       51.17

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.14
                  TIME SHIFT OF PEAK FLOW         (min)=105.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  5.0996

------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     7.47      7.00     22.58
    SHIFT ID= 1 (9029):  406.96     7.47      9.50     22.58

------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   8.546     8.75    30.04
        + ID2= 2 (9021):    89.70   4.688     6.50    49.98
          ==================================================
          ID = 3 (5062):   699.78   9.861     8.50    32.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2012):    26.45    2.747     6.00    42.30
        + ID2= 2 (7001):    63.32    4.414     6.00    38.19
          ==================================================
          ID = 3 (7002):    89.77    7.161     6.00    39.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57     .000      .00      .00
        + ID2= 2 (9248):    54.89     .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46     .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   10.214     6.00    53.56
        + ID2= 2 (9020):   145.27    1.758     7.75    51.17
          ==================================================
          ID = 3 (7013):   227.32   10.369     6.00    52.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
         .20   274.70    .665E+04        .6           .56     172.84
         .39   274.89    .247E+05       4.2          1.00      97.27
         .59   275.09    .478E+05      11.1          1.35      71.58
         .78   275.28    .756E+05      21.4          1.64      58.99
         .98   275.48    .108E+06      35.2          1.89      51.17
        1.17   275.67    .145E+06      52.9          2.12      45.70
        1.37   275.87    .187E+06      74.8          2.33      41.60
        1.56   276.06    .233E+06     101.2          2.53      38.37
        1.76   276.26    .284E+06     132.2          2.71      35.80
        1.95   276.45    .342E+06     160.8          2.73      35.50
        2.17   276.67    .421E+06     204.7          2.83      34.30
        2.38   276.88    .516E+06     258.7          2.91      33.25
        2.60   277.10    .627E+06     323.9          3.00      32.28
        2.82   277.32    .754E+06     402.4          3.11      31.21
        3.03   277.53    .894E+06     517.5          3.37      28.78
        3.25   277.75    .105E+07     645.6          3.58      27.06
        3.47   277.97    .122E+07     787.1          3.76      25.78
        3.68   278.18    .140E+07     942.2          3.91      24.79
        3.90   278.40    .160E+07    1110.1          4.03      24.06

                                    <---- hydrograph ---->   <-pipe / channel->
```



```
                              AREA    QPEAK    TPEAK    R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)    (hrs)    (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     7.47     9.50   22.58       .48      1.14
     OUTFLOW: ID= 1 (6019)  406.96     5.03    10.75   22.58       .41      1.03


------------------------------------------------------------------------------


 ADD HYD   (5064)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73     .930     9.00    11.92
        + ID2= 2 (7002):    89.77    7.161     6.00    39.40
          ==================================================
          ID = 3 (5064):   260.50    7.193     6.00    21.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46     .000      .00      .00
        + ID2= 2 (1046):   672.95    3.258     9.75    12.30
          ==================================================
          ID = 3 (9250):  1097.41    3.258     9.75     7.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2042):    54.50    6.337     6.00    51.20
        + ID2= 2 (7013):   227.32   10.369     6.00    52.04
          ==================================================
          ID = 3 (7014):   281.82   16.706     6.00    51.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000       .0000  |   4.8100      1.1900
                           .4200       .6400  |  14.3300      1.2700
                          1.5900       .9400  |  53.8000      1.3300
                          3.2000      1.1100  |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      3.258        9.75        7.54
     OUTFLOW: ID= 1 (9018)   1097.411      3.253       10.00        7.54

                   PEAK   FLOW    REDUCTION [Qout/Qin](%)= 99.83
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.1127

------------------------------------------------------------------------------


 ADD HYD   (5061)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62    7.732     8.50    30.91
        + ID2= 2 (7014):   281.82   16.706     6.00    51.88
          ==================================================
          ID = 3 (5061):   769.44   17.498     6.00    38.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
```

```
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE -------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81      43.21
        .57   270.59    .257E+05      13.9         1.14      30.76
        .85   270.87    .484E+05      32.0         1.39      25.24
       1.13   271.15    .776E+05      59.6         1.61      21.71
       1.42   271.44    .112E+06     100.0         1.87      18.71
       1.70   271.72    .151E+06     157.2         2.18      16.04
       1.99   272.01    .195E+06     225.9         2.44      14.37
       2.27   272.29    .242E+06     305.9         2.65      13.21
       2.55   272.57    .294E+06     398.1         2.84      12.31
       2.84   272.86    .350E+06     501.8         3.01      11.61
       3.12   273.14    .409E+06     617.0         3.17      11.05
       3.40   273.42    .472E+06     744.3         3.31      10.58
       3.69   273.71    .539E+06     882.9         3.44      10.18
       3.97   273.99    .611E+06    1033.6         3.55       9.85
       4.26   274.28    .687E+06    1196.8         3.66       9.57
       4.54   274.56    .768E+06    1370.2         3.75       9.35
       4.82   274.84    .856E+06    1556.4         3.82       9.16
       5.11   275.13    .950E+06    1757.0         3.89       9.01
       5.39   275.41    .105E+07    1967.6         3.93       8.91

                               <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41    3.25   10.00   7.54       .25       .81
     OUTFLOW: ID= 1 (9251) 1097.41    3.08   11.00   7.54       .24       .81

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--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  17.498     6.00    38.59
        + ID2= 2 (6019):   406.96   5.034    10.75    22.58
          ==================================================
          ID = 3 (7016):  1176.40  17.498     6.00    33.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   2.362     9.75    12.30
        + ID2= 2 (9251):  1097.41   3.082    11.00     7.54
          ==================================================
          ID = 3 (5000):  1576.98   5.291    10.75     8.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   7.193     6.00    21.39
        + ID2= 2 (5000):  1576.98   5.291    10.75     8.99
          ==================================================
```



```
          ID = 3 (5001):  1837.48   7.247     6.00    10.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.8300     3.4900
                           .2800      .2500   |   3.8200     3.9500
                           .7100      .6300   |   4.6700     4.2000
                          1.1300     1.1400   |   7.3600     4.6900
                          1.5600     1.7300   |   8.7800     4.8500
                          1.8400     2.2600   |  35.4000     6.6100
                          2.2700     2.9600   |  *******     8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      7.247        6.00       10.75
     OUTFLOW: ID= 1 (9017)   1837.481      6.211       11.25       10.75

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 85.71
                  TIME SHIFT OF PEAK FLOW         (min)=315.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  4.4814

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   8.907     6.00    18.07
        + ID2= 2 (9017):  1837.48   6.211    11.25    10.75
          ==================================================
          ID = 3 (9041):  2376.18   9.679     6.00    12.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   7.193     6.00    50.09
        + ID2= 2 (9041):  2376.18   9.679     6.00    12.41
          ==================================================
          ID = 3 (5002):  2432.16  16.872     6.00    13.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    16.87      6.00     13.27
    SHIFT ID= 1 (9040): 2432.16    16.87      7.00     13.27

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        274.29         .0800
                  30.80        273.73         .0800
                  51.30        270.17         .0800
                  61.60        266.84         .0800
                  66.80        266.02         .0800
                 102.70        265.42         .0350      Main Channel
                 123.20        261.00         .0350      Main Channel
                 128.40        261.17         .0350      Main Channel
                 154.00        264.62         .0350      Main Channel
                 174.60        266.82         .0800
                 205.40        268.07         .0800
                 236.20        268.74         .0800
                 282.40        271.31         .0800
                 302.90        272.11         .0800
```

```
                  348.90        274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63   .702E+04       5.2          1.14       22.47
       1.26   262.26   .220E+05      24.8          1.74       14.74
       1.89   262.89   .443E+05      64.0          2.22       11.54
       2.53   263.53   .741E+05     127.4          2.65        9.69
       3.16   264.16   .111E+06     219.6          3.04        8.44
       3.79   264.79   .156E+06     343.2          3.39        7.57
       4.42   265.42   .209E+06     501.2          3.70        6.94
       5.16   266.16   .304E+06     766.4          3.88        6.61
       5.90   266.90   .428E+06    1123.8          4.05        6.34
       6.64   267.64   .570E+06    1628.6          4.40        5.84
       7.38   268.38   .738E+06    2225.4          4.65        5.53
       8.12   269.12   .941E+06    2928.9          4.80        5.35
       8.85   269.85   .116E+07    3743.0          4.95        5.18
       9.59   270.59   .141E+07    4656.3          5.10        5.03
      10.33   271.33   .167E+07    5671.9          5.24        4.90
      11.07   272.07   .195E+07    6784.6          5.36        4.80
      11.81   272.81   .226E+07    8029.1          5.47        4.69
      12.55   273.55   .259E+07    9393.0          5.59        4.60
      13.29   274.29   .295E+07   10648.3          5.55        4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16   16.87    7.00  13.27      1.01      1.44
     OUTFLOW: ID= 1 (6029) 2432.16   11.09    7.25  13.27       .82      1.27

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--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  11.094     7.25    13.27
        + ID2= 2 (1040):    14.62    .342     6.75    21.92
          ==================================================
          ID = 3 (5003):  2446.78  11.376     7.25    13.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  11.376     7.25    13.33
        + ID2= 2 (7016):  1176.40  17.498     6.00    33.05
          ==================================================
          ID = 3 (5004):  3623.18  21.295     7.25    19.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA      QPEAK      TPEAK       R.V.
--------------------      (ha)      (cms)      (hrs)       (mm)
          ID= 2 (5004): 3623.18     21.29       7.25      19.73
    SHIFT ID= 1 (9015): 3623.18     21.29       9.25      19.73

--------------------------------------------------------------------------------

--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        260.30         .0800
                  34.10        260.43         .0800
                  62.40        259.79         .0800
                  79.50        255.72         .0800
                 113.50        254.00         .0800
                 153.30        253.33         .0350       Main Channel
                 187.30        253.06         .0350       Main Channel
                 198.70        251.88         .0350       Main Channel
                 204.40        252.61         .0350       Main Channel
```



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                 249.80        254.00         .0800
                 334.90        255.77         .0800
                 351.90        256.37         .0800
                 414.40        260.24         .0800
                 465.50        260.75         .0800
                 514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .36   252.24   .596E+04        .4           .39      223.90
        .73   252.61   .238E+05       2.8           .61      141.05
       1.09   252.97   .619E+05       8.2           .69      126.14
       1.45   253.33   .151E+06      18.8           .65      134.06
       1.91   253.79   .383E+06      68.4           .93       93.14
       2.38   254.26   .713E+06     157.3          1.15       75.58
       2.84   254.72   .112E+07     287.3          1.33       65.13
       3.31   255.19   .161E+07     454.2          1.47       59.01
       3.77   255.65   .217E+07     659.0          1.58       54.87
       4.24   256.12   .279E+07     908.7          1.69       51.25
       4.70   256.58   .346E+07    1199.1          1.80       48.03
       5.17   257.05   .414E+07    1527.9          1.92       45.17
       5.63   257.51   .485E+07    1892.4          2.03       42.71
       6.10   257.98   .558E+07    2291.8          2.13       40.59
       6.56   258.44   .634E+07    2725.7          2.23       38.74
       7.03   258.91   .711E+07    3193.6          2.33       37.12
       7.49   259.37   .791E+07    3695.3          2.43       35.69
       7.96   259.84   .874E+07    4221.9          2.51       34.48
       8.42   260.30   .961E+07    4697.6          2.54       34.09

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18   21.29    9.25  19.73      1.47       .66
     OUTFLOW: ID= 1 (6031) 3623.18   16.73   14.25  19.73      1.38       .65

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5005) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   9.861     8.50    32.60
        + ID2= 2 (6031):  3623.18  16.731    14.25    19.73
          ==================================================
          ID = 3 (5005):  4322.96  20.307    10.50    21.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   5 **        100-Year Storm
  ****************************

--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal=104.07 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    2.29 |  3.25    4.16 |  6.25   18.73 |  9.25    3.16
                  .50    2.41 |  3.50    4.16 |  6.50   18.73 |  9.50    2.91
                  .75    2.46 |  3.75    4.16 |  6.75    9.91 |  9.75    2.79
                 1.00    2.54 |  4.00    4.16 |  7.00    6.74 | 10.00    2.83
                 1.25    2.66 |  4.25    5.74 |  7.25    6.24 | 10.25    2.75
                 1.50    2.75 |  4.50    6.74 |  7.50    6.24 | 10.50    2.58
                 1.75    2.79 |  4.75    7.53 |  7.75    6.24 | 10.75    2.37
                 2.00    2.91 |  5.00    9.12 |  8.00    6.24 | 11.00    2.21
                 2.25    2.91 |  5.25   12.49 |  8.25    5.33 | 11.25    1.96
                 2.50    2.91 |  5.50   12.49 |  8.50    4.58 | 11.50    1.79
                 2.75    3.12 |  5.75   49.95 |  8.75    4.00 | 11.75    1.58
                 3.00    3.54 |  6.00  137.37 |  9.00    3.54 | 12.00    1.42

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--------------------
| CALIB            |
| NASHYD    (1032) |   Area     (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia       (mm)=   9.00   # of Linear Res.(N)= 3.00
```

```
-------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=  12.719 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  44.321
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.00
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.68 (ii)   16.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       7.74         8.71         13.552 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        55.08          67.20
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .53            .65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       102.01
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.66 (ii)   15.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       6.95         4.03          9.610 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        46.64          66.57
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .45            .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
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--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.80
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.22 (ii)   13.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                           *TOTALS*
     PEAK FLOW      (cms)=       3.64         2.12          5.761 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      94.07        46.60          65.59
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .45            .63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        99.64
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.14 (ii)   15.84 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=       8.63         4.89         11.845 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      94.07        45.60          62.56
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .44            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW      (cms)=   3.773 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
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```
-------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=   1.719 (i)
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58       15.87
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     419.90       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37       78.85
                over (min)       15.00       15.00
     Storage Coeff.  (min)=       5.32 (ii)  14.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=        .11         .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.42        2.43          4.852 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57       41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07      104.07         104.07
     RUNOFF COEFFICIENT   =       1.00         .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08       13.62
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     389.00       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37       78.85
                over (min)       15.00       15.00
     Storage Coeff.  (min)=       5.08 (ii)  14.64 (ii)
     Unit Hyd. Tpeak (min)=      15.00       15.00
     Unit Hyd. peak  (cms)=        .11         .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.09        2.10          4.191 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57       41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07      104.07         104.07
     RUNOFF COEFFICIENT   =       1.00         .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
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--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25       24.37
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     520.40       40.00
     Mannings n          =        .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37       78.85
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.05 (ii)  15.61 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.66        2.99          5.609 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57       41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07      104.07         104.07
     RUNOFF COEFFICIENT   =       1.00         .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   4.316 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   6.047 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  21.790
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .209

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   2.047 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  28.911
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .278

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
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```
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   5.946 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .525 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  33.262
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .320

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=  11.484 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  45.460
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .437

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80       32.70
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     602.80       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      108.14
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.61 (ii)   15.03 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.84        5.60          8.616 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57       56.93          68.59
     TOTAL RAINFALL   (mm)=     104.07      104.07         104.07
     RUNOFF COEFFICIENT   =       1.00         .55            .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
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| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
-------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92       45.13
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     739.60       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      111.02
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.47 (ii)   15.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       8.54        7.81         13.792 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57       57.41          71.26
     TOTAL RAINFALL   (mm)=     104.07      104.07         104.07
     RUNOFF COEFFICIENT   =       1.00         .55            .68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
-------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11       87.16
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     984.10       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      108.14
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       8.87 (ii)   17.29 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=      12.10       14.21         21.603 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57       56.93          68.59
     TOTAL RAINFALL   (mm)=     104.07      104.07         104.07
     RUNOFF COEFFICIENT   =       1.00         .55            .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=  11.495 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  34.179
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .328

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
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| NASHYD    (9254) |   Area    (ha)=  24.78   Curve Number   (CN)= 58.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.38

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                            ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .083    2.29 | 3.083    4.16 | 6.083   18.73 |  9.08    3.16
                  .167    2.29 | 3.167    4.16 | 6.167   18.73 |  9.17    3.16
                  .250    2.29 | 3.250    4.16 | 6.250   18.73 |  9.25    3.16
                  .333    2.41 | 3.333    4.16 | 6.333   18.73 |  9.33    2.91
                  .417    2.41 | 3.417    4.16 | 6.417   18.73 |  9.42    2.91
                  .500    2.41 | 3.500    4.16 | 6.500   18.73 |  9.50    2.91
                  .583    2.46 | 3.583    4.16 | 6.583    9.91 |  9.58    2.79
                  .667    2.46 | 3.667    4.16 | 6.667    9.91 |  9.67    2.79
                  .750    2.46 | 3.750    4.16 | 6.750    9.91 |  9.75    2.79
                  .833    2.54 | 3.833    4.16 | 6.833    6.74 |  9.83    2.83
                  .917    2.54 | 3.917    4.16 | 6.917    6.74 |  9.92    2.83
                 1.000    2.54 | 4.000    4.16 | 7.000    6.74 | 10.00    2.83
                 1.083    2.66 | 4.083    5.74 | 7.083    6.24 | 10.08    2.75
                 1.167    2.66 | 4.167    5.74 | 7.167    6.24 | 10.17    2.75
                 1.250    2.66 | 4.250    5.74 | 7.250    6.24 | 10.25    2.75
                 1.333    2.75 | 4.333    6.74 | 7.333    6.24 | 10.33    2.58
                 1.417    2.75 | 4.417    6.74 | 7.417    6.24 | 10.42    2.58
                 1.500    2.75 | 4.500    6.74 | 7.500    6.24 | 10.50    2.58
                 1.583    2.79 | 4.583    7.53 | 7.583    6.24 | 10.58    2.37
                 1.667    2.79 | 4.667    7.53 | 7.667    6.24 | 10.67    2.37
                 1.750    2.79 | 4.750    7.53 | 7.750    6.24 | 10.75    2.37
                 1.833    2.91 | 4.833    9.12 | 7.833    6.24 | 10.83    2.21
                 1.917    2.91 | 4.917    9.12 | 7.917    6.24 | 10.92    2.21
                 2.000    2.91 | 5.000    9.12 | 8.000    6.24 | 11.00    2.21
                 2.083    2.91 | 5.083   12.49 | 8.083    5.33 | 11.08    1.96
                 2.167    2.91 | 5.167   12.49 | 8.167    5.33 | 11.17    1.96
                 2.250    2.91 | 5.250   12.49 | 8.250    5.33 | 11.25    1.96
                 2.333    2.91 | 5.333   12.49 | 8.333    4.58 | 11.33    1.79
                 2.417    2.91 | 5.417   12.49 | 8.417    4.58 | 11.42    1.79
                 2.500    2.91 | 5.500   12.49 | 8.500    4.58 | 11.50    1.79
                 2.583    3.12 | 5.583   49.95 | 8.583    4.00 | 11.58    1.58
                 2.667    3.12 | 5.667   49.95 | 8.667    4.00 | 11.67    1.58
                 2.750    3.12 | 5.750   49.96 | 8.750    4.00 | 11.75    1.58
                 2.833    3.54 | 5.833  137.37 | 8.833    3.54 | 11.83    1.42
                 2.917    3.54 | 5.917  137.37 | 8.917    3.54 | 11.92    1.42
                 3.000    3.54 | 6.000  137.37 | 9.000    3.54 | 12.00    1.42

     Unit Hyd Qpeak  (cms)=    .398

     PEAK FLOW      (cms)=    .238 (i)
     TIME TO PEAK    (hrs)=   9.167
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000       .9900
                           .0290      .3700   |   2.7000      1.4200
                           .5000      .6900   |   6.1000      2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     13.552        6.00       67.20
     OUTFLOW: ID= 1 (9021)     89.700      6.901        6.50       67.16

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 50.92
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.3882

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0800       .8375
```



```
                           .0100      .4725   |    .1300       .9815
                           .0450      .7030   |    .2380      1.2455

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      5.761        6.00       65.59
     OUTFLOW: ID= 1 (9022)     24.780       .238        8.75       64.96

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.13
                  TIME SHIFT OF PEAK FLOW         (min)=165.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.2452

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .238     8.75    64.96
        + ID2= 2 (2021):    70.42   11.845     6.00    62.56
          ==================================================
          ID = 3 (7008):    95.20   11.880     6.00    63.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20   11.880     6.00    63.19
        + ID2= 2 (1044):   443.50    3.773     9.75    21.26
          ==================================================
          ID = 3 (5065):   538.70   11.982     6.00    28.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      4.191        6.00       57.25
     OUTFLOW: ID= 1 (9019)     22.700      1.116        6.50       45.79

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.63
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .6335

------------------------------------------------------------------------------

--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70    1.116     6.50    45.79
        + ID2= 2 (2011):    40.62    5.609     6.00    57.25
          ==================================================
          ID = 3 (7001):    63.32    6.549     6.00    53.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      6.047        7.25       21.79
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00
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                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  8.0530

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000     *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891      2.047        6.50      28.91
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00        .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.5870

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.7200      5.0000
                          .2200     3.0000    |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     21.603        6.00      68.59
     OUTFLOW: ID= 1 (9020)    145.270      2.400        7.50      68.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.11
                   TIME SHIFT OF PEAK FLOW         (min)= 90.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  6.7462

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     11.49      7.00     34.18
    SHIFT ID= 1 (9029):  406.96     11.49      9.50     34.18

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08  12.719     8.75    44.32
        + ID2= 2 (9021):    89.70   6.901     6.50    67.16
          ===============================================
          ID = 3 (5062):   699.78  14.432     8.50    47.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2012):    26.45   4.852     6.00    57.25
        + ID2= 2 (7001):    63.32   6.549     6.00    53.14
          ===============================================
          ID = 3 (7002):    89.77  11.401     6.00    54.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
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          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  13.792     6.00    71.26
        + ID2= 2 (9020):   145.27   2.400     7.50    68.57
          ===============================================
          ID = 3 (7013):   227.32  14.003     6.00    69.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .20   274.70    .665E+04        .6          .56      172.84
        .39   274.89    .247E+05       4.2         1.00       97.27
        .59   275.09    .478E+05      11.1         1.35       71.58
        .78   275.28    .756E+05      21.4         1.64       58.99
        .98   275.48    .108E+06      35.2         1.89       51.17
       1.17   275.67    .145E+06      52.9         2.12       45.70
       1.37   275.87    .187E+06      74.8         2.33       41.60
       1.56   276.06    .233E+06     101.2         2.53       38.37
       1.76   276.26    .284E+06     132.2         2.71       35.80
       1.95   276.45    .342E+06     160.8         2.73       35.50
       2.17   276.67    .421E+06     204.7         2.83       34.30
       2.38   276.88    .516E+06     258.7         2.91       33.25
       2.60   277.10    .627E+06     323.9         3.00       32.28
       2.82   277.32    .754E+06     402.4         3.11       31.21
       3.03   277.53    .894E+06     517.5         3.37       28.78
       3.25   277.75    .105E+07     645.6         3.58       27.06
       3.47   277.97    .122E+07     787.1         3.76       25.78
       3.68   278.18    .140E+07     942.2         3.91       24.79
       3.90   278.40    .160E+07    1110.1         4.03       24.06

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96    11.49    9.50  34.18       .59      1.36
     OUTFLOW: ID= 1 (6019)  406.96     8.03   10.50  34.18       .50      1.17


-------------------------------------------------------------------------------

  ADD HYD   (5064)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73   1.719     8.75    21.26
        + ID2= 2 (7002):    89.77  11.401     6.00    54.35
          ===============================================
          ID = 3 (5064):   260.50  11.478     6.00    32.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   5.946     9.50    21.89
          ================================================
          ID = 3 (9250):  1097.41   5.946     9.50    13.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2042):    54.50   8.616     6.00    68.59
        + ID2= 2 (7013):   227.32  14.003     6.00    69.54
          ================================================
          ID = 3 (7014):   281.82  22.619     6.00    69.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   4.8100     1.1900
                          .4200      .6400    |  14.3300     1.2700
                         1.5900      .9400    |  53.8000     1.3300
                         3.2000     1.1100    |    .0000      .0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      5.946        9.50       13.43
     OUTFLOW: ID= 1 (9018)   1097.411      5.975        9.50       13.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.48
                   TIME SHIFT OF PEAK FLOW         (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.2011

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                     CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
------------------------------------------------------------------------------

  ADD HYD   (5061)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62  11.484     8.25    45.46
        + ID2= 2 (7014):   281.82  22.619     6.00    69.36
          ================================================
          ID = 3 (5061):   769.44  23.980     6.00    54.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33          .0800
                  46.71       277.77          .0800
                  57.10       277.40          .0800
                  62.29       276.96          .0800
                  67.48       275.94          .0800
                  77.86       273.27          .0800
                  83.05       272.29          .0800
                  93.43       270.99          .0800
                 109.00       270.02          .0350      Main Channel
                 119.38       270.02          .0350      Main Channel
                 150.53       271.36     .0350 / .0800  Main Channel
                 186.86       273.45          .0800
                 207.62       274.37          .0800
                 233.57       275.12          .0800
```



```
                 247.79       275.41          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)       (m)      (cu.m.)     (cms)       (m/s)       (min)
        .28    270.30    .950E+04      3.7          .81       43.21
        .57    270.59    .257E+05     13.9         1.14       30.76
        .85    270.87    .484E+05     32.0         1.39       25.24
       1.13    271.15    .776E+05     59.6         1.61       21.71
       1.42    271.44    .112E+06    100.0         1.87       18.71
       1.70    271.72    .151E+06    157.2         2.18       16.04
       1.99    272.01    .195E+06    225.9         2.44       14.37
       2.27    272.29    .242E+06    305.9         2.65       13.21
       2.55    272.57    .294E+06    398.1         2.84       12.31
       2.84    272.86    .350E+06    501.8         3.01       11.61
       3.12    273.14    .409E+06    617.0         3.17       11.05
       3.40    273.42    .472E+06    744.3         3.31       10.58
       3.69    273.71    .539E+06    882.9         3.44       10.18
       3.97    273.99    .611E+06   1033.6         3.55        9.85
       4.26    274.28    .687E+06   1196.8         3.66        9.57
       4.54    274.56    .768E+06   1370.2         3.75        9.35
       4.82    274.84    .856E+06   1556.4         3.82        9.16
       5.11    275.13    .950E+06   1757.0         3.89        9.01
       5.39    275.41    .105E+07   1967.6         3.93        8.91

                                     <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.    MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)       (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     5.98    9.50  13.43       .35        .87
     OUTFLOW: ID= 1 (9251) 1097.41     5.71   10.50  13.43       .34        .86


------------------------------------------------------------------------------

--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  23.980     6.00    54.21
        + ID2= 2 (6019):   406.96   8.029    10.50    34.18
          ================================================
          ID = 3 (7016):  1176.40  23.980     6.00    47.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   4.316     9.50    21.89
        + ID2= 2 (9251):  1097.41   5.713    10.50    13.43
          ================================================
          ID = 3 (5000):  1576.98   9.884    10.00    16.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50  11.478     6.00    32.67
        + ID2= 2 (5000):  1576.98   9.884    10.00    16.00
          ================================================
          ID = 3 (5001):  1837.48  11.958    10.00    18.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   2.8300     3.4900
                          .2800      .2500    |   3.8200     3.9500
                          .7100      .6300    |   4.6700     4.2000
                         1.1300     1.1400    |   7.3600     4.6900
                         1.5600     1.7300    |   8.7800     4.8500
                         1.8400     2.2600    |  35.4000     6.6100
```

```
                          2.2700     2.9600   |  *******      8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     11.958       10.00       18.36
     OUTFLOW: ID= 1 (9017)   1837.481     11.934       10.00       18.36

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.80
                   TIME SHIFT OF PEAK FLOW          (min)=   .00
                   MAXIMUM  STORAGE   USED        (ha.m.)=  5.0596

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70  11.982     6.00    28.67
        + ID2= 2 (9017):  1837.48  11.934    10.00    18.36
          ===============================================
          ID = 3 (9041):  2376.18  16.349    10.00    20.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   9.610     6.00    66.57
        + ID2= 2 (9041):  2376.18  16.349    10.00    20.70
          ===============================================
          ID = 3 (5002):  2432.16  22.656     6.00    21.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    22.66      6.00     21.76
    SHIFT ID= 1 (9040): 2432.16    22.66      7.00     21.76

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        274.29         .0800
                  30.80        273.73         .0800
                  51.30        270.17         .0800
                  61.60        266.84         .0800
                  66.80        266.02         .0800
                 102.70        265.42         .0350      Main Channel
                 123.20        261.00         .0350      Main Channel
                 128.40        261.17         .0350      Main Channel
                 154.00        264.62         .0350      Main Channel
                 174.60        266.82         .0800
                 205.40        268.07         .0800
                 236.20        268.74         .0800
                 282.40        271.31         .0800
                 302.90        272.11         .0800
                 348.90        274.45         .0800

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
         .63   261.63    .702E+04       5.2         1.14      22.47
        1.26   262.26    .220E+05      24.8         1.74      14.74
        1.89   262.89    .443E+05      64.0         2.22      11.54
        2.53   263.53    .741E+05     127.4         2.65       9.69
        3.16   264.16    .111E+06     219.6         3.04       8.44
        3.79   264.79    .156E+06     343.2         3.39       7.57
        4.42   265.42    .209E+06     501.2         3.70       6.94
        5.16   266.16    .304E+06     766.4         3.88       6.61
        5.90   266.90    .428E+06    1123.8         4.05       6.34
        6.64   267.64    .570E+06    1628.6         4.40       5.84
        7.38   268.38    .738E+06    2225.4         4.65       5.53
```



```
        8.12   269.12    .941E+06    2928.9          4.80       5.35
        8.85   269.85    .116E+07    3743.0          4.95       5.18
        9.59   270.59    .141E+07    4656.3          5.10       5.03
       10.33   271.33    .167E+07    5671.9          5.24       4.90
       11.07   272.07    .195E+07    6784.6          5.36       4.80
       11.81   272.81    .226E+07    8029.1          5.47       4.69
       12.55   273.55    .259E+07    9393.0          5.59       4.60
       13.29   274.29    .295E+07   10648.3          5.55       4.62

                                 <---- hydrograph ---->   <-pipe / channel->
                           AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                           (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    22.66    7.00  21.76      1.19      1.65
     OUTFLOW: ID= 1 (6029) 2432.16    16.66   11.25  21.76      1.00      1.43


-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  16.660    11.25    21.76
        + ID2= 2 (1040):    14.62    .525     6.75    33.26
          ===============================================
          ID = 3 (5003):  2446.78  16.722    11.25    21.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  16.722    11.25    21.83
        + ID2= 2 (7016):  1176.40  23.980     6.00    47.28
          ===============================================
          ID = 3 (5004):  3623.18  35.048    10.50    30.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    35.05     10.50     30.09
    SHIFT ID= 1 (9015): 3623.18    35.05     12.50     30.09

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        260.30         .0800
                  34.10        260.43         .0800
                  62.40        259.79         .0800
                  79.50        255.72         .0800
                 113.50        254.00         .0800
                 153.30        253.33         .0350      Main Channel
                 187.30        253.06         .0350      Main Channel
                 198.70        251.88         .0350      Main Channel
                 204.40        252.61         .0350      Main Channel
                 249.80        254.00         .0800
                 334.90        255.77         .0800
                 351.90        256.37         .0800
                 414.40        260.24         .0800
                 465.50        260.75         .0800
                 514.40        261.48         .0800

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
         .36   252.24    .596E+04        .4          .39     223.90
         .73   252.61    .238E+05       2.8          .61     141.05
        1.09   252.97    .619E+05       8.2          .69     126.14
        1.45   253.33    .151E+06      18.8          .65     134.06
        1.91   253.79    .383E+06      68.4          .93      93.14
        2.38   254.26    .713E+06     157.3         1.15      75.58
```

2.84	254.72	.112E+07	287.3	1.33	65.13
3.31	255.19	.161E+07	454.2	1.47	59.01
3.77	255.65	.217E+07	659.0	1.58	54.87
4.24	256.12	.279E+07	908.7	1.69	51.25
4.70	256.58	.346E+07	1199.1	1.80	48.03
5.17	257.05	.414E+07	1527.9	1.92	45.17
5.63	257.51	.485E+07	1892.4	2.03	42.71
6.10	257.98	.558E+07	2291.8	2.13	40.59
6.56	258.44	.634E+07	2725.7	2.23	38.74
7.03	258.91	.711E+07	3193.6	2.33	37.12
7.49	259.37	.791E+07	3695.3	2.43	35.69
7.96	259.84	.874E+07	4221.9	2.51	34.48
8.42	260.30	.961E+07	4697.6	2.54	34.09

	AREA (ha)	<---- hydrograph ----> QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<-pipe / channel-> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (9015)	3623.18	35.05	12.50	30.09	1.60	.72
OUTFLOW: ID= 1 (6031)	3623.18	29.27	13.75	30.09	1.55	.69

ADD HYD (5005)
1 + 2 = 3

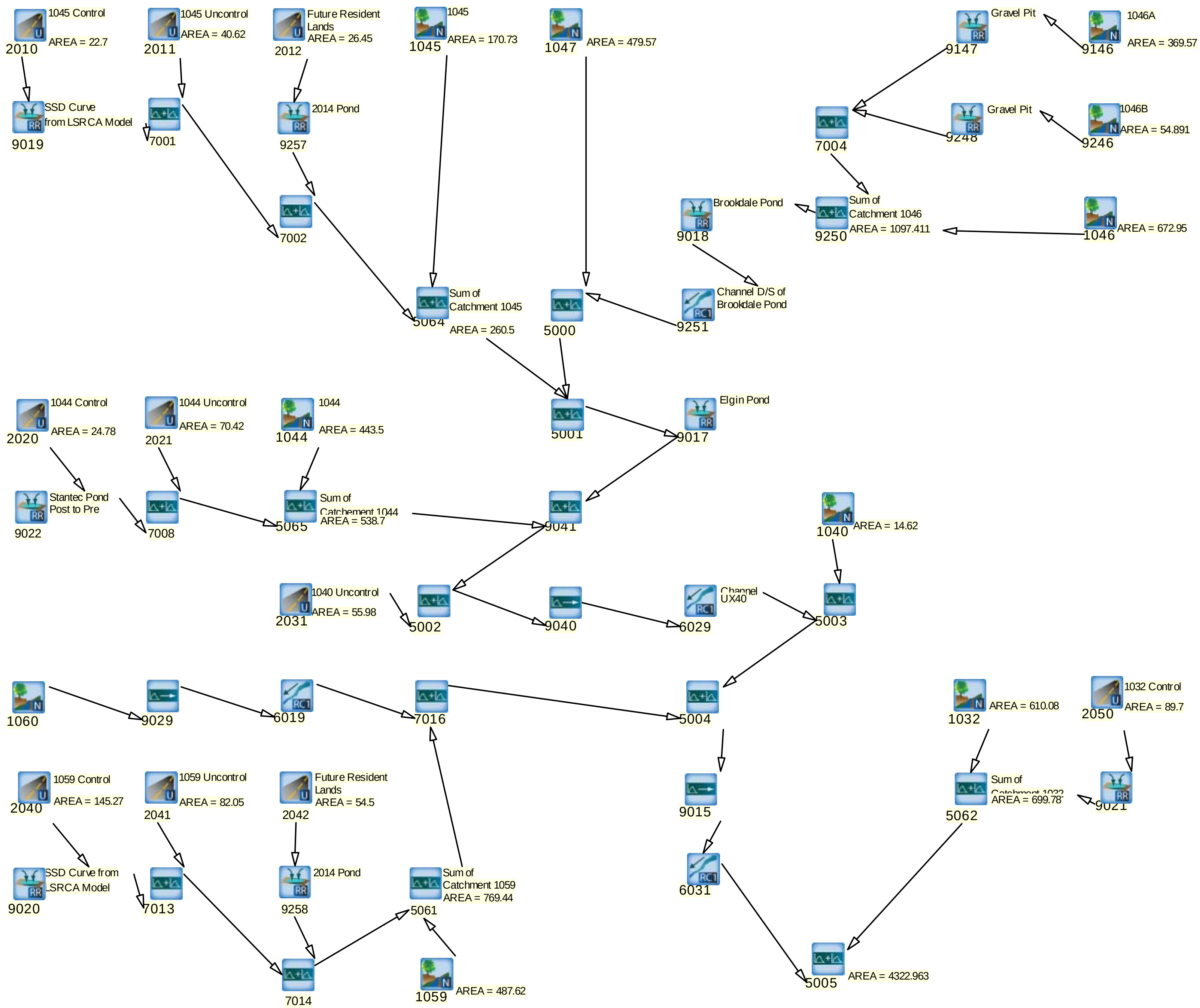
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (5062):	699.78	14.432	8.50	47.25
+ ID2= 2 (6031):	3623.18	29.267	13.75	30.09
ID = 3 (5005):	4322.96	33.777	13.25	32.87

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

==

Future Conditions VO2 Schematic (with SWM Controls)



```
=====================================================================================================
==

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```



```
                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.3\voin.dat
  Output  filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Future With
  Summary filename: V:\01606\Active\160621777\SWM Master Plans\Analysis\SWM\Hydrology\Uxbridge-update
Dec 2014\Uxbridge\Uxbridge Future With


DATE: 12/12/2014                           TIME: 11:38:38 AM

USER:


COMMENTS: ____________________________________________________________

-----------------------------------------------------------------------------------------------------
--
  ****************************
  ** SIMULATION NUMBER:   1 **     2-Year Storm
  ****************************

--------------------
| MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 43.70 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25     .96 |  3.25    1.75 |  6.25    7.87 |  9.25    1.33
                  .50    1.01 |  3.50    1.75 |  6.50    7.87 |  9.50    1.22
                  .75    1.03 |  3.75    1.75 |  6.75    4.16 |  9.75    1.17
                 1.00    1.07 |  4.00    1.75 |  7.00    2.83 | 10.00    1.19
                 1.25    1.12 |  4.25    2.41 |  7.25    2.62 | 10.25    1.15
                 1.50    1.15 |  4.50    2.83 |  7.50    2.62 | 10.50    1.08
                 1.75    1.17 |  4.75    3.16 |  7.75    2.62 | 10.75    1.00
                 2.00    1.22 |  5.00    3.83 |  8.00    2.62 | 11.00     .93
                 2.25    1.22 |  5.25    5.24 |  8.25    2.24 | 11.25     .82
                 2.50    1.22 |  5.50    5.24 |  8.50    1.92 | 11.50     .75
                 2.75    1.31 |  5.75   20.98 |  8.75    1.68 | 11.75     .66
                 3.00    1.49 |  6.00   57.68 |  9.00    1.49 | 12.00     .59

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   2.298 (i)
     TIME TO PEAK   (hrs)=   9.000
     RUNOFF VOLUME   (mm)=   8.387
     TOTAL RAINFALL  (mm)=  43.700
     RUNOFF COEFFICIENT   =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```



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------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        15.59
                over (min)      15.00        30.00
     Storage Coeff.  (min)=      10.86 (ii)   29.14 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW      (cms)=       2.96         1.59          3.942 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        13.50          20.93
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .31            .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        14.07
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       9.43 (ii)   28.47 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                          *TOTALS*
     PEAK FLOW      (cms)=       2.70          .68          3.117 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        10.73          22.09
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .25            .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        14.61
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.38 (ii)   26.14 (ii)
```

```
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.45          .29        1.627 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      33.70        10.73        19.92
     TOTAL RAINFALL   (mm)=      43.70        43.70        43.70
     RUNOFF COEFFICIENT   =        .77          .25          .46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        13.62
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.10 (ii)   29.39 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=       3.32          .82        3.818 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      33.70        10.40        18.56
     TOTAL RAINFALL   (mm)=      43.70        43.70        43.70
     RUNOFF COEFFICIENT   =        .77          .24          .42

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=    .163 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .069 (i)
     TIME TO PEAK    (hrs)=  11.250
     RUNOFF VOLUME    (mm)=    .950
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .022

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.53 (ii)   29.06 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .96          .31        1.153 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21        17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70        43.70
     RUNOFF COEFFICIENT   =        .99          .21          .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.19 (ii)   28.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .83          .27         .999 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25         6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21        17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70        43.70
     RUNOFF COEFFICIENT   =        .99          .21          .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     520.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        10.35
                over (min)       15.00        45.00
     Storage Coeff.  (min)=       8.56 (ii)   30.09 (ii)
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```
     Unit Hyd. Tpeak (min)=      15.00        45.00
     Unit Hyd. peak  (cms)=        .09          .03
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.43          .44          1.613 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.50           6.00
     RUNOFF VOLUME    (mm)=      43.20         9.21          17.71
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .21            .41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=    .186 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .987
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .023

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=    .306 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=   1.544
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .035

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .088 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=   2.245
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .051

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=    .259 (i)
     TIME TO PEAK    (hrs)=  12.000
     RUNOFF VOLUME    (mm)=    .987
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .023
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     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .083 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   5.698
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .130

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   2.081 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=   8.697
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .199

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        26.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.35 (ii)   24.03 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.88         1.14          2.597 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        14.39          21.59
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .33            .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        27.85
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                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.58 (ii)   25.07 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.27         1.59          4.273 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        14.58          23.16
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .33            .53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      57.68        26.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      12.55 (ii)   27.22 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.55         2.85          6.339 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      43.20        14.39          21.59
     TOTAL RAINFALL   (mm)=      43.70        43.70          43.70
     RUNOFF COEFFICIENT   =        .99          .33            .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   1.841 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=   5.901
     TOTAL RAINFALL   (mm)=  43.700
     RUNOFF COEFFICIENT   =    .135

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.2000      .9900
                           .0290      .3700   |   2.7000     1.4200
                           .5000      .6900   |   6.1000     2.1800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      3.942        6.00       20.93
     OUTFLOW: ID= 1 (9021)     89.700      1.121        6.75       20.89
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                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 28.44
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .9644

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620      .8805
                           .0150      .6000   |    .4710     1.0180
                           .1240      .7875   |    .9610     1.2660

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      1.627        6.00       19.92
     OUTFLOW: ID= 1 (9022)     24.780       .012       12.25       19.51

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .72
                  TIME SHIFT OF PEAK FLOW         (min)=375.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .4688

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .012    12.25    19.51
        + ID2= 2 (2021):    70.42    3.818     6.00    18.56
          ==============================================
          ID = 3 (7008):    95.20    3.821     6.00    18.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    3.821     6.00    18.80
        + ID2= 2 (1044):   443.50     .163    12.00      .95
          ==============================================
          ID = 3 (5065):   538.70    3.821     6.00     4.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990      .7350
                           .0110      .4435   |    .1630      .8595
                           .0550      .6265   |    .3050     1.0800

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      1.153        6.00       17.71
     OUTFLOW: ID= 1 (9257)     26.450       .011       12.25       17.32

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .95
                  TIME SHIFT OF PEAK FLOW         (min)=375.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .4432

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800      .5900
                           .0000      .2600   |   1.2200      .7400
                           .5700      .3500   |   1.3500      .9300
                           .9900      .4700   |   2.8300      .9900

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700       .999        6.00       17.71
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     OUTFLOW: ID= 1 (9019)     22.700       .130        7.25        6.25

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.98
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .2806

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .130     7.25     6.25
        + ID2= 2 (2011):    40.62    1.613     6.00    17.71
          ==================================================
          ID = 3 (7001):    63.32    1.613     6.00    13.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570       .306        8.50        1.54
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .5705

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .088        7.00        2.24
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .1232

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--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730     1.6365
                           .0490     1.0690   |    .7910     1.8915
                           .2480     1.4290   |   1.4810     2.3855

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500      2.597        6.00       21.59
     OUTFLOW: ID= 1 (9258)     54.500       .049       12.25       21.49

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.89
                   TIME SHIFT OF PEAK FLOW         (min)=375.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0689

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--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200     5.0000
                           .2200     3.0000   |   2.5000     7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
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```
     INFLOW : ID= 2 (2040)    145.270      6.339        6.00       21.59
     OUTFLOW: ID= 1 (9020)    145.270       .198       12.00       21.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.12
                   TIME SHIFT OF PEAK FLOW         (min)=360.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.7014

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     1.84      7.25      5.90
    SHIFT ID= 1 (9029):  406.96     1.84      9.75      5.90

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08    2.298     9.00     8.39
        + ID2= 2 (9021):    89.70    1.121     6.75    20.89
          ==================================================
          ID = 3 (5062):   699.78    2.917     8.50     9.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45     .011    12.25    17.32
        + ID2= 2 (7001):    63.32    1.613     6.00    13.60
          ==================================================
          ID = 3 (7002):    89.77    1.617     6.00    14.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57     .000      .00      .00
        + ID2= 2 (9248):    54.89     .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46     .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05    4.273     6.00    23.16
        + ID2= 2 (9020):   145.27     .198    12.00    21.57
          ==================================================
          ID = 3 (7013):   227.32    4.338     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                   .00        281.05          .0800
                 34.48        278.78          .0800
                 62.07        280.75          .0800
                 75.86        280.87          .0800
                110.34        277.13          .0800
                124.14        276.45      .0800 / .0350  Main Channel
                137.93        274.50          .0350      Main Channel
                151.72        274.76          .0350      Main Channel
```

```
                172.41        276.25         .0350      Main Channel
                213.79        277.31         .0800
                255.17        278.25         .0800
                275.86        278.49         .0800
                289.66        279.07         .0800
                303.45        278.41         .0800
                312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
        .20   274.70    .665E+04       .6           .56     172.84
        .39   274.89    .247E+05      4.2          1.00      97.27
        .59   275.09    .478E+05     11.1          1.35      71.58
        .78   275.28    .756E+05     21.4          1.64      58.99
        .98   275.48    .108E+06     35.2          1.89      51.17
       1.17   275.67    .145E+06     52.9          2.12      45.70
       1.37   275.87    .187E+06     74.8          2.33      41.60
       1.56   276.06    .233E+06    101.2          2.53      38.37
       1.76   276.26    .284E+06    132.2          2.71      35.80
       1.95   276.45    .342E+06    160.8          2.73      35.50
       2.17   276.67    .421E+06    204.7          2.83      34.30
       2.38   276.88    .516E+06    258.7          2.91      33.25
       2.60   277.10    .627E+06    323.9          3.00      32.28
       2.82   277.32    .754E+06    402.4          3.11      31.21
       3.03   277.53    .894E+06    517.5          3.37      28.78
       3.25   277.75    .105E+07    645.6          3.58      27.06
       3.47   277.97    .122E+07    787.1          3.76      25.78
       3.68   278.18    .140E+07    942.2          3.91      24.79
       3.90   278.40    .160E+07   1110.1          4.03      24.06

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     1.84    9.75   5.90       .26       .66
     OUTFLOW: ID= 1 (6019)  406.96      .94   11.50   5.90       .21       .58

-------------------------------------------------------------------------------

 ADD HYD   (5064)
   1 +  2 =  3                AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):    170.73     .069    11.25      .95
        + ID2= 2 (7002):     89.77    1.617     6.00    14.69
          ===============================================
          ID = 3 (5064):    260.50    1.617     6.00     5.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):    424.46     .000      .00      .00
        + ID2= 2 (1046):    672.95     .259    12.00      .99
          ===============================================
          ID = 3 (9250):   1097.41     .259    12.00      .61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------           (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):     54.50     .049    12.25    21.49
        + ID2= 2 (7013):    227.32    4.338     6.00    22.15
          ===============================================
          ID = 3 (7014):    281.82    4.354     6.00    22.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
```



```
                          .0000      .0000   |   4.8100      1.1900
                          .4200      .6400   |  14.3300      1.2700
                         1.5900      .9400   |  53.8000      1.3300
                         3.2000     1.1100   |    .0000       .0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411       .259       12.00         .61
     OUTFLOW: ID= 1 (9018)   1097.411       .173       14.50         .60

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 66.98
                  TIME SHIFT OF PEAK FLOW         (min)=150.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .2640

-------------------------------------------------------------------------------

 ADD HYD   (5061)
   1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62   2.081     8.50     8.70
        + ID2= 2 (7014):   281.82   4.354     6.00    22.02
          ==================================================
          ID = 3 (5061):   769.44   4.481     6.00    13.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
-------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33          .0800
                  46.71        277.77          .0800
                  57.10        277.40          .0800
                  62.29        276.96          .0800
                  67.48        275.94          .0800
                  77.86        273.27          .0800
                  83.05        272.29          .0800
                  93.43        270.99          .0800
                 109.00        270.02          .0350      Main Channel
                 119.38        270.02          .0350      Main Channel
                 150.53        271.36      .0350 / .0800  Main Channel
                 186.86        273.45          .0800
                 207.62        274.37          .0800
                 233.57        275.12          .0800
                 247.79        275.41          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
        .28   270.30    .950E+04      3.7           .81      43.21
        .57   270.59    .257E+05     13.9          1.14      30.76
        .85   270.87    .484E+05     32.0          1.39      25.24
       1.13   271.15    .776E+05     59.6          1.61      21.71
       1.42   271.44    .112E+06    100.0          1.87      18.71
       1.70   271.72    .151E+06    157.2          2.18      16.04
       1.99   272.01    .195E+06    225.9          2.44      14.37
       2.27   272.29    .242E+06    305.9          2.65      13.21
       2.55   272.57    .294E+06    398.1          2.84      12.31
       2.84   272.86    .350E+06    501.8          3.01      11.61
       3.12   273.14    .409E+06    617.0          3.17      11.05
       3.40   273.42    .472E+06    744.3          3.31      10.58
       3.69   273.71    .539E+06    882.9          3.44      10.18
       3.97   273.99    .611E+06   1033.6          3.55       9.85
       4.26   274.28    .687E+06   1196.8          3.66       9.57
       4.54   274.56    .768E+06   1370.2          3.75       9.35
       4.82   274.84    .856E+06   1556.4          3.82       9.16
       5.11   275.13    .950E+06   1757.0          3.89       9.01
       5.39   275.41    .105E+07   1967.6          3.93       8.91

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41      .17   14.50    .60       .01       .81
     OUTFLOW: ID= 1 (9251) 1097.41      .17   15.25    .60       .01       .81

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```
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44   4.481     6.00    13.58
        + ID2= 2 (6019):   406.96    .942    11.50     5.90
          ===============================================
          ID = 3 (7016):  1176.40   4.481     6.00    10.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57    .186    12.00      .99
        + ID2= 2 (9251):  1097.41    .170    15.25      .60
          ===============================================
          ID = 3 (5000):  1576.98    .312    13.00      .72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   1.617     6.00     5.69
        + ID2= 2 (5000):  1576.98    .312    13.00      .72
          ===============================================
          ID = 3 (5001):  1837.48   1.617     6.00     1.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   2.8300     3.4900
                          .2800      .2500    |   3.8200     3.9500
                          .7100      .6300    |   4.6700     4.2000
                         1.1300     1.1400    |   7.3600     4.6900
                         1.5600     1.7300    |   8.7800     4.8500
                         1.8400     2.2600    |  35.4000     6.6100
                         2.2700     2.9600    |  *******     8.6500

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     1.617        6.00        1.42
     OUTFLOW: ID= 1 (9017)   1837.481      .416       12.50        1.42

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.75
                   TIME SHIFT OF PEAK FLOW         (min)=390.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3705

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   3.821     6.00     4.11
        + ID2= 2 (9017):  1837.48    .416    12.50     1.42
          ===============================================
          ID = 3 (9041):  2376.18   4.014     6.00     2.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   3.117     6.00    22.09
        + ID2= 2 (9041):  2376.18   4.014     6.00     2.03
          ===============================================
          ID = 3 (5002):  2432.16   7.131     6.00     2.49
```



```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16     7.13      6.00      2.49
    SHIFT ID= 1 (9040): 2432.16     7.13      7.00      2.49

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation      Manning
                    .00       274.29         .0800
                  30.80       273.73         .0800
                  51.30       270.17         .0800
                  61.60       266.84         .0800
                  66.80       266.02         .0800
                 102.70       265.42         .0350      Main Channel
                 123.20       261.00         .0350      Main Channel
                 128.40       261.17         .0350      Main Channel
                 154.00       264.62         .0350      Main Channel
                 174.60       266.82         .0800
                 205.40       268.07         .0800
                 236.20       268.74         .0800
                 282.40       271.31         .0800
                 302.90       272.11         .0800
                 348.90       274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
         .63   261.63    .702E+04      5.2         1.14      22.47
        1.26   262.26    .220E+05     24.8         1.74      14.74
        1.89   262.89    .443E+05     64.0         2.22      11.54
        2.53   263.53    .741E+05    127.4         2.65       9.69
        3.16   264.16    .111E+06    219.6         3.04       8.44
        3.79   264.79    .156E+06    343.2         3.39       7.57
        4.42   265.42    .209E+06    501.2         3.70       6.94
        5.16   266.16    .304E+06    766.4         3.88       6.61
        5.90   266.90    .428E+06   1123.8         4.05       6.34
        6.64   267.64    .570E+06   1628.6         4.40       5.84
        7.38   268.38    .738E+06   2225.4         4.65       5.53
        8.12   269.12    .941E+06   2928.9         4.80       5.35
        8.85   269.85    .116E+07   3743.0         4.95       5.18
        9.59   270.59    .141E+07   4656.3         5.10       5.03
       10.33   271.33    .167E+07   5671.9         5.24       4.90
       11.07   272.07    .195E+07   6784.6         5.36       4.80
       11.81   272.81    .226E+07   8029.1         5.47       4.69
       12.55   273.55    .259E+07   9393.0         5.59       4.60
       13.29   274.29    .295E+07  10648.3         5.55       4.62

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16   7.13    7.00   2.49       .69      1.18
     OUTFLOW: ID= 1 (6029) 2432.16   4.21    7.25   2.49       .51      1.14


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--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   4.214     7.25     2.49
        + ID2= 2 (1040):    14.62    .083     6.75     5.70
          ===============================================
          ID = 3 (5003):  2446.78   4.286     7.25     2.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (5003):  2446.78   4.286     7.25     2.51
        + ID2= 2 (7016):  1176.40   4.481     6.00    10.92
          ==================================================
          ID = 3 (5004):  3623.18   6.633     7.25     5.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | SHIFT HYD (9015) |
 | IN= 2---> OUT= 1 |
 | SHIFT=120.0 min  |       AREA     QPEAK     TPEAK       R.V.
 --------------------       (ha)     (cms)     (hrs)       (mm)
          ID= 2 (5004): 3623.18      6.63      7.25       5.24
     SHIFT ID= 1 (9015): 3623.18      6.63      9.25       5.24

 ------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6031) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        260.30          .0800
                  34.10        260.43          .0800
                  62.40        259.79          .0800
                  79.50        255.72          .0800
                 113.50        254.00          .0800
                 153.30        253.33          .0350      Main Channel
                 187.30        253.06          .0350      Main Channel
                 198.70        251.88          .0350      Main Channel
                 204.40        252.61          .0350      Main Channel
                 249.80        254.00          .0800
                 334.90        255.77          .0800
                 351.90        256.37          .0800
                 414.40        260.24          .0800
                 465.50        260.75          .0800
                 514.40        261.48          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME     FLOW RATE    VELOCITY    TRAV.TIME
        (m)     (m)      (cu.m.)      (cms)        (m/s)        (min)
        .36   252.24    .596E+04        .4           .39        223.90
        .73   252.61    .238E+05       2.8           .61        141.05
       1.09   252.97    .619E+05       8.2           .69        126.14
       1.45   253.33    .151E+06      18.8           .65        134.06
       1.91   253.79    .383E+06      68.4           .93         93.14
       2.38   254.26    .713E+06     157.3          1.15         75.58
       2.84   254.72    .112E+07     287.3          1.33         65.13
       3.31   255.19    .161E+07     454.2          1.47         59.01
       3.77   255.65    .217E+07     659.0          1.58         54.87
       4.24   256.12    .279E+07     908.7          1.69         51.25
       4.70   256.58    .346E+07    1199.1          1.80         48.03
       5.17   257.05    .414E+07    1527.9          1.92         45.17
       5.63   257.51    .485E+07    1892.4          2.03         42.71
       6.10   257.98    .558E+07    2291.8          2.13         40.59
       6.56   258.44    .634E+07    2725.7          2.23         38.74
       7.03   258.91    .711E+07    3193.6          2.33         37.12
       7.49   259.37    .791E+07    3695.3          2.43         35.69
       7.96   259.84    .874E+07    4221.9          2.51         34.48
       8.42   260.30    .961E+07    4697.6          2.54         34.09

                                       <---- hydrograph ---->   <-pipe / channel->
                              AREA     QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)     (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18     6.63    9.25   5.24       .98       .66
     OUTFLOW: ID= 1 (6031) 3623.18     3.74   12.25   5.24       .79       .62

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 --------------------
 | ADD HYD   (5005) |
 |   1 +  2 =  3    |          AREA    QPEAK    TPEAK      R.V.
 --------------------          (ha)    (cms)    (hrs)      (mm)
          ID1= 1 (5062):   699.78   2.917     8.50     9.99
        + ID2= 2 (6031):  3623.18   3.738    12.25     5.24
          ==================================================
          ID = 3 (5005):  4322.96   5.957    10.25     6.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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5-Year Storm

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  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

--------------------
| MASS STORM        |    Filename: V:\01606\Active\160621777\SWM Master Plans
|                   |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 60.45 mm  |    Comments: SCS 24 HR MASS CURVE
--------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.33 |  3.25    2.42 |  6.25   10.88 |  9.25    1.84
                  .50    1.40 |  3.50    2.42 |  6.50   10.88 |  9.50    1.69
                  .75    1.43 |  3.75    2.42 |  6.75    5.75 |  9.75    1.62
                 1.00    1.47 |  4.00    2.42 |  7.00    3.92 | 10.00    1.64
                 1.25    1.55 |  4.25    3.34 |  7.25    3.63 | 10.25    1.60
                 1.50    1.60 |  4.50    3.92 |  7.50    3.63 | 10.50    1.50
                 1.75    1.62 |  4.75    4.38 |  7.75    3.63 | 10.75    1.38
                 2.00    1.69 |  5.00    5.30 |  8.00    3.63 | 11.00    1.28
                 2.25    1.69 |  5.25    7.25 |  8.25    3.10 | 11.25    1.14
                 2.50    1.69 |  5.50    7.25 |  8.50    2.66 | 11.50    1.04
                 2.75    1.81 |  5.75   29.02 |  8.75    2.32 | 11.75     .92
                 3.00    2.06 |  6.00   79.79 |  9.00    2.06 | 12.00     .82

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1032)  |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min  |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   4.618 (i)
     TIME TO PEAK   (hrs)=   9.000
     RUNOFF VOLUME    (mm)=  16.513
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2050)  |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min  |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88         53.82
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     773.30         40.00
     Mannings n          =       .013          .250

     Max.Eff.Inten.(mm/hr)=      79.79         44.49
                over (min)       15.00         30.00
     Storage Coeff.  (min)=       9.54 (ii)    21.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .09           .05
                                                            *TOTALS*
     PEAK FLOW      (cms)=       4.26          3.26          6.334 (iii)
     TIME TO PEAK   (hrs)=       6.00          6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95         23.47          32.59
     TOTAL RAINFALL   (mm)=      60.45         60.45          60.45
     RUNOFF COEFFICIENT   =        .99           .39            .54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2031)  |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min  |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
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                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        41.24
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.28 (ii)   20.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=        3.86         1.44          4.768 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        19.06          33.37
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .32            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        42.78
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.49 (ii)   18.69 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=        2.05          .61          2.442 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      50.45        19.05          31.61
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .83          .32            .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        40.05
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.87 (ii)   21.40 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=        4.77         1.73          5.861 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      50.45        18.53          29.70
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
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     RUNOFF COEFFICIENT   =        .83          .31            .49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW      (cms)=    .721 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW      (cms)=    .318 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=   4.325
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .072

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        30.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.61 (ii)   20.50 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW      (cms)=        1.36          .68          1.792 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
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                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08       13.62
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     389.00       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=      79.79       30.97
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       6.32 (ii)   20.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.18         .59          1.550 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95       16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45       60.45          60.45
     RUNOFF COEFFICIENT  =        .99         .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25       24.37
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     520.40       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=      79.79       30.97
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       7.52 (ii)   21.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.04        1.03          2.687 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95       16.62          27.45
     TOTAL RAINFALL   (mm)=      60.45       60.45          60.45
     RUNOFF COEFFICIENT  =        .99         .27            .45

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=    .825 (i)
     TIME TO PEAK    (hrs)=  10.250
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT  =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20
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```
     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   1.204 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   5.165
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT  =    .085

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .398 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=   7.283
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT  =    .120

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   1.141 (i)
     TIME TO PEAK    (hrs)=  10.500
     RUNOFF VOLUME    (mm)=   4.480
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT  =    .074

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .176 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  11.606
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT  =    .192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   4.194 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  17.056
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT  =    .282

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
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|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.22 (ii)   20.01 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       2.69         2.15          4.075 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        47.99
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       9.29 (ii)   20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       4.71         2.99          6.636 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      59.95        24.95          35.45
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=      79.79        46.60
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      11.02 (ii)   22.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                           *TOTALS*
     PEAK FLOW       (cms)=       6.59         5.40         10.054 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
```



```
     RUNOFF VOLUME    (mm)=      59.95        24.68          33.50
     TOTAL RAINFALL   (mm)=      60.45        60.45          60.45
     RUNOFF COEFFICIENT   =        .99          .41            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   3.879 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  11.988
     TOTAL RAINFALL   (mm)=  60.450
     RUNOFF COEFFICIENT   =    .198

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.2000       .9900
                          .0290      .3700    |   2.7000      1.4200
                          .5000      .6900    |   6.1000      2.1800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      6.334        6.00       32.59
     OUTFLOW: ID= 1 (9021)     89.700      2.428        6.75       32.56

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.33
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.3607

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .2620       .8805
                          .0150      .6000    |    .4710      1.0180
                          .1240      .7875    |    .9610      1.2660

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      2.442        6.00       31.61
     OUTFLOW: ID= 1 (9022)     24.780       .065       11.00       31.20

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.64
                   TIME SHIFT OF PEAK FLOW         (min)=300.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6853

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):     24.78     .065    11.00    31.20
        + ID2= 2 (2021):     70.42    5.861     6.00    29.70
          ==================================================
          ID = 3 (7008):     95.20    5.867     6.00    30.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (7008):    95.20   5.867     6.00    30.09
       + ID2= 2 (1044):   443.50    .721    10.50     4.32
         ===============================================
         ID = 3 (5065):   538.70   5.876     6.00     8.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990       .7350
                           .0110      .4435   |    .1630       .8595
                           .0550      .6265   |    .3050      1.0800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      1.792        6.00       27.45
     OUTFLOW: ID= 1 (9257)     26.450       .055       11.25       27.06

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.06
                   TIME SHIFT OF PEAK FLOW         (min)=315.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6262

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-------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      1.550        6.00       27.45
     OUTFLOW: ID= 1 (9019)     22.700       .476        6.50       15.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.71
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3393

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-------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (9019):    22.70    .476     6.50    15.99
       + ID2= 2 (2011):    40.62   2.687     6.00    27.45
         ===============================================
         ID = 3 (7001):    63.32   2.687     6.00    23.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      1.204        7.50        5.17
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.9089

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-------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
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```
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .398        6.75        7.28
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3998

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-------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730      1.6365
                           .0490     1.0690   |    .7910      1.8915
                           .2480     1.4290   |   1.4810      2.3855

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500      4.075        6.00       33.50
     OUTFLOW: ID= 1 (9258)     54.500       .248        9.00       33.39

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.08
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.4289

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-------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     10.054        6.00       33.50
     OUTFLOW: ID= 1 (9020)    145.270       .752        9.00       33.47

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.48
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.7118

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-------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
-------------------       (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96      3.88      7.25     11.99
    SHIFT ID= 1 (9029):  406.96      3.88      9.75     11.99

-----------------------------------------------------------------------------

-------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1032):   610.08   4.618     9.00    16.51
       + ID2= 2 (9021):    89.70   2.428     6.75    32.56
         ===============================================
         ID = 3 (5062):   699.78   5.556     8.50    18.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (9257):    26.45    .055    11.25    27.06
       + ID2= 2 (7001):    63.32   2.687     6.00    23.34
         ===============================================
         ID = 3 (7002):    89.77   2.693     6.00    24.44
```

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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57     .000      .00      .00
        + ID2= 2 (9248):    54.89     .000      .00      .00
          ==================================================
          ID = 3 (7004):   424.46     .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05    6.636     6.00    35.45
        + ID2= 2 (9020):   145.27     .752     9.00    33.47
          ==================================================
          ID = 3 (7013):   227.32    6.736     6.00    34.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       281.05          .0800
                  34.48       278.78          .0800
                  62.07       280.75          .0800
                  75.86       280.87          .0800
                 110.34       277.13          .0800
                 124.14       276.45     .0800 / .0350  Main Channel
                 137.93       274.50          .0350     Main Channel
                 151.72       274.76          .0350     Main Channel
                 172.41       276.25          .0350     Main Channel
                 213.79       277.31          .0800
                 255.17       278.25          .0800
                 275.86       278.49          .0800
                 289.66       279.07          .0800
                 303.45       278.41          .0800
                 312.47       278.40          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06

                                     <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     3.88    9.75  11.99       .37       .93
     OUTFLOW: ID= 1 (6019)  406.96     2.12   11.00  11.99       .28       .68


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```



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--------------------
| ADD HYD   (5064) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73     .318     9.50     4.32
        + ID2= 2 (7002):    89.77    2.693     6.00    24.44
          ==================================================
          ID = 3 (5064):   260.50    2.700     6.00    11.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46     .000      .00      .00
        + ID2= 2 (1046):   672.95    1.141    10.50     4.48
          ==================================================
          ID = 3 (9250):  1097.41    1.141    10.50     2.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50     .248     9.00    33.39
        + ID2= 2 (7013):   227.32    6.736     6.00    34.19
          ==================================================
          ID = 3 (7014):   281.82    6.761     6.00    34.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   4.8100     1.1900
                           .4200      .6400    |  14.3300     1.2700
                          1.5900      .9400    |  53.8000     1.3300
                          3.2000     1.1100    |    .0000      .0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411      1.141       10.50        2.75
     OUTFLOW: ID= 1 (9018)   1097.411      1.065       11.75        2.75

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 93.36
                   TIME SHIFT OF PEAK FLOW        (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8056

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--------------------
| ADD HYD   (5061) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62    4.194     8.50    17.06
        + ID2= 2 (7014):   281.82    6.761     6.00    34.03
          ==================================================
          ID = 3 (5061):   769.44    7.098     6.00    23.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |      Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33          .0800
                  46.71       277.77          .0800
                  57.10       277.40          .0800
                  62.29       276.96          .0800
                  67.48       275.94          .0800
                  77.86       273.27          .0800
```

```
               83.05        272.29         .0800
               93.43        270.99         .0800
              109.00        270.02         .0350      Main Channel
              119.38        270.02         .0350      Main Channel
              150.53        271.36     .0350 / .0800  Main Channel
              186.86        273.45         .0800
              207.62        274.37         .0800
              233.57        275.12         .0800
              247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7           .81      43.21
        .57   270.59    .257E+05      13.9          1.14      30.76
        .85   270.87    .484E+05      32.0          1.39      25.24
       1.13   271.15    .776E+05      59.6          1.61      21.71
       1.42   271.44    .112E+06     100.0          1.87      18.71
       1.70   271.72    .151E+06     157.2          2.18      16.04
       1.99   272.01    .195E+06     225.9          2.44      14.37
       2.27   272.29    .242E+06     305.9          2.65      13.21
       2.55   272.57    .294E+06     398.1          2.84      12.31
       2.84   272.86    .350E+06     501.8          3.01      11.61
       3.12   273.14    .409E+06     617.0          3.17      11.05
       3.40   273.42    .472E+06     744.3          3.31      10.58
       3.69   273.71    .539E+06     882.9          3.44      10.18
       3.97   273.99    .611E+06    1033.6          3.55       9.85
       4.26   274.28    .687E+06    1196.8          3.66       9.57
       4.54   274.56    .768E+06    1370.2          3.75       9.35
       4.82   274.84    .856E+06    1556.4          3.82       9.16
       5.11   275.13    .950E+06    1757.0          3.89       9.01
       5.39   275.41    .105E+07    1967.6          3.93       8.91

                               <---- hydrograph ---->   <-pipe / channel->
                         AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                         (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     1.07   11.75   2.75       .08       .81
     OUTFLOW: ID= 1 (9251) 1097.41     1.02   12.75   2.75       .08       .81

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--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (5061):   769.44   7.098     6.00    23.27
      + ID2= 2 (6019):   406.96   2.125    11.00    11.99
        ===============================================
        ID = 3 (7016):  1176.40   7.098     6.00    19.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (1047):   479.57    .825    10.25     4.48
      + ID2= 2 (9251):  1097.41   1.018    12.75     2.75
        ===============================================
        ID = 3 (5000):  1576.98   1.725    12.00     3.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (5064):   260.50   2.700     6.00    11.26
      + ID2= 2 (5000):  1576.98   1.725    12.00     3.27
        ===============================================
        ID = 3 (5001):  1837.48   2.711     6.00     4.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
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```
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   2.8300     3.4900
                          .2800      .2500    |   3.8200     3.9500
                          .7100      .6300    |   4.6700     4.2000
                         1.1300     1.1400    |   7.3600     4.6900
                         1.5600     1.7300    |   8.7800     4.8500
                         1.8400     2.2600    |  35.4000     6.6100
                         2.2700     2.9600    |  *******     8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      2.711        6.00        4.41
     OUTFLOW: ID= 1 (9017)   1837.481      1.643       13.75        4.41

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 60.62
                   TIME SHIFT OF PEAK FLOW         (min)=465.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8892

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (5065):   538.70   5.876     6.00     8.88
      + ID2= 2 (9017):  1837.48   1.643    13.75     4.41
        ===============================================
        ID = 3 (9041):  2376.18   6.184     6.00     5.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (2031):    55.98   4.768     6.00    33.37
      + ID2= 2 (9041):  2376.18   6.184     6.00     5.42
        ===============================================
        ID = 3 (5002):  2432.16  10.952     6.00     6.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
        ID= 2 (5002): 2432.16    10.95      6.00      6.06
   SHIFT ID= 1 (9040): 2432.16    10.95      7.00      6.06

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        274.29         .0800
                  30.80        273.73         .0800
                  51.30        270.17         .0800
                  61.60        266.84         .0800
                  66.80        266.02         .0800
                 102.70        265.42         .0350      Main Channel
                 123.20        261.00         .0350      Main Channel
                 128.40        261.17         .0350      Main Channel
                 154.00        264.62         .0350      Main Channel
                 174.60        266.82         .0800
                 205.40        268.07         .0800
                 236.20        268.74         .0800
                 282.40        271.31         .0800
                 302.90        272.11         .0800
                 348.90        274.45         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .63   261.63    .702E+04       5.2          1.14      22.47
       1.26   262.26    .220E+05      24.8          1.74      14.74
       1.89   262.89    .443E+05      64.0          2.22      11.54
```

```
       2.53   263.53    .741E+05     127.4          2.65       9.69
       3.16   264.16    .111E+06     219.6          3.04       8.44
       3.79   264.79    .156E+06     343.2          3.39       7.57
       4.42   265.42    .209E+06     501.2          3.70       6.94
       5.16   266.16    .304E+06     766.4          3.88       6.61
       5.90   266.90    .428E+06    1123.8          4.05       6.34
       6.64   267.64    .570E+06    1628.6          4.40       5.84
       7.38   268.38    .738E+06    2225.4          4.65       5.53
       8.12   269.12    .941E+06    2928.9          4.80       5.35
       8.85   269.85    .116E+07    3743.0          4.95       5.18
       9.59   270.59    .141E+07    4656.3          5.10       5.03
      10.33   271.33    .167E+07    5671.9          5.24       4.90
      11.07   272.07    .195E+07    6784.6          5.36       4.80
      11.81   272.81    .226E+07    8029.1          5.47       4.69
      12.55   273.55    .259E+07    9393.0          5.59       4.60
      13.29   274.29    .295E+07   10648.3          5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    10.95    7.00   6.06       .82      1.27
     OUTFLOW: ID= 1 (6029) 2432.16     6.73    7.25   6.06       .68      1.17

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   6.729     7.25     6.06
        + ID2= 2 (1040):    14.62    .176     6.75    11.61
          ==================================================
          ID = 3 (5003):  2446.78   6.877     7.25     6.10

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   6.877     7.25     6.10
        + ID2= 2 (7016):  1176.40   7.098     6.00    19.37
          ==================================================
          ID = 3 (5004):  3623.18  11.731     7.25    10.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    11.73      7.25     10.41
    SHIFT ID= 1 (9015): 3623.18    11.73      9.25     10.41

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00         260.30         .0800
                  34.10         260.43         .0800
                  62.40         259.79         .0800
                  79.50         255.72         .0800
                 113.50         254.00         .0800
                 153.30         253.33         .0350      Main Channel
                 187.30         253.06         .0350      Main Channel
                 198.70         251.88         .0350      Main Channel
                 204.40         252.61         .0350      Main Channel
                 249.80         254.00         .0800
                 334.90         255.77         .0800
                 351.90         256.37         .0800
                 414.40         260.24         .0800
                 465.50         260.75         .0800
                 514.40         261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
```



```
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .36   252.24    .596E+04        .4           .39     223.90
        .73   252.61    .238E+05       2.8           .61     141.05
       1.09   252.97    .619E+05       8.2           .69     126.14
       1.45   253.33    .151E+06      18.8           .65     134.06
       1.91   253.79    .383E+06      68.4           .93      93.14
       2.38   254.26    .713E+06     157.3          1.15      75.58
       2.84   254.72    .112E+07     287.3          1.33      65.13
       3.31   255.19    .161E+07     454.2          1.47      59.01
       3.77   255.65    .217E+07     659.0          1.58      54.87
       4.24   256.12    .279E+07     908.7          1.69      51.25
       4.70   256.58    .346E+07    1199.1          1.80      48.03
       5.17   257.05    .414E+07    1527.9          1.92      45.17
       5.63   257.51    .485E+07    1892.4          2.03      42.71
       6.10   257.98    .558E+07    2291.8          2.13      40.59
       6.56   258.44    .634E+07    2725.7          2.23      38.74
       7.03   258.91    .711E+07    3193.6          2.33      37.12
       7.49   259.37    .791E+07    3695.3          2.43      35.69
       7.96   259.84    .874E+07    4221.9          2.51      34.48
       8.42   260.30    .961E+07    4697.6          2.54      34.09

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    11.73    9.25  10.41      1.21       .67
     OUTFLOW: ID= 1 (6031) 3623.18     8.02   13.25  10.41      1.07       .68

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5005) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   5.556     8.50    18.57
        + ID2= 2 (6031):  3623.18   8.018    13.25    10.41
          ==================================================
          ID = 3 (5005):  4322.96  11.089    10.50    11.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************
```

10-Year Storm

```
--------------------
| MASS STORM       |     Filename: V:\01606\Active\160621777\SWM Master Plans
|                  |               \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
| Ptotal= 71.22 mm |     Comments: SCS 24 HR MASS CURVE
--------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                 TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                  .25    1.57 |  3.25    2.85 |  6.25   12.82 |  9.25    2.17
                  .50    1.65 |  3.50    2.85 |  6.50   12.82 |  9.50    1.99
                  .75    1.68 |  3.75    2.85 |  6.75    6.78 |  9.75    1.91
                 1.00    1.74 |  4.00    2.85 |  7.00    4.62 | 10.00    1.94
                 1.25    1.82 |  4.25    3.93 |  7.25    4.27 | 10.25    1.88
                 1.50    1.88 |  4.50    4.62 |  7.50    4.27 | 10.50    1.77
                 1.75    1.91 |  4.75    5.16 |  7.75    4.27 | 10.75    1.62
                 2.00    1.99 |  5.00    6.24 |  8.00    4.27 | 11.00    1.51
                 2.25    1.99 |  5.25    8.55 |  8.25    3.65 | 11.25    1.34
                 2.50    1.99 |  5.50    8.55 |  8.50    3.13 | 11.50    1.22
                 2.75    2.14 |  5.75   34.19 |  8.75    2.73 | 11.75    1.08
                 3.00    2.42 |  6.00   94.01 |  9.00    2.42 | 12.00     .97

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   6.388 (i)
     TIME TO PEAK   (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  22.629
     TOTAL RAINFALL   (mm)=  71.220
```

```
     RUNOFF COEFFICIENT   =    .318

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (2050) |   Area    (ha)=  89.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88       53.82
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     773.30       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       58.25
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       8.93 (ii)  19.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.10        4.45          7.981 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72       30.65          40.67
     TOTAL RAINFALL   (mm)=      71.22       71.22          71.22
     RUNOFF COEFFICIENT   =        .99         .43            .57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (2031) |   Area    (ha)=  55.98
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79       25.19
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     610.90       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       54.71
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.76 (ii)  18.82 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.62        1.99          5.890 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72       25.19          41.13
     TOTAL RAINFALL   (mm)=      71.22       71.22          71.22
     RUNOFF COEFFICIENT   =        .99         .35            .58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (2020) |   Area    (ha)=  24.78
|ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87        9.91
     Dep. Storage     (mm)=      10.00        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     406.40       40.00
     Mannings n           =       .013        .250
```


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```
     Max.Eff.Inten.(mm/hr)=      94.01       56.75
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.07 (ii)  16.97 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       2.44         .85          2.988 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      61.22       25.17          39.59
     TOTAL RAINFALL   (mm)=      71.22       71.22          71.22
     RUNOFF COEFFICIENT   =        .86         .35            .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73       31.69
     Dep. Storage     (mm)=      10.00        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     685.20       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       53.21
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       8.31 (ii)  19.49 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.72        2.40          7.245 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      61.22       24.53          37.37
     TOTAL RAINFALL   (mm)=      71.22       71.22          71.22
     RUNOFF COEFFICIENT   =        .86         .34            .52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   1.282 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .572 (i)
     TIME TO PEAK    (hrs)=   9.250
     RUNOFF VOLUME    (mm)=   7.546
     TOTAL RAINFALL   (mm)=  71.220
```

```
     RUNOFF COEFFICIENT   =    .106

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58       15.87
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     419.90       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       41.43
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       6.19 (ii)   18.55 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       1.63         .95         2.231 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      70.72       22.15         34.29
     TOTAL RAINFALL   (mm)=      71.22       71.22         71.22
     RUNOFF COEFFICIENT   =        .99         .31           .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08       13.62
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     389.00       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=      94.01       41.43
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       5.92 (ii)   18.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       1.40         .82         1.928 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      70.72       22.15         34.29
     TOTAL RAINFALL   (mm)=      71.22       71.22         71.22
     RUNOFF COEFFICIENT   =        .99         .31           .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25       24.37
     Dep. Storage     (mm)=        .50        2.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     520.40       40.00
     Mannings n          =       .013        .250
```



```
     Max.Eff.Inten.(mm/hr)=      94.01       41.43
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.04 (ii)   19.41 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       2.44        1.44         3.351 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      70.72       22.15         34.29
     TOTAL RAINFALL   (mm)=      71.22       71.22         71.22
     RUNOFF COEFFICIENT   =        .99         .31           .48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   1.467 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.804
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .110

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   2.098 (i)
     TIME TO PEAK    (hrs)=   7.500
     RUNOFF VOLUME    (mm)=   8.408
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .118

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=    .705 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  11.652
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .164

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   2.027 (i)
     TIME TO PEAK    (hrs)=  10.000
     RUNOFF VOLUME    (mm)=   7.804
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     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .110

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .250 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  16.207
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .228

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   5.792 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  23.326
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .328

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     602.80        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        60.66
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.69 (ii)   18.31 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       3.22         2.91          5.116 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        32.04          41.71
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .45            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     739.60        40.00
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     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        62.41
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       8.70 (ii)   19.19 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       5.64         4.05          8.287 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        32.37          43.87
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .45            .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11        87.16
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     984.10        40.00
     Mannings n           =       .013         .250

     Max.Eff.Inten.(mm/hr)=      94.01        60.66
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      10.33 (ii)   20.94 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                         *TOTALS*
     PEAK FLOW       (cms)=       7.93         7.33         12.687 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      70.72        32.04          41.71
     TOTAL RAINFALL   (mm)=      71.22        71.22          71.22
     RUNOFF COEFFICIENT   =        .99          .45            .59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   5.477 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  16.717
     TOTAL RAINFALL   (mm)=  71.220
     RUNOFF COEFFICIENT   =    .235

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.2000      .9900
                          .0290      .3700    |   2.7000     1.4200
                          .5000      .6900    |   6.1000     2.1800

                                AREA      QPEAK       TPEAK       R.V.
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                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700      7.981        6.00       40.67
     OUTFLOW: ID= 1 (9021)     89.700      3.472        6.50       40.63

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.51
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.6071

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .2620       .8805
                           .0150      .6000   |    .4710      1.0180
                           .1240      .7875   |    .9610      1.2660

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      2.988        6.00       39.59
     OUTFLOW: ID= 1 (9022)     24.780       .123        9.25       39.18

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.12
                   TIME SHIFT OF PEAK FLOW         (min)=195.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .7862

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .123     9.25    39.18
        + ID2= 2 (2021):    70.42    7.245     6.00    37.37
          ==================================================
          ID = 3 (7008):    95.20    7.253     6.00    37.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20    7.253     6.00    37.84
        + ID2= 2 (1044):   443.50    1.282    10.00     7.55
          ==================================================
          ID = 3 (5065):   538.70    7.275     6.00    12.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .0990       .7350
                           .0110      .4435   |    .1630       .8595
                           .0550      .6265   |    .3050      1.0800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      2.231        6.00       34.29
     OUTFLOW: ID= 1 (9257)     26.450       .099        9.75       33.90

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.43
                   TIME SHIFT OF PEAK FLOW         (min)=225.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .7349

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.0800       .5900
                           .0000      .2600   |   1.2200       .7400
                           .5700      .3500   |   1.3500       .9300
                           .9900      .4700   |   2.8300       .9900
```



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                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700      1.928        6.00       34.29
     OUTFLOW: ID= 1 (9019)     22.700       .712        6.50       22.83

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.93
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .3911

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--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70     .712     6.50    22.83
        + ID2= 2 (2011):    40.62    3.351     6.00    34.29
          ==================================================
          ID = 3 (7001):    63.32    3.351     6.00    30.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570      2.098        7.50        8.41
     OUTFLOW: ID= 1 (9147)    369.570       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.1075

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--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891       .705        6.50       11.65
     OUTFLOW: ID= 1 (9248)     54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6396

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--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730      1.6365
                           .0490     1.0690   |    .7910      1.8915
                           .2480     1.4290   |   1.4810      2.3855

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500      5.116        6.00       41.71
     OUTFLOW: ID= 1 (9258)     54.500       .472        8.25       41.61

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.23
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.6362

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000
```

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                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270     12.687        6.00       41.71
     OUTFLOW: ID= 1 (9020)    145.270      1.220        8.25       41.69

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.62
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.3353

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--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     5.48      7.25     16.72
    SHIFT ID= 1 (9029):  406.96     5.48      9.75     16.72

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--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   6.388     8.75    22.63
        + ID2= 2 (9021):    89.70   3.472     6.50    40.63
          ===============================================
          ID = 3 (5062):   699.78   7.487     8.50    24.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45    .099     9.75    33.90
        + ID2= 2 (7001):    63.32   3.351     6.00    30.18
          ===============================================
          ID = 3 (7002):    89.77   3.359     6.00    31.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05   8.287     6.00    43.87
        + ID2= 2 (9020):   145.27   1.220     8.25    41.69
          ===============================================
          ID = 3 (7013):   227.32   8.413     6.00    42.48

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
                  62.07        280.75         .0800
                  75.86        280.87         .0800
                 110.34        277.13         .0800
```



```
                 124.14        276.45     .0800 / .0350  Main Channel
                 137.93        274.50         .0350      Main Channel
                 151.72        274.76         .0350      Main Channel
                 172.41        276.25         .0350      Main Channel
                 213.79        277.31         .0800
                 255.17        278.25         .0800
                 275.86        278.49         .0800
                 289.66        279.07         .0800
                 303.45        278.41         .0800
                 312.47        278.40         .0800

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)       (min)
        .20   274.70   .665E+04        .6           .56     172.84
        .39   274.89   .247E+05       4.2          1.00      97.27
        .59   275.09   .478E+05      11.1          1.35      71.58
        .78   275.28   .756E+05      21.4          1.64      58.99
        .98   275.48   .108E+06      35.2          1.89      51.17
       1.17   275.67   .145E+06      52.9          2.12      45.70
       1.37   275.87   .187E+06      74.8          2.33      41.60
       1.56   276.06   .233E+06     101.2          2.53      38.37
       1.76   276.26   .284E+06     132.2          2.71      35.80
       1.95   276.45   .342E+06     160.8          2.73      35.50
       2.17   276.67   .421E+06     204.7          2.83      34.30
       2.38   276.88   .516E+06     258.7          2.91      33.25
       2.60   277.10   .627E+06     323.9          3.00      32.28
       2.82   277.32   .754E+06     402.4          3.11      31.21
       3.03   277.53   .894E+06     517.5          3.37      28.78
       3.25   277.75   .105E+07     645.6          3.58      27.06
       3.47   277.97   .122E+07     787.1          3.76      25.78
       3.68   278.18   .140E+07     942.2          3.91      24.79
       3.90   278.40   .160E+07    1110.1          4.03      24.06

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96     5.48    9.75  16.72       .43      1.05
     OUTFLOW: ID= 1 (6019)  406.96     3.43   10.75  16.71       .35       .85

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 ADD HYD   (5064)
   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73    .572     9.25     7.55
        + ID2= 2 (7002):    89.77   3.359     6.00    31.28
          ===============================================
          ID = 3 (5064):   260.50   3.375     6.00    15.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   2.027    10.00     7.80
          ===============================================
          ID = 3 (9250):  1097.41   2.027    10.00     4.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50    .472     8.25    41.61
        + ID2= 2 (7013):   227.32   8.413     6.00    42.48
          ===============================================
          ID = 3 (7014):   281.82   8.444     6.00    42.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
```

```
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000       .0000   |   4.8100      1.1900
                          .4200       .6400   |  14.3300      1.2700
                         1.5900       .9400   |  53.8000      1.3300
                         3.2000      1.1100   |    .0000       .0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411     2.027       10.00        4.79
     OUTFLOW: ID= 1 (9018)   1097.411     2.001       10.50        4.78

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 98.74
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9837

--------------------------------------------------------------------------------

  ADD HYD   (5061)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):    487.62   5.792     8.50    23.33
        + ID2= 2 (7014):    281.82   8.444     6.00    42.31
          ==================================================
          ID = 3 (5061):    769.44   8.974     6.00    30.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       278.33          .0800
                  46.71       277.77          .0800
                  57.10       277.40          .0800
                  62.29       276.96          .0800
                  67.48       275.94          .0800
                  77.86       273.27          .0800
                  83.05       272.29          .0800
                  93.43       270.99          .0800
                 109.00       270.02          .0350      Main Channel
                 119.38       270.02          .0350      Main Channel
                 150.53       271.36      .0350 / .0800  Main Channel
                 186.86       273.45          .0800
                 207.62       274.37          .0800
                 233.57       275.12          .0800
                 247.79       275.41          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81       43.21
        .57   270.59    .257E+05      13.9         1.14       30.76
        .85   270.87    .484E+05      32.0         1.39       25.24
       1.13   271.15    .776E+05      59.6         1.61       21.71
       1.42   271.44    .112E+06     100.0         1.87       18.71
       1.70   271.72    .151E+06     157.2         2.18       16.04
       1.99   272.01    .195E+06     225.9         2.44       14.37
       2.27   272.29    .242E+06     305.9         2.65       13.21
       2.55   272.57    .294E+06     398.1         2.84       12.31
       2.84   272.86    .350E+06     501.8         3.01       11.61
       3.12   273.14    .409E+06     617.0         3.17       11.05
       3.40   273.42    .472E+06     744.3         3.31       10.58
       3.69   273.71    .539E+06     882.9         3.44       10.18
       3.97   273.99    .611E+06    1033.6         3.55        9.85
       4.26   274.28    .687E+06    1196.8         3.66        9.57
       4.54   274.56    .768E+06    1370.2         3.75        9.35
       4.82   274.84    .856E+06    1556.4         3.82        9.16
       5.11   275.13    .950E+06    1757.0         3.89        9.01
       5.39   275.41    .105E+07    1967.6         3.93        8.91

                                                <---- hydrograph ---->   <-pipe / channel->
                              AREA     QPEAK    TPEAK   R.V.   MAX DEPTH   MAX VEL
                              (ha)     (cms)    (hrs)   (mm)      (m)       (m/s)
     INFLOW : ID= 2 (9018) 1097.41      2.00    10.50   4.78       .15        .81
     OUTFLOW: ID= 1 (9251) 1097.41      1.89    11.50   4.78       .14        .81
```



```
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):    769.44   8.974     6.00    30.28
        + ID2= 2 (6019):    406.96   3.432    10.75    16.71
          ==================================================
          ID = 3 (7016):   1176.40   9.233    10.25    25.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):    479.57   1.467    10.00     7.80
        + ID2= 2 (9251):   1097.41   1.886    11.50     4.78
          ==================================================
          ID = 3 (5000):   1576.98   3.230    11.25     5.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):    260.50   3.375     6.00    15.72
        + ID2= 2 (5000):   1576.98   3.230    11.25     5.70
          ==================================================
          ID = 3 (5001):   1837.48   3.992    11.00     7.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000       .0000   |   2.8300      3.4900
                          .2800       .2500   |   3.8200      3.9500
                          .7100       .6300   |   4.6700      4.2000
                         1.1300      1.1400   |   7.3600      4.6900
                         1.5600      1.7300   |   8.7800      4.8500
                         1.8400      2.2600   |  35.4000      6.6100
                         2.2700      2.9600   |  *******      8.6500

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     3.992       11.00        7.12
     OUTFLOW: ID= 1 (9017)   1837.481     3.108       13.00        7.12

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 77.86
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  3.6212

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--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):    538.70   7.275     6.00    12.90
        + ID2= 2 (9017):   1837.48   3.108    13.00     7.12
          ==================================================
          ID = 3 (9041):   2376.18   7.658     6.00     8.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):     55.98   5.890     6.00    41.13
        + ID2= 2 (9041):   2376.18   7.658     6.00     8.43
```

```
          ==================================================
          ID = 3 (5002):  2432.16  13.548     6.00     9.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    13.55      6.00      9.19
    SHIFT ID= 1 (9040): 2432.16    13.55      7.00      9.19

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29          .0800
                  30.80       273.73          .0800
                  51.30       270.17          .0800
                  61.60       266.84          .0800
                  66.80       266.02          .0800
                 102.70       265.42          .0350      Main Channel
                 123.20       261.00          .0350      Main Channel
                 128.40       261.17          .0350      Main Channel
                 154.00       264.62          .0350      Main Channel
                 174.60       266.82          .0800
                 205.40       268.07          .0800
                 236.20       268.74          .0800
                 282.40       271.31          .0800
                 302.90       272.11          .0800
                 348.90       274.45          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)      (cu.m.)      (cms)       (m/s)      (min)
          .63   261.63    .702E+04       5.2         1.14      22.47
         1.26   262.26    .220E+05      24.8         1.74      14.74
         1.89   262.89    .443E+05      64.0         2.22      11.54
         2.53   263.53    .741E+05     127.4         2.65       9.69
         3.16   264.16    .111E+06     219.6         3.04       8.44
         3.79   264.79    .156E+06     343.2         3.39       7.57
         4.42   265.42    .209E+06     501.2         3.70       6.94
         5.16   266.16    .304E+06     766.4         3.88       6.61
         5.90   266.90    .428E+06    1123.8         4.05       6.34
         6.64   267.64    .570E+06    1628.6         4.40       5.84
         7.38   268.38    .738E+06    2225.4         4.65       5.53
         8.12   269.12    .941E+06    2928.9         4.80       5.35
         8.85   269.85    .116E+07    3743.0         4.95       5.18
         9.59   270.59    .141E+07    4656.3         5.10       5.03
        10.33   271.33    .167E+07    5671.9         5.24       4.90
        11.07   272.07    .195E+07    6784.6         5.36       4.80
        11.81   272.81    .226E+07    8029.1         5.47       4.69
        12.55   273.55    .259E+07    9393.0         5.59       4.60
        13.29   274.29    .295E+07   10648.3         5.55       4.62

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    13.55    7.00   9.19       .90      1.34
     OUTFLOW: ID= 1 (6029) 2432.16     8.54    7.25   9.19       .74      1.21


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--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16   8.543     7.25     9.19
        + ID2= 2 (1040):    14.62    .250     6.75    16.21
          ==================================================
          ID = 3 (5003):  2446.78   8.750     7.25     9.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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```
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78   8.750     7.25     9.23
        + ID2= 2 (7016):  1176.40   9.233    10.25    25.59
          ==================================================
          ID = 3 (5004):  3623.18  15.891     7.25    14.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    15.89      7.25     14.54
    SHIFT ID= 1 (9015): 3623.18    15.89      9.25     14.54

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       260.30          .0800
                  34.10       260.43          .0800
                  62.40       259.79          .0800
                  79.50       255.72          .0800
                 113.50       254.00          .0800
                 153.30       253.33          .0350      Main Channel
                 187.30       253.06          .0350      Main Channel
                 198.70       251.88          .0350      Main Channel
                 204.40       252.61          .0350      Main Channel
                 249.80       254.00          .0800
                 334.90       255.77          .0800
                 351.90       256.37          .0800
                 414.40       260.24          .0800
                 465.50       260.75          .0800
                 514.40       261.48          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)      (cu.m.)      (cms)       (m/s)      (min)
          .36   252.24    .596E+04        .4          .39     223.90
          .73   252.61    .238E+05       2.8          .61     141.05
         1.09   252.97    .619E+05       8.2          .69     126.14
         1.45   253.33    .151E+06      18.8          .65     134.06
         1.91   253.79    .383E+06      68.4          .93      93.14
         2.38   254.26    .713E+06     157.3         1.15      75.58
         2.84   254.72    .112E+07     287.3         1.33      65.13
         3.31   255.19    .161E+07     454.2         1.47      59.01
         3.77   255.65    .217E+07     659.0         1.58      54.87
         4.24   256.12    .279E+07     908.7         1.69      51.25
         4.70   256.58    .346E+07    1199.1         1.80      48.03
         5.17   257.05    .414E+07    1527.9         1.92      45.17
         5.63   257.51    .485E+07    1892.4         2.03      42.71
         6.10   257.98    .558E+07    2291.8         2.13      40.59
         6.56   258.44    .634E+07    2725.7         2.23      38.74
         7.03   258.91    .711E+07    3193.6         2.33      37.12
         7.49   259.37    .791E+07    3695.3         2.43      35.69
         7.96   259.84    .874E+07    4221.9         2.51      34.48
         8.42   260.30    .961E+07    4697.6         2.54      34.09

                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    15.89    9.25  14.54      1.35       .66
     OUTFLOW: ID= 1 (6031) 3623.18    11.47   13.50  14.54      1.20       .67


-------------------------------------------------------------------------------


  ADD HYD   (5005)
    1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):   699.78   7.487     8.50    24.94
        + ID2= 2 (6031):  3623.18  11.470    13.50    14.54
          ==================================================
          ID = 3 (5005):  4322.96  14.967    10.50    16.22
```

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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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   ****************************
   ** SIMULATION NUMBER:   4 **
   ****************************
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25-Year Storm

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 -------------------
 | MASS STORM       |    Filename: V:\01606\Active\160621777\SWM Master Plans
 |                  |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal= 83.15 mm |    Comments: SCS 24 HR MASS CURVE
 -------------------
                         Duration of storm    = 12.00 hrs
                         Mass curve time step = 15.00 min

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                   .25    1.83 |  3.25    3.33 |  6.25   14.97 |  9.25    2.53
                   .50    1.93 |  3.50    3.33 |  6.50   14.97 |  9.50    2.33
                   .75    1.96 |  3.75    3.33 |  6.75    7.92 |  9.75    2.23
                  1.00    2.03 |  4.00    3.33 |  7.00    5.39 | 10.00    2.26
                  1.25    2.13 |  4.25    4.59 |  7.25    4.99 | 10.25    2.20
                  1.50    2.20 |  4.50    5.39 |  7.50    4.99 | 10.50    2.06
                  1.75    2.23 |  4.75    6.02 |  7.75    4.99 | 10.75    1.90
                  2.00    2.33 |  5.00    7.28 |  8.00    4.99 | 11.00    1.76
                  2.25    2.33 |  5.25    9.98 |  8.25    4.26 | 11.25    1.56
                  2.50    2.33 |  5.50    9.98 |  8.50    3.66 | 11.50    1.43
                  2.75    2.49 |  5.75   39.91 |  8.75    3.19 | 11.75    1.26
                  3.00    2.83 |  6.00  109.76 |  9.00    2.83 | 12.00    1.13

 -------------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW      (cms)=   8.546 (i)
     TIME TO PEAK   (hrs)=   8.750
     RUNOFF VOLUME   (mm)=  30.044
     TOTAL RAINFALL  (mm)=  83.150
     RUNOFF COEFFICIENT  =    .361

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | STANDHYD  (2050) |   Area    (ha)=  89.70
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88        53.82
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     773.30        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        74.52
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       8.40 (ii)   18.17 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .09          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       6.06         5.90          9.919 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME   (mm)=      82.65        39.14          50.02
     TOTAL RAINFALL  (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT  =        .99          .47            .60

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  70.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 | CALIB            |
```



```
 | STANDHYD  (2031) |   Area    (ha)=  55.98
 |ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79        25.19
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     610.90        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        70.93
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.29 (ii)   17.26 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       5.46         2.68          7.193 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME   (mm)=      82.65        32.56          50.09
     TOTAL RAINFALL  (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT  =        .99          .39            .60

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  59.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB            |
 | STANDHYD  (2020) |   Area    (ha)=  24.78
 |ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87         9.91
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     406.40        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        73.57
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       5.71 (ii)   15.53 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       2.88         1.14          3.618 (iii)
     TIME TO PEAK   (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME   (mm)=      73.15        32.53          48.78
     TOTAL RAINFALL  (mm)=      83.15        83.15          83.15
     RUNOFF COEFFICIENT  =        .88          .39            .59

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  58.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 -------------------
 | CALIB            |
 | STANDHYD  (2021) |   Area    (ha)=  70.42
 |ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
 -------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =        .013         .250

     Max.Eff.Inten.(mm/hr)=     109.76        69.10
                over (min)      15.00        30.00
     Storage Coeff.  (min)=       7.81 (ii)   17.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                          *TOTALS*
     PEAK FLOW      (cms)=       6.77         3.23          8.855 (iii)
```

```
     TIME TO PEAK    (hrs)=      6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     73.15       31.76         46.24
     TOTAL RAINFALL   (mm)=     83.15       83.15         83.15
     RUNOFF COEFFICIENT   =       .88         .38           .56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW       (cms)=   2.063 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW       (cms)=    .930 (i)
     TIME TO PEAK    (hrs)=   9.000
     RUNOFF VOLUME    (mm)=  11.915
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .143

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     10.58       15.87
     Dep. Storage     (mm)=       .50        2.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=    419.90       40.00
     Mannings n           =      .013        .250

     Max.Eff.Inten.(mm/hr)=    109.76       54.15
                over (min)      15.00       30.00
     Storage Coeff.  (min)=      5.82 (ii)  16.93 (ii)
     Unit Hyd. Tpeak (min)=     15.00       30.00
     Unit Hyd. peak  (cms)=       .10         .05
                                                       *TOTALS*
     PEAK FLOW       (cms)=      1.92        1.29         2.747 (iii)
     TIME TO PEAK    (hrs)=      6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     82.65       28.85         42.30
     TOTAL RAINFALL   (mm)=     83.15       83.15         83.15
     RUNOFF COEFFICIENT   =       .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
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| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      9.08       13.62
     Dep. Storage     (mm)=       .50        2.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=    389.00       40.00
     Mannings n           =      .013        .250

     Max.Eff.Inten.(mm/hr)=    109.76       54.15
                over (min)      15.00       30.00
     Storage Coeff.  (min)=      5.56 (ii)  16.67 (ii)
     Unit Hyd. Tpeak (min)=     15.00       30.00
     Unit Hyd. peak  (cms)=       .11         .05
                                                       *TOTALS*
     PEAK FLOW       (cms)=      1.65        1.12         2.372 (iii)
     TIME TO PEAK    (hrs)=      6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     82.65       28.85         42.30
     TOTAL RAINFALL   (mm)=     83.15       83.15         83.15
     RUNOFF COEFFICIENT   =       .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     16.25       24.37
     Dep. Storage     (mm)=       .50        2.50
     Average Slope     (%)=      1.00        1.00
     Length            (m)=    520.40       40.00
     Mannings n           =      .013        .250

     Max.Eff.Inten.(mm/hr)=    109.76       54.15
                over (min)      15.00       30.00
     Storage Coeff.  (min)=      6.62 (ii)  17.73 (ii)
     Unit Hyd. Tpeak (min)=     15.00       30.00
     Unit Hyd. peak  (cms)=       .10         .05
                                                       *TOTALS*
     PEAK FLOW       (cms)=      2.88        1.95         4.134 (iii)
     TIME TO PEAK    (hrs)=      6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     82.65       28.85         42.30
     TOTAL RAINFALL   (mm)=     83.15       83.15         83.15
     RUNOFF COEFFICIENT   =       .99         .35           .51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW       (cms)=   2.362 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.300
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
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| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW       (cms)=   3.332 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  12.712
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .153

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW       (cms)=   1.134 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  17.315
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180

     PEAK FLOW       (cms)=   3.258 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  12.300
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .148

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW       (cms)=    .342 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  21.923
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .264

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW       (cms)=   7.732 (i)
     TIME TO PEAK    (hrs)=   8.500
     RUNOFF VOLUME    (mm)=  30.906
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .372

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80       32.70
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     602.80       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       77.23
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       7.23 (ii)   16.87 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.80        3.83          6.337 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      82.65       40.71          51.20
     TOTAL RAINFALL   (mm)=      83.15       83.15          83.15
     RUNOFF COEFFICIENT   =        .99         .49            .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92       45.13
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     739.60       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       79.39
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       8.18 (ii)   17.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.69        5.34         10.214 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25           6.00
     RUNOFF VOLUME    (mm)=      82.65       41.10          53.56
     TOTAL RAINFALL   (mm)=      83.15       83.15          83.15
     RUNOFF COEFFICIENT   =        .99         .49            .64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11       87.16
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     984.10       40.00
     Mannings n          =       .013        .250

     Max.Eff.Inten.(mm/hr)=     109.76       77.23
                over (min)      15.00       30.00
     Storage Coeff.  (min)=       9.70 (ii)   19.34 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
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                                                   *TOTALS*
     PEAK FLOW       (cms)=       9.43        9.68        15.788 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=      82.65       40.71         51.20
     TOTAL RAINFALL   (mm)=      83.15       83.15         83.15
     RUNOFF COEFFICIENT   =        .99         .49           .62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=   7.472 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  22.578
     TOTAL RAINFALL   (mm)=  83.150
     RUNOFF COEFFICIENT   =    .272

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.2000       .9900
                          .0290      .3700    |   2.7000      1.4200
                          .5000      .6900    |   6.1000      2.1800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     9.919        6.00       50.02
     OUTFLOW: ID= 1 (9021)     89.700     4.688        6.50       49.98

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.27
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8649

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--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .2620       .8805
                          .0150      .6000    |    .4710      1.0180
                          .1240      .7875    |    .9610      1.2660

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780     3.618        6.00       48.78
     OUTFLOW: ID= 1 (9022)     24.780      .255        8.00       48.37

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.05
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8761

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--------------------
| ADD HYD   (7008) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78    .255     8.00    48.37
        + ID2= 2 (2021):    70.42   8.855     6.00    46.24
          ==================================================
          ID = 3 (7008):    95.20   8.865     6.00    46.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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| ADD HYD   (5065) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20   8.865     6.00    46.80
        + ID2= 2 (1044):   443.50   2.063     9.75    11.92
          ==================================================
          ID = 3 (5065):   538.70   8.908     6.00    18.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .0990       .7350
                          .0110      .4435    |    .1630       .8595
                          .0550      .6265    |    .3050      1.0800

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450     2.747        6.00       42.30
     OUTFLOW: ID= 1 (9257)     26.450      .163        9.00       41.91

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.93
                   TIME SHIFT OF PEAK FLOW         (min)=180.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .8593

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--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.0800       .5900
                          .0000      .2600    |   1.2200       .7400
                          .5700      .3500    |   1.3500       .9300
                          .9900      .4700    |   2.8300       .9900

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700     2.372        6.00       42.30
     OUTFLOW: ID= 1 (9019)     22.700      .929        6.50       30.84

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.15
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .4536

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| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70    .929     6.50    30.84
        + ID2= 2 (2011):    40.62   4.134     6.00    42.30
          ==================================================
          ID = 3 (7001):    63.32   4.414     6.00    38.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******    |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     3.332        7.25       12.71
     OUTFLOW: ID= 1 (9147)    369.570      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.6980

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| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000    *******   |    .0010    ********

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)      54.891      1.134        6.50       17.31
     OUTFLOW: ID= 1 (9248)      54.891       .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .9504

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--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |    .4730      1.6365
                           .0490     1.0690   |    .7910      1.8915
                           .2480     1.4290   |   1.4810      2.3855

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)      54.500      6.337        6.00       51.20
     OUTFLOW: ID= 1 (9258)      54.500       .789        7.25       51.10

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.46
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.8915

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   1.7200      5.0000
                           .2200     3.0000   |   2.5000      7.0000

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)     145.270     15.788        6.00       51.20
     OUTFLOW: ID= 1 (9020)     145.270      1.758        7.75       51.17

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.14
                   TIME SHIFT OF PEAK FLOW         (min)=105.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  5.0996

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK       R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96     7.47      7.00     22.58
    SHIFT ID= 1 (9029):  406.96     7.47      9.50     22.58

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08   8.546     8.75    30.04
        + ID2= 2 (9021):    89.70   4.688     6.50    49.98
          ===============================================
          ID = 3 (5062):   699.78   9.861     8.50    32.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45    .163     9.00    41.91
        + ID2= 2 (7001):    63.32   4.414     6.00    38.19
```



```
          ===============================================
          ID = 3 (7002):    89.77   4.423     6.00    39.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  10.214     6.00    53.56
        + ID2= 2 (9020):   145.27   1.758     7.75    51.17
          ===============================================
          ID = 3 (7013):   227.32  10.369     6.00    52.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
              <------ DATA FOR SECTION (   1.0) ------>
              Distance      Elevation       Manning
                   .00       281.05          .0800
                 34.48       278.78          .0800
                 62.07       280.75          .0800
                 75.86       280.87          .0800
                110.34       277.13          .0800
                124.14       276.45      .0800 / .0350  Main Channel
                137.93       274.50          .0350      Main Channel
                151.72       274.76          .0350      Main Channel
                172.41       276.25          .0350      Main Channel
                213.79       277.31          .0800
                255.17       278.25          .0800
                275.86       278.49          .0800
                289.66       279.07          .0800
                303.45       278.41          .0800
                312.47       278.40          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .20   274.70    .665E+04        .6           .56     172.84
        .39   274.89    .247E+05       4.2          1.00      97.27
        .59   275.09    .478E+05      11.1          1.35      71.58
        .78   275.28    .756E+05      21.4          1.64      58.99
        .98   275.48    .108E+06      35.2          1.89      51.17
       1.17   275.67    .145E+06      52.9          2.12      45.70
       1.37   275.87    .187E+06      74.8          2.33      41.60
       1.56   276.06    .233E+06     101.2          2.53      38.37
       1.76   276.26    .284E+06     132.2          2.71      35.80
       1.95   276.45    .342E+06     160.8          2.73      35.50
       2.17   276.67    .421E+06     204.7          2.83      34.30
       2.38   276.88    .516E+06     258.7          2.91      33.25
       2.60   277.10    .627E+06     323.9          3.00      32.28
       2.82   277.32    .754E+06     402.4          3.11      31.21
       3.03   277.53    .894E+06     517.5          3.37      28.78
       3.25   277.75    .105E+07     645.6          3.58      27.06
       3.47   277.97    .122E+07     787.1          3.76      25.78
       3.68   278.18    .140E+07     942.2          3.91      24.79
       3.90   278.40    .160E+07    1110.1          4.03      24.06

                                 <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029) 406.96     7.47    9.50  22.58       .48      1.14
     OUTFLOW: ID= 1 (6019) 406.96     5.03   10.75  22.58       .41      1.03
```

```
-------------------------------------------------------------------------------

 ADD HYD   (5064)
   1 +  2 =  3             AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1045):   170.73    .930     9.00    11.92
       + ID2= 2 (7002):    89.77   4.423     6.00    39.29
         ==================================================
         ID = 3 (5064):   260.50   4.456     6.00    21.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (7004):   424.46    .000      .00      .00
       + ID2= 2 (1046):   672.95   3.258     9.75    12.30
         ==================================================
         ID = 3 (9250):  1097.41   3.258     9.75     7.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (9258):    54.50    .789     7.25    51.10
       + ID2= 2 (7013):   227.32  10.369     6.00    52.04
         ==================================================
         ID = 3 (7014):   281.82  10.408     6.00    51.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   4.8100      1.1900
                          .4200      .6400    |  14.3300      1.2700
                         1.5900      .9400    |  53.8000      1.3300
                         3.2000     1.1100    |    .0000       .0000

                              AREA      QPEAK       TPEAK       R.V.
                              (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)   1097.411     3.258        9.75        7.54
     OUTFLOW: ID= 1 (9018)   1097.411     3.253       10.00        7.54

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.83
                  TIME SHIFT OF PEAK FLOW         (min)= 15.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.1127

-------------------------------------------------------------------------------

 ADD HYD   (5061)
   1 +  2 =  3             AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1059):   487.62   7.732     8.50    30.91
       + ID2= 2 (7014):   281.82  10.408     6.00    51.86
         ==================================================
         ID = 3 (5061):   769.44  11.200     6.00    38.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33         .0800
                  46.71        277.77         .0800
                  57.10        277.40         .0800
```



```
                  62.29        276.96         .0800
                  67.48        275.94         .0800
                  77.86        273.27         .0800
                  83.05        272.29         .0800
                  93.43        270.99         .0800
                 109.00        270.02         .0350      Main Channel
                 119.38        270.02         .0350      Main Channel
                 150.53        271.36     .0350 / .0800  Main Channel
                 186.86        273.45         .0800
                 207.62        274.37         .0800
                 233.57        275.12         .0800
                 247.79        275.41         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
        .28   270.30    .950E+04       3.7          .81       43.21
        .57   270.59    .257E+05      13.9         1.14       30.76
        .85   270.87    .484E+05      32.0         1.39       25.24
       1.13   271.15    .776E+05      59.6         1.61       21.71
       1.42   271.44    .112E+06     100.0         1.87       18.71
       1.70   271.72    .151E+06     157.2         2.18       16.04
       1.99   272.01    .195E+06     225.9         2.44       14.37
       2.27   272.29    .242E+06     305.9         2.65       13.21
       2.55   272.57    .294E+06     398.1         2.84       12.31
       2.84   272.86    .350E+06     501.8         3.01       11.61
       3.12   273.14    .409E+06     617.0         3.17       11.05
       3.40   273.42    .472E+06     744.3         3.31       10.58
       3.69   273.71    .539E+06     882.9         3.44       10.18
       3.97   273.99    .611E+06    1033.6         3.55        9.85
       4.26   274.28    .687E+06    1196.8         3.66        9.57
       4.54   274.56    .768E+06    1370.2         3.75        9.35
       4.82   274.84    .856E+06    1556.4         3.82        9.16
       5.11   275.13    .950E+06    1757.0         3.89        9.01
       5.39   275.41    .105E+07    1967.6         3.93        8.91

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     3.25   10.00   7.54       .25       .81
     OUTFLOW: ID= 1 (9251) 1097.41     3.08   11.00   7.54       .24       .81


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--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (5061):   769.44  11.200     6.00    38.58
       + ID2= 2 (6019):   406.96   5.034    10.75    22.58
         ==================================================
         ID = 3 (7016):  1176.40  12.939    10.25    33.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1047):   479.57   2.362     9.75    12.30
       + ID2= 2 (9251):  1097.41   3.082    11.00     7.54
         ==================================================
         ID = 3 (5000):  1576.98   5.291    10.75     8.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (5064):   260.50   4.456     6.00    21.35
       + ID2= 2 (5000):  1576.98   5.291    10.75     8.99
         ==================================================
         ID = 3 (5001):  1837.48   6.508    10.50    10.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
```

```
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .0000      .0000   |   2.8300     3.4900
                            .2800      .2500   |   3.8200     3.9500
                            .7100      .6300   |   4.6700     4.2000
                           1.1300     1.1400   |   7.3600     4.6900
                           1.5600     1.7300   |   8.7800     4.8500
                           1.8400     2.2600   |  35.4000     6.6100
                           2.2700     2.9600   |  *******     8.6500

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481      6.508       10.50       10.74
     OUTFLOW: ID= 1 (9017)   1837.481      6.173       11.50       10.74

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.85
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  4.4766

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70   8.908     6.00    18.08
        + ID2= 2 (9017):  1837.48   6.173    11.50    10.74
          ================================================
          ID = 3 (9041):  2376.18   9.394     6.00    12.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   7.193     6.00    50.09
        + ID2= 2 (9041):  2376.18   9.394     6.00    12.40
          ================================================
          ID = 3 (5002):  2432.16  16.588     6.00    13.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16     16.59      6.00     13.27
    SHIFT ID= 1 (9040): 2432.16     16.59      7.00     13.27

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29         .0800
                  30.80       273.73         .0800
                  51.30       270.17         .0800
                  61.60       266.84         .0800
                  66.80       266.02         .0800
                 102.70       265.42         .0350      Main Channel
                 123.20       261.00         .0350      Main Channel
                 128.40       261.17         .0350      Main Channel
                 154.00       264.62         .0350      Main Channel
                 174.60       266.82         .0800
                 205.40       268.07         .0800
                 236.20       268.74         .0800
                 282.40       271.31         .0800
                 302.90       272.11         .0800
                 348.90       274.45         .0800

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
```



```
         .63   261.63    .702E+04       5.2          1.14      22.47
        1.26   262.26    .220E+05      24.8          1.74      14.74
        1.89   262.89    .443E+05      64.0          2.22      11.54
        2.53   263.53    .741E+05     127.4          2.65       9.69
        3.16   264.16    .111E+06     219.6          3.04       8.44
        3.79   264.79    .156E+06     343.2          3.39       7.57
        4.42   265.42    .209E+06     501.2          3.70       6.94
        5.16   266.16    .304E+06     766.4          3.88       6.61
        5.90   266.90    .428E+06    1123.8          4.05       6.34
        6.64   267.64    .570E+06    1628.6          4.40       5.84
        7.38   268.38    .738E+06    2225.4          4.65       5.53
        8.12   269.12    .941E+06    2928.9          4.80       5.35
        8.85   269.85    .116E+07    3743.0          4.95       5.18
        9.59   270.59    .141E+07    4656.3          5.10       5.03
       10.33   271.33    .167E+07    5671.9          5.24       4.90
       11.07   272.07    .195E+07    6784.6          5.36       4.80
       11.81   272.81    .226E+07    8029.1          5.47       4.69
       12.55   273.55    .259E+07    9393.0          5.59       4.60
       13.29   274.29    .295E+07   10648.3          5.55       4.62

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    16.59    7.00  13.27      1.00      1.43
     OUTFLOW: ID= 1 (6029) 2432.16    10.80    7.25  13.27       .81      1.26

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  10.800     7.25    13.27
        + ID2= 2 (1040):    14.62    .342     6.75    21.92
          ================================================
          ID = 3 (5003):  2446.78  11.081     7.25    13.32

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (5004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  11.081     7.25    13.32
        + ID2= 2 (7016):  1176.40  12.939    10.25    33.04
          ================================================
          ID = 3 (5004):  3623.18  20.972     7.25    19.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9015) |
| IN= 2---> OUT= 1 |
| SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18     20.97      7.25     19.73
    SHIFT ID= 1 (9015): 3623.18     20.97      9.25     19.73

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6031) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       260.30         .0800
                  34.10       260.43         .0800
                  62.40       259.79         .0800
                  79.50       255.72         .0800
                 113.50       254.00         .0800
                 153.30       253.33         .0350      Main Channel
                 187.30       253.06         .0350      Main Channel
                 198.70       251.88         .0350      Main Channel
                 204.40       252.61         .0350      Main Channel
                 249.80       254.00         .0800
                 334.90       255.77         .0800
                 351.90       256.37         .0800
                 414.40       260.24         .0800
                 465.50       260.75         .0800
```

```
                 514.40        261.48         .0800

       <-------------------- TRAVEL TIME TABLE --------------------->
        DEPTH    ELEV      VOLUME     FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)      (cu.m.)      (cms)        (m/s)      (min)
         .36    252.24    .596E+04        .4          .39      223.90
         .73    252.61    .238E+05       2.8          .61      141.05
        1.09    252.97    .619E+05       8.2          .69      126.14
        1.45    253.33    .151E+06      18.8          .65      134.06
        1.91    253.79    .383E+06      68.4          .93       93.14
        2.38    254.26    .713E+06     157.3         1.15       75.58
        2.84    254.72    .112E+07     287.3         1.33       65.13
        3.31    255.19    .161E+07     454.2         1.47       59.01
        3.77    255.65    .217E+07     659.0         1.58       54.87
        4.24    256.12    .279E+07     908.7         1.69       51.25
        4.70    256.58    .346E+07    1199.1         1.80       48.03
        5.17    257.05    .414E+07    1527.9         1.92       45.17
        5.63    257.51    .485E+07    1892.4         2.03       42.71
        6.10    257.98    .558E+07    2291.8         2.13       40.59
        6.56    258.44    .634E+07    2725.7         2.23       38.74
        7.03    258.91    .711E+07    3193.6         2.33       37.12
        7.49    259.37    .791E+07    3695.3         2.43       35.69
        7.96    259.84    .874E+07    4221.9         2.51       34.48
        8.42    260.30    .961E+07    4697.6         2.54       34.09

                                     <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    20.97    9.25  19.73      1.47       .65
     OUTFLOW: ID= 1 (6031) 3623.18    16.48   14.50  19.73      1.37       .65

 -----------------------------------------------------------------------------

   ADD HYD   (5005)
     1 +  2 =  3               AREA    QPEAK    TPEAK     R.V.
                               (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5062):    699.78    9.861     8.50    32.60
        + ID2= 2 (6031):   3623.18   16.485    14.50    19.73
          ================================================
          ID = 3 (5005):   4322.96   19.564    12.50    21.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -----------------------------------------------------------------------------
   ****************************
   ** SIMULATION NUMBER:   5 **       100-Year Storm
   ****************************

 -------------------
 | MASS STORM      |    Filename: V:\01606\Active\160621777\SWM Master Plans
 |                 |              \Analysis\SWM\Hydrology\Uxbridge\12hrSCS.mst
 | Ptotal=104.07 mm |   Comments: SCS 24 HR MASS CURVE
 -------------------
                        Duration of storm    = 12.00 hrs
                        Mass curve time step = 15.00 min

                  TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                   .25    2.29 |  3.25    4.16 |  6.25   18.73 |  9.25    3.16
                   .50    2.41 |  3.50    4.16 |  6.50   18.73 |  9.50    2.91
                   .75    2.46 |  3.75    4.16 |  6.75    9.91 |  9.75    2.79
                  1.00    2.54 |  4.00    4.16 |  7.00    6.74 | 10.00    2.83
                  1.25    2.66 |  4.25    5.74 |  7.25    6.24 | 10.25    2.75
                  1.50    2.75 |  4.50    6.74 |  7.50    6.24 | 10.50    2.58
                  1.75    2.79 |  4.75    7.53 |  7.75    6.24 | 10.75    2.37
                  2.00    2.91 |  5.00    9.12 |  8.00    6.24 | 11.00    2.21
                  2.25    2.91 |  5.25   12.49 |  8.25    5.33 | 11.25    1.96
                  2.50    2.91 |  5.50   12.49 |  8.50    4.58 | 11.50    1.79
                  2.75    3.12 |  5.75   49.95 |  8.75    4.00 | 11.75    1.58
                  3.00    3.54 |  6.00  137.37 |  9.00    3.54 | 12.00    1.42

 -----------------------------------------------------------------------------
 -------------------
 | CALIB           |
 | NASHYD    (1032) |   Area    (ha)= 610.08   Curve Number   (CN)= 70.0
 |ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
 -------------------   U.H. Tp(hrs)=   2.46

     Unit Hyd Qpeak  (cms)=   9.472

     PEAK FLOW       (cms)=  12.719 (i)
```



```
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  44.321
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .426

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB           |
 | STANDHYD  (2050) |   Area    (ha)=  89.70
 |ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
 -------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.88         53.82
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     773.30         40.00
     Mannings n          =        .013          .250

     Max.Eff.Inten.(mm/hr)=     137.37        105.00
                over (min)      15.00         30.00
     Storage Coeff.  (min)=       7.68 (ii)   16.20 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .10           .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       7.74          8.71        13.552 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57         55.08         67.20
     TOTAL RAINFALL   (mm)=     104.07        104.07        104.07
     RUNOFF COEFFICIENT   =       1.00           .53           .65

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  70.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB           |
 | STANDHYD  (2031) |   Area    (ha)=  55.98
 |ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
 -------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      30.79         25.19
     Dep. Storage     (mm)=        .50          2.50
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     610.90         40.00
     Mannings n          =        .013          .250

     Max.Eff.Inten.(mm/hr)=     137.37        102.01
                over (min)      15.00         30.00
     Storage Coeff.  (min)=       6.66 (ii)   15.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00         30.00
     Unit Hyd. peak  (cms)=        .10           .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.95          4.03         9.610 (iii)
     TIME TO PEAK    (hrs)=       6.00          6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57         46.64         66.57
     TOTAL RAINFALL   (mm)=     104.07        104.07        104.07
     RUNOFF COEFFICIENT   =       1.00           .45           .64

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  59.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 -------------------
 | CALIB           |
 | STANDHYD  (2020) |   Area    (ha)=  24.78
 |ID= 1 DT=15.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  40.00
 -------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.87          9.91
     Dep. Storage     (mm)=      10.00          2.50
     Average Slope     (%)=       1.00          1.00
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     Length           (m)=     406.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       105.80
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.22 (ii)   13.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .08
                                                         *TOTALS*
     PEAK FLOW      (cms)=       3.64         2.12          5.761 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      94.07        46.60          65.59
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .45            .63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2021) |   Area    (ha)=  70.42
|ID= 1 DT=15.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  35.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      38.73        31.69
     Dep. Storage     (mm)=      10.00         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     685.20        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        99.64
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       7.14 (ii)   15.84 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       8.63         4.89         11.845 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=      94.07        45.60          62.56
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =        .90          .44            .60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1044) |   Area    (ha)= 443.50   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.83

     Unit Hyd Qpeak  (cms)=   5.986

     PEAK FLOW      (cms)=   3.773 (i)
     TIME TO PEAK    (hrs)=   9.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1045) |   Area    (ha)= 170.73   Curve Number   (CN)= 58.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.22

     Unit Hyd Qpeak  (cms)=   2.937

     PEAK FLOW      (cms)=   1.719 (i)
```



```
     TIME TO PEAK    (hrs)=   8.750
     RUNOFF VOLUME    (mm)=  21.265
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .204

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2012) |   Area    (ha)=  26.45
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.58        15.87
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     419.90        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.32 (ii)   14.88 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                         *TOTALS*
     PEAK FLOW      (cms)=       2.42         2.43          4.852 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2010) |   Area    (ha)=  22.70
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.08        13.62
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     389.00        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)       15.00        15.00
     Storage Coeff.  (min)=       5.08 (ii)   14.64 (ii)
     Unit Hyd. Tpeak (min)=      15.00        15.00
     Unit Hyd. peak  (cms)=        .11          .07
                                                         *TOTALS*
     PEAK FLOW      (cms)=       2.09         2.10          4.191 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2011) |   Area    (ha)=  40.62
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.25        24.37
     Dep. Storage     (mm)=        .50         2.50
     Average Slope     (%)=       1.00         1.00
```

```
     Length           (m)=     520.40        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37        78.85
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.05 (ii)   15.61 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                             *TOTALS*
     PEAK FLOW      (cms)=       3.66         2.99          5.609 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        41.80          57.25
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .40            .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  58.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1047) |   Area    (ha)= 479.57   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.73

     Unit Hyd Qpeak  (cms)=   6.710

     PEAK FLOW      (cms)=   4.316 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (9146) |   Area    (ha)= 369.57   Curve Number   (CN)= 55.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.20

     Unit Hyd Qpeak  (cms)=  11.763

     PEAK FLOW      (cms)=   6.047 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)=  21.790
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .209

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (9246) |   Area    (ha)=  54.89   Curve Number   (CN)= 65.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  25.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .60

     Unit Hyd Qpeak  (cms)=   3.494

     PEAK FLOW      (cms)=   2.047 (i)
     TIME TO PEAK    (hrs)=   6.500
     RUNOFF VOLUME    (mm)=  28.911
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .278

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1046) |   Area    (ha)= 672.95   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=  30.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.80

     Unit Hyd Qpeak  (cms)=   9.180
```



```
     PEAK FLOW      (cms)=   5.946 (i)
     TIME TO PEAK    (hrs)=   9.500
     RUNOFF VOLUME    (mm)=  21.895
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .210

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1040) |   Area    (ha)=  14.62   Curve Number   (CN)= 59.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

     Unit Hyd Qpeak  (cms)=    .681

     PEAK FLOW      (cms)=    .525 (i)
     TIME TO PEAK    (hrs)=   6.750
     RUNOFF VOLUME    (mm)=  33.262
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .320

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| NASHYD    (1059) |   Area    (ha)= 487.62   Curve Number   (CN)= 71.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   2.17

     Unit Hyd Qpeak  (cms)=   8.583

     PEAK FLOW      (cms)=  11.484 (i)
     TIME TO PEAK    (hrs)=   8.250
     RUNOFF VOLUME    (mm)=  45.460
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .437

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2042) |   Area    (ha)=  54.50
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.80        32.70
     Dep. Storage     (mm)=        .50         1.50
     Average Slope     (%)=       1.00         1.00
     Length           (m)=     602.80        40.00
     Mannings n          =       .013         .250

     Max.Eff.Inten.(mm/hr)=     137.37       108.14
                over (min)       15.00        30.00
     Storage Coeff.  (min)=       6.61 (ii)   15.03 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .10          .05
                                                             *TOTALS*
     PEAK FLOW      (cms)=       4.84         5.60          8.616 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.25           6.00
     RUNOFF VOLUME    (mm)=     103.57        56.93          68.59
     TOTAL RAINFALL   (mm)=     104.07       104.07         104.07
     RUNOFF COEFFICIENT   =       1.00          .55            .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (2041) |   Area    (ha)=  82.05
|ID= 1 DT=15.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      36.92        45.13
```

```
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     739.60       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      111.02
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       7.47 (ii)   15.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .10         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       8.54        7.81        13.792 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57       57.41         71.26
     TOTAL RAINFALL   (mm)=     104.07      104.07        104.07
     RUNOFF COEFFICIENT   =       1.00         .55           .68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB             |
| STANDHYD  (2040) |   Area    (ha)= 145.27
|ID= 1 DT=15.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      58.11       87.16
     Dep. Storage     (mm)=        .50        1.50
     Average Slope     (%)=       1.00        1.00
     Length            (m)=     984.10       40.00
     Mannings n           =       .013        .250

     Max.Eff.Inten.(mm/hr)=     137.37      108.14
                over (min)       15.00       30.00
     Storage Coeff.  (min)=       8.87 (ii)   17.29 (ii)
     Unit Hyd. Tpeak (min)=      15.00       30.00
     Unit Hyd. peak  (cms)=        .09         .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=      12.10       14.21        21.603 (iii)
     TIME TO PEAK    (hrs)=       6.00        6.25          6.00
     RUNOFF VOLUME    (mm)=     103.57       56.93         68.59
     TOTAL RAINFALL   (mm)=     104.07      104.07        104.07
     RUNOFF COEFFICIENT   =       1.00         .55           .66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (1060) |   Area    (ha)= 406.96   Curve Number   (CN)= 60.0
|ID= 1 DT=15.0 min |   Ia      (mm)=   9.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.16

     Unit Hyd Qpeak  (cms)=  13.400

     PEAK FLOW       (cms)=  11.495 (i)
     TIME TO PEAK    (hrs)=   7.000
     RUNOFF VOLUME    (mm)=  34.179
     TOTAL RAINFALL   (mm)= 104.070
     RUNOFF COEFFICIENT   =    .328

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9021) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   1.2000      .9900
                           .0290      .3700    |   2.7000     1.4200
```



```
                           .5000      .6900    |   6.1000      2.1800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2050)     89.700     13.552        6.00       67.20
     OUTFLOW: ID= 1 (9021)     89.700      6.901        6.50       67.16

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 50.92
                   TIME SHIFT OF PEAK FLOW        (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.3882

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9022) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |    .2620       .8805
                           .0150      .6000    |    .4710      1.0180
                           .1240      .7875    |    .9610      1.2660

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2020)     24.780      5.761        6.00       65.59
     OUTFLOW: ID= 1 (9022)     24.780       .587        6.75       65.18

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.19
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0811

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (7008) |
|  1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9022):    24.78     .587     6.75    65.18
        + ID2= 2 (2021):    70.42  11.845     6.00    62.56
          ===============================================
          ID = 3 (7008):    95.20  11.879     6.00    63.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD   (5065) |
|  1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7008):    95.20  11.879     6.00    63.24
        + ID2= 2 (1044):   443.50   3.773     9.75    21.26
          ===============================================
          ID = 3 (5065):   538.70  11.982     6.00    28.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9257) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |    .0990       .7350
                           .0110      .4435    |    .1630       .8595
                           .0550      .6265    |    .3050      1.0800

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2012)     26.450      4.852        6.00       57.25
     OUTFLOW: ID= 1 (9257)     26.450       .305        8.25       56.86

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.28
                   TIME SHIFT OF PEAK FLOW        (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.0799

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9019) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000    |   1.0800      .5900
                           .0000      .2600    |   1.2200      .7400
```

```
                          .5700      .3500   |   1.3500       .9300
                          .9900      .4700   |   2.8300       .9900

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2010)     22.700     4.191        6.00       57.25
     OUTFLOW: ID= 1 (9019)     22.700     1.116        6.50       45.79

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.63
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .6335

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (7001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9019):    22.70   1.116     6.50    45.79
        + ID2= 2 (2011):    40.62   5.609     6.00    57.25
          ===============================================
          ID = 3 (7001):    63.32   6.549     6.00    53.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9147) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******    |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9146)    369.570     6.047        7.25       21.79
     OUTFLOW: ID= 1 (9147)    369.570      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  8.0530

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9248) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000    *******    |    .0010    ********

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9246)     54.891     2.047        6.50       28.91
     OUTFLOW: ID= 1 (9248)     54.891      .000         .00         .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   .00
                   TIME SHIFT OF PEAK FLOW         (min)=******
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.5870

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9258) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |    .4730      1.6365
                          .0490     1.0690    |    .7910      1.8915
                          .2480     1.4290    |   1.4810      2.3855

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2042)     54.500     8.616        6.00       68.59
     OUTFLOW: ID= 1 (9258)     54.500     1.479        7.00       68.49

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.17
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.3855

-------------------------------------------------------------------------------
--------------------
| RESERVOIR (9020) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```



```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .0000      .0000    |   1.7200      5.0000
                          .2200     3.0000    |   2.5000      7.0000

                                AREA      QPEAK       TPEAK       R.V.
                                (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (2040)    145.270    21.603        6.00       68.59
     OUTFLOW: ID= 1 (9020)    145.270     2.400        7.50       68.57

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.11
                   TIME SHIFT OF PEAK FLOW         (min)= 90.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  6.7462

-------------------------------------------------------------------------------
--------------------
| SHIFT HYD (9029) |
| IN= 2---> OUT= 1 |
| SHIFT=150.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (1060):  406.96    11.49      7.00     34.18
    SHIFT ID= 1 (9029):  406.96    11.49      9.50     34.18

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (5062) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1032):   610.08  12.719     8.75    44.32
        + ID2= 2 (9021):    89.70   6.901     6.50    67.16
          ===============================================
          ID = 3 (5062):   699.78  14.432     8.50    47.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (7002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9257):    26.45    .305     8.25    56.86
        + ID2= 2 (7001):    63.32   6.549     6.00    53.14
          ===============================================
          ID = 3 (7002):    89.77   6.591     6.00    54.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (7004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9147):   369.57    .000      .00      .00
        + ID2= 2 (9248):    54.89    .000      .00      .00
          ===============================================
          ID = 3 (7004):   424.46    .000      .00      .00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ADD HYD   (7013) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2041):    82.05  13.792     6.00    71.26
        + ID2= 2 (9020):   145.27   2.400     7.50    68.57
          ===============================================
          ID = 3 (7013):   227.32  14.003     6.00    69.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| ROUTE CHN (6019) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        281.05         .0800
                  34.48        278.78         .0800
```

```
              62.07        280.75         .0800
              75.86        280.87         .0800
             110.34        277.13         .0800
             124.14        276.45     .0800 / .0350  Main Channel
             137.93        274.50         .0350      Main Channel
             151.72        274.76         .0350      Main Channel
             172.41        276.25         .0350      Main Channel
             213.79        277.31         .0800
             255.17        278.25         .0800
             275.86        278.49         .0800
             289.66        279.07         .0800
             303.45        278.41         .0800
             312.47        278.40         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE     VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)       (min)
        .20    274.70    .665E+04       .6           .56      172.84
        .39    274.89    .247E+05      4.2          1.00       97.27
        .59    275.09    .478E+05     11.1          1.35       71.58
        .78    275.28    .756E+05     21.4          1.64       58.99
        .98    275.48    .108E+06     35.2          1.89       51.17
       1.17    275.67    .145E+06     52.9          2.12       45.70
       1.37    275.87    .187E+06     74.8          2.33       41.60
       1.56    276.06    .233E+06    101.2          2.53       38.37
       1.76    276.26    .284E+06    132.2          2.71       35.80
       1.95    276.45    .342E+06    160.8          2.73       35.50
       2.17    276.67    .421E+06    204.7          2.83       34.30
       2.38    276.88    .516E+06    258.7          2.91       33.25
       2.60    277.10    .627E+06    323.9          3.00       32.28
       2.82    277.32    .754E+06    402.4          3.11       31.21
       3.03    277.53    .894E+06    517.5          3.37       28.78
       3.25    277.75    .105E+07    645.6          3.58       27.06
       3.47    277.97    .122E+07    787.1          3.76       25.78
       3.68    278.18    .140E+07    942.2          3.91       24.79
       3.90    278.40    .160E+07   1110.1          4.03       24.06

                              <---- hydrograph ---->   <-pipe / channel->
                        AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                        (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9029)  406.96    11.49    9.50  34.18       .59      1.36
     OUTFLOW: ID= 1 (6019)  406.96     8.03   10.50  34.18       .50      1.17

------------------------------------------------------------------------------

 ADD HYD   (5064)
   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1045):   170.73   1.719     8.75    21.26
        + ID2= 2 (7002):    89.77   6.591     6.00    54.23
          ==================================================
          ID = 3 (5064):   260.50   6.668     6.00    32.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (9250) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (7004):   424.46    .000      .00      .00
        + ID2= 2 (1046):   672.95   5.946     9.50    21.89
          ==================================================
          ID = 3 (9250):  1097.41   5.946     9.50    13.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD   (7014) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (9258):    54.50   1.479     7.00    68.49
        + ID2= 2 (7013):   227.32  14.003     6.00    69.54
          ==================================================
          ID = 3 (7014):   281.82  14.091     6.00    69.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```



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------------------------------------------------------------------------------
--------------------
| RESERVOIR (9018) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   4.8100      1.1900
                           .4200      .6400   |  14.3300      1.2700
                          1.5900      .9400   |  53.8000      1.3300
                          3.2000     1.1100   |    .0000       .0000

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (9250)    1097.411     5.946        9.50       13.43
     OUTFLOW: ID= 1 (9018)    1097.411     5.975        9.50       13.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.48
                   TIME SHIFT OF PEAK FLOW         (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  1.2011

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                     CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
------------------------------------------------------------------------------

 ADD HYD   (5061)
   1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                            (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1059):   487.62  11.484     8.25    45.46
        + ID2= 2 (7014):   281.82  14.091     6.00    69.34
          ==================================================
          ID = 3 (5061):   769.44  16.196     8.25    54.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| ROUTE CHN (9251) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        278.33          .0800
                  46.71        277.77          .0800
                  57.10        277.40          .0800
                  62.29        276.96          .0800
                  67.48        275.94          .0800
                  77.86        273.27          .0800
                  83.05        272.29          .0800
                  93.43        270.99          .0800
                 109.00        270.02          .0350      Main Channel
                 119.38        270.02          .0350      Main Channel
                 150.53        271.36      .0350 / .0800  Main Channel
                 186.86        273.45          .0800
                 207.62        274.37          .0800
                 233.57        275.12          .0800
                 247.79        275.41          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE     VELOCITY   TRAV.TIME
        (m)      (m)      (cu.m.)     (cms)        (m/s)       (min)
        .28    270.30    .950E+04      3.7           .81       43.21
        .57    270.59    .257E+05     13.9          1.14       30.76
        .85    270.87    .484E+05     32.0          1.39       25.24
       1.13    271.15    .776E+05     59.6          1.61       21.71
       1.42    271.44    .112E+06    100.0          1.87       18.71
       1.70    271.72    .151E+06    157.2          2.18       16.04
       1.99    272.01    .195E+06    225.9          2.44       14.37
       2.27    272.29    .242E+06    305.9          2.65       13.21
       2.55    272.57    .294E+06    398.1          2.84       12.31
       2.84    272.86    .350E+06    501.8          3.01       11.61
       3.12    273.14    .409E+06    617.0          3.17       11.05
       3.40    273.42    .472E+06    744.3          3.31       10.58
       3.69    273.71    .539E+06    882.9          3.44       10.18
       3.97    273.99    .611E+06   1033.6          3.55        9.85
       4.26    274.28    .687E+06   1196.8          3.66        9.57
       4.54    274.56    .768E+06   1370.2          3.75        9.35
       4.82    274.84    .856E+06   1556.4          3.82        9.16
       5.11    275.13    .950E+06   1757.0          3.89        9.01
       5.39    275.41    .105E+07   1967.6          3.93        8.91

                              <---- hydrograph ---->   <-pipe / channel->
                        AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
```

```
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9018) 1097.41     5.98    9.50  13.43       .35       .87
     OUTFLOW: ID= 1 (9251) 1097.41     5.71   10.50  13.43       .34       .86


-----------------------------------------------------------------------------

--------------------
| ADD HYD   (7016) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5061):   769.44  16.196     8.25    54.21
        + ID2= 2 (6019):   406.96   8.029    10.50    34.18
          ==================================================
          ID = 3 (7016):  1176.40  19.820    10.00    47.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5000) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1047):   479.57   4.316     9.50    21.89
        + ID2= 2 (9251):  1097.41   5.713    10.50    13.43
          ==================================================
          ID = 3 (5000):  1576.98   9.884    10.00    16.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (5001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5064):   260.50   6.668     6.00    32.63
        + ID2= 2 (5000):  1576.98   9.884    10.00    16.00
          ==================================================
          ID = 3 (5001):  1837.48  12.073    10.00    18.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| RESERVOIR (9017) |
| IN= 2---> OUT= 1 |
| DT= 15.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .0000      .0000   |   2.8300      3.4900
                           .2800      .2500   |   3.8200      3.9500
                           .7100      .6300   |   4.6700      4.2000
                          1.1300     1.1400   |   7.3600      4.6900
                          1.5600     1.7300   |   8.7800      4.8500
                          1.8400     2.2600   |  35.4000      6.6100
                          2.2700     2.9600   |  *******      8.6500

                                 AREA      QPEAK       TPEAK       R.V.
                                 (ha)      (cms)       (hrs)       (mm)
     INFLOW : ID= 2 (5001)   1837.481     12.073       10.00       18.36
     OUTFLOW: ID= 1 (9017)   1837.481     12.052       10.00       18.36

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.82
                   TIME SHIFT OF PEAK FLOW         (min)=   .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  5.0673

-----------------------------------------------------------------------------

--------------------
| ADD HYD   (9041) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5065):   538.70  11.982     6.00    28.68
        + ID2= 2 (9017):  1837.48  12.052    10.00    18.36
          ==================================================
          ID = 3 (9041):  2376.18  16.532    10.00    20.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------

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```
| ADD HYD   (5002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2031):    55.98   9.610     6.00    66.57
        + ID2= 2 (9041):  2376.18  16.532    10.00    20.70
          ==================================================
          ID = 3 (5002):  2432.16  22.282     6.00    21.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-----------------------------------------------------------------------------
--------------------
| SHIFT HYD (9040) |
| IN= 2---> OUT= 1 |
| SHIFT= 60.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5002): 2432.16    22.28      6.00     21.75
    SHIFT ID= 1 (9040): 2432.16    22.28      7.00     21.75

-----------------------------------------------------------------------------
--------------------
| ROUTE CHN (6029) |
| IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
--------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00       274.29          .0800
                  30.80       273.73          .0800
                  51.30       270.17          .0800
                  61.60       266.84          .0800
                  66.80       266.02          .0800
                 102.70       265.42          .0350      Main Channel
                 123.20       261.00          .0350      Main Channel
                 128.40       261.17          .0350      Main Channel
                 154.00       264.62          .0350      Main Channel
                 174.60       266.82          .0800
                 205.40       268.07          .0800
                 236.20       268.74          .0800
                 282.40       271.31          .0800
                 302.90       272.11          .0800
                 348.90       274.45          .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)     (m)      (cu.m.)      (cms)       (m/s)      (min)
         .63   261.63    .702E+04       5.2          1.14      22.47
        1.26   262.26    .220E+05      24.8          1.74      14.74
        1.89   262.89    .443E+05      64.0          2.22      11.54
        2.53   263.53    .741E+05     127.4          2.65       9.69
        3.16   264.16    .111E+06     219.6          3.04       8.44
        3.79   264.79    .156E+06     343.2          3.39       7.57
        4.42   265.42    .209E+06     501.2          3.70       6.94
        5.16   266.16    .304E+06     766.4          3.88       6.61
        5.90   266.90    .428E+06    1123.8          4.05       6.34
        6.64   267.64    .570E+06    1628.6          4.40       5.84
        7.38   268.38    .738E+06    2225.4          4.65       5.53
        8.12   269.12    .941E+06    2928.9          4.80       5.35
        8.85   269.85    .116E+07    3743.0          4.95       5.18
        9.59   270.59    .141E+07    4656.3          5.10       5.03
       10.33   271.33    .167E+07    5671.9          5.24       4.90
       11.07   272.07    .195E+07    6784.6          5.36       4.80
       11.81   272.81    .226E+07    8029.1          5.47       4.69
       12.55   273.55    .259E+07    9393.0          5.59       4.60
       13.29   274.29    .295E+07   10648.3          5.55       4.62

                                <---- hydrograph ---->   <-pipe / channel->
                          AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                          (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9040) 2432.16    22.28    7.00  21.75      1.18      1.63
     OUTFLOW: ID= 1 (6029) 2432.16    16.84   11.25  21.75      1.00      1.44


-----------------------------------------------------------------------------

--------------------
| ADD HYD   (5003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (6029):  2432.16  16.837    11.25    21.75
        + ID2= 2 (1040):    14.62    .525     6.75    33.26
          ==================================================
          ID = 3 (5003):  2446.78  16.899    11.25    21.82
```

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD   (5004) |
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (5003):  2446.78  16.899    11.25    21.82
        + ID2= 2 (7016):  1176.40  19.820    10.00    47.28
          ==================================================
          ID = 3 (5004):  3623.18  35.373    10.50    30.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 --------------------
 | SHIFT HYD (9015) |
 | IN= 2---> OUT= 1 |
 | SHIFT=120.0 min  |      AREA     QPEAK     TPEAK      R.V.
 --------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 2 (5004): 3623.18    35.37     10.50     30.09
    SHIFT ID= 1 (9015): 3623.18    35.37     12.50     30.09

 ------------------------------------------------------------------------------
 --------------------
 | ROUTE CHN (6031) |
 | IN= 2---> OUT= 1 |     Routing time step (min)'= 15.00
 --------------------
               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00        260.30         .0800
                  34.10        260.43         .0800
                  62.40        259.79         .0800
                  79.50        255.72         .0800
                 113.50        254.00         .0800
                 153.30        253.33         .0350      Main Channel
                 187.30        253.06         .0350      Main Channel
                 198.70        251.88         .0350      Main Channel
                 204.40        252.61         .0350      Main Channel
                 249.80        254.00         .0800
                 334.90        255.77         .0800
                 351.90        256.37         .0800
                 414.40        260.24         .0800
                 465.50        260.75         .0800
                 514.40        261.48         .0800

      <-------------------- TRAVEL TIME TABLE --------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)       (m/s)      (min)
        .36   252.24    .596E+04        .4          .39      223.90
        .73   252.61    .238E+05       2.8          .61      141.05
       1.09   252.97    .619E+05       8.2          .69      126.14
       1.45   253.33    .151E+06      18.8          .65      134.06
       1.91   253.79    .383E+06      68.4          .93       93.14
       2.38   254.26    .713E+06     157.3         1.15       75.58
       2.84   254.72    .112E+07     287.3         1.33       65.13
       3.31   255.19    .161E+07     454.2         1.47       59.01
       3.77   255.65    .217E+07     659.0         1.58       54.87
       4.24   256.12    .279E+07     908.7         1.69       51.25
       4.70   256.58    .346E+07    1199.1         1.80       48.03
       5.17   257.05    .414E+07    1527.9         1.92       45.17
       5.63   257.51    .485E+07    1892.4         2.03       42.71
       6.10   257.98    .558E+07    2291.8         2.13       40.59
       6.56   258.44    .634E+07    2725.7         2.23       38.74
       7.03   258.91    .711E+07    3193.6         2.33       37.12
       7.49   259.37    .791E+07    3695.3         2.43       35.69
       7.96   259.84    .874E+07    4221.9         2.51       34.48
       8.42   260.30    .961E+07    4697.6         2.54       34.09

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
     INFLOW : ID= 2 (9015) 3623.18    35.37   12.50  30.09      1.61       .72
     OUTFLOW: ID= 1 (6031) 3623.18    29.26   14.00  30.09      1.55       .69


 ------------------------------------------------------------------------------


   ADD HYD   (5005)
     1 +  2 =  3              AREA    QPEAK    TPEAK     R.V.
                              (ha)    (cms)    (hrs)     (mm)
```



```
          ID1= 1 (5062):   699.78  14.432     8.50    47.25
        + ID2= 2 (6031):  3623.18  29.257    14.00    30.09
          ==================================================
          ID = 3 (5005):  4322.96  33.598    13.50    32.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  FINISH
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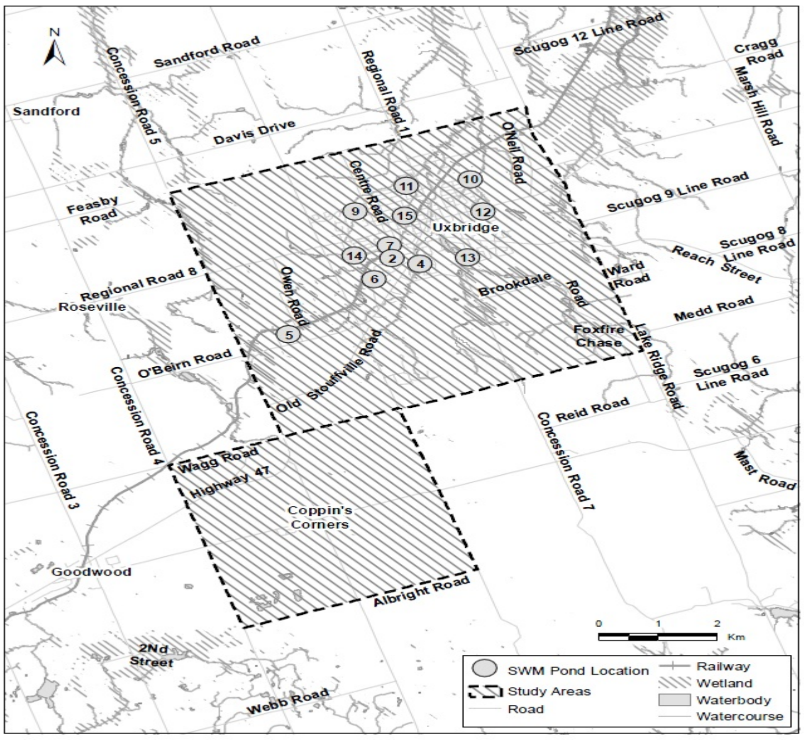
Appendix G NOTICE OF COMMENCEMENT

TOWNSHIP OF UXBRIDGE

CLASS ENVIRONMENTAL ASSESSMENT STORMWATER MANAGEMENT PLAN

THE STUDY

The Township of Uxbridge has chosen Stantec Consulting Ltd. to develop a Stormwater Management Master Plan for the Uxbridge Urban Area and the Hamlet of Coppin's Corners, in order to define all anticipated works necessary to maintain and improve the storm drainage system while protecting the natural resources of the Study Area. This Class Environmental Assessment (EA) Master Plan is intended to improve the management of stormwater for both existing and planned development.



A key component of the study will be consultation with interested stakeholders (public, landowners and regulatory agencies). Public consultation will involve one (1) Public Information Centre (PIC) and a Public Education Campaign. These sessions will be designed to obtain input from the public to assist informing the decision making process.

THE PROCESS

The study is currently planned as a 'Master Plan' project in compliance with the Municipal Engineers Association document "Municipal Class Environmental Assessment," (October 2000, amended 2007).

COMMENTS

We are interested in hearing any comments or input that you may have about this study. Comments and information regarding the study are being collected to assist the Town in meeting the requirements of the Environmental Assessment Act.

These comments will be maintained for reference throughout the project and will become part of the public record. Under the *Freedom of Information and Protection of Privacy Act* and the *Environmental Assessment Act*, unless otherwise stated in the submission, any personal information such as name, address, telephone number and property location included in a submission will become part of the public record files for this matter and will be released, if requested, to any person.

Information requests or questions may be directed to:

Mr. Ben Kester
Director of Public Works and Operations
Town of Uxbridge
51 Toronto Street South
Uxbridge, Ontario L9P 1T1
Phone: (905) 852-9181, ext. 215
Fax: (905) 852-9674
Email: bkester@town.uxbridge.on.ca

Roy Johnson, P. Eng.
Senior Water Resources Engineer
Stantec Consulting Ltd.
300 - 675 Cochrane Drive West Tower
Markham, Ontario
Phone: (905) 944-7777
Fax: (905) 474-9889
Email: Roy.Johnson2@stantec.com

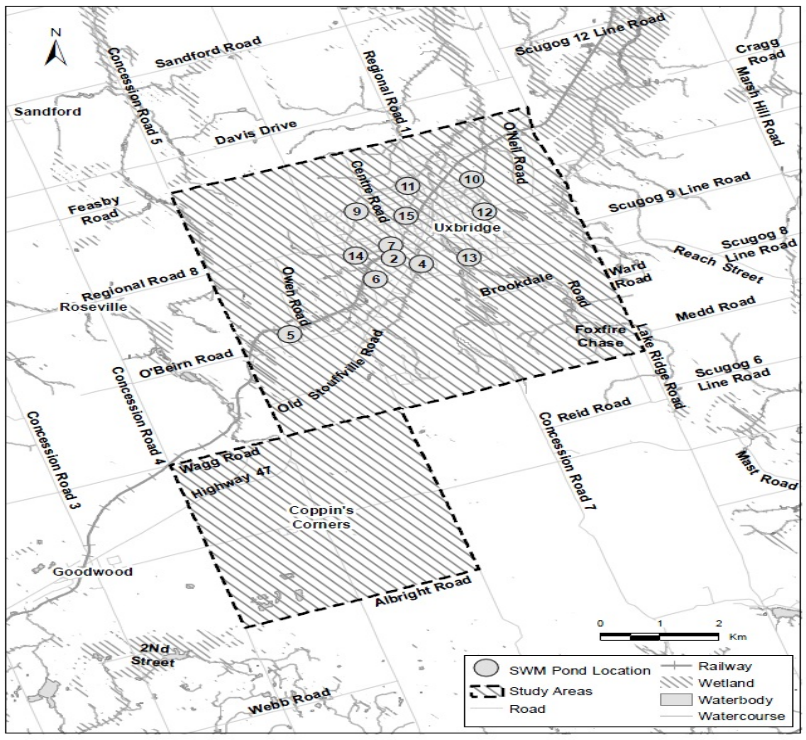
This Notice first issued on Aug 29, 2013.

Stantec

Appendix H NOTICE OF PUBLIC INFORMATION CENTRE

TOWNSHIP OF UXBRIDGE

CLASS ENVIRONMENTAL ASSESSMENT STORMWATER MANAGEMENT PLAN
PUBLIC INFORMATION CENTRE
TOWN HALL COUNCIL CHAMBERS
51 TORONTO ST. S
WEDNESDAY, MAY 7, 2014
7:00 P.M. – 9:00 P.M.



THE STUDY
The Township of Uxbridge (Township) has retained Stantec Consulting Ltd. to develop a Stormwater Management Master Plan for the Uxbridge Urban Area and the Hamlet of Coppin's Corners, in order to define all anticipated works necessary to maintain and improve the storm drainage system while protecting the natural resources of the Study Area. This Class Environmental Assessment (EA) Master Plan is intended to improve the management of stormwater for both existing and planned development.

A key component of the study is consultation with interested stakeholders (public, landowners and regulatory agencies). Public consultation will involve one (1) Public Information Centre (PIC). This PIC will be designed to obtain input from the public to assist informing the decision making process.

THE PROCESS
The study is currently planned as a 'Master Plan' project in compliance with the Municipal Engineers Association document "Municipal Class Environmental Assessment," (October 2000, as amended in 2007 and 2011).

We are interested in hearing any comments or input that you may have about this study. Comments and information regarding the study are being collected to assist the Township in meeting the requirements of the Environmental Assessment Act. You are invited to attend the PIC being held at Town Hall Council Chambers, 51Toronto St. S. on May 7, 2014 from 7:00 p.m. – 9:00 p.m.

These comments will be maintained for reference throughout the project and will become part of the public record. Under the *Freedom of Information and Protection of Privacy Act* and the *Environmental Assessment Act*, unless otherwise stated in the submission, any personal information such as name, address, telephone number and property location included in a submission will become part of the public record files for this matter and will be released, if requested, to any person.

Information requests or questions may be directed to:

Mr. Ben Kester, C.E.T., CRS-S
Director of Public Works and Operations
Township of Uxbridge
51 Toronto Street South
Uxbridge, Ontario L9P 1T1
Phone: (905) 852-9181, ext. 215
Fax: (905) 852-9674
Email: bkester@town.uxbridge.on.ca

Roy Johnson, P. Eng.
Senior Water Resources Engineer
Stantec Consulting Ltd.
300 - 675 Cochrane Drive West Tower
Markham, Ontario
Phone: (905) 944-7777
Fax: (905) 474-9889
Email: Roy.Johnson2@stantec.com

Stantec

Appendix I PUBLIC INFORMATION CENTRE BOARDS

Welcome to the Township of Uxbridge

Stormwater Management Master Plan

Schedule "B" Class Environmental Assessment
Public Information Centre

Please sign in

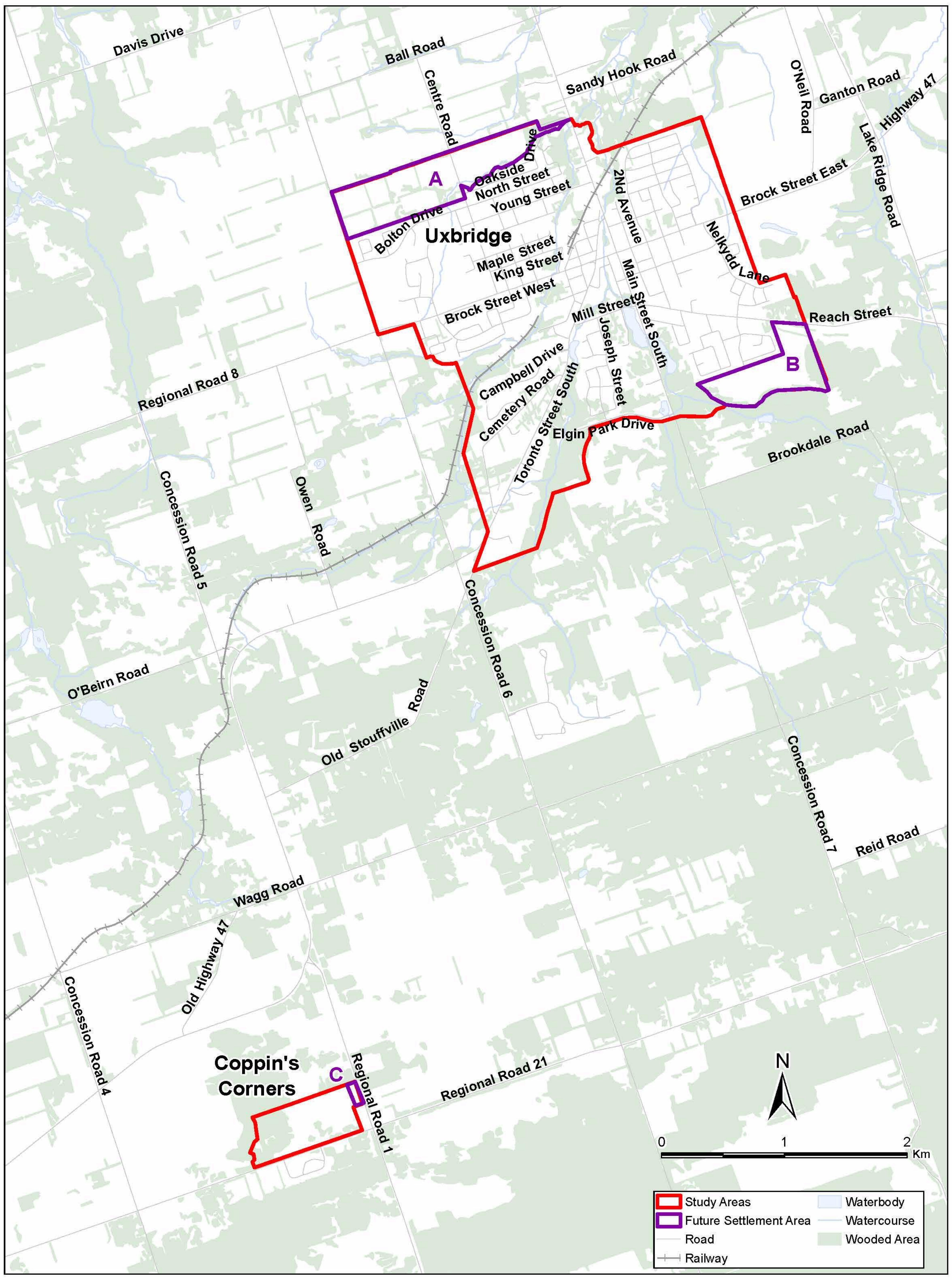
Take a comment sheet and information package to record your thoughts as you review the display materials

Township staff and the study team are available to discuss your questions and concerns

Public input will influence this study; please take the time to fill out a comment sheet

Stantec

Study Area



- The study area is located in the Township of Uxbridge and Hamlet of Coppin’s Corners, within the Uxbridge Brook watershed.
- It includes the Future Settlement Areas of the Township and Hamlet.

Stantec

Problem and Opportunity

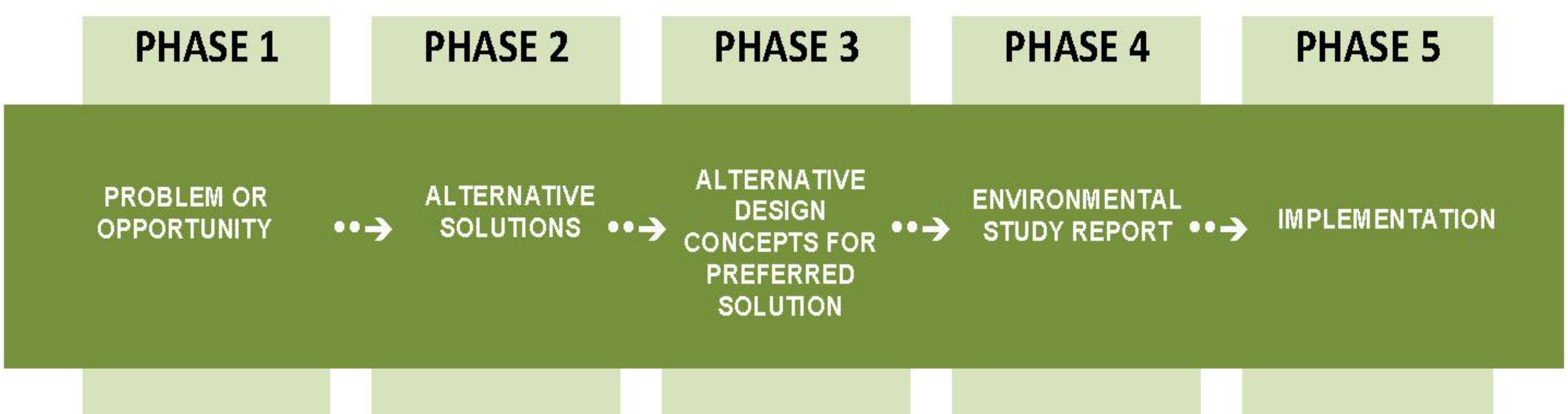
- The primary objective of the project is to meet the requirements of the Lake Simcoe Protection Plan (specifically Section 4.5 SA), the Lake Simcoe *Comprehensive Stormwater Management Master Plan (SWWMP)Guidelines* and the LSRCA Watershed Development Policies, while considering the intentions of the Township's Official Plan (OP) and applicable strategies/goals/guidelines set out by the Region of Durham's OP.
- To develop a SWMMP to define all anticipated works necessary to maintain, expand and improve the existing storm drainage system (including SWM ponds) while protecting the valued natural resources both within and beyond Township limits.
- The SWMMP will be prepared in accordance with the Class EA process and will be available for public review.
- An opportunity exists to implement a drainage strategy within the Township to meet the requirements as set out in the Lake Simcoe Protection Plan. While implementing drainage improvements, there will be opportunities to minimize ongoing erosion and sedimentation, phosphorus loadings and changes in water balance which may cause a negative impact on the Lake Simcoe watershed.

Stantec

Municipal Class EA Process

- The project is being conducted as a Schedule B project in accordance with the *Municipal Engineers Association Class Environmental Assessment (October 2000, as amended in 2007, and 2011)*.

- The requirements for Schedule B activities include **Phase 1 (Identification and Description of the Problem) and Phase 2 (Identification/Evaluation of Alternative Solutions to the Problem)** of the planning process of the Class EA and associated consultation.

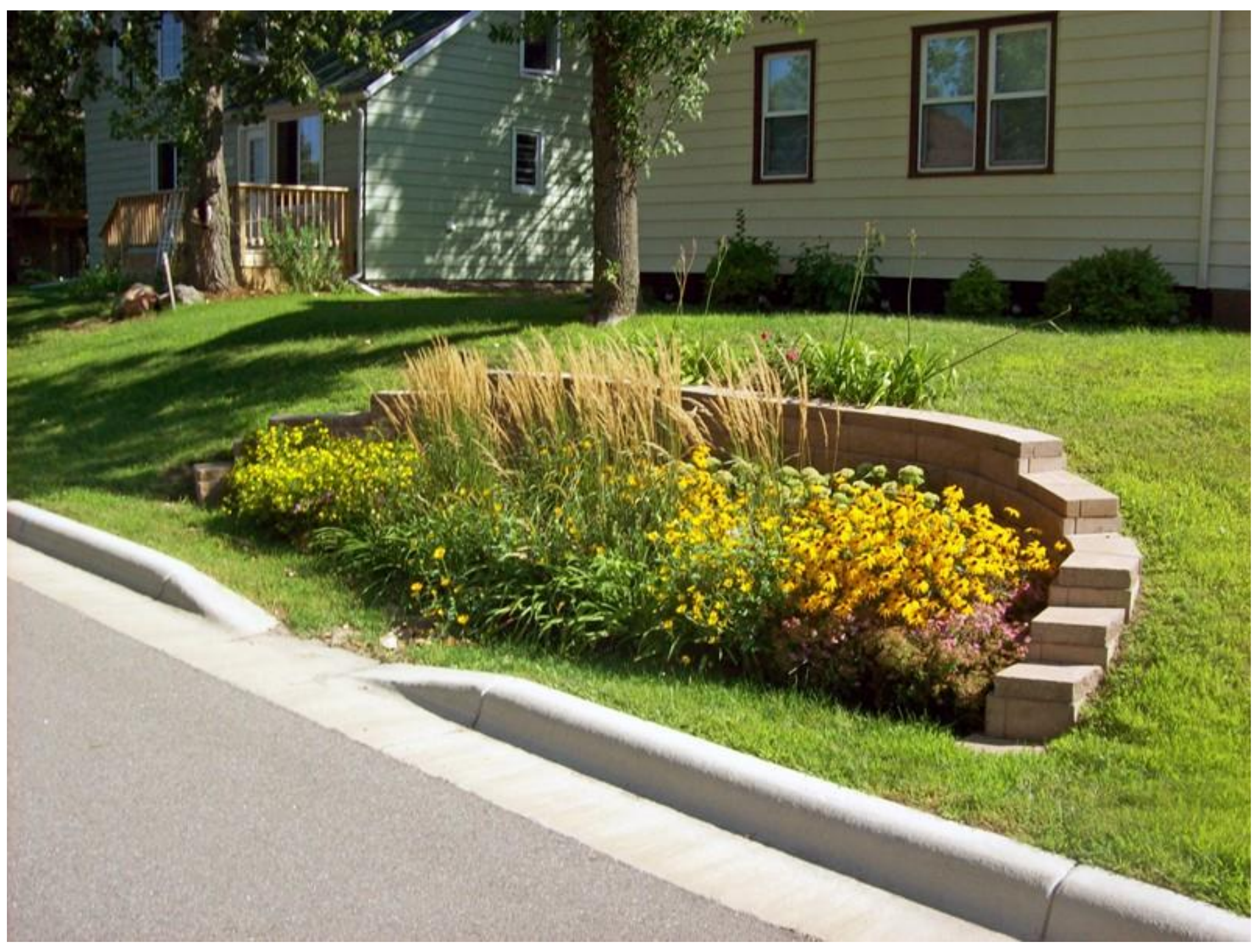


- Following this Public Consultation and the Class Environmental Study process, the Project File report will be made available for a 30-day public review and comment period.

Stantec

Alternative Solutions

- **Do Nothing**: With the "Do Nothing" approach, existing SWMFs are left "as is" and Future Settlement Areas are developed without SWM measures. That strategy would result in water balance deficit, reduced baseflows, increased erosion; increased peak flows, and increased phosphorus loading.
- **Traditional SWM Strategy (Ponds):** Reduces high flow rates and erosion potential and phosphorus debris, therefore reducing damage to the environment and property. It does not address water balance deficits, increasing baseflows, nor reducing runoff volumes.
- **Traditional SWM with BMP Implementation Strategy**: This approach consists of SWM ponds in conjunction with BMPs/LIDs for Future Settlement Areas. This combination can reduce water balance deficit, decrease volumetric runoff, increase baseflow, reduce erosion, reduce peak flows, and reduce phosphorus loading.



- **Traditional SWM with Retrofit Strategy**: This approach consists of SWM ponds in conjunction with BMPs/LIDs for Future Settlement Areas; as well as retrofitting of existing SWMFs, or application of BMPs in areas with SWMFs. This combination can reduce water balance deficit, decrease volumetric runoff, increase baseflow, reduce erosion, reduce peak flows, and reduce phosphorus loading.

Stantec

Analysis of Alternative Solutions

- The alternative solutions will be evaluated and rated against five evaluation criteria. The result of this evaluation will be the selection of the preferred alternative.

- The preliminary evaluation criteria were selected based on the guiding objectives of the project, existing conditions inventories, and engineering considerations.

Preliminary Evaluation Criteria
1. Phosphorus Removal Efficiency/ Water Quality Improvement
2. Land Availability/Constraints
3. Technical Feasibility (Engineering)
4. Cost
5. Aesthetic Value (Public Interaction)

Stantec

Next Steps in the EA Process

- Consider input received through the public consultation process on the problem opportunity statement, the evaluation criteria and alternative solutions.

- Analyze the alternative solutions against the evaluation criteria and select the preferred alternative.

- Following Public Consultation and the Class Environmental Study process, the Project File report will be made available for a 30-day public review and comment period.

- This provides the opportunity for interested stakeholders to file a Part II Order request (requests for a bump-up).

- The project is subject to approval in the Township of Uxbridge 2015 budget.

Stantec

Preferred Alternative

- **Area A – Uxbridge Northwest Settlement Area**
- The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – SWM pond(s) for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.
- As this Future Settlement Area is designated for Residential development, increasing imperviousness requires peak flow control and erosion control. The use of LID BMPs at the lot level could reduce costs over a traditional SWM wet pond, which requires draining, soil testing, hauling, etc. In addition, wet ponds can produce odours, which LID measures can reduce.
- When SWM Ponds and LID measures are utilized in conjunction with one another (i.e. a treatment train approach), TP loading can be reduced further over Traditional SWM (Ponds) alone.
- Area A sits predominantly within the Dundonald Sandy Loam soils region. Based on the MOE Manual, these soils generally have percolation rates greater than the recommended minimum of 15 mm/hours for infiltration measures; which supports LID measures.
- **Area B – Uxbridge Southeast Settlement Area**
- The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – SWM pond(s) for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.
- It is important to note that within this settlement boundary there are areas of high aquifer vulnerability and wellhead protection areas that should be avoided when attempting to infiltrate stormwater runoff. The DROP should be consulted when determining the regulations surrounding the implementation of SWM ponds and LIDs.
- **Area C - Coppin's Corners**
- Coppin's Corners is to drain internally to the Wyndance Infiltration SWM Pond, which is within the jurisdiction of the TRCA; therefore, no recommendations are made as part of this SWMMP.

Stantec

Thank you!

- Thank you for coming to our Public Information Centre.
- Please let us know what you thought, and if you have any comments or questions.
- **If you prefer to mail or fax back the comment form, please respond by May 14th, 2014.**
- If you have any questions about this study, feel free to ask any member of the Study Team.
- Information requests or questions may be directed to:

Mr. Ben Kester
Director of Public Works
Township of Uxbridge
51 Toronto St. S
Uxbridge, ON L9P 1T1
Phone: (905) 852-9181, ext 215
Fax: (905) 852-9674
bkester@town.uxbridge.on.ca

Mr. Roy Johnson, M. A. Sc., P. Eng.
Senior Water Resources Engineer
Stantec Consulting Ltd.
300 W- 675 Cochrane Dr
Markham, ON L3R 0B8
Phone: (905) 415-6372
Fax: (905) 474-6889
roy.johnson2@stantec.com

Stantec

Appendix J PUBLIC INFORMATION CENTRE SIGN-IN SHEET AND COMMENT FORM

PLEASE SIGN-IN

STORMWATER MANAGEMENT MASTER PLAN – SCHEDULE 'B' CLASS ENVIRONMENTAL ASSESSMENT - MAY 7, 2014

Name	Address	Telephone	email
Pamela Beach	6050 Conc 2 Stouffville	905-852-6440	pamelabeach2014@gmail.com
Gary Woodward	163 TORONTO ST S	cell 416-995-2912	bigfoot1631@gmail.com
Gordon Highet	TOWNSHIP OF UXBRIDGE	905-852-9181	ghighet@town.uxbridge.on.ca
Phil Shantz	270 Brock St. W Uxbridge	905-862-2500	pshantz@senes.ca

Stantec

Stormwater Management Master Plan – Schedule "B" Class Environmental Assessment

Please provide your comments on the proposed Stormwater Management Master Plan:

Looks fine

Please send me a copy (electronic) of the Plan (current date) so the UWAC can provide comment

Send to Phil Shantz

pshantz@sene s.ca

Comment sheets can be completed at the Public Information Centre, or mailed/faxed to either of the contacts below:

Mr. Ben Kester
Director of Public Works
Township of Uxbridge
51 Toronto St. S
Uxbridge, ON L9P 1T1
Phone: (905) 852-9181, ext 215
Fax: (905) 852-9674
bkester@town.uxbridge.on.ca

Mr. Roy Johnson, M. A. Sc., P. Eng.
Senior Water Resources Engineer
Stantec Consulting Ltd.
300 W- 675 Cochrane Dr
Markham, ON L3R 0B8
Phone: (905) 415-6372
Fax: (905) 474-6889
roy.johnson2@stantec.com

Freedom of Information and Protection of Privacy

Information collected at this Public Information Centre is being collected in accordance with the Freedom of Information and Protection of Privacy Act (RSO 1990). This information will be kept by r the Township of Uxbridge on file and may be include in study documentation. With the exception of personal information, all comments will become part of the public record. Names and addresses will be kept confidential.

Stantec

PIC ENTRY BOARD

PIC STORYBOARDS

Appendix K FIRST NATIONS LETTER

Stantec Consulting Ltd.
300W-675 Cochrane Drive, Markham ON L3R 0B8

September 1, 2015
File: 160621777

Attention: Chief Kris Nahrgang
Kawartha Nishnawbe First Nation
PO Box 1432 Lakefield, ON K0L 2H0

Dear Chief Nahrgant,

Reference: Township of Uxbridge Stormwater Management Master Plan
Notice of MOECC Public Comment Period

The Township of Uxbridge retained Stantec Consulting Ltd. (Stantec) to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management Master Plan (SWMMP) for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWM Master Plan has been prepared in accordance with the Comprehensive SWM Master Plan Guidelines, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the Municipal Class Environmental Assessment Guideline, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011).

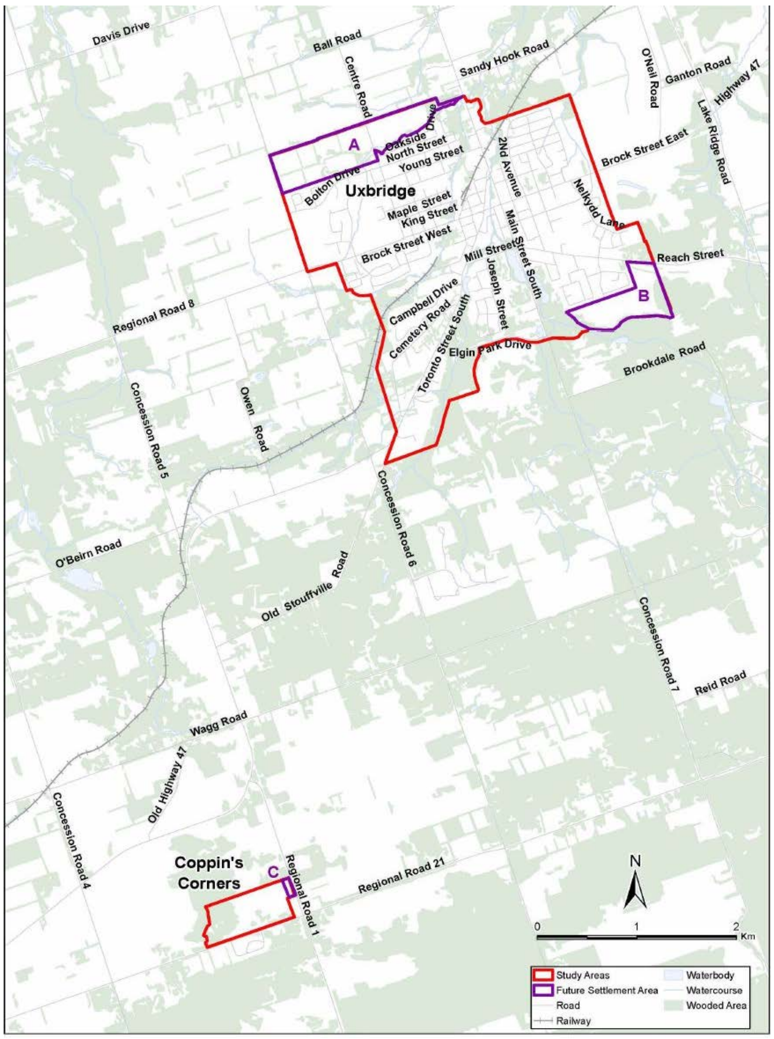
The Township of Uxbridge (the Township) received a letter from the Ministry of Environment and Climate Change (MOECC) indicating that the required scope of the SWM Master Plan must include the settlement areas noted above. We will be submitting the SWM-MP to the MOECC for 30 day public review. For your convenience, the Study's executive summary is included below.

Executive Summary of SWM-MP

The intent of the Stormwater Management Master Plan (SWMMP) was to prepare a practical and implementable framework which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities. The MOE published the *Lake Simcoe Protection Plan* in June of 2009 that called for all settlement areas to prepare and implement comprehensive SWMMP that would improve the management of stormwater for both existing and planned development.

The Study Area encompasses locations within both The Township of Uxbridge and Coppin's Corners, located south of Lake Simcoe. The Uxbridge study sub-area is generally bounded by Ball Road (north), Concession Road 7 (east), Wagg Road (south), Concession Rd#6 (west). The Coppin's Corners study sub-area is generally bounded by Regional Road HWY 47 (north), Concession Regional Road No. 1 (east), Regional Road No.21 (south) and Concession Road #4 (west). The Study Area is the urban areas from the Town's Official Plan (OP). It is important to note that the urban area from the Town's OP slightly differs from that of Durham Region's.

Reference: Township of Uxbridge Stormwater Management Master Plan
Notice of MOECC Public Comment Period



Uxbridge and Coppin's Corners Study Area

The Study Area drains to two sub watersheds: Uxbridge Brook and Pefferlaw Brook. There are various existing Stormwater Management (SWM) facilities within the Study Area. There are parts of the Greenbelt and Oak Ridges Moraine that are within the Township Boundary. The intent of the SWMMP is to develop the practical and implementable framework, which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities. The land use within the Town's Urban

Reference: Township of Uxbridge Stormwater Management Master Plan
Notice of MOECC Public Comment Period

Boundary is predominantly residential, commercial, and institutional with some park and open space areas. There are several employment areas at the intersection of Main and Maple St and the intersection of Reach St and Hamilton St. There is a cemetery to the south west within Lot 27 and Lot 28. Mixed land use areas are generally in the north eastern section from lot 31 to lot 33. There is also a small section of private open space for a golf course at the east end of the urban boundary along Lot 29. There are several Environmental Constraint Areas that are within the vicinity of watercourses and bounded by the floodplain.

SWMMP Strategy

The primary objective of the project is to meet the requirements of the Lake Simcoe Protection Plan (specifically Section 4.5 SA), the Lake Simcoe *Comprehensive Stormwater Management Master Plan Guidelines* and the LSRCA Watershed Development Policies, while considering the intentions of the Township's OP and applicable strategies/goals/guidelines set out by the Region of Durham's OP. The objectives of each plan in detail are described below:

Public Information Centre / Stakeholder Consultation

A Public Information Centre was held May 8, 2014.

SWM Recommendations

Using the existing conditions, the Township's OP, and the results of this Study, recommendations based on each settlement area have been developed.

Area A – Uxbridge Northwest Settlement Area

The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – a SWM pond for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.

As this Future Settlement Area is designated for Residential development, increasing imperviousness requires peak flow control and erosion control. The use of LID BMPs at the lot level could reduce costs over a traditional SWM wet pond, which requires draining, soil testing, hauling, etc. In addition, wet ponds can produce odours, which LID measures can reduce.

When SWM Ponds and LID measures are utilized in conjunction with one another (i.e. a treatment train approach), TP loading can be reduced further over Traditional SWM (Ponds) alone.

**Reference: Township of Uxbridge Stormwater Management Master Plan
Notice of MOECC Public Comment Period**

Area A sits predominantly within the Dundonald Sandy Loam soils region. Based on the MOE Manual, these soils generally have percolation rates greater than the recommended minimum of 15 mm/hours for infiltration measures; which supports LID measures.

Area B – Uxbridge Southeast Settlement Area

The preferred SWM strategy for this area is the Traditional SWM with BMP Implementation Strategy – a SWM pond for peak flow control and erosion control, in conjunction with LID BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. Where applicable, it is recommended to provide BMPs in areas where soils and groundwater levels permit on a future development basis.

It is important to note that within this settlement boundary there are areas of high aquifer vulnerability and wellhead protection areas that should be avoided when attempting to infiltrate stormwater runoff. The DROP should be consulted when determining the regulations surrounding the implementation of SWM ponds and LIDs.

Area C - Coppin's Corners

As noted in Section 1.0, Coppin's Corners is to drain internally to the Wyndance Infiltration SWM Pond, which is within the jurisdiction of the TRCA.

Uxbridge Urban Area

For areas that experience redevelopment in the future, the preferred strategy is the Traditional SWM with Urban Retrofits Strategy. Pond upgrades and LID measure should be evaluated for feasibility of implementation on a site specific basis.

In short, the Master Plan does not propose any physical works at this time, it merely provides a framework for how future development within the Uxbridge urban area should proceed with respect to stormwater management.

Reference: Township of Uxbridge Stormwater Management Master Plan
Notice of MOECC Public Comment Period

We trust that the foregoing will provide sufficient information to assist you in reviewing the forthcoming MOECC review period materials.

Regards,

STANTEC CONSULTING LTD.

Roy Johnson, B. Eng., M. A. Sc., P. Eng.
Senior Water Resources Engineer
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Attachment: -

c. Chief James Marsden – Alderville First Nation/Mississauga of Alderville c/o dsimpson@alderville.ca
Chief Phyllis Williams – Curve Lake First Nation/Mississaugas of Mud Lake c/o cdutytoconsult@curvelakefn.ca
Chief Kelly LaRocca - Mississaugas of Scugog Island First Nation c/o consultation@scugogfirstnation.com, msanford@scugogfirstnation.com
Chief Greg Cowie – Hiawatha First Nation/Mississauga of Rice Lake chiefcowie@hiawatha.ca
Chief Donna Big Canoe - Chippewas of Georgina Island First Nation c/o Suzanne.howes@georginaisland.com
Mr. James Wagar - Metis Nation of Ontario Consultation Unit c/o glenl@metisnation.org, jamesw@metisnation.org
Grand Chief Konrad Sioui – Huron Wendat c/o administration@cnhw.qc.ca

rrj v:\01606\active\160621777\swm master plans\correspondence\letters\let_first_nations_20150901_fin.docx

Ng, Timothy

From: Johnson, Roy (Markham)
Sent: Friday, September 11, 2015 2:00 PM
To: administration@cnhw.qc.ca; glenl@metisnation.org; jamesw@metisnation.org; Suzanne.howes@georginaisland.com; chiefcowie@hiawatha.ca; msanford@scugogfirstnation.com; consultation@scugogfirstnation.com; cdutytoconsult@curvelakefn.ca; dsimpson@alderville.ca; sanderson@alderville.ca; MelissaD@curvelake.ca; LoisT@curvelake.ca
Subject: RE: Township of Uxbridge Stormwater Management Master Plan

Hi

I'm just following up on the attached notification to see if there are any questions or concerns.

Regards;

Roy Johnson, B. Eng., M. A. Sc., P. Eng.
Senior Water Resources Engineer
Stantec
300W-675 Cochrane Drive Markham ON L3R 0B8
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Stantec

From: Johnson, Roy (Markham)
Sent: Tuesday, September 01, 2015 9:06 AM
To: 'administration@cnhw.qc.ca'; 'glenl@metisnation.org'; 'jamesw@metisnation.org'; 'Suzanne.howes@georginaisland.com'; 'chiefcowie@hiawatha.ca'; 'msanford@scugogfirstnation.com'; 'consultation@scugogfirstnation.com'; 'cdutytoconsult@curvelakefn.ca'; 'dsimpson@alderville.ca'
Cc: Ng, Timothy; Blommers, James
Subject: Township of Uxbridge Stormwater Management Master Plan

Hi:

The Township of Uxbridge retained Stantec Consulting Ltd. (Stantec) to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management Master Plan (SWMMP) for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWM Master Plan has been prepared in accordance with the Comprehensive SWM Master Plan Guidelines, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the Municipal Class Environmental Assessment Guideline, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011).

The Township of Uxbridge (the Township) received a letter from the Ministry of Environment and Climate Change (MOECC) indicating that the required scope of the SWM Master Plan must include the settlement areas noted above. We will be submitting the SWM-MP to the MOECC for 30 day public review. The MOECC identified First Nations representatives cc'd on this email.

The Master Plan does not propose any physical works at this time, it merely provides a framework for how future development within the Uxbridge urban area should proceed with respect to stormwater management. The vast majority of the urban area drains north to Lake Simcoe. A small block of land in Coppin's Corners is technically part of a watershed ultimately draining south, but, in reality, remains with Lake Simcoe.

Attached is the letter of notification and an executive summary of the Master Plan. The next step will be uploading the Master Plan document to the MOE for public review.

Regards;

Roy Johnson, B. Eng., M. A. Sc., P. Eng.
Senior Water Resources Engineer
Stantec
300W-675 Cochrane Drive Markham ON L3R 0B8
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Stantec

Appendix L LAKE SIMCOE REGION CONSERVATION AUTHORITY CORRESPONDENCE

Stantec Consulting Ltd.
300 - 675 Cochrane Drive West Tower
Markham ON L3R 0B8
Tel: (905) 944-7777
Fax: (905) 474-9889

Proposal File: P-2483

December 19, 2012
File: 160621777

Township of Uxbridge
PO Box 190
51 Toronto Street South
Uxbridge, ON L9P 1T1

Attention: **Mr. Ben Kester**

Dear Ben:

Reference: **Stormwater Management Master Plan**
Uxbridge Urban Area and Hamlet of Coppin's Corners
Township of Uxbridge, ON

We are pleased to present the following letter proposal to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management (SWM) Master Plan for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWM Master Plan shall be prepared in accordance with the *Comprehensive SWM Master Plan Guidelines*, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the *Municipal Class Environmental Assessment Guideline*, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011). The Township of Uxbridge (the Town) has received a letter from the Ministry of Environment (MOE) indicating that the required scope of the SWM Master Plan must include the settlement areas noted above. Stantec also met with the LSRCA on Monday, December 6th, 2012, to confirm their level of expectation as it relates to several of the planning and technical requirements identified in their guideline. Based on these background documents and discussions, Stantec has prepared this proposal and fee estimate to undertake the required scope of services on behalf of the Township.

Through the Class EA Master Plan process, planning and technical review, several 'preferred alternatives' will be established with respect to the existing natural environment. This process will also provide the design criteria for future new development, redevelopment, and/or the upgrading or replacement of existing infrastructure. SWM design criteria as it relates to water quality, water quantity, water balance, and erosion controls will be established for both Uxbridge and Coppin's Corners. The Master Plan will also provide recommendations for SWM implementation approaches and ongoing inspection/maintenance considerations.

The project will be led and managed by Tim Gallagher from the Markham Stantec office. He will be complemented by key Stantec staff from Markham's Urban Development and Environmental Management groups, which have extensive experience undertaking Class EAs, stormwater management, aquatic ecology, terrestrial ecology and water resources design.

The following work plan outlines the tasks associated with the SWM Master Plan.

Reference: Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners
Township of Uxbridge, ON

1.0 WORK PLAN

To initiate the project, a study kick-off meeting will be held with Town and/or LSRCA staff to review and discuss all relevant information and data including existing hydrology/hydraulic models (if any), grading/servicing plans, survey information, files, etc., thereby ensuring a clear understanding of the existing settlement areas. We understand that the LSRCA has several background studies and design reports that are likely to cover the majority of the settlement areas on file in their office. The LSRCA has also indicated that they will enable access to the same files for the purpose of this study. As such, we would complete a review of the previous reports/studies related to the existing SWM and development planning policy, existing natural heritage environment, existing drainage patterns, SWM infrastructure, and planned future development. The background document reviews will be supplemented with onsite investigations for the receiving watercourses in the vicinity of the planned developments with both settlement areas. Upon completion of our relevant background document review, Stantec will prepare a Terms of Reference for submission to the Town and LSRCA to confirm an agreed upon approach to satisfy the requirements of the SWM Master Plan. Confirming the LSRCA is in agreement will minimize the potential risk for inconsistent approaches later in the study process. Establishing a Terms of Reference was also encouraged by the LSRCA at our recent meeting.

1.1 CLASS ENVIRONMENTAL ASSESSMENT (MASTER PLAN)

The work plan for completing the Class EA will identify any potential environmental effects and recommend appropriate SWM requirements for future development in the Master Plan. The two phases included in the 'Master Plan' MEA Class EA process are Phase 1 (Identification and Description of the Problem) and Phase 2 (Identification/Evaluation of Alternative Solutions to the Problem). Phase 3 to Phase 5 of the MEA Class EA process will not be required as part of this study.

Phase 1

Phase 1 is primarily focused on collecting and reviewing relevant background data, confirming the project objectives and schedule with Town staff, and developing a clear and concise problem statement, which is generally identified in the LSRCA's guidelines. During Phase 1, we will develop a project contact list in consultation with the Town and LSRCA noting relevant government agencies and stakeholders within the community, which will include, for example:

- **Provincial Agencies:** Ministry of the Environment; Ministry of Natural Resources; Ministry of Aboriginal Affairs; Ministry of Public Infrastructure and Renewal; and, Ministry of Transportation.
- **Federal Agencies:** Department of Fisheries and Oceans (if required); Department of Indian and Northern Affairs; and, Environment Canada.
- **Municipal Governments:** Region of Durham and Township of Uxbridge.
- **Stakeholder Organizations:** Lake Simcoe Region Conservation Authority; various interested community organizations.
- **Relevant Utilities and Local Stakeholders:** Enbridge Gas; Veridian; Hydro One; and, study area property owners.

Input from the public and affected agencies will be obtained through two required notifications, which will include one Open House event (Public Information Centre). The first point of contact with the public will be a "Notice of Study Commencement and Open House" that would be prepared and provided to the Town for placement in local newspapers during the appropriate time in Phase 2. At the same time, a cover letter and a copy of the Notice of Study Commencement and Open House will be mailed or delivered by the consulting team to stakeholders identified on the project contact list.

Phase 2

During Phase 2, the preliminary alternative solutions to the problem will be discussed with the Town and will be evaluated as part of the Class EA process. Phase 2 will include the following tasks:

1) **Identify and describe the relevant alternative solutions** to the stated problem(s) in consultation with the Town. Our preliminary list may include but will not necessarily be limited to the following alternatives:
    1. Do nothing (included as required by the MEA Class EA)
    2. Retrofit of Existing SWM Facilities
    3. Low Impact Development Opportunities (New or Retrofitted Development)
    4. Integration of Land Form Alterations and Vegetation Techniques in Open Spaces
    5. Phosphorus Reduction Techniques
    6. Future SWM Facilities
        a. End-of-Pipe Controls
        b. Source Controls
        c. Conveyance Controls
    7. Public SWM Education/Outreach
2) **Review the relevant natural, and social/cultural background information**, followed by any literature searches and field investigations as required to expand on the key components of the environment potentially affected. Stantec staff will review key background reports and provide a summary of our findings as it relates to relevant natural heritage and social/cultural information. It is anticipated that field assessments of the natural heritage systems will be necessary for the major receiving watercourses in the Study Area. Stage 1 Cultural Heritage assessments will be sufficient to support the SWM Master Plan.
3) **Review and analyze the relevant technical information** and conduct technical field investigations required to augment the existing data. It is understood that the Town has access to GIS data through the Region of Durham. We anticipate utilizing this resource to support this study. As noted above, the LSRCA has indicated that their filing system is very extensive and that they will most likely have have background design reports and drawings for most (if not all) of the existing SWM facilties within the Tonwhip. We also understand that historical documents such as the Uxbridge Watershed Pan, SWM Retrofit Class EA Studies, various SWM pond design reorts, among others, will be directly applicable to this study. As such, we envision a significant effort in reviewing all available background technical information/documentation, models, and planimetric information at the onset of this assignment.
4) **Develop evaluation criteria** pertaining to water quality, water quantity, water balance, erosion controls, general storm drainage, natural environment, and cost based on the existing conditions inventories, technical studies and any other identified issues raised by agency and public stakeholders during the process.

5) **Evaluate the alternative solutions** using the evaluation criteria. We will identify the potential net effects and advantages/disadvantages, after mitigation measures have been applied, for each alternative. The various alternatives will then be rated on a relative basis to each other as the basis for the selection of a recommended alternative solution as it relates to establishing proper SWM planning and design criteria.

6) **Consult review agences and the public.** The newspaper advertisement prepared in Phase 1 for the "Notice of Study Commencement and Open House" will be posted in local paper(s). It is assumed the newspaper posting will be arranged by the Town. Stantec will arrange for the notice to be mailed and/or delivered to stakeholders identified in the project contact list prepared in Phase 1.

   The materials at the open house will describe the Class EA process being followed, the problem being addressed, identification and evaluation of the alternative solutions and design concepts, the recommended alternative solution, the potential environmental effects associated with the preferred solution, and next steps. It is assumed that the open house could be held at a Town sponsored location at an appropriate time when draft results have been developed.

   A draft of the open house materials will be provided to the Town for review and comment prior to finalization and issuance. It is assumed the Town will arrange for notice placement in the local paper(s). We will be responsible for costs associated with the open house materials.

7) **Incorporate the information provided by stakeholders** and confirm the preferred alternative solution.

8) **Prepare the Project File** for the proposed SWM Master Plan that documents each step of the Class EA process undertaken and the results in a traceable, easily understood manner, and meets all MEA Class EA requirements. We will provide the Town and LSRCA with one copy of the Project File for review. Upon receipt of the Town and LSRCA comments, we will finalize the document and provide two hard copies and a digital copy to the Town to place in a public forum for review.

9) **Place the Project File in a public forum** (i.e. Municipal Clerk's Office, library, etc.) for the required 30 day review period.

10) **Prepare a "Notice of Completion**" in the form of a letter and a newspaper advertisement, which advises stakeholders where the Project File may be reviewed and the manner in which comment is to be received. The notice will also advise stakeholders and review agencies of their rights with regard to requesting a Part II Order under the EA Act. A draft of the notice will be provided to the Town for review prior to finalization and issuance. We will coordinate the mail-out to those on the project contact list. It is assumed the Town will arrange for the advertisement to be posted in the local newspaper(s). Stantec will maintain contact with the Ministry of the Environment's Environmental Assessment and Approvals Branch during and immediately after the 30 calendar day review period in order to quickly determine if any public and/or review agency concerns have been submitted (Part II Order).

1.2 SWM MASTER PLAN GUIDELINES

The LSRCA has prepared a document entitled, *Comprehensive Stormwater Management Master Plan Guidelines*, dated April 26, 2011. In this document, the LSRCA has established what is referred to as the *Ten Steps*, which are described in detail and generally summarized as follows:

1) **Scoping:** Identify the urban areas or rural settlement areas where development is concentrated and lands are designated in the Official Plan for development over the long term. The Uxbridge Urban Area and Hamlet of Coppin's Corners have already been identified. As such, this step is considered to be complete.

Reference: Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners
Township of Uxbridge, ON

2) **Determine Study Area for the Settlement Area:** Identify the existing settlement area designated in the Official Plan, proposed or contemplated future development, and all associated permanent and intermittent streams within the same.

3) **Develop a Characterization of the Study Area:** Establish an understanding of existing and future land uses, natural environment, cultural environment, and watershed conditions. Interpretation of relevant planning/regulatory policies and identification of any known restrictions and/or constraints.

4) **Divide Study Area into Management Units:** In the event that portions of the study areas would be better broken down into separate management units due to distinct natural heritage characteristics, then those specific management areas need to be identified. This could include differences based on receiving watercourse characteristics, abrupt changes to existing/proposed land uses, unique underlying soil characteristics, etc.

5) **Evaluate Cumulative Environmental Impact of Stormwater from Existing and Planned Development:** Undertake an assessment of water balance, water quality, and water quantity considerations for both existing and proposed conditions to establish an understanding of the potential cumulative effects to the existing receiving systems.

6) **Determine Effectiveness of Existing Stormwater Management Systems:** Assess the existing SWM facilities, their inlet/outlet structures, and their apparent ability to address water quality/quantity and erosion controls in their receiving watercourses. Review effectiveness of SWM facilities to satisfy climate change implications.

7) **Identify and Evaluate Stormwater Improvement and Retrofit Opportunities:** Opportunities to be identified based upon the effectiveness of existing facilities, conditions of receiving watercourses, background studies, infrastructure constraints, and land availability. Opportunities to introduce Low Impact Development, land form alterations, and/or re-vegetation techniques within existing open spaces will also be considered. In addition, past SWM recommendations from planning policy, will also be revisited to ensure continued relevance with current SWM practices and the findings of this study. Alternatives will be evaluated against each other regarding technical effectiveness, construction feasibility, natural environmental, social/cultural environment, and cost.

8) **Establish a Recommended Approach for Stormwater Management for the Study Area:** Develop an overall SWM strategy for the study area that will be effective at managing the stormwater flow characteristics, water quality, water quantity, and erosion controls. Establish specific and quantifiable SWM design criteria for future development in the study area. Stantec will provide justification/rationale for the recommended approach in accordance with Phase 1 and Phase 2 of the Municipal Class EA (Master Plan process).

9) **Develop an Implementation Plan for the Recommended Approaches:** Stantec will outline how the recommended SWM measures, policies, and operation/maintenance strategies are to be implemented with consideration for responsible party, schedule, and funding mechanisms.

10) **Develop Programs for Inspection and Maintenance of Stormwater Management Facilities:** Stantec will prepare an inspection and maintenance program for the recommended SWM works as part of this study. The plan will provide for annual reporting with a sufficient level of detail to

Reference: **Stormwater Management Master Plan**
Uxbridge Urban Area and Hamlet of Coppin's Corners
Township of Uxbridge, ON

determine if the implemented SWM recommendations are operating in a manner consistent with the intended design.

2.0 SCHEDULE AND COST

The SWM Master Plan Class EA will commence upon notification from the Town to proceed (assumed to be provided by no later than March of 2013). With this assumed start date, the Class EA is anticipated to be completed by December of 2013.

The total cost estimate for this project is $89,400 excluding applicable taxes and our 8% flat rate disbursement fee. Disbursements include added expenses for report production, correspondence and other administrative costs associated with the above scope of work. The cost is presented as an upset limit, not to be exceeded without the Town's prior knowledge and approval. A more detailed breakdown of the overall cost estimate is provided below:

LSRCA Ten Steps	Description	Estimated Fee
1	Scoping	N/A[1]
2	Determine the Study Area for the Settlement Area	$2,200
3	Develop a Characterization of the Study Area	$22,900
4	Divide the Area into Management Units Where Appropriate	$2,000
5	Evaluate the Cumulative Environmental Impact of Stormwater from Existing and Planned Development	$14,100
6	Determine the Effectiveness of Existing Stormwater Management Facilities	$5,000
7	Identify and Evaluate Stormwater Improvement and Retrofit Opportunities	$12,500
8	Establish a Recommended Approach for Stormwater Management for the Study Area	$23,700
9	Develop an Implementation Plan for the Recommended Approaches	$3,500
10	Develop Programs for Inspection and Maintenance of Stormwater Management Facilities	$3,500
	Total (excl. disbursements & HST) =	**$89,400**

1 – Settlement Areas for the Class EA have been previously established.

Reference: Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners
Township of Uxbridge, ON

3.0 ASSUMPTIONS

The work plan and costing for this proposal have been based on the following assumptions:

- Up to two (2) site visits and/or meetings with agencies will be required.
- One Public Information Centre (PIC) will be required.
- Up to six (6) Open House boards (story boards) will be required at the PIC.
- Costs have not been allocated for the purchase of additional data, if required.
- No detailed topographic surveys for any of the existing SWM Facilities or receiving watercourses will be required.
- Existing Natural Heritage and Cultural Heritage characterizations shall be summarized from existing background documents. Only desktop analyses will be completed as part of this scope of work.
- The cost of newspaper advertisements, mailings and rental of the open house location will be assumed by the Town.
- One draft review of each deliverable will be required by the Town.
- Two large-format hard-copies of the engineering design drawings will be provided to the Town along with pdf and CAD format digital versions.
- Agency review fees have been excluded and are assumed will be paid for directly by the Town.
- No permits under the Endangered Species Act will be required.
- No MOE Part II Orders will be raised during the process.
- Any service not specifically described in this proposal is excluded.

Reference: **Stormwater Management Master Plan**
Uxbridge Urban Area and Hamlet of Coppin's Corners
Township of Uxbridge, ON

4.0 CLOSURE

Stantec is pleased to have the opportunity to provide this proposal to the Town. Our project management approach has been designed in a manner to be flexible and interactive to address the evolving requirements of the project. As such, our team is open to discussing our approach to this project at any time throughout the process.

To acknowledge this proposal and initiate the project, please return the signed version by fax to (905) 474-9889 attention, Tim Gallagher or by e-mail to tim.gallagher@stantec.com.

Sincerely,

STANTEC CONSULTING LTD.

Original signed by

Tim Gallagher, M.Sc., P.Eng., P.E.
Senior Associate, Water Resources
Tel: (905) 944-6870
Fax: (905) 474-9889
tim.gallagher@stantec.com

FOR STANTEC CONSULTING LTD:

[signature] Feb. 6, 2013
Signature ***Date***

Tim Gallagher, Senior Associate
Print Name and Title

FOR CLIENT:
Approval to Proceed:

Ben Kester Feb 6, 2013
Signature ***Date***

BEN KESTER
Print Name and Title
DIRECTOR OF PUBLIC WORKS AND OPERATIONS

Lake Simcoe Region
conservation authority

A Watershed for Life

Via Email Only: Roy.Johnson2@stantec.com

IMS No. PEAA417C2

July 16, 2014

Mr. Roy Johnson, P.Eng.
Senior Water Resources Engineer
Stantec Consulting Ltd.
300-675 Cochrane Drive
Markham, ON L3R 0B8

Dear Mr. Johnson:

Re: Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corner
Municipal Class EA
Report Dated May 21, 2014
Township of Uxbridge, Regional Municipality of Durham

We have completed our review of the above noted submission which we received on May 26, 2014. In order to provide clear and concise comments for the study, a table of comments has been created and attached to this letter.

Please contact the undersigned if you have any questions regarding these comments. Please refer to the above noted IMS number in any future correspondence.

Yours truly,

Tom Hogenbirk, CMM, P.Eng.
Manager, Engineering and Technical Services

TH/ph

c. Ben Kester, Township of Uxbridge - email

Encl. 4 pages

S:\Planning and Development Services\Other Legislation, Policy and Guidelines\Environmental Assessment Act\Environmental Assessments\Uxbridge\2014\UXB CSWMMP Comments.docx

Page(s):	Section(s):	Comments:
all	all	All figures need to reference the source (and date) of the data shown on the Figure.
all	all	As Coppin's Corners is part of Lake Simcoe's watershed as defined in the LSPP, this area needs to be addressed as part of this CSWMMP.
i	2nd paragraph	The **MOE** released the Lake Simcoe Protection Plan (LSPP) in 2009 (not the LSRCA).
iii	Area C	As Coppin's Corners is part of Lake Simcoe's watershed as defined in the LSPP, recommendations are required as part of this CSWMMP.
1.1	1.1	The **MOE** released the Lake Simcoe Protection Plan – LSPP in 2009 (not the LSRCA).
1.2	1.2	As Coppin's Corners is part of Lake Simcoe's watershed as defined in the LSPP, recommendations are required as part of this CSWMMP.
1.4	1.4	Lake Simcoe Region Conservation Authority. The correct name of the LSRCA needs to be used in this section.
3.15	3.1.2	Institutional, private open space and cemetery areas are not considered Natural Heritage features. This list should include Habitat for Endangered and Threatened Species, Wetlands, Woodlands, Valleylands, Wildlife Habitat, Areas of Natural and Scientific Interest, Fish Habitat, Linkages.
3.16	3.1.2	How do items c, d and e enhance Natural Heritage Systems?
3.16	3.2	This entire section needs to be revised to reflect the current plan review process pertaining to Natural Heritage. The MNR has minimal involvement. LSRCA has signed an MOU with the Region of Durham to provide technical advice regarding Natural Heritage as part of the plan review process.
3.16	3.2.1	The LSRCA has ESA's identified for the study area.
3.16	3.2.2 2nd Paragraph	This section needs to be revised to provide more clarity. What is the term "recognized natural areas"?
3.17	3.2.3	The MNR identifies wetlands; it is the LSRCA that deals with proposals to construct within the 120 setback area through Regulation 179/06 and through our MOU with the Region under the Planning Act.
3.17	3.2.4	This section should mention the Federal *Migratory Birds Convention Act* and explain its applicability / purpose.
3.18	3.2.6	The wording in this section needs to be clarified. The **UUSA** does not have records for sensitive species. Perhaps "The MNR has indicated that there are sensitive species and SAR in the UUSA"?
3.18	3.3	Reference should be made to Section 38 of the Fisheries Act.
3.19	3.3.1	LSRCA has required Enhanced (Level 1) protection for the entire Lake Simcoe watershed since 1995.
3.19	3.3.2	Reference needs to be made to the water quality conditions in Uxbridge Brook.
3.27	3.6	Reference should be made to Elgin and Electric Light Ponds, both in terms of location, history and present conditions. These ponds should be shown on the appropriate plan.
3.27	3.6	There is an error in the second last sentence. "The Township" should read

Page(s):	Section(s):	Comments:
		"Uxbridge".
3.28	3.7.1	The 22 ponds should be listed in a table and shown on an appropriate figure.
3.29	3.7.3	The location of the WPCP should be shown on one of the figures.
4.1	4.2	Land use information on Coppins Corners needs to be provided and shown on the appropriate figure(s).
4.1	4.2	Is Attachment 1 the same as Schedule A? This needs to be clarified.
4.2	Schedule A	This needs to be labelled as a Figure. A similar figure is needed for Coppins Corners.
4.3	4.3	The 2009 MMM model represents a calibrated VO2 model. One of the key calibrate components is tp (time to peak). In order to calibrate the flows, the Williams (1977) tp was calculated for each catchment (NASHYD) and then multiplied by 3.5. This revised tp was then utilized. A similar approach is needed for any revisions / update of this model.
4.4	4.3.3	A specific comparison is required between the total rainfall amounts in the LSRCA (MMM) model versus the model developed by Stantec.
4.4	Table 3	Additional nodes should be shown on this table and the locations shown on an appropriate figure.
4.5	4.4.2.2	The acronym is **LSEMS**.
4.8	4.4.2.2.2	The value of 1453.9 kg/yr. is not a recommend value; it is the post development load with recommended BMP's.
4.8	Table 5	The subwatershed areas listed of A, B etc. need to be shown on the appropriate figure.
4.9	4.4.2.2.2.1	LSRCA Retrofit, second paragraph: The 1.32 and 1.82 values listed should be labeled as 1.32 **kg**. and 1.82 **kg**. The last sentence in this paragraph should be removed.
4.11	4.4.4	The 2010 Berger Phosphorous loadings for new development assume that BMP's are already in place. For example, the after BMP urban load of 0.206 kg/ha/yr represents an assumed P removal rate of 84% for 1.32 kg/ha/yr. In order to be consistent with the original work done by TSH in 2000, the uncontrolled P loads of 1.32 kg/ha/yr and 1.82 kg/ha/yr need to be utilized as part of the Stantec study with suitable BMP reduction factors applied depending on the type of BMP used.
4.12-4.14	4.4.3 – 4.4.7	The various tables in this section need to be revised based on the above comment.
4.12-4.14	Tables 7-9	These tables need to clearly identify which areas are being referred to, i.e. these are the total yearly P loads for which areas?
4.12-4.14	4.4.3 – 4.4.7	Coppins Corners needs to be addressed in these Sections.
4.15	4.5	Figure 1 needs to id the sub areas in the legend.
4.15	4.5	An important technical guideline that needs to be referenced and complied with is the "Hydrogeological Assessment Submissions: Conservation Authority Guidelines to Support Development Applications – June 2013". This document can be found at http://cloca.ca/devreview/HydroAssessmentGuidelines-

Page(s):	Section(s):	Comments:
		20130610-FINAL2.pdf
4.17	4.5	Data from 1991 is somewhat outdated. More current data should be used for the water balance and the calculation of the 76% rainfall. For example, LSRCA has calculated the 90% storm to be 23.3 mm based on data from 9 EC stations based on 10 years of recent precipitation data. Lance Aspden of our office can be contacted for more information on this recent work.
5.1	5.0	A specific section is required on creek erosion in the study area. Step 5 of the CSWMMP Guidelines requires that an erosion study be done for existing and future conditions. Are there currently erosion issues in the study area? Are these expected to worsen under future conditions? Are there specific controls required for the catchments to address these issues?
5.4 & 5.5	Tables 13, 14 & 15	Where are these flow nodes or Catchments? A figure is required showing all flow nodes and catchments and the text updated to refer to this figure in the appropriate sections.
5.4	Table 13	Additional nodes need to be shown on this table for a better understanding of the impacts on climate change in various parts of the study area.
5.5	5.2	It is agreed that a new rain gauge should be installed in Uxbridge; a suggested location is the WPCP. For a good summary of adjacent Environment Canada Gauges, please refer to the following link: http://www1.toronto.ca/city_of_toronto/environment_and_energy/key_priorities/files/pdf/tfwcds-chapter1.pdf
6.1	6.1	A list of all 22 ponds should be provided along with a plan showing their locations.
6.3	Table 16	Reference is to be made to the appropriate figure showing the pond locations.
7.3-7.4	7.3.1	The section of Regulation 179/06 that is quoted in this section is incomplete. It is recommended that the regulation be summarized rather than directly quoted.
7.6	Table 17	The reference to the Lake Ontario waterfront needs to be removed. In the LSRCA section, refer to Regulation 179/06.
7.7	7.4	The cost per m3 for sediment removal can be substantially more if the material is contaminated.
7.10	7.5.2.1	Last sentence: LSRCA's regulation is **179/06.**
7.14	Table 18	The recommended month for cleanout is September wherever possible. Reference should be made to the Federal Migratory Bird Act - Breeding Bird season. Refer to: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=8D910CAC-1 for more details.
9.1-9.5	9.0	All nodes and catchments need to be shown on the appropriate figure and referenced in this section.
9.1-9.5	9.0	This section needs to also include alternative solutions pertaining to water

Page(s):	Section(s):	Comments:
		balance, phosphorous and erosion control.
9.3	Table 20	Has the 40 mm extended detention requirement been included in this flow assessment?
9.4	9.4	The MNR is not involved with review of development within ESA's or within wetland zone of influences. The LSRCA reviews under our MOU with the Region of Durham and under Regulation 179/06.
9.4	9.4	SWM wet ponds and on-line ponds can have significant impacts on the thermal regime of a coldwater system. Thermal impacts are a significant issue in some parts of the Uxbridge Brook.
10.1-10.2	10.1	Specific and detailed recommendations are to be provided for each of Areas A, B, C and the Uxbridge Urban Area pertaining to water balance, phosphorous, peak control and erosion control.
	Figure 1	The legend needs to identify what A, B and C means. Also, the lines for Protected Countryside and the CA Boundary that appear in the legend cannot be found on the plan.
	Figure 2	All SWM ponds need to be shown and numbered.
	Figure 3	The legend refers to a "Hamlet Institutional ..... Area" that does not show up on the plan.
	Figure 4	If the SWM ponds are to be shown on this figure, they should be numbered in accordance with the Town's pond identification system.
	Figure 5	All 22 SWM ponds should be shown and numbered.
	Figure 6	The difference between this figure and Figure 7 should be clarified.
	Figure 8	Are the wells shown on this figure MOE wells or are they private / public wells obtained from the MOE PTTW database? The legend needs to be revised accordingly.
	Figure 11	All sub catchments and nodes in the Stantec VO2 model need to be included. The Coppins Corners catchment needs to be identified.
	Appendix B	The tables in this section are not natural environment tables; they refer to various species of animals found in the study area. The tables on Pages 5, 6 and 7 are incorrect and need to be revised.
	Appendix D	The revised tp's used in the Stantec model needs to be checked as per the Page 4.3 comment above.
	Appendix F	The revised tp's used in the Stantec model needs to be checked as per the Page 4.3 comment above.
	Appendix E	Refer to the comments regarding Page 4.11 above.

Stantec Consulting Ltd.
300 - 675 Cochrane Drive West Tower, Markham ON L3R 0B8

December 19, 2014
File: 1606 21777-29

Attention: Tom Hogenbirk, CMM, P. Eng.
120 Bayview Parkway,
Box 282
Newmarket, Ontario
L3Y 4X1

Dear Tom Hogenbirk,

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Report Dated December 19, 2014
LSRCA IMS No. PEAA417C2
Township of Uxbridge, Regional Municipality of Durham

We have updated the "*Stormwater Management Master Plan - Uxbridge Urban Area and Hamlet of Coppin's Corners, Township of Uxbridge, ON,*" report (CSWM-MP, attached)with respect to your response letter dated July 16 2014. Comments and **Stantec responses** are presented in the table following (note, each comment has been numbered for easy reference as Section or page numbers may have changed from the first Draft).

Table 1: Response to Comments

No.	Page(s):	Section(s):	Comments:
1	all	all	All figures need to reference the source (and date) of the data shown on the Figure. **Updated.**
2	all	all	As Coppin's Corners is part of Lake Simcoe's watershed as defined in the LSPP, this area needs to be addressed as part of this CSWMMP. **This area has been included in the CSWM-MP assessment. The existing and future development areas within Coppin's Corners will drain to the existing infiltration pond.**
3	i	2nd paragraph	The **MOE** released the Lake Simcoe Protection Plan (LSPP) in 2009 (not the LSRCA). **Corrected.**
4	iii	Area C	As Coppin's Corners is part of Lake Simcoe's watershed as defined in the LSPP, recommendations are required as part of this CSWMMP.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
Municipal Class EA Report Dated December 19, 2014
LSRCA IMS No. PEAA417C2
Township of Uxbridge, Regional Municipality of Durham

No.	Page(s):	Section(s):	Comments:
			See Comment 2 above.
5	1.1	1.1	The **MOE** released the Lake Simcoe Protection Plan – LSPP in 2009 (not the LSRCA). **Corrected.**
6	1.2	1.2	As Coppin's Corners is part of Lake Simcoe's watershed as defined in the LSPP, recommendations are required as part of this CSWMMP. **See Comment 2 above.**
7	1.4	1.4	Lake Simcoe Region Conservation Authority. The correct name of the LSRCA needs to be used in this section. **Corrected.**
8	3.15	3.1.2	Institutional, private open space and cemetery areas are not considered Natural Heritage features. This list should include Habitat for Endangered and Threatened Species, Wetlands, Woodlands, Valleylands, Wildlife Habitat, Areas of Natural and Scientific Interest, Fish Habitat, Linkages. **Updated.**
9	3.16	3.1.2	How do items c, d and e enhance Natural Heritage Systems? **A line has been added to the report in the Natural Heritage Section indicating the following:** **1. "Refer to the Natural Heritage System section of the Township of Uxbridge Official plan for information on how each of the items mentioned above enhance the natural heritage system."**
10	3.16	3.2	This entire section needs to be revised to reflect the current plan review process pertaining to Natural Heritage. The MNR has minimal involvement. LSRCA has signed an MOU with the Region of Durham to provide technical advice regarding Natural Heritage as part of the plan review process. **Corrected.**
11	3.16	3.2.1	The LSRCA has ESA's identified for the study area.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
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No.	Page(s):	Section(s):	Comments:
			Noted.
12	3.16	3.2.2 2nd Paragraph	This section needs to be revised to provide more clarity. What is the term "recognized natural areas"? **Removed: Not relevant to SWM covered under OP designations and consultation with Region TWP LSRCA**
13	3.17	3.2.3	The MNR identifies wetlands; it is the LSRCA that deals with proposals to construct within the 120 setback area through Regulation 179/06 and through our MOU with the Region under the Planning Act. **Removed.**
14	3.17	3.2.4	This section should mention the Federal *Migratory Birds Convention Act* and explain its applicability / purpose. **Added. Now Section 3.2.3**
15	3.18	3.2.6	The wording in this section needs to be clarified. The **UUSA** does not have records for sensitive species. Perhaps "The MNR has indicated that there are sensitive species and SAR in the UUSA"? **Updated.**
16	3.18	3.3	Reference should be made to Section 38 of the Fisheries Act. **Added.**
17	3.19	3.3.1	LSRCA has required Enhanced (Level 1) protection for the entire Lake Simcoe watershed since 1995. **Noted.**
18	3.19	3.3.2	Reference needs to be made to the water quality conditions in Uxbridge Brook. **Additional discussions regarding water quality at the Uxbridge Station have been added.**
19	3.27	3.6	Reference should be made to Elgin and Electric Light Ponds, both in terms of location, history and present conditions. These ponds should be shown on the appropriate plan. **See Section 3.6.1 of the report. Refer to Figure ERSN-1 for location**.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Report Dated December 19, 2014 LSRCA IMS No. PEAA417C2 Township of Uxbridge, Regional Municipality of Durham

No.	Page(s):	Section(s):	Comments:
20	3.27	3.6	There is an error in the second last sentence. "The Township" should read "Uxbridge". **Corrected.**
21	3.28	3.7.1	The 22 ponds should be listed in a table and shown on an appropriate figure. **Reference added to refer reader to Figure SWMF-1.**
22	3.29	3.7.3	The location of the WPCP should be shown on one of the figures. **The location of the WPCP is now shown on Figure 1.**
23	4.1	4.2	Land use information on Coppin's Corners needs to be provided and shown on the appropriate figure(s). **Refer to Figures OP-A and OP-F.**
24	4.1	4.2	Is Attachment 1 the same as Schedule A? This needs to be clarified. **Schedule A has now been included as a Figure OP-A**
25	4.2	Schedule A	This needs to be labelled as a Figure. A similar figure is needed for Coppins Corners. **Refer to Figure OP-A and Figure OP-F. for Schedule A (Uxbridge Urban Area) and Schedule F (Coppin's Corners)**
26	4.3	4.3	The 2009 MMM model represents a calibrated VO2 model. One of the key calibrate components is tp (time to peak). In order to calibrate the flows, the Williams (1977) tp was calculated for each catchment (NASHYD) and then multiplied by 3.5. This revised tp was then utilized. A similar approach is needed for any revisions / update of this model. **The time to peak for all NASHYDs (including the two new NASHYDs) have been revised based on the updated area. The initial time to peak was calculated using the Williams 2-paramter formula which was then multiplied by a time to peak multiplier to obtain a calibrated time to peak. The calibrated time to peak was used in the model.**
27	4.4	4.3.3	A specific comparison is required between the total rainfall amounts in the LSRCA (MMM) model versus the model developed by Stantec.

**Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
Municipal Class EA Report Dated December 19, 2014
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No.	Page(s):	Section(s):	Comments:
			A comparison table, Table 3, has been added which shows the total rainfall depth for the 2009 LSRCA model and the updated existing conditions model.
28	4.4	Table 3	Additional nodes should be shown on this table and the locations shown on an appropriate figure. **As requested, additional flow nodes have been added to Table 4 (previously named Table 3). The flow nodes are shown on Figure 11.**
29	4.5	4.4.2.2	The acronym is **LSEMS**. **Corrected.**
30	4.8	4.4.2.2.2	The value of 1453.9 kg/yr. is not a recommend value; it is the post development load with recommended BMP's. **Noted, corrected in Table 4.**
31	4.8	Table 5	The subwatershed areas listed of A, B etc. need to be shown on the appropriate figure. **This is shown on Figure TSH-1**
32	4.9	4.4.2.2.2.1	LSRCA Retrofit, second paragraph: The 1.32 and 1.82 values listed should be labeled as 1.32 **kg**. and 1.82 **kg**. The last sentence in this paragraph should be removed. **Corrected.**
33	4.11	4.4.4	The 2010 Berger Phosphorous loadings for new development assume that BMP's are already in place. For example, the after BMP urban load of 0.206 kg/ha/yr represents an assumed P removal rate of 84% for 1.32 kg/ha/yr. In order to be consistent with the original work done by TSH in 2000, the uncontrolled P loads of 1.32 kg/ha/yr and 1.82 kg/ha/yr need to be utilized as part of the Stantec study with suitable BMP reduction factors applied depending on the type of BMP used. **Phosphorus loading calculations have been updated to reflect these loading rates within this section and in Appendix E**
34	4.12-4.14	4.4.3 – 4.4.7	The various tables in this section need to be revised based on the above comment.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Report Dated December 19, 2014 LSRCA IMS No. PEAA417C2 Township of Uxbridge, Regional Municipality of Durham

No.	Page(s):	Section(s):	Comments:
			The tables have been revised as per the recommendation noted above.
35	4.12-4.14	Tables 7-9	These tables need to clearly identify which areas are being referred to, i.e. these are the total yearly P loads for which areas? **The tables now clearly identify the areas for the yearly phosphorus loading.**
36	4.12-4.14	4.4.3 – 4.4.7	Coppins Corners needs to be addressed in these Sections. **Coppin's corners is addressed in Section 4.4.4.**
37	4.15	4.5	Figure 1 needs to id the sub areas in the legend. **Figure 1 identifies the sub areas in the legend.**
38	4.15	4.5	An important technical guideline that needs to be referenced and complied with is the "Hydrogeological Assessment Submissions: Conservation Authority Guidelines to Support Development Applications – June 2013". This document can be found at http://cloca.ca/devreview/HydroAssessmentGuidelines-20130610-FINAL2.pdf **Reference to these guidelines has been added to the Section as being a requirement for future development applications in the Study Area.**
39	4.17	4.5	Data from 1991 is somewhat outdated. More current data should be used for the water balance and the calculation of the 76% rainfall. For example, LSRCA has calculated the 90% storm to be 23.3 mm based on data from 9 EC stations based on 10 years of recent precipitation data. Lance Aspden of our office can be contacted for more information on this recent work. **The data results have been updated to reflect the average 66th percentile, events up to and including the 13 mm events correspond to 66% average annual precipitation volume.**
40	5.1	5.0	A specific section is required on creek erosion in the study area. Step 5 of the CSWMMP Guidelines requires that an erosion study be done for existing and future conditions. Are there currently erosion issues in the study area? Are these expected to worsen under future conditions? Are there specific controls required for the catchments to address these issues?

**Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
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No.	Page(s):	Section(s):	Comments:
			See Section 5.3 of the report.
41	5.4 & 5.5	Tables 13, 14 & 15	Where are these flow nodes or Catchments? A figure is required showing all flow nodes and catchments and the text updated to refer to this figure in the appropriate sections. **All flow nodes and catchments are now shown on Figure 11. The text has been updated to refer to this figure.**
42	5.4	Table 13	Additional nodes need to be shown on this table for a better understanding of the impacts on climate change in various parts of the study area. **Additional flow nodes have been added to Table 14 (formerly Table 13). Flow node locations are shown on Figure 11**
43	5.5	5.2	It is agreed that a new rain gauge should be installed in Uxbridge; a suggested location is the WPCP. For a good summary of adjacent Environment Canada Gauges, please refer to the following link: http://www1.toronto.ca/city_of_toronto/environment_and_energy/key_priorities/files/pdf/tfwcds-chapter1.pdf **The end of Section 5.2 has been updated.**
44	6.1	6.1	A list of all 22 ponds should be provided along with a plan showing their locations. **Refer to Comment 21.**
45	6.3	Table 16	Reference is to be made to the appropriate figure showing the pond locations. **Updated, refer to Figure 2.**
46	7.3-7.4	7.3.1	The section of Regulation 179/06 that is quoted in this section is incomplete. It is recommended that the regulation be summarized rather than directly quoted. **Summary added.**
47	7.6	Table 17	The reference to the Lake Ontario waterfront needs to be removed. In

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
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No.	Page(s):	Section(s):	Comments:
			the LSRCA section, refer to Regulation 179/06. **Updated.**
48	7.7	7.4	The cost per m^3 for sediment removal can be substantially more if the material is contaminated. **Noted. See also Section 7.7.**
49	7.10	7.5.2.1	Last sentence: LSRCA's regulation is **179/06.** **Corrected in Section 7.5.2.1 (i).**
50	7.14	Table 18	The recommended month for cleanout is September wherever possible. Reference should be made to the Federal Migratory Bird Act - Breeding Bird season. Refer to: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=8D910CAC-1 for more details. **Updated in Section 7.7.1.1**
51	9.1-9.5	9.0	All nodes and catchments need to be shown on the appropriate figure and referenced in this section. **All nodes and catchments are shown on Figure 11.**
52	9.1-9.5	9.0	This section needs to also include alternative solutions pertaining to water balance, phosphorous and erosion control. **Material added.**
53	9.3	Table 20	Has the 40 mm extended detention requirement been included in this flow assessment? **The 40 mm extended detention has not been included in this flow assessment as that element was not available for all the ponds. Similar to the 2009 modeling approach, the Route Reservoirs in the model were included to ensure post developed peak flows were equivalent to pre-development levels.**
54	9.4	9.4	The MNR is not involved with review of development within ESA's or within wetland zone of influences. The LSRCA reviews under our MOU with the Region of Durham and under Regulation 179/06.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
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No.	Page(s):	Section(s):	Comments:
			Corrected.
55	9.4	9.4	SWM wet ponds and on-line ponds can have significant impacts on the thermal regime of a coldwater system. Thermal impacts are a significant issue in some parts of the Uxbridge Brook. **Added to the technical criteria in Table 21. Mitigation techniques are described further in section 12.1.3.**
56	10.1-10.2	10.1	Specific and detailed recommendations are to be provided for each of Areas A, B, C and the Uxbridge Urban Area pertaining to water balance, phosphorous, peak control and erosion control.
57		Figure 1	The legend needs to identify what A, B and C means. Also, the lines for Protected Countryside and the CA Boundary that appear in the legend cannot be found on the plan. **The legend now includes A, B and C. They are future residential areas A and B and a future commercial area C. The Protected Countryside and CA boundary are indicated by a black dashed line and a green hatched line.**
58		Figure 2	All SWM ponds need to be shown and numbered. **All SWM ponds are shown and numbered. Figure SWMF-1 shows all SWM ponds including those outside of the Uxbridge Urban Boundary.**
59		Figure 3	The legend refers to a "Hamlet Institutional ….. Area" that does not show up on the plan. **The area (Area C) is indicated on the plan in fuchsia (pink) and on Figure OP-F, from the Township's Official Plan.**
60		Figure 4	If the SWM ponds are to be shown on this figure, they should be numbered in accordance with the Town's pond identification system. **The SWM pond numbers shown were developed as part of the SWM Facility Assessment completed in 2012. For consistency, this numbering system has been used in this report.**
61		Figure 5	All 22 SWM ponds should be shown and numbered. **All 22 SWM ponds are identified in SWMF-1.**
62		Figure 6	The difference between this figure and Figure 7 should be clarified.

**Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner
Municipal Class EA Report Dated December 19, 2014
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No.	Page(s):	Section(s):	Comments:
			Refer to descriptions on pages 3.25 and 3.26.
63		Figure 8	Are the wells shown on this figure MOE wells or are they private / public wells obtained from the MOE PTTW database? The legend needs to be revised accordingly. **Figure edited to address.**
64		Figure 11	All sub catchments and nodes in the Stantec VO2 model need to be included. The Coppins Corners catchment needs to be identified. **Figure 11 shows the Uxbridge Study Area, subwatershed boundaries and flow nodes. It also identifies areas draining to ponds and uncontrolled areas within the Study Area.**
65		Appendix B	The tables in this section are not natural environment tables; they refer to various species of animals found in the study area. The tables on Pages 5, 6 and 7 are incorrect and need to be revised. **The tables have been revised in Appendix B and the title has been renamed to 'Wildlife Records in the Study Area'.**
66		Appendix D	The revised tp's used in the Stantec model needs to be checked as per the Page 4.3 comment above. **Time to peaks have been updated accordingly. Please refer to the response to comment 26 for more information.**
67		Appendix F	The revised tp's used in the Stantec model needs to be checked as per the Page 4.3 comment above. **Time to peaks have been updated accordingly. Please refer to the response to comment 26 for more information.**
68		Appendix E	Refer to the comments regarding Page 4.11 above.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Report Dated December 19, 2014 LSRCA IMS No. PEAA417C2 Township of Uxbridge, Regional Municipality of Durham

We trust that the above information is satisfactory. If you have any questions or concerns please contact the undersigned.

Regards,

STANTEC CONSULTING LTD.

Roy Johnson, B.Eng., M.A.Sc.,P.Eng.
Senior Water Resources Engineer
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Attachment: Updated CSWM-MP

c. Ben Kester, Township of Uxbridge (via FTP)
Tom Fowle, Watershed Committee, Township of Uxbridge (via FTP)
Dave Fumerton, MOE York-Durham District Office (via FTP)

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Lake Simcoe Region
conservation authority

A Watershed for Life

Sent by Email: Roy.Johnson2@stantec.com

IMS No. PEAA417C4

February 9, 2015

Mr. Roy Johnson, P.Eng.
Senior Water Resources Engineer
Stantec Consulting Ltd.
300-675 Cochrane Drive
Markham, ON L3R 0B8

Dear Mr. Johnson:

Re: Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corner
Municipal Class EA
Report Dated December 19th, 2014
Township of Uxbridge, Regional Municipality of Durham

We have completed our review of the above noted second submission which we received on January 6, 2015. In order to provide clear and concise comments for the study, a table of comments has been created and attached to this letter.

Please contact the undersigned if you have any questions regarding these comments. Please refer to the above noted IMS number in any future correspondence.

Yours truly,

Tom Hogenbirk, CMM, P.Eng.
Manager, Engineering and Technical Services

TH/ph

c. Ben Kester, Township of Uxbridge (email only)

S:\Planning and Development Services\Engineering and Technical Services\General Correspondence\UXB CSWMMP Comments 2.docx

Page(s):	Section(s):	Comments:
3.16	3.2.5	There is a Word error message in this section.
3.17	3.3.1	The final sentence in this section is redundant as it is already stated in Section 3.3 above.
4.13 – 4.15	Tables 10 - 12	The format of these tables should be adjusted such that a specific table is not split between two pages.
4.13	Table 9	The term "after treatment" should be removed from the final column.
4.13	Table 10	- 1st row: "S" should read "SWM". - 2nd row: "569.84" should read "559.84" (520.37 + 39.47) - Rows 2 and 3 need more clarification i.e. what exactly is being treated to achieve the loads of 236 kg and 224 kg? - Row 4, first column: This sentence is incorrect. The 127 kg loading would indicate significant SWM treatment.
4.14	Table 11	Row 5: This row has the same loading as the row above (8 kg) but the 1st column indicates no SWM measures.
4.14	Table 11a?	Table 10 adds future loadings from Areas A/B and the Uxbridge Urban Area. As such, a Table needs to be added in this section for the Uxbridge Urban Area only to clearly indicate what the totals in Table 10 are comprised of. For example, the future condition total load of 236 kg would appear to consist of a load of 22 kg from A/B and a load of 214 kg from the Uxbridge Urban Area. The new table would clarify this.
4.14	Table 12	The value of 569.84 kg would appear to be incorrect.
4.15	Table 12	All assumed removal rates should be summarized after this table i.e. 63% wet pond, 79.5% LID and 90% LID plus wet pond.
4.15	4.4.6	More details are required regarding implementation of LID's in the Urban Area and Areas A/B. What roads or existing properties in the existing urban area are suitable candidates for LID's? Are there proposed road reconstructions or other municipal projects where LID's would be utilized? Similarly in new development areas A/B, what are the likely LID measures and is there a typical road cross section that would facilitate LID usage.
4.18	4.5	Second last paragraph: It must be stated that the 13 mm is based on the watershed average infiltration rate. It would be better to state that this is the minimum target infiltration amount as in some areas; greater infiltration amounts can be achieved. It should be noted that the LSRCA is currently developing updated SWM policies / guidelines that will target the capture and retention on site of 25 mm of runoff from the new and/or fully reconstructed impervious surfaces (90 percentile storm).
7.3	7.3	The last sentence needs to be revised, for example "Further details on O.Reg. 179/06 can be found at: http://www.e-laws.gov.on.ca/navigation?file=home
10.1	10.1	The general requirements for all new developments (Section 12.1.4) should be listed in the first paragraph of Section 10.0

Page(s):	Section(s):	Comments:
10.1.1	10.2	Last sentence: The MOECC has revised their approach to allowing infiltration as a SWM treatment measure in certain soils (**INTERPRETATION BULLETIN ONTARIO MINISTRY OF ENVIROMENT AND CLIMATE CHANGE EXPECTATIONS RE: STORMWATER MANAGEMENT February 2015**). This (in part) states: *"If the lot level and conveyance facilities can be sized such that they empty between events, or will be installed in areas where quantity control is not a primary concern (areas draining directly to a large surface water body like Lake Ontario, for example), LID facilities can be used where the infiltration rate is less than 15 mm/hr to achieve water balance and water quality (including thermal impacts) through retention, filtration, evaporation and transpiration. Thus, the soil infiltration capacity guidance in the manual should not be interpreted as a prohibition. Rather, it should be interpreted as a caution that controls relying primarily on infiltration may not be as effective on soils with low infiltration rates as they would be on soils with higher rates of infiltration".*
10.2	10.1	A table is to be provided for each of the areas in order to provide a summary of the requirements for water quality (LID and standard SWM controls), water quantity, water balance, erosion control and thermal impact control as per the main body of the text.
10.3	10.1.4	Due to the potential for thermal impairments to Uxbridge Brook, traditional SWM wet ponds are not the preferred approach in this area. Any retrofits proposed should incorporate significant thermal reduction measures. As noted below, bottom draws have been found to have environmental issues under certain conditions and are not a good thermal control measure.
12.3	12.1.3	Bottom draws can cause environmental issues under certain conditions. Please refer to Section 4.2 of **"Stormwater Pond Maintenance and Anoxic Conditions Investigation FINAL REPORT"** http://www.lsrca.on.ca/pdf/reports/stormwater_maintenance.pdf
12.5	12.1.4	Second bullet point: It should be noted that the 13 mm is an average amount and in many locations, additional infiltration volumes can be achievable.
12.6	12.3	It is to be noted in this Section that the LSRCA Phosphorus Offsetting Program has not yet been approved by the Province.

Stantec Consulting Ltd.
300W-675 Cochrane Drive, Markham ON L3R 0B8

June 18, 2015
File: 160621777

Attention: Tom Hogenbirk
120 Bayview Parkway, Box 282
Newmarket, Ontario
L3Y 4X1

Dear Mr Hogenbirk,

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Township of Uxbridge, Regional Municipality of Durham IMS No. PEAA417C4

We have completed our review of your comments and have provided responses indicated in the table below.

Page(s):	Section(s):	Comments:	Stantec Response:
3.16	3.2.5	There is a Word error message in this section.	Corrected
3.17	3.3.1	The final sentence in this section is redundant as it is already stated in Section 3.3 above.	Corrected/removed
4.13 – 4.15	Tables 10 - 12	The format of these tables should be adjusted such that a specific table is not split between two pages.	Corrected
4.13	Table 9	The term "after treatment" should be removed from the final column.	Corrected

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Township of Uxbridge, Regional Municipality of Durham IMS No. PEAA417C4

4.13	Table 10	- 1st row: "S" should read "SWM". - 2nd row: "569.84" should read "559.84" (520.37 + 39.47) - Rows 2 and 3 need more clarification i.e. what exactly is being treated to achieve the loads of 236 kg and 224 kg? - Row 4, first column: This sentence is incorrect. The 127 kg loading would indicate significant SWM treatment.	Corrected and calculations have been clarified.
4.14	Table 11	Row 5: This row has the same loading as the row above (8 kg) but the 1st column indicates no SWM measures.	Corrected
4.14	Table 11a?	Table 10 adds future loadings from Areas A/B and the Uxbridge Urban Area. As such, a Table needs to be added in this section for the Uxbridge Urban Area only to clearly indicate what the totals in Table 10 are comprised of. For example, the future condition total load of 236 kg would appear to consist of a load of 22 kg from A/B and a load of 214 kg from the Uxbridge Urban Area. The new table would clarify this.	A table has been added, see Table 11.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Township of Uxbridge, Regional Municipality of Durham IMS No. PEAA417C4

4.14	Table 12	The value of 569.84 kg would appear to be incorrect.	Corrected.
4.15	Table 12	All assumed removal rates should be summarized after this table i.e. 63% wet pond, 79.5% LID and 90% LID plus wet pond.	Corrected.
4.15	4.4.6	More details are required regarding implementation of LID's in the Urban Area and Areas A/B. What roads or existing properties in the existing urban area are suitable candidates for LID's? Are there proposed road reconstructions or other municipal projects where LID's would be utilized? Similarly in new development areas A/B, what are the likely LID measures and is there a typical road cross section that would facilitate LID usage.	The Township is not yet in a position to analyze their 10 year forecast to be able to determine which projects may be retrofit priorities; these projects will come forward as the budget is approved on an annual basis. Therefore, site specific recommendations are at the Area A/B/C level.

4.18	4.5	Second last paragraph: It must be stated that the 13 mm is based on the watershed average infiltration rate. It would be better to state that this is the minimum target infiltration amount as in some areas; greater infiltration amounts can be achieved. It should be noted that the LSRCA is currently developing updated SWM policies / guidelines that will target the capture and retention on site of 25 mm of runoff from the new and/or fully reconstructed impervious surfaces (90 percentile storm).	Added.
7.3	7.3	The last sentence needs to be revised, for example "Further details on O.Reg. 179/06 can be found at: http://www.e-laws.gov.on.ca/navigation?file=home	Corrected
10.1	10.1	The general requirements for all new developments (Section 12.1.4) should be listed in the first paragraph of Section 10.0	Corrected

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Township of Uxbridge, Regional Municipality of Durham IMS No. PEAA417C4

10.1.1	10.2	Last sentence: The MOECC has revised their approach to allowing infiltration as a SWM treatment measure in certain soils (INTERPRETATION BULLETIN ONTARIO MINISTRY OF ENVIROMENT AND CLIMATE CHANGE EXPECTATIONS RE: STORMWATER MANAGEMENT February 2015). This (in part) states: "If the lot level and conveyance facilities can be sized such that they empty between events, or will be installed in areas where quantity control is not a primary concern (areas draining directly to a large surface water body like Lake Ontario, for example), LID facilities can be used where the infiltration rate is less than 15 mm/hr to achieve water balance and water quality (including thermal impacts) through retention, filtration, evaporation and transpiration. Thus, the soil infiltration capacity guidance in the manual should not be interpreted as a prohibition. Rather, it should be interpreted as a caution that controls relying primarily on infiltration may not be as effective on soils with low infiltration rates as they would be on soils with higher rates of infiltration".	Added.

Reference: **Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Township of Uxbridge, Regional Municipality of Durham**
IMS No. PEAA417C4

10.2	10.1	A table is to be provided for each of the areas in order to provide a summary of the requirements for water quality (LID and standard SWM controls), water quantity, water balance, erosion control and thermal impact control as per the main body of the text.	A table has been provided, see Table 27.
10.3	10.1.4	Due to the potential for thermal impairments to Uxbridge Brook, traditional SWM wet ponds are not the preferred approach in this area. Any retrofits proposed should incorporate significant thermal reduction measures. As noted below, bottom draws have been found to have environmental issues under certain conditions and are not a good thermal control measure.	Added to section 10.1.4.
12.3	12.1.3	Bottom draws can cause environmental issues under certain conditions. Please refer to Section 4.2 of "Stormwater Pond Maintenance and Anoxic Conditions Investigation FINAL REPORT" http://www.lsrca.on.ca/pdf/reports/stormwater_maintenance.pdf	Updated Section.

Reference: Stormwater Management Master Plan Uxbridge Urban Area and Hamlet of Coppin's Corner Municipal Class EA Township of Uxbridge, Regional Municipality of Durham IMS No. PEAA417C4

12.5	12.1.4	Second bullet point: It should be noted that the 13 mm is an average amount and in many locations, additional infiltration volumes can be achievable.	Corrected.
12.6	12.3	It is to be noted in this Section that the LSRCA Phosphorus Offsetting Program has not yet been approved by the Province.	Corrected.

Please contact the undersigned if you require any clarification.

Regards,

STANTEC CONSULTING LTD.

Roy Johnson
Senior Water Resources Engineer
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Attachment:

c. Ben Kester (Township of Uxbridge)

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Lake Simcoe Region
conservation authority

A Watershed for Life

Sent by Email Only: bkester@town.uxbridge.on.ca

July 6, 2015

IMS No: PEAA417C5

Mr. Ben Kester
Director of Public Works and Operations
Township of Uxbridge
51 Toronto St South
Uxbridge, ON
L9P 1T1

Dear Mr. Kester:

Re: Stormwater Management Master Plan
Uxbridge Urban Area and Hamlet of Coppin's Corners
Municipal Class EA
Report Dated June 18th, 2015
Township of Uxbridge, Regional Municipality of Durham

We have completed our review of the above noted submission which we received on June 19th, 2015.

Please be advised that the above noted SWM Master Plan generally meets the technical requirements of the Comprehensive Stormwater Management Master Plan Guidelines (April 26, 2012) and as such is acceptable.

Please contact the undersigned if you have any questions regarding this letter. Please refer to the above noted IMS number in any future correspondence.

Yours truly,

Tom Hogenbirk, CMM, P.Eng.
Manager, Engineering and Technical Services

TH/cn

c. Roy Johnson, Stantec (Roy.Johnson2@stantec.com)

Appendix M MINISTRY OF ENVIRONMENT CORRESPONDENCE

Stantec Consulting Ltd.
300 - 675 Cochrane Drive West Tower
Markham ON L3R 0B8
Tel: (905) 944-7777
Fax: (905) 474-9889

February 10, 2014
File: 1606 21777

Attention: Robin Skeates
Senior Program Advisor
Ministry of the Environment
Barrie District Office
Place Nouveau, 8th Floor – 5775 Yonge Street
Toronto, ON M2M 4J1

Dear Robin Skeates,

Reference: Status of Stormwater Management Plan – Uxbridge Urban Area and Hamlet of Coppin's Corners – Township of Uxbridge, ON

Stantec Consulting Ltd. has undertaken to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management (SWM) Master Plan for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWM Master Plan shall be prepared in accordance with the *Comprehensive SWM Master Plan Guidelines*, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the *Municipal Class Environmental Assessment Guideline*, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011).

Described below is the current status of the development of the above noted study.

Stantec Consulting Ltd. has completed, or substantially completed, the following steps of the LSRCA's , *Comprehensive Stormwater Management Master Plan Guidelines*, dated April 26, 2011:

1. Scoping: Identified development areas from Official Plan;

2. Determination of Study Area: Identified existing and future development areas;

3. Develop a Characterization of the Study Area: Substantially complete input from terrestrial and aquatic biologists, hydrogeologists, archeologists, etc. in conjunction with GIS data for the area;

4. Divide Study Area into Management Units;

5. Evaluate Cumulative Environmental impact of Stormwater from Existing and Planned Development: A lumped hydrologic model for the area, as well as hydraulic modeling for the various watercourses within the study area were obtained from the LSRCA and has been evaluated for application to the study. As the hydrology model was a high level lumped model, work is progressing on the digitization of drainage areas obtained from a variety of SWM reports provided by LSRCA, in conjunction with GIS data on storm sewers and topographic information, to develop a means of characterizing controlled and uncontrolled areas of existing and future development;

Reference: Status of Stormwater Management Plan – Uxbridge Urban Area and Hamlet of Coppin's Corners – Township of Uxbridge, ON

6. Determine Effectiveness of Existing Stormwater Management Systems: Once a lumped hydrologic model representing the ponds is completed, climate change scenarios will be simulated;

7. Identify and Evaluate Stormwater Improvement and Retrofit Opportunities: Past SWM recommendations from planning policy have been reviewed to ensure continued relevance with current SWM practices and the findings of this study. Alternatives will be evaluated against each other regarding technical effectiveness, construction feasibility, natural environmental, social/cultural environment, and cost. A number of retrofit studies have been previously completed and these are summarized in the draft report.

8. Develop an Implementation Plan for the Recommended Approaches: Previous studies have evaluated how their recommended SWM measures, policies, and operation/maintenance strategies are to be implemented with consideration for responsible party, schedule, and funding mechanisms. Stantec will consolidate these as required in conjunction with new findings/recommendation from this study.

9. Develop an Implementation Plan for the Recommended Approaches: To be completed. Stantec will outline how the recommended SWM measures, policies, and operation/maintenance strategies are to be implemented with consideration for responsible party, schedule, and funding mechanisms.

10. Develop Programs for Inspection and Maintenance of Stormwater Management Facilities: To be completed. Stantec will prepare an inspection and maintenance program for the recommended SWM works as part of this study. The plan will provide for annual reporting with a sufficient level of detail to determine if the implemented SWM recommendations are operating in a manner consistent with the intended design.

It is anticipated that Steps 1-10 will be completed by the end of March, 2014.

To satisfy the Municipal Class EA process, an Open House will be arranged. The materials at the open house will describe the Class EA process being followed, the problem being addressed, identification and evaluation of the alternative solutions and design concepts, the recommended alternative solution, the potential environmental effects associated with the preferred solution, and next steps. It is assumed that the open house could be held at a Town sponsored location at an appropriate time when draft results have been developed. Estimated completion, April, 2014.

A draft of the open house materials will be provided to the Town for review and comment prior to finalization and issuance. It is assumed the Town will arrange for notice placement in the local paper(s). We will be responsible for costs associated with the open house materials.

Stantec will incorporate the information provided by stakeholders and confirm the preferred alternative solution. Estimated completion, May, 2014.

Stantec will prepare the Project File for the proposed SWM Master Plan that documents each step of the Class EA process undertaken and the results in a traceable, easily understood manner, and meets all MEA

Reference: Status of Stormwater Management Plan – Uxbridge Urban Area and Hamlet of Coppin's Corners – Township of Uxbridge, ON

Class EA requirements. We will provide the Town and LSRCA with one copy of the Project File for review. Upon receipt of the Town and LSRCA comments, we will finalize the document and provide two hard copies and a digital copy to the Town to place in a public forum for review. Estimated completion, June, 2014.

Stantec will place the Project File in a public forum (i.e. Municipal Clerk's Office, library, etc.) for the required 30 day review period.

Stantec will prepare a "Notice of Completion" in the form of a letter and a newspaper advertisement, which advises stakeholders where the Project File may be reviewed and the manner in which comment is to be received. The notice will also advise stakeholders and review agencies of their rights with regard to requesting a Part II Order under the EA Act. A draft of the notice will be provided to the Town for review prior to finalization and issuance.

If you have any questions or concerns, please contact the undersigned.

Regards,

STANTEC CONSULTING LTD.

Roy Johnson, B. Eng., M. A. Sc., P. Eng.
Senior Water Resources Engineer
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Attachment: Attachment

c. Ben Kester, Township of Uxbridge
Tom Fowle, Watershed Committee, Township of Uxbridge
Dave Fumerton, MOE York-Durham District Office

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From: Johnson, Roy (Markham) [mailto:Roy.Johnson2@stantec.com]
Sent: May-06-16 9:18 AM
To: Liu, Chunmei (MOECC)
Cc: bkester@town.uxbridge.on.ca; Shulyarenko, Alexander (MOECC); Tom Hogenbirk; Ng, Timothy
Subject: RE: Township of Uxbridge Stormwater Management Master Plan

Hi

We are submitting the attached letter to finalize approval for the SWMMP so that copies of the final report can be provided to the Township and Lake Simcoe Region Conservation Authority (LSRCA), rather than update, compile, and submit a report at this time.

Once MOECC approves the materials attached, we will update and issue a final report for all parties.

We have reviewed MOECC comments and offer the attached response. MOECC comments have been numbered for convenience; Stantec responses are in bold. Also attached are the revised sections of the SWMMP Report for your reference.

Regards;
Roy Johnson, B. Eng., M. A. Sc., P. Eng.
Senior Water Resources Engineer
Stantec
300W-675 Cochrane Drive Markham ON L3R 0B8
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Stantec

From: Shulyarenko, Alexander (MOECC) [mailto:Alexander.Shulyarenko@ontario.ca]
Sent: Thursday, October 22, 2015 2:55 PM
To: Johnson, Roy (Markham)
Cc: bkester@town.uxbridge.on.ca; Liu, Chunmei (MOECC); Belayneh, Ted (MOECC); Zhang, Helen (MOECC)
Subject: Township of Uxbridge Stormwater Management Master Plan

Hello Roy,

I have completed a surface water review of the Stormwater Management Master Plan – Uxbridge Urban Area and Hamlet of Coppin's Corners, Township of Uxbridge, Ontario, prepared by Stantec Consulting Ltd.

Please find attached memo for your attention. While in general it is very well prepared report, I have commented on several issues that need to be addressed.

If you have any further questions, please contact me by phone or e-mail at your convenience.

Best regards,

Alexander Shulyarenko, Ph.D.
Surface Water Specialist
Technical Support Section, Water Resources Unit
Central Region, Ontario Ministry of the Environment and Climate Change
5775 Yonge St., 8th Floor, North York, ON M2M 4J1

E-mail: alexander.shulyarenko@ontario.ca
Phone: (416) 326-9771

Stantec Consulting Ltd.
300W-675 Cochrane Drive, Markham ON L3R 0B8

May 6, 2016
File: 1606 21777-SWMMP

Attention: Chunmei Liu
Environmental Resource Planner/EA Coordinator
Ministry of the Environment and Climate Change
Central Region Office – Technical Support
5775 Yonge Street
8th Floor
North York, ON M2M 4J1

Dear Chunmei Liu,

Reference: Stormwater Management Master Plan (SWMMP) – Uxbridge Urban Area and Hamlet of Coppin's Corners – June 18, 2015
Response to MOECC Comments of October 22, 2015
Township of Uxbridge, ON

We are submitting the following letter to finalize approval for the SWMMP so that copies of the final report can be provided to the Township and Lake Simcoe Region Conservation Authority (LSRCA), rather than update, compile, and submit a report at this time. Once MOECC approves the materials attached, we will update and issue a final report for all parties.

We have reviewed MOECC comments noted above and offer the following response. MOECC comments have been numbered for convenience; Stantec responses are in **bold**. Also attached are the revised sections of the SWMMP Report for your reference.

1. The previous Stormwater Management Plan for the Uxbridge Urban Area developed by TSH Associates in 2000, which could provide basis for the development of the current SWMMP, is not mentioned in Section 1.0 (Introduction) and not referenced in Section 13.0 (References). Some information from the TSH report can be found only in Section 4.4.2 – background information on phosphorus loading. It is unclear whether the TSH recommendations were implemented over the last 14 years and whether they were taken into consideration by Stantec Consulting during the SWMMP development.

   The SWMMP provides essential framework for future stormwater management in the Uxbridge Urban Area but does not mention or refer to the earlier Township's commitment to decrease phosphorus loading from urban areas by 122.4 kg/yr as a result of stormwater retrofit measures according to the requirements in the MOE Certificate of Approval #3-0952-97-987 for the Uxbridge Brook WPCP upgrade from 2004. One of the objectives of the study should refer to that Certificate of Approval.

Reference: Stormwater Management Master Plan (SWMMP) – Uxbridge Urban Area and Hamlet of Coppin's Corners – June 18, 2015
Response to MOECC Comments of October 22, 2015
Township of Uxbridge, ON

Alexander Shulyarenko has changed his comment to the following on December 8 2015 (refer to Email Correspondence Attached):

"The SWMMP provides essential framework for the future stormwater management in the Uxbridge Urban Area but does not mention or refer to the earlier Township's commitment to decrease phosphorus loading from urban areas by 122.4 kg/yr as a result of stormwater retrofit measures according to the requirements established during the approval process for the Uxbridge Brook WPCP upgrade in the early 2000s. One of the objectives of the study should refer to that commitment."

While in the 2012 report to the MOE the Township asserted that the total net reduction from 2000 levels in phosphorus loading to Uxbridge Brook was 107.84 kg/yr or 88% of the original target of 122.4 kg/yr, I have reasons to believe that the previous stormwater treatment phosphorus removal calculations overestimated achieved TP loading reduction from the urban area of interest. While it is obvious that phosphorus loadings from the Uxbridge Urban Area were also overestimated by TSH in 2000, it is necessary to adjust the earlier Township's calculations and establish the clear TP reduction target in the SWMMP taking into consideration the previous Township's commitment as well as more stringent objectives for TP loadings in the Lake Simcoe Protection Plan.

The TSH report is mentioned in section 1.4 previous studies and is referenced in Section 13.0 (References). An excerpt of this is attached. The Uxbridge Urban Area Stormwater Management Study, Report to MOECC in concludes that the Township of Uxbridge had achieved 100% of the original target of 122.4 kg/year set by the TSH report. This is summarized in Section 4.4.2.2.4 attached.

We have added information on the *Uxbridge Brook Water Pollution Control Plant Annual Performance Report 2014*, to the report Section 4.4.2.2.3. That section details the total phosphorus removal performance for 2014 from the water pollution control plant. The average total phosphorus removal was within ECA limits (0.15 mg/l) and ECA objectives (0.10 mg/l), with an average total phosphorus concentration of 0.06 mg/l. An excerpt of section 4.4.2.2.3 from the report is attached:

We have received the *Uxbridge Urban Area Stormwater Management Study, Report to MOE* (prepared by AECOM dated February 11, 2016), which identifies all measures taken to the date of the report that reduce phosphorus loading within Uxbridge Brook. The report summarized phosphorus removal targets under plans of subdivision, Site Plans, retrofitting of existing SWM Ponds and Elgin Pond Rehabilitation. The report concludes that the

Reference: Stormwater Management Master Plan (SWMMP) – Uxbridge Urban Area and Hamlet of Coppin's Corners – June 18, 2015
Response to MOECC Comments of October 22, 2015
Township of Uxbridge, ON

Township of Uxbridge has achieved 100% of the original target of 122.4 kg/yr. This text has been added to report Section 4.4.2.2.4. An excerpt of Section 4.4.2.2.4 is attached:

Stantec recognizes the MOECC's comments and questions with respect to various phosphorus calculations contained within AECOM's reports; however, Stantec's role in the Municipal Class EA process for the SWMMP does not include making revisions to other consultants reports, nor is the SWMMP intended as a 'living document' to be revised continuously. We have provided the summary of the AECOM analysis in the SWMMP "as is" and consider the SWMMP complete in that regard.

2. There are some inaccuracies in the report that need clarifications. For example, according to the Table of Contents Appendix L supposed to have minutes from a meeting with LSRCA. In reality, there is a letter to Ben Kester, Director of Public Works and Operations, Township of Uxbridge. It is unclear if there were any discussions with LSRCA regarding the report and whether the report was reviewed by the LSRCA staff.

LSRCA reviewed and approved the report. Appendix L has been revised to "Agency Correspondence" and includes Stantec responses to LSRCA and MOECC comments. A Notice of Completion was issued November 12, 2015. This is included in Appendix O (see attached).

3. There is inconsistency between total area of the future development (Areas A and B) in Table 9 (81.04 ha) and Table 16 as well as on p.4.18 (93.8 ha).

Total Areas of future development Areas A and B have been updated in Tables 15 and 16, and the corresponding water budget calculations have been updated accordingly in Section 4.5. The correct total area of A and B is 81.04. The changes to water budget calculations have no impact on the infiltration targets outlined in Section 4.5, as the new 25 mm retention requirement from LSRCA governs (LSRCA Technical Guidelines for Stormwater Management Submissions (Draft Dated February 12, 2016). Lake Simcoe Region Conservation Authority). An excerpt of revised section 4.5 is attached. An excerpt of revised Figures 1, 2, 4, 5, 6, 7, 8, 9, and ERSN 1 are also attached.

4. As well, existing land use conditions in Areas A and B are referenced as forest for the whole area in Table 9 but looking at orthophotos at Figure 2 it becomes obvious that only small portions of both areas are currently covered by forest. The rest looks like agricultural fields or transition (open spaces).

**Reference: Stormwater Management Master Plan (SWMMP) – Uxbridge Urban Area and Hamlet of Coppin's Corners – June 18, 2015
Response to MOECC Comments of October 22, 2015
Township of Uxbridge, ON**

The pre-development land use conditions in Areas A and B have been referenced as forest instead of open field or agricultural fields for the whole area to be conservative to establish phosphorus targets. The forest phosphorus loadings are much lower than the agricultural loadings and are therefore a more conservative assumption in setting targets.

5. I cannot agree with estimation that forested areas generate zero phosphorus loading (Tables 7, 8 and 9). According to various research data, phosphorus loading from forested areas varies from 0.02 to 0.10 kg/ha.

   As per the Berger report 0.0001 kg/ha is the loading rate for forest. The report has been adjusted to show 0.0001 kg/ha instead of 0. An excerpt of Table 7, 8 and 9 are attached.

   In addition to the above, we have included loading rates using the MOE Lake Simcoe Phosphorus Tool. The results indicate that the difference between the existing and post development conditions with BMPS produces a net reduction of -396.68 kg/year. This is approximately the same value that is stated in Table 13 of the SWMMP (-394.42 kg/year. Refer to the excerpt of Table 13 and Appendix E of the report (attached).

6. There is a mistake in volumetric infiltration deficit per hectare calculations on p. 4.18. The value there should be 551.7 m^3/ha/yr and correspondently 55 mm/yr that cannot equate 66% of precipitation volume but only 6.6%.

   The report has been updated in Section 4.5 to reflect the corrected areas. Areas A and B have a total volumetric deficit of 50,073 m^3/year. That averages to approximately 62 mm/year; based on the average precipitation volume of 831 mm/year, 62 mm/year equates to 7.4% of precipitation volume.

   Based on rainfall data collected and supplied by LSRCA, events up to and including 6 mm events correspond to approximately 7.4% of average annual rainfall depth. Section 4.5 was revised and an excerpt is included (see attached).

7. On p.6.1 it is mentioned that the SWM facilities assessment report is discussed in Section 3.4.1. The mentioned section discusses objectives of the archaeological assessment.

   This reference has been corrected to reference Section 3.7.1.

8. The Stormwater Management Master Plan should clearly identify contributing drainage areas of each current and future stormwater facility (ponds, swales, OGS) as well as level of their functionality. While there is a map of current SWMP locations, no other information

Reference: Stormwater Management Master Plan (SWMMP) – Uxbridge Urban Area and Hamlet of Coppin's Corners – June 18, 2015
Response to MOECC Comments of October 22, 2015
Township of Uxbridge, ON

is provided. Engineered wetlands are proven type of stormwater management treatment that should be considered as one of retrofit options at the SWMMP.

As discussed (telephone conversation, January 8, 2016), the lumped modelling approach was acceptable to LSRCA and no further discretization is required.

9. Hydrologic modelling and changes in parameter values are not reviewed in detail and should be sent to LSRCA for review by their engineering staff. Please ensure LSRCA is consulted and any their comments incorporated into the final report. It was noticed that some values in Appendix D – Hydrologic Modelling are given in non-metric units, e.g. slope – feet/mile, areas – square miles etc. that is not common in Canada.

   Hydrologic parameters were reviewed and approved by LSRCA. The Imperial units were used per the charts contained within *Urban Hydrology for Small Watersheds TR-55* (prepared by United States Department of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, Technical Release 55, dated June 1986) in calculating time to peak using the Williams' method and converted to metric for use in the VO2 modeling.

10. MOECC defers any comments on the assessment, impacts and mitigation of natural features and fish habitat to the Ministry of Natural Resources and Forestry (MNRF). Of particular concern are the effects that changes in water quality and water quantity may have on species identified in the study area classified as Endangered, Threatened or of Special Concern. Please ensure that MNRF is consulted and any comments from MNRF incorporated into the final report.

    As confirmed with LSRCA, based on Step 10 of the CSWMMP Terms of Reference, the LSRCA is listed as the reviewer of these plans, and was forwarded to MOECC for consideration under the requirements of the Municipal Class EA process. No other agencies are listed as reviewers; therefore, consultation with MNRF is not required. In addition, the SWMMP outlines requirements for stormwater quality and quantity controls consistent with existing guideline documents.

We trust that the foregoing is sufficient to address the MOECC's comments and that the SWMMP can now be considered final and approved. If you have any questions, please contact the undersigned.

Reference: Stormwater Management Master Plan (SWMMP) – Uxbridge Urban Area and Hamlet of Coppin's Corners – June 18, 2015
Response to MOECC Comments of October 22, 2015
Township of Uxbridge, ON

Regards,

STANTEC CONSULTING LTD.

Roy Johnson, B. Eng., M. A. Sc., P. Eng.
Senior Water Resources Engineer
Phone: (905) 415-6372
Fax: (905) 474-9889
Roy.Johnson2@stantec.com

Attachment: Correspondence with MOE and Updated Comments
Figures 1, 2, 4-9, ERSN1
Sections 4.4.2.2.3, 4.4.2.2.4, and 4.5
Excerpt of Table 7, 8 and 13
Appendix E – Phosphorus Calculations
Appendix O – Notice of Completion

These Attachments are now included in main body of report and are therefore not duplicated in this Appendix.

c. Alexander Shulyarenko - Alexander.Shulyarenko@ontario.ca
Tom Hogenbirk – t.hogenbirk@lsrca.on.ca
Ben Kester – bkester@town.uxbridge.on.ca

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Ng, Timothy

From: Liu, Chunmei (MOECC) <Chunmei.Liu@ontario.ca>
Sent: Monday, May 09, 2016 9:17 AM
To: Shulyarenko, Alexander (MOECC); Johnson, Roy (Markham)
Cc: bkester@town.uxbridge.on.ca; Tom Hogenbirk; Ng, Timothy; O'Leary, Emilee (MOECC)
Subject: RE: Township of Uxbridge Stormwater Management Master Plan

Good morning Roy,

Further to the final comment from our surface water specialist Alexander Shulyarenko, our review for this Class EA is completed. If you have further questions regarding our review comments, please feel free to contact me or my colleague Emilee O'Leary who is the EA and Planning Coordinator for projects within Durham Region.

Please send us a hardcopy of the final EA report for our filing.

Thanks,
Chunmei

From: Shulyarenko, Alexander (MOECC)
Sent: May-06-16 12:29 PM
To: Johnson, Roy (Markham); Liu, Chunmei (MOECC)
Cc: bkester@town.uxbridge.on.ca; Tom Hogenbirk; Ng, Timothy
Subject: RE: Township of Uxbridge Stormwater Management Master Plan

Hello Roy,

I have read Stantec's response to the MOECC comments regarding the Stormwater Management Master Plan – Uxbridge Urban Area and Hamlet of Coppin's Corners, Township of Uxbridge.

Please note that the suggested phosphorus loading rate from forested areas of 0.0001 kg/ha/yr is not acceptable for the MOECC. Please use the loading rate of **0.03** kg/ha/yr as suggested in the MOE Phosphorus Loading Tool. This phosphorus export coefficient was specifically established for the Pefferlaw/Uxbridge watershed and should be used in all calculations.

The phosphorus export coefficients in the Berger report resulted from modelling exercises and often do not reproduce the true empirical loading rates. In addition, the value of 0.0001 kg/ha/yr is taken out of context of the Berger report, which separated uncontrollable natural P sources in four categories (forest, wetland, stream bank and groundwater) instead of usually used two categories (forest and wetland).

Regards,

Alexander Shulyarenko, Ph.D.
Surface Water Specialist
Technical Support Section, Water Resources Unit
Central Region, Ontario Ministry of the Environment and Climate Change

Appendix N POND INSPECTION CHECKLIST TEMPLATE

Stormwater Management Facility Inspection Form

1. General Details

Inspected by:_______________

Facility Number:____ Date of Inspection:___________

Facility Name:____ Rainfall 24 hours prior: ____mm

Intersection:____ Rainfall 72 hours prior: ____mm

Discharges to:____

Watershed:____

Facility Type: circle

wet pond on-line	wet pond off-line	wetland	dry pond

sediment forebay Yes / No

2. Observations:

Waterlevel Reading (from top of HW): ____cm

						NOTES
Water Colour:	Clear	Green	Brown	Other______________		____________________
Foul Odour		None	Minor	Moderate	High	____________________
Floating Material		None	Minor	Moderate	High	____________________
	algae	None	Minor	Moderate	High	____________________
	debris	None	Minor	Moderate	High	____________________
	oil/sheen	None	Minor	Moderate	High	____________________
	floatables	None	Minor	Moderate	High	____________________
Is sediment visible below or above water surface?			Yes	No		____________________

NOTES:____

____

3. Inspection of Structural Components

INLET					NOTES
Blockage/Debris	None	Minor	Moderate	High	____________________
Sediment Accumulation	None	Minor	Moderate	High	____________________
Cracking/damage concrete	None	Minor	Moderate	High	____________________
Damage to other components	None	Minor	Moderate	High	____________________
Grate secure	Yes	No			____________________
Seepage	Yes	No			____________________
Erosion Protection Condition	None	Minor	Moderate	High	____________________

OUTLET					NOTES
Blockage/Debris	None	Minor	Moderate	High	____________________
Cracking/damage concrete	None	Minor	Moderate	High	____________________
Damage to other components	None	Minor	Moderate	High	____________________
Grate secure	yes	no			____________________
Structural damage	None	Minor	Moderate	High	____________________
Armourstone	None	Minor	Moderate	High	____________________
Seepage	Yes	No			

NOTES:____

____

Severity Ranking:

None-No issue Minor-Requires monitoring Moderate-Requires routine maintenance High-Requires immediate maintenance

3. Inspection of Structural Components (continued)

					NOTES
OUTLET SWALE					
Blockage	None	Minor	Moderate	High	____________________
Erosion	None	Minor	Moderate	High	____________________
Clarity of flow out of pond	clear	clear-brown	brown		____________________
Sediment Depth in channel	_________	cm			____________________
(Depth measurement taken at outfall headwall)					
EMERGENCY OVERFLOW					NOTES
Erosion	None	Minor	Moderate	High	____________________
Evidence of overtopping	yes	no			____________________

NOTES:____
____

4. Inspection of Vegetation

			NOTES
Aquatic	Un-Healthy	Healthy	____________________
Shoreline	Un-Healthy	Healthy	____________________
Upland	Un-Healthy	Healthy	____________________
Trees/Shrubs	Un-Healthy	Healthy	____________________

Re-seeding/Replanting Requirements:____

NOTES:____
____

5. Overall Conditions

			NOTES
Access Roads	Un-satisfactory	Satisfactory	____________________
Fences	Un-satisfactory	Satisfactory	____________________
Gates	Un-satisfactory	Satisfactory	____________________
Locks	Un-satisfactory	Satisfactory	____________________
Signage	Un-satisfactory	Satisfactory	____________________
Evidence of Encroachments	Un-satisfactory	Satisfactory	____________________
Evidence of Beaver Activity	Un-satisfactory	Satisfactory	____________________
Evidence of Waterfowl Activity	Un-satisfactory	Satisfactory	____________________
Evidence of Fish	Un-satisfactory	Satisfactory	____________________

OTHER COMMENTS:____
____
____

Severity Ranking:
None-No issue   Minor-Requires monitoring   Moderate-Requires routine maintenance   High-Requires immediate maintenance

Appendix O NOTICE OF STUDY COMPLETION

Township of Uxbridge

NOTICE OF STUDY COMPLETION

Stormwater Management Master Plan – Uxbridge Urban Area and Hamlet of Coppin's Corners, Township of Uxbridge

The Township of Uxbridge retained Stantec Consulting Ltd. (Stantec) to complete the Schedule B Class Environmental Assessment (Class EA) Stormwater Management Master Plan (SWMMP) for the Uxbridge Urban Area and Hamlet of Coppin's Corner. The SWMMP has been prepared in accordance with the Comprehensive SWM Master Plan Guidelines, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), dated April 26, 2011, and in accordance with the Municipal Class Environmental Assessment Guideline, prepared by the Municipal Engineers Association, dated October 2000 (as amended in 2007 and 2011). The Township of Uxbridge (the Township) has received a letter from the Ministry of Environment (MOE) indicating that the required scope of the SWM Master Plan must include the settlement areas noted above.

The intent of the Stormwater Management Master Plan (SWMMP) was to prepare a practical and implementable framework which balances the requirements of proposed and existing development with infrastructure requirements, economic, social and environmental constraints and opportunities. The MOE published the Lake Simcoe Protection Plan in June of 2009 that called for all settlement areas to prepare and implement comprehensive SWMMP that would improve the management of stormwater for both existing and planned development.

The Master Plan process included public, agency and stakeholder consultation, an evaluation of alternative solutions, assessment of potential impacts, and identification of mitigation measures. As part of the consultation program a public meeting was held on May 8, 2014 to provide information on the project and to receive comments. Public and agency comments have been received and considered in the selection of the preferred alternatives.

The SWMMP has been completed and is available for review at the following location:

Township office of the Township of Uxbridge
51 Toronto Street South
P.O Box 190
Uxbridge, Ontario
L9P 1T1

The Project File is available online at: http://town.uxbridge.on.ca/public_works

The preferred SWM strategy for the Uxbridge Future Settlement Areas is the Traditional SWM with Best Management Practices (BMP) Implementation Strategy – a SWM pond for peak flow control and erosion control, in conjunction with Low Impact Development (LID) BMPs to reduce phosphorus, promote infiltration, and to potentially offset the need for a permanent pool. For areas that experience redevelopment in the future, the preferred strategy is the Traditional SWM with Urban Retrofits Strategy. The Urban Retrofits Strategy is to either implement new Enhanced wet ponds and/or upgrade existing wet ponds. The retrofit measure that is implemented would be monitored to analyze how it is performing and be modified if required.

Interested persons may provide written comment to the undersigned within 30 calendar days from the date of this Notice. If concerns arise regarding this project, which cannot be resolved in discussion with the Township of Uxbridge, a person or party may request that the Minister of the Environment make an order for the project to comply with the Part II of the Environmental Assessment Act (referred to as a Part II Order). Requests must be received by the Minister at the address below by December 11, 2015.

Minister of the Environment
77 Wellesley Street West, 11th Floor, Ferguson Block
Toronto ON M7A 2T5

A copy of the request must also be sent to one of the undersigned. Subject to comments received as a result of this Notice and the receipt of necessary approvals, design and construction of works noted within the Master Servicing Plan can proceed (with the exception of Schedule C Class EA activities). Master Plans are not subject to requests from the public for a Part II Order. However, individual projects (Schedule B Class EA activities) identified within this Master Plan may be subject to a Part II Order.

Notice issued on November 12, 2015

Ben Kester, C.E.T., CRS-S
Director of Public Works & Operations
Township of Uxbridge
51 Toronto Street South
Uxbridge, ON L9P 1T1
Email: bkester@town.uxbridge.on.ca

Roy Johnson
Senior Water Resources Engineer
Stantec Consulting Ltd.
300-675 Cochrane Drive
Markham ON L3R 0B8
Email:Roy.Johnson2@stantec.com

Personal information submitted in writing on this subject is collected under the authority of the Municipal Act, 2001and will be used by members of Council and Township staff in their review of this study.