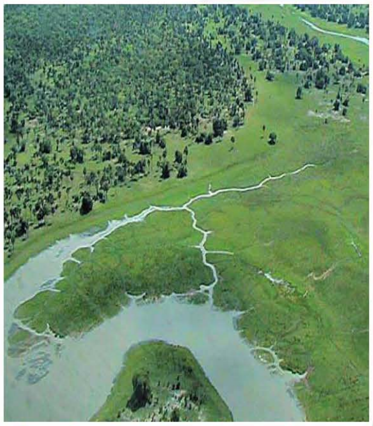
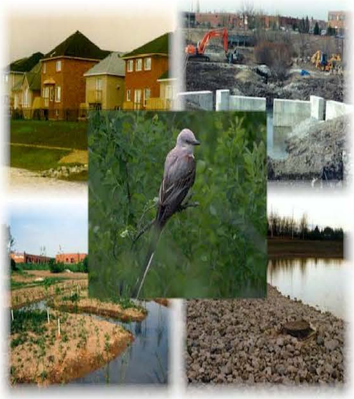
Everett Secondary Plan Master Servicing Plan

Class Environmental Assessment Study Report

VOLUME 3 (Parts 1&2)

Master Servicing Studies



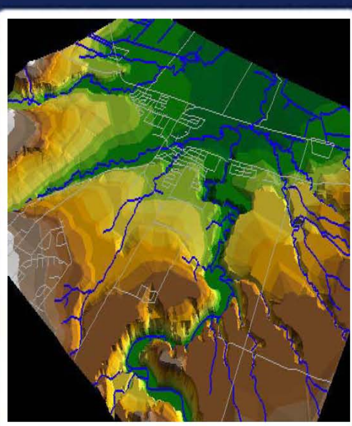


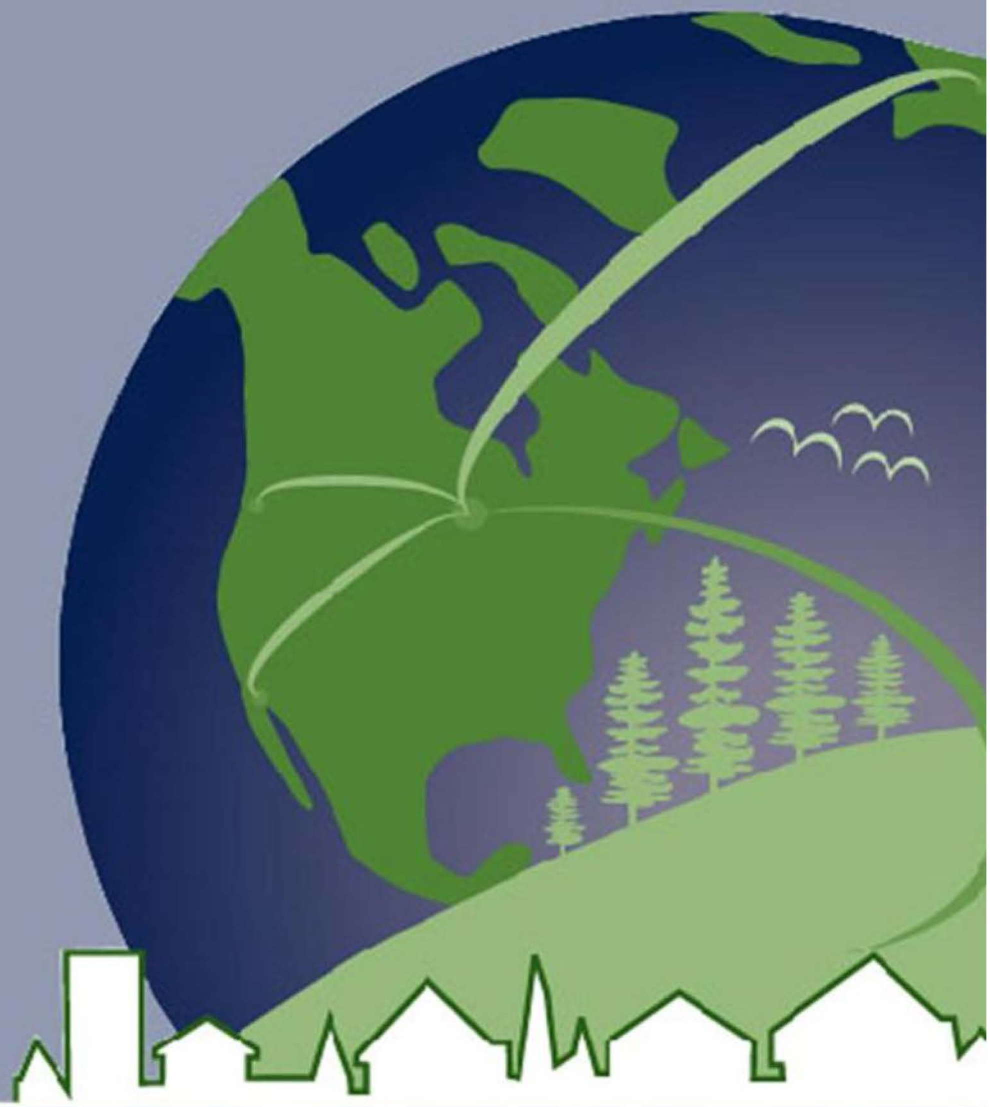
Prepared For:

The Township of

Adjala-Tosorontio

January, 2013





GREENLAND® Consulting Engineers

A member of the Greenland Group of Companies

120 Hume Street, Collingwood, Ontario, Canada L9Y 1V5

tel: 705.444.8805 • fax: 705.444.5482

Web: www.grnland.com

VOLUME 3: MASTER SERVING STUDIES

Part 1 – Master Drainage Plan Study Report

Everett Secondary Plan
Township of Adjala-Tosorontio
Master Drainage Plan Study Report

November 2012

Greenland Project No. 12-G-2804

FINAL REPORT

GREENLAND® **International Consulting Ltd.**
A Member of the Greenland Group of Companies
120 Hume Street, Collingwood, Ontario, Canada, L9Y 1V5
TEL: 705 444-8805 FAX: 705 444-5482
E-MAIL: greenland@grnland.com WEBSITE: www.grnland.com

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

1 INTRODUCTION

1.1 General

Due to significant changes in planning directives at the Provincial level in recent years, and uncertainty related to the timing of approvals of local and County of Simcoe Official Plans, the Township of Adjala-Tosorontio (Township) recently undertook an in-depth review of development trends within the Township boundaries. This review showed that although Council had adopted a new Official Plan in 2005, the new policies were not yet in place, and development was stagnating. In addition, the limited amount of development that was occurring did not necessarily promote best planning practices.

Current local planning policies are aimed at protecting the agricultural community and environmentally sensitive lands, however, key shortcomings related to future residential and commercial development in the area have been identified:

- A lack of fully serviced (water and sewer) lots available for development;
- No clear direction on future servicing plans for settlement areas; and,
- Few policies related to promoting healthy and sustainable communities.

In November of 2011, Council adopted a new policy (based on a Growth Management Study prepared by the Planning Partnership) to provide guidance for future development within the Township. One of the key components of this policy is the promotion of the community of Everett as the area where the majority of growth in the Township should be directed.

To implement the findings of the new Growth policy, the Township undertook a comprehensive review of the existing situation with a goal to find the best way to move forward. It soon became apparent that using the land base within the existing boundary of Everett would not allow for a sustainable form of development, particularly as it relates to Municipal wastewater disposal. Issues with the existing sewage treatment plant, concerns about the MOE's continued acceptance of sub-surface treatment options, and uncertainty about the economic viability of operating several facilities led to the conclusion that a larger area would likely be needed to provide a suitable level of service for community.

The expansion of the Everett settlement boundary (Everett Secondary Plan Area) will provide the Township an opportunity to address other areas of Provincial interest (such as the Source Water Protection and Green Energy Acts) while at the same time making the community more pedestrian friendly and less of a concern financially, all within the parameters of Places to Grow legislation.

As an agricultural based community, Everett is envisioned to continue to be a rural settlement that reflects the unique heritage of the area and supports the values and lifestyles of its residents, while facilitating healthy and sustainable growth. Specifically, policies have been included to address, among other things:

- Protection and enhancement of natural features and resources;
- Provision of a mix of housing types and densities;
- Connections between park facilities and pedestrian linkage with future commercial development;

- Implementation of a comprehensive plan for all municipal services; and,
- Identification of a Community Improvement Area.

Figure A-1, **Appendix MDP-A** illustrates the location of the Everett Secondary Plan area as well as description of its surroundings. The Secondary Plan Area lands make up a total of approximately 665 hectares (ha), bounded in the west boundary by County Road 4, in the east by Concession Road 6, in the south by the 9th Line and in the north by the Pine River and the 13th Line.

The un-developed lands can be described as generally flat agricultural fields, sloping in a north easterly direction, with an existing developed area in south westerly portion of the Secondary Plan Area, comprised mainly of low density residential properties, with the exception of various single unit commercial properties (predominantly small retail) located along County Road 5 and County Road 13. The northern portion of the Secondary Plan is largely comprised of County Greenland associated with the Pine River.

The following Master Drainage Plan (MDP) has been prepared in support of the Secondary Plan for the Everett community. It also forms a part of the Master Servicing Plan for the Everett Secondary Plan, which is being completed under the Municipal Class Environmental Assessment (EA) process, Schedule 'B' – Master Plan.

1.2 Background

The existing landuse shown in **Appendix MDP-A (Figure A-2)** in the Study Area includes a combination of: agricultural land; floodplain; natural areas; existing residential development; and vacant or fallow agricultural land. The Study Area is divided by three (3) primary watercourses in the Nottawasaga River Watershed including: the main branch of the Pine River (north west corner of the Secondary Plan Area); the Everett Drain (center of the Secondary Plan Area) which is tributary to a branch of the Pine River; and, a tributary of the Boyne River, in the south west portion of the Secondary Plan.

The existing developed community in the Study Area is serviced by the Town's municipal water systems. With exception of the south east developed areas of the Secondary Plan (existing New Horizons Subdivision), which is serviced by the a municipal wastewater treatment plant with sub-surface disposal, the existing developed community is serviced by individual private wastewater treatment systems (e.g. septic systems).

A Natural Heritage Study and Hydrogeological Study for the Study Area have been completed by Plan B (**Appendix MDP-B**) and Golder Associates (**Appendix MDP-C**), respectively.

1.3 Purpose of the Study

The purpose of this Study is to prepare a Stormwater Management and Drainage Plan for the Study Area in a manner which harmonizes the community's need for housing, employment and services with the need for sustaining a healthy ecosystem.

The Secondary Plan and this Master Drainage Plan (Study) provide the required background information to the Township and the NVCA to proceed with implementation of the Master Servicing Plan (MSP).

The recommended Master Drainage Plan will provide guidance to local and upper tier authorities in planning stormwater management for existing and future land use development while ensuring the protection, restoration and enhancement of the natural features in the Secondary Plan area and the Study Area subwatersheds. The Master Drainage Plan will also be useful for the review and regulation of stormwater management issues related to individual development proposals.

1.4 Goals, Objectives and Scope of the Study

The overall goal of this Study was to prepare a comprehensive master drainage and stormwater management strategy for the Study Area that addresses functional drainage concerns of the Town, while addressing various other issues of concern within the community such as existing flooding conditions and the enhancement of tributary stream and Nottawasaga River watershed water quality. Further objectives identified in achieving the overall goal include:

- Enhancement or maintenance of the natural characteristics of the tributary areas;
- Integrated stormwater management;
- Enhanced stormwater quality and quantity control;
- Improved flood control;
- Maximized erosion control benefit; and
- Sustainable development within the subwatersheds of watercourses that transect the Study Area lands.

The scope of work for the Study included the following:

- Collect and review all available existing background information for the Study Area;
- Inventory and map all stormwater management facilities and land use within the Study Area;
- Review previously completed inventories of hydrogeologic, aquatic and terrestrial features and conduct a cursory water quality assessment to determine opportunities and constraints to the master drainage concept;
- Review background studies with respect to watercourse reaches which appear to be highly sensitive to changes in flow regime;
- Prepare a Visual OTTHYMO hydrologic model for pre-development conditions and develop a future development model to establish peak flows within the watercourses that transect the subject lands;
- Provide screening level evaluation of existing stormwater management techniques to assess feasibility of incorporating any/all of these approaches into the master drainage concept;

- Prepare a list of alternative master drainage concepts and evaluate these using a decision matrix based on significant criteria such as effectiveness in achieving desired level of control, feasibility, impact on environment, cost, etc;

- Identify the preferred/recommended alternative consisting of a master drainage concept which will provide effective stormwater management and thereby protect and/or enhance the subject property natural features and ecological functions;

- Prepare an Implementation Strategy outlining roles, responsibilities and mechanisms for implementing the recommended MDP components; and, also, prepare a monitoring strategy to ensure that the goals and objectives of the MDP are being achieved.

1.5 Master Drainage and Study Approach

This Study incorporates an ecosystem-based approach in keeping with the following main tasks associated with the MDP planning process:

- Development of an understanding of the existing natural features within the subwatershed and how they function;

- Prediction of potential future impacts on the natural environment which may result from land use changes and development; and;

- Development of a preferred approach for managing stormwater runoff from future developments in the subwatershed which will least affect established ecosystem components.

This approach is consistent with an “ecosystem approach” to master drainage planning.

An ecosystem approach to master drainage planning is based on the fact the natural features and functions of a subwatershed are linked by the movement of water. A subwatershed is an area that includes all of the land drained by a single watercourse, such as each of the watercourses that transect and receive drainage from the property. Changes in the subwatershed that affect this movement of water may, in turn, affect the natural features and functions. The impact assessment of land use change in a subwatershed must consider these fundamental relationships. The hydrologic processes, aquatic resources and terrestrial resources of a subwatershed define the unique set of ecosystem functions, attributes and linkages and provide an overall framework for an assessment of the subwatershed ecosystem in a holistic manner. Management of a subwatershed from an ecosystem perspective must address these functional components. Maintenance of the subwatershed functions, attributes and linkages would typically maintain the existing environmental quality. An ecosystem-based approach to master drainage planning, therefore, attempts to balance environmental protection, conservation and restoration, with development to ensure the long-term ecological sustainability of the subwatershed and its significant resources.

1.6 Report Organization

This MDP Report is arranged into eight (8) Chapters. The intent of the report is to provide a characterization of the existing conditions within the Subwatershed, and to assess the impact that future development may have on the various resources and ecological processes in the area. In addition, the report details the selection process undertaken to determine the preferred

MDP alternative to achieve sustainable development, thus enabling the protection, enhancement and/or restoration of sensitive resource features and ecological functions. Finally, the report presents a means by which to implement the preferred MDP alternative and recommends a monitoring program to ensure that the goals and objectives of the MDP are achieved. Thus, the sections within the report are arranged as follows:

Chapter 1.0: **Introduction**

Chapter 2.0: **Existing Conditions**

Chapter 3.0: **Potential Impacts of Future Development**

Chapter 4.0: **MDP Criteria, Opportunities and Constraints**

Chapter 5.0: **General MDP Alternatives**

Chapter 6.0: **Identification and Evaluation MDP Options**

Chapter 7.0: **Summary of the Preferred MDP**

Chapter 8.0: **Implementation Strategy/Monitoring Program**

2 EXISTING CONDITIONS

2.1 General

The following Chapter presents the existing conditions for the Study Area. In addition to the reports prepared to support this Secondary Plan (included in the MDP Appendices), the following background reports were reviewed in preparation of this Chapter:

- *Walton Group - Pine River Assimilative Capacity Study, Greenland International Consulting Ltd., 2012.*
- *R&M Homes Stormwater Management Report*, Pearson McCuaig Eng. Ltd., 2011.
- *R&M Homes – Assimilative Capacity Study for the Pine River at Everett*, Azimuth Environmental, 2011.
- *The Everett Water Supply System Engineers Report*, RJ Burnside and Associates Limited, 2000.
- *Cumac Subdivision, Final Preliminary Stormwater Management Plan*, Trow, 1998.
- *Cumac Subdivision, Floodline Mapping and Preliminary Stormwater Management Plan*, Trow, 1998.

2.2 Climate

The climate of the Study Area can be characterized using climate normals from the Environment Canada station 6116132, located in Owen Sound approximately, for the years 1965 to 2003. The average annual precipitation is 1,100 mm for this station.

2.3 Geology and Hydrogeology

Based on local geologic mapping, the Secondary Plan Area is situated in a physiographic region known as the Simcoe Lowlands. The site is specifically situated in an area known as the Camp Borden Sand Plain. The area is characterized by glaciolacustrine deposits of sand to silty sand. Typically, the area is flat and poorly drained by highwater table conditions.

The Everett Water Supply System Engineers Report, completed by RJ Burnside and Associates Limited (November 2000), concluded that shallow groundwater flow reflects surface water flows north to north westerly. As a result, the lands to the south and southeast would be considered upgradient and the lands to the north and west would be considered down gradient.

Overburden soils in the vicinity of Everett consists of glaciofluvial deposits of sand and gravel. Well records associated with the municipal wells indicate that there are two (2) main overburden aquifers from which groundwater is drawn for the existing community water supply. The shallow wells are developed in an upper aquifer that is unconfined with elevations ranging from 234 m to 228 m (ASL). The deeper aquifer is located at an elevation of approximately 185 m, while the bedrock is located at an elevation of approximately 181 m and consists of limestone associated with Georgian Bay Formation.

The Soil Map of Simcoe County was consulted to understand the soil conditions in the Study Area (See **Figure A-3** – **Appendix MDP-A**).

From a hydrologic perspective there is high infiltration potential for site soils. The presence of shallow groundwater levels for the lands is an important consideration as they provide a potential supply of base flow to the watercourses, however, limit the effectiveness of potential mitigation measures and techniques.

2.4 Topography

In general, grades within the Everett Secondary Plan area can be broken into three (3) distinct grading patterns. With the exception of the New Horizons Subdivision, most of the lands located east of County Road 13, and currently developed lands west of County Road 13 slope from the south west to the north east and ultimately drain to a tributary of the Pine River east and north of the Secondary Plan Area.

Undeveloped lands located to the west of County Road 13 drain from south to north, with a low point in the main branch of the Pine River north east of the Secondary Plan Area.

Finally, a small portion of the Secondary Plan, primarily located south of County Road 5 and including the New Horizons Subdivision (and SWM Facility) slopes from north to south, with drainage from this area entering the Boyne River.

The Secondary Plan Area receiving watercourses are further described in the **Section 2.6**. Topographic elevation contours of the Study Area are shown in **Figure A-4** (**Appendix MDP-A**), along with an existing condition drainage map.

2.5 Natural Heritage Features

As per the Natural Heritage Study **(Appendix MDP-B)**, there are natural environment features across the Study Area that require consideration.

The north boundary of the Secondary Plan includes a considerable of amount area designated as County Greenlands, which are associated with the wetlands, floodplain, slopes and forested areas associated with the Pine River.

Smaller natural features are associated with the tributaries of the Everett Drain in the central portion of the Secondary Plan Area and the tributary of the Boyne River in the south west portion of Secondary Plan Area.

Finally, a groundwater seepage area has been identified in south east portion of the Study Area. The significant natural heritage features identified in Appendix MDP-B have been included in the Natural Heritage System of the Everett Secondary Plan.

2.6 Existing Drainage Conditions – Hydrology

The Study Area is divided by three (3) primary watercourses in the Nottawasaga River Watershed including: the main branch of the Pine River (north west corner of the Secondary Plan Area); the Everett Drain (center of the Secondary Plan Area) which is tributary to a branch of the Pine River; and, a tributary of the Boyne River, in the south west portion of the Secondary Plan.

The existing drainage catchments for the affected watercourses in the Secondary Plan Area are presented in **Figure A-4 (Appendix MDP-A**). Nodes were created in the model to represent the confluences of all sub-catchments with their respective discharge locations, described herein.

2.6.1 Boyne River: Node #300

The Boyne River Node #300 represents the confluence of drainage from the Southwestern Quadrant of the Secondary Plan Area. The Catchment is comprised predominantly of undeveloped agricultural land and external drainage areas including small areas which fall within the Secondary Plan boundaries. **Figure A-4 (Appendix MDP-A)** presents the existing conditions drainage map, including sub-catchment, node, and existing storm water management facility (SWMF) locations.

The total contributing area is 408.47 ha, approximately 30-40% of which falls within the study area. The upstream drainage area includes one SWMF located within the New Horizons Subdivision. Sub-catchment descriptions are provided below:

- Sub-catchment 10: 87.06 ha of agricultural land which also contains a portion of wooded area draining south into Sub-catchment 13.
- Sub-catchment 13: 174.87 ha of wetland and woodlot located east of R&M subdivision draining north.
- Sub-catchment 11: 73.21 ha of woodlot and agricultural land draining southeast into Sub-catchment 13.
- Sub-catchment 12: 59.85 ha of agricultural land draining south into a tributary of the Boyne River
- Sub-catchment 15: 13.48 ha of developed land representing the majority of the New Horizon Subdivision. The catchment includes an existing SWMF (Ex. SWMF No. 1) which provides quantity control for the sub-catchment area. A rating curve for Ex. SWMF No. 1 was developed based on measurements taken from design drawings for the facility. It is unknown what quality controls, if any are in place at this facility.

2.6.2 Pine River Main Branch: Node #200

The Pine River Main Branch Node #200 includes the drainage from the Northwestern Quadrant of the Secondary Plan Area. This area predominantly consists of undeveloped agricultural land with a small amount of rural residential housing located outside of the Study Area.

No storm water quality or quantity controls are known to be implemented currently upstream of this node. The total tributary area is 375.92 ha, roughly 50% of which is within the boundaries of Secondary Plan Area. Sub-catchment descriptions are provided below:

- Sub-catchment 1: 52.21 ha of agricultural land located south of County Road 13 and Pine Plains Road draining north to the watercourse.

- Sub-catchment 2: a total 323.71 ha which contains small area (2.53 ha) of existing residential development and the majority of woodlot and agricultural land located east of the Concession Road 4 and Gatewood Drive intersection, draining north to the watercourse.

2.6.3 Pine River Tributary: Node #100

The Pine River Tributary Node #100 is the main drainage course for existing developed areas in the Community of Everett. Currently this watercourse collects drainage from existing and proposed development areas within the Secondary Plan boundaries. Stormwater quality and quantity control improvements are proposed to the existing linear Storm Water Management Facility (SWMF) Ex. SWMF No. 3 in Sub-catchment 16 (R&M Homes) following construction of a new 47 ha development therein (Draft Plan Approved). There is also an existing dry pond (Ex. SWMF No. 2) which collects drainage from lands to the north of the New Horizon Subdivision, and part of Dekker Street (Sub-catchment 17).

The total tributary area is 584.24 ha, the majority of which is within the study area (70-80%) with some external drainage. Sub-catchment descriptions are provided below:

- Sub-catchment 3: 55.32 ha of agricultural land which also contains a portion of wooded area draining north to the watercourse.
- Sub-catchment 4: 71.21 ha of woodlot and wetland located at the west of Pine River main branch and draining northeast.
- Sub-catchment 5: 78.49 ha of woodlot located northeast of R&M subdivision draining north.
- Sub-catchment 6: 13.22 ha of swamp and woodlot located east of R&M subdivision draining north.
- Sub-catchment 7: 57.93 ha which contains 18.5 ha of residential development, 7.16 ha of woodlot and agricultural land draining north into catchment 6.
- Sub-catchment 8: 71.99 ha which contains 20.8 ha of residential development and agricultural land.
- Sub-catchment 9: 121.37 ha which is predominantly agricultural land with minor residential development areas and wood-lot.
- Sub-catchment 14: 21.17 ha urban catchment representing the Blanchard Development – Drains East into Catchment 9.
- Sub-catchment 16: 74.7 ha urban catchment representing the R&M Homes Development (Draft Plan Approved, “In Process”) complete with SWM Facility – Model provided by R&M’s engineering reports (Pearson, 2012) has been implemented in our model as Received.
- Sub-catchment 17: 18.85 ha urban catchment representing lands to the north of the New Horizon Subdivision, and part of Dekker Street. The catchment includes a small SWMF

(Ex. SWMF No. 2) with known dimensions and an unknown outlet configuration. As such, an outlet configuration (orifice size) for the facility was assumed, on the basis that the resulting rating curve for this SWMF, once modeled, would provide adequate storage for storms up to and including the 100 year event.

2.6.4 Peak Flows

A hydrologic analysis of the Study Area was completed utilizing a single event Visual Otthymo Version 2.0 (VO2) model. Peak flow rates for the 25 mm, 2 year, 5-Year, 10-Year, 25- Year, 100-Year and Regional (Timmins) storm events were assessed. The model development details are as follows:

- Rainfall IDF data from the City of Owen Sound (24 hour SCS Type II) and the Timmins Storm (Regional Storm) rainfall event were utilized. The City of Owen Sound intensity-duration-frequency (IDF) data is provided in **Appendix MDP-D**.
- Drainage areas for the watercourses which transverse the Secondary Plan Area were developed for Study Area from the NVCA digital elevation model (DEM). All catchment boundaries were field checked. A copy of the existing conditions drainage area mapping **Figure A-4**, **(Appendix MDP-A)** for the entire Secondary Plan.
- Land uses were established using current aerial photography and verified through field checks. CN values were developed from current land uses and soil types.
- Time to peak values for the catchment areas were calculated using the Airport Method and 'n' storage values were set to reflect the runoff characteristics.
- The existing conditions CN and time to peak parameter development is presented in the MDP Hydrological Analysis Appendix, **Appendix MDP-D**.

Table 2.1 presents the existing peak flow conditions for the Study Area as determined from the hydrologic analysis (VO2 model) completed for this Study.

Table 2.1: Existing Conditions Event Peak Flow Modelled Results

	Peak Flow (m3/s)									
Node	**Timmins**	**100 yr SCS**	**25 yr SCS**	**5 yr SCS**	**2 yr SCS**	**100 yr Chicago**	**25 yr Chicago**	**5 yr Chicago**	**2 yr Chicago**	**4 hr 25mm**
Node #100 Pine River Tributary	18.36	11.38	8.35	5.40	3.71	14.93	12.31	6.92	4.47	2.81
Node #200 Pine River Main Branch	16.45	8.49	5.76	3.20	1.83	7.50	5.19	2.45	1.17	0.51
Node #300 Boyne River Tributary	18.47	9.66	6.69	3.81	2.24	8.39	5.88	2.88	1.43	0.64

Please note that existing conditions assumes full buildout of the Draft Plan Approved R&M Homes Development and associated Storm Water Management Controls.

2.7 Existing Drainage Conditions – Floodplain Hydraulics

There has been no floodplain modelling completed as part of this Study. The NVCA generic floodplain mapping / natural hazards (*Development, Interference with Wetlands & Alterations to Shorelines & Watercourses Regulation*) have been included within the Natural Heritage System for the Everet Secondary Plan. The Natural Hazards mapping is presented in **Figure A-5**, **Appendix MDP-A**.

2.8 Stream Channel Characteristics and Erosion

The basic stream channel and erosion characteristics of the five (5) watercourses traversing the subject Secondary Plan Area were identified as follows:

- The main branch and north tributary of the Pine River are the most natural of the systems in the Study Area exhibiting good natural channel characteristics and relatively stable channel forms throughout its reaches.

- The branches of the Everett Drain (tributary to the Pine River) are considered altered watercourses with agricultural landuse in the upper reaches and urban development in the lower reaches. Despite their altered nature, the Everett Drain does not show obvious signs of significant erosion or sedimentation.

- The branches of the Boyne River tributary are altered watercourses with agricultural and urban landuse in the upper reaches and agricultural landuse in the lower reaches. Despite their altered nature, the Boyne River tributaries in the Study Area do not show obvious signs of significant erosion or sedimentation.

2.9 Water Quality

There is considerable information available with respect water quality information for the Pine River, which is the receiving water course for the majority of the Secondary Plan Area drainage. This information has been documented in the Pine River Assimilative Capacity Study, completed by Greenland International Consulting Ltd., in 2012 (**Appendix MDP-E**). In general terms, the Pine River at Everett, has relatively good water quality and assimilative capacity for the key parameters of concern for the Nottawasaga River watershed, namely ammonia and phosphorus. The Pine River would be considered a Ministry of Environment (MOE) Level 1 receiving water course and requires Enhanced level protection from a stormwater management perspective.

As detailed in Appendix MDP-B, water quality in the Boyne River is rated as poor to fair due to impacts of agricultural runoff and loss of riparian cover. The boyne River tributaries would be considered MOE Level 1 receiving water courses and require Enhanced level protection from a stormwater management perspective.

3 POTENTIAL IMPACTS OF FUTURE DEVELOPMENT

3.1 General

This Chapter summarizes the potential impacts that could occur as a result of future proposed changes in land use without any mitigation or management measures in place. Impacts associated with hydrology and hydraulics, surficial soil erosion, surface water quality, natural heritage features, and groundwater quality and quantity are discussed. Management measures which can minimize these potential impacts are presented.

3.2 Future Land Use

The future land use scenario for the Community of Everett Secondary Plan lands is presented in **Figure A-1 Appendix MDP-A**. This scenario represents "ultimate" development planned for the Study Area. An ultimate equivalent residential population of approximately 10,669 (or an equivalent of 3,995 residential units) has been estimated for the Secondary Plan lands (new and existing). **Appendix MDP-D** presents the existing and proposed development land uses by area for each of the drainage catchments contributing to Node 100, 200 and 300, respectively. The total imperviousness within the drainage areas of each of the receiving watercourses for the site will increase from a total of approximately 22% to greater than 32% overall for the subject subwatersheds.

All new development areas in the Secondary Plan will be serviced by the Community of Everett Well System and all sewage flows will be treated at a communal Water Pollution Control Plant (WPCP). The details concerning the WPCP location and discharge method (i.e. surface water discharge or subsurface discharge) are being determined through the water and wastewater component of the Class EA Master Plan process which includes this MDP.

3.3 Hydrology and Hydraulics

Changes to the future hydrology and hydraulics were assessed in terms of future uncontrolled peak flow rates (existing and “in process” SWM controls were kept in). The post development hydrologic (VO2) modelling is presented in **Appendix MDP-D**. The results of this modelling exercise are presented in **Table 3.1**. The locations of the flow nodes are shown in the post development model schematic in **Appendix MDP-D**.

Table 3.1: Post Development Hydrologic Flow Summary – Uncontrolled

	Storm Flow (m^3/s)									
Node & Location	Timmins		100-Yr (SCS)		25-Yr (SCS)		5-Yr (SCS)		2-Yr (SCS)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	18.36	20.27	11.38	13.65	8.35	10.48	5.40	7.00	3.71	4.93
Pine River Main Branch Node #200	16.45	15.47	8.49	8.02	5.76	5.45	3.20	3.02	1.83	1.73
Boyne River Tributary Node #300	18.47	16.37	9.66	9.48	6.69	6.90	3.81	4.25	2.24	2.76
Node & Location	100 yr (Chicago)		25 yr (Chicago)		5 yr (Chicago)		2 yr Chicago		4 hr 25mm Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	14.93	17.89	12.31	14.51	6.92	10.23	4.47	6.15	2.81	4.15
Pine River Main Branch Node #200	7.50	7.18	5.19	4.97	2.45	2.34	1.17	1.02	0.51	0.48
Boyne River Tributary Node #300	8.39	8.90	5.88	7.22	2.88	4.56	1.43	2.92	0.64	1.96

As demonstrated in **Table 3.1**, the uncontrolled release of stormwater under the proposed future land use scenario will result in higher peak flows at two (2) of the three (3) drainage nodes without the implementation of mitigation measures. This can be directly attributed to the greater total impervious area proposed under future conditions which results in a less attenuated runoff response and an increase in runoff volume. In addition, a portion of the drainage area which drains to Node #200 under existing conditions will be shifted into the Node #100 drainage area under proposed conditions. Increases in peak flows will result in higher flood line elevations and could lead to increased flood risk in some areas.

3.4 Surface Water Quality

3.4.1 Surficial Soil Erosion

Depending on the nature of pre-development land use, the rate of surficial soil erosion can be impacted differently by future land use changes. Based on previous experience, lands used predominantly for agricultural purposes are often associated with a relatively high rate of surficial soil erosion. This results from the large area of exposed soil, especially apparent in row crops such as corn. Future development which consists of residential, commercial, and industrial land use will consist predominantly of paved and grassed surfaces which are more resistant to the erosion processes. This will likely result in a net reduction in the rate of soil erosion. Other problems, however, such as increased pollutant loadings associated with developed lands and streambank erosion must be considered.

3.4.2 Urban Stormwater Runoff

Complete development of all lands identified in the Secondary Plan lands will result in urbanization of a significant portion of the tributary watersheds in the Secondary Plan Area contributing flow to the Pine and Boyne Rivers. The effects of urbanization on surface water quality resulting from uncontrolled releases of urban storm water runoff can be significant. The potentially adverse impacts associated with urban stormwater runoff include:

- Degradation/impairment of surface water quality in the tributary watercourses as well as the receiving water watercourse, the Nottawasaga River, and ultimately, Georgian Bay;
- Restriction of water uses for drinking and recreation;
- Degradation of aquatic habitats through increased algae and plant growth;
- Thermal warming of cold water receiving streams; and
- Reduction in the number and diversity of fish and other aquatic species.

Significant impacts of proposed development within the Study Area could result during construction. Impacts during construction could result in indirect impacts to surface water quality arising from increased surficial erosion. During the construction phase of new development, pollutant export can be expected to increase significantly due to the erosion of soil material, without the implementation of mitigation measures. Increased sediment loading can cause deterioration of water quality and stream aesthetics, reduced flow capacity of downstream channels and culverts, and degradation/destruction of fish and aquatic habitats.

3.4.3 Agricultural/Rural Runoff

Approximately 60% of the collective contributing drainage area from the subject subwatersheds will remain in agriculture/rural land use in the foreseeable future. Intensive crop production will continue, as will hog, dairy, beef and equine operations. In the absence of agricultural Best Management Practices, pollutants such as suspended sediments from eroded soil, nutrient discharges (phosphorus, nitrogen) from fertilizers, livestock effluent, decaying vegetation, and bacterial inputs from septic systems, manure spreading, livestock access and barnyard runoff will continue to reach the watercourses and ultimately Georgian Bay. The potentially adverse impacts associated with agricultural/rural land runoff include:

- Degradation/impairment of surface and ground water quality;
- Restriction of water uses for drinking, livestock watering and recreation;
- Degradation of aquatic habitats through increased algae and plant growth; and
- Reduction in the number and diversity of fish species.

3.4.4 Comparison of Pre and Post Development TSS and Phosphorus Loading

As discussed previously in this Study, the Everett Secondary Plan Area is located on the border of the Pine River and Boyne River Subwatershed's of the Nottwasaga River Watershed. Both of these watercourses would be classified as Policy 1 receivers based on measured Phosphorous loading of less than 0,03 mg/L (*Source: NVCA, Boyne River & Pine River Watershed Report Cards, 2007*). An Assimilative Capacity Study was completed by Greenland in 2012 for the Pine River sub-watershed, and can be found in **Appendix MDP-E**. Additional information on existing conditions Phosphorous loading for the Pine River is presented therein.

3.5 Natural Heritage Features and Areas

The proposed changes in land use could impact natural heritage features and areas, and their inherent ecological functions. Significant natural heritage features and ecological functions that could be impacted include fish and other aquatic species habitat, and terrestrial species habitat such as meadows and woodlands. The degradation of surface water quality associated with future development without proper control measures could pose a significant threat to existing aquatic organisms such as fish, amphibians and aquatic invertebrates sensitive to change. Loss of terrestrial habitat such as meadows and woodlands also poses a threat to existing terrestrial animals by reducing foraging area, natural shelter and connective links with other terrestrial habitat. Much of the natural heritage features and functions within the Study Area and associated watercourses will be retained. The Natural Heritage Study completed in support of this MDP is included in **Appendix MDP-B**.

3.6 Groundwater Quality and Quantity

Groundwater quality and quantity impacts resulting from development without proper control measures in place could include the following:

- Impaired groundwater quality resulting from chemical spills and leaking hazardous chemical storage tanks.
- The intensification of existing farm operations due to loss of agricultural land could lead to increased risk of groundwater contamination resulting from large scale manure handling and spreading.
- Reduced groundwater quantity, without the implementation of mitigation measures, due to increases in impervious surfaces and reduced infiltration.

The *Community of Everett Preliminary Hydrogeological Investigation (DRAFT November 2012)* completed by Golder Associates (Reference **Appendix MDP-C**) provides details regarding hydrogeology in the Study Area.

3.7 Required Management Measures

It is apparent that future development, without any controls or mitigation strategies, will result in a gradual degradation of the natural features and ecological functions within the watercourses that transect the subject lands or receive drainage from the subject land discharging ultimately to Georgian Bay. In addition, existing erosion and flooding conditions would be increased and new flooding problems would emerge. In order to prevent this from occurring and to allow for sustainable growth, the following management measures are proposed to be incorporated into the MDP:

- Storm water management controls for the control of peak flows and treatment of urban storm water runoff (water quality);
- Land use controls and management measures to protect human life and property from natural hazards associated with flooding and erosion;
- Land use controls to protect significant natural heritage features and ecological functions integral to the functioning of the subwatersheds of the subject watercourses;

- Land use controls and management initiatives to protect and/or enhance sensitive water quality and quantity areas and groundwater recharge/discharge areas, including their functioning to ensure that existing sources of surface and groundwater are maintained; and,

- Low Impact Development (LID) SWM measures should be encouraged through draft plan conditions or municipal guidelines to promote groundwater infiltration and provide tertiary stormwater quality control within future development areas.

The measures identified herein also represent the basis for the development of MDP evaluation criteria and the identification of MDP opportunities and constraints presented in **Chapter 4.0**

4 MDP CRITERIA, OPPORTUNITIES, AND CONSTRAINTS

4.1 General

Based on a review of existing conditions, and review of applicable guidelines and standards from relevant agencies, general drainage and stormwater management criteria were compiled for the Study Area. In addition, management and mitigation opportunities and constraints for the proposed development in the Everett Secondary Plan Area (**Appendix MDP-A – Figure A-1**) were identified. The following Chapter presents these criteria, constraints and opportunities provided by development of the Secondary Plan, as they serve as the basis for identifying general MDP alternatives and options.

4.2 MDP Criteria

4.2.1 Peak Flow Attenuation and Floodplain Management

Agency Guidelines (specifically the NVCA) require peak flow attenuation for all developed areas in the Secondary Plan to control post development flows to pre-development levels (up to and including the 100-Year storm). This will ensure the occurrence of downstream flood events do not increase.

The NVCA also identifies the following peak flow attenuation and floodplain management criteria:

- The existing conditions Regional Storm (Timmins Event) floodplain represents the regulated area/no development zone, unless mitigation or management measures are proposed. No new development is permitted within the Hazard Lands (including the regulated floodplain), which is consistent with the Provincial Policy Statement (PPS) and Simcoe County Official Plan (OP). The existing conditions Regional Storm floodplain for the Secondary Plan has been taken from the NVCA's Generic Floodplain Mapping and is presented in **Figure A-5** (**Appendix MDP-A**).

- The regulated area includes Regional Storm Spill Zones, if applicable.

- SWM Facilities (SWMFs) for water quality and peak flow attenuation must be located outside of identified Natural Environment Areas such as the regulated floodplain, natural hazard areas, watercourses and wetlands. However, stormwater pond outflows and stormwater pond infiltration trenches may be allowed within Natural Environmental Areas subject to approval of an Environmental Impact Study.

Chapter 6.0 and **Appendix MDP-F** present SWMF Options and associated calculations, respectively.

4.2.2 Water Quality

The following stormwater quality controls for the subject Secondary Plan Area are required:

- Enhanced (Level 1) criteria to be met as per the 2003 MOE *Stormwater Management Manual* for discharges to the receiving watercourses from developed areas.

This is achieved through the implementation of Best Management Practices (BMPs) typically by providing the required permanent pool and extended detention volume in end of pipe SWM facilities (SWMFs).

4.2.3 Erosion and Stream Morphology

The maintenance of the channel characteristics of each watercourse is an important consideration when establishing the drainage plan criteria. Typically, it is recommended that additional extended detention flow control be provided to ensure the erosion causing flow occurrences do not increase following development. This additional volume should be released via distributed runoff control technique to a degree necessary to prevent downstream erosion from occurring.

As a minimum the NVCA has a standard of 24 hour extended detention release of the runoff volume captured in a 25 mm storm event. Controlled release of this event, and control of peak storm flows to pre-development levels (as per section 4.2.1 above) should provide sufficient mitigation, as no significant stream erosion issues were noted in the Natural Heritage Study.

Both of the main receiving waterways within the Study area are considered cold water streams, with the Boyne river supporting both warm and coldwater species. For cold water streams, the NVCA also recommends incorporating measures to cool runoff through a combination of outlet design features (i.e. buried stone trenches) and shade plantings along receiving channels downstream of SWM Facilities.

4.2.4 Natural Heritage Features

As detailed in the Natural Heritage Study (**See Appendix MDP-B for Reference**) 30m buffers for new development are required around all natural heritage features, including significant wetlands, woodlots and watercourses. Larger buffers may be required in certain areas i.e. areas outlined in the Floodplain mapping or which experience seasonal flooding. In addition, natural heritage linkages between significant natural heritage features of the Secondary Plan must be considered. The proposed Secondary Plan as shown in **Figure A-1 (Appendix MDP-A)** proposes a natural heritage system, which incorporated natural areas are hazard lands identified by the NVCA and County, in addition to proposed linkages and 30m buffers.

4.2.5 Infiltration Balance & Low Impact Development

With respect to infiltration balance, the SWM Plan criteria for this MDP requires recommendations for mitigation techniques with the goal of maintaining the existing infiltration balance under post development conditions. Infiltration systems are recommended where soil or design conditions permit this objective to be achieved.

Based on available preliminary soils information, most of the non-wetland areas located within the Study boundaries are sandy loam with drainage characteristics which are conducive to infiltration.

As a result, infiltration BMPs and LID stormwater management measures such as bio-swales, permeable pavement, and infiltration trenches should be considered where feasible while developing the preferred SWM concept and MDP option.

A detailed infiltration balance assessment is required for the post development conditions presented in the proposed Everett South Secondary Plan Area, compared with existing conditions, to maintain and/or improve localized groundwater recharge.

4.2.6 Slope Stability (Erosion) Hazards and NVCA Generic Regulations Mapping

The NVCA requires the identification of floodplains, slope stability and erosion hazards and that all new development be located outside of the hazard lands. Floodplain, slope stability/erosion hazards have been identified by the NVCA in their generic Regulations mapping for each of the major watercourses (Nodes 100, 200 & 300) within the Secondary Plan. **Figure A-5** (**Appendix MDP-A**) presents the floodplain and erosion hazards for the Secondary Plan. It should be noted that all new development in the Secondary Plan is located outside of the NVCA Regulated areas.

4.3 Additional Constraints

4.3.1 Recognition of Hazard Setbacks

In accordance with NVCA Standards, SWMFs must be located outside the Regional storm floodplain elevation and erosion hazard limits, however it is expected that the construction of SWMFs will be permitted within the 30m buffer zones.

4.3.2 Cold Water Fishery Constraints

As both of the receiving watercourses in the Secondary Plan Area are classified as cold water streams, additional measures will need to be considered at the design stage for any individual facility, which could include (but would not necessarily be limited to) requirements for shade plantings to help regulate run-off temperature, and time-of-year constraints on the construction of new facilities.

4.4 Opportunities

4.4.1 Water Balance and Infiltration

Given the predominance of sandy loam type soils in the study area, a large portion of the proposed development areas are suitable for infiltration systems. On this basis, at-source BMPs or LID SWM features could be implemented where possible to ensure that post development infiltration rates match pre-development levels.

Infiltration systems on the discharge systems for end of pipe SWMFs within the study area present an opportunity to balance the infiltration levels between post development and pre-development .

4.4.2 Water Quality

Based on conclusions of the Assimilative Capacity Study completed by Greenland in 2012 for the Pine River sub-watershed, (**Appendix MDP-E**), the Pine River at Everett is a Policy 1 receiving watercourse for nutrients (i.e. phosphorus) as defined by Provincial Water Quality Objectives (PWQO's). However, downstream conditions in the Nottawasaga River have fair to poor water quality conditions. An opportunity exists to develop BMP's and LID SWM guidelines for development in Everett which would positively impact downstream nutrient loading including the Boyne River, Nottawasaga River and Nottawasaga Bay.

5 GENERAL MDP ALTERNATIVES

5.1 General

Based on the preliminary identification of SWM Plan criteria, opportunities and constraints presented herein, the following general long-list of SWM Plan/MDP alternatives have been identified. A preliminary evaluation of each alternative is also presented, resulting in the identification of a short-list of MDP Options presented and evaluated in **Chapter 6.0**.

5.2 Water Balance and Infiltration Alternatives

The following water balance and infiltration alternatives have been identified and a preliminary evaluation is provided in **Table 5.1**.

Table 5.1: Water Balance and Infiltration Alternatives

Alternative		Description	Advantages	Disadvantages
1.	At-Source Controls in Areas with Sandy Loam Soil	• In areas where soil/groundwater conditions permit, at source infiltration measures such as soakaway pits installed at lot level. Roof leaders and yard drainage directed to a soakaway pit to promote infiltration. • Road infiltration trenches.	• Achieve basic criteria for enhancing post development infiltration and maintaining pre-development water balance. • Enhances infiltration without the concern for causing nuisance ponding conditions.	• Requires local soil conditions to have good infiltration potential to function effectively.
2.	Reduced Lot Slopes for all development areas.	• Reduced lot grades to allow for greater ponding and detention of precipitation to promote infiltration (i.e. approx. 2%).	• Cost effective technique for promoting infiltration under post development conditions.	• Not a stand-alone solution to the water balance and infiltration criteria. • Municipal Standards for minimum lot grading is 2% slope.
3.	Rear Yard Ponding Areas for all development areas.	• The discharge of roof leaders and yard drainage to ponding areas to promote infiltration.	• Cost effective technique for promoting infiltration under post development conditions. • Thermal benefits (cooling stormwater)	• Not a stand-alone solution to the water balance and infiltration criteria. • Creates potential for unacceptable nuisance ponding.
4.	End of Pipe SWMFs.	• Infiltration within proposed SWMFs and/or exfiltration trenches at the discharge points of all end of pipe SWMFs to promote infiltration.	• Promotes infiltration, improves water quality and mitigates thermal impacts of SWMFs on stormwater discharge temperature.	• Subject to fouling where soil and groundwater conditions are not appropriate.

Based on the foregoing, only Water Balance/Infiltration alternatives 1 and 4 are feasible. These mitigation measures should be implemented where groundwater and soil conditions permit. At source lot level measures (e.g. soakaway pits and infiltration trenches) should only be considered in areas where soil conditions have been verified as conducive to infiltration measures. A water balance evaluation for pre-development and post development conditions will be required prior to implementation of these measures.

5.3 Water Quality

The 2003 MOE SWM Manual identifies the appropriateness of various water quality control measures. A general evaluation of SWM water quality control measures are presented in **Table 5.2** and **Table 5.3**.

Based on the information presented in **Table 5.2**, only the end of pipe wet pond, wetland and dry pond facilities meet the physical constraints of the subject site while providing sufficient control for large drainage areas. The remaining SWM measures would be complimentary or appropriate for site specific situations. **Table 5.3** provides further evaluation of SWMFs.
Wet pond, wetland and wet pond-wetland hybrids all represent effective stormwater quality control end of pipe facilities. For the purposes of this Study, all SWMFs have been evaluated as wet pond facilities. It should be noted that stand alone post development influent phosphorus removal for SWM facilities have been estimated at approximately 70% to 80%. Given the fact that both the Pine River and Boyne River have good water quality (*Source: NVCA, Boyne River & Pine River Watershed Report Cards, 2007*), further reduction of runoff from what is currently predominantly agricultural land would result in further reductions in downstream total nutrient and sediment loading.

Table 5.2: Evaluation of General MOE SWM Options – Physical Constraints

SWMP	Topography	Soils	Bedrock	Groundwater	Area	General Evaluation
Wet pond	None	None	None	None	>5 ha	Appropriate for Post Development Conditions
Dry pond	None	None	None	None	>5 ha	Appropriate for Post Development Conditions
Wetland	None	None	None	None	>5 ha	Appropriate for Post Dev.Conditions
Infiltration Basin	None	Loam (min. inf. Rate ≥ 60 mm/h	> 1 m below bottom	> 1 m below bottom	<5 ha	Appropriate for Post Development Conditions Subject to Verification of Soil Conditions (small drainage areas)
Infiltration Trench	None	Loam (min. inf. Rate ≥ 15 mm/h	> 1 m below bottom	> 1 m below bottom	<2 ha	Appropriate for Post Development Conditions Subject to Verification of Soil Conditions (small drainage areas)
Reduced lot grading	< 2%	Loam (min. inf. Rate ≥ 15 mm/h)	None	None	None	Does not Meet Municipal Criteria
Soakaway pit	None	Loam (min. inf. Rate ≥ 15mm/h)	> 1 m below bottom	> 1 m below bottom	<0.5 ha	Appropriate for Post Development Conditions Subject to Verification of Soil Conditions (small drainage areas)
Rear Yard Ponding	<2%	Loam (min. inf. Rate ≥ 15mm/h)	> 1 m below bottom	> 1 m below bottom	<0.5 ha	Does not Meet Municipal Criteria
Grassed	<5%	None	None	None	<2 ha	Appropriate for Post

Table 5.2: Evaluation of General MOE SWM Options – Physical Constraints

Swales						Development Conditions Where Physical Criteria Met
Pervious Pipes	None	Loam (min. inf. Rate ≥ 15 mm/h	> 1 m below bottom	> 1 m below bottom	None	Appropriate in localized areas Subject to Verification of water table elevations.
Vegetated Filter Strips	<10%	None	None	>0.5 m below bottom	<2 ha	Appropriate for Post Development Conditions Where Physical Criteria Met
Sand Filters	None	None	None	>0.5m below bottom	<5 ha	Appropriate in localized areas Subject to Verification of water table elevations.
Oil/Grit Separators	None	None	None	None	<2 ha	Appropriate for Post Development Conditions Where Physical Criteria Met

Table 5.3: Relative Effectiveness of SWMFs

Description of SWMP for General Class	Suspended Solids	Total Phosphorus	Total Nitrogen	Heavy Metals	Maintenance Aspects	Overall Effective-ness	Seasonal Effective-ness	Ranking SWMFs
Wet pond	High Potential	Medium Potential	Medium Potential	High Potential	High	High	High	1
Dry pond	Low Potential	Low Potential	Low Potential	Low Potential	Low	Low	Low	3
Wetland	High Potential	Medium Potential	Medium Potential	High Potential	Medium	Medium	Low-Medium	2
Wet Pond Wetland Hybrids	High Potential	Medium Potential	Medium Potential	High Potential	Medium	Medium	Low-Medium	2

Several options exist to improve stormwater nutrient and sediment loading reductions and overall reductions of phosphorus loading to the receiving watercourses, including:

- Employ additional treatment technologies in conjunction with end of pipe SWMFs (e.g. filtration systems);
- Provide at source controls in upstream drainage areas, external to the development lands;
- Examine stormwater retrofit opportunities within the affected sub-watersheds;
- Consider the use of enhanced treatment options such as the use of “inert” additives with the ability to coagulate and bind phosphorus;
- Implementation of agricultural BMPs;
- Enhanced urban stormwater infiltration design to minimize stormwater runoff;

- Investigate the potential for recycling treated effluent water (of a high quality) for use as irrigation water; and

- Increase forested land cover in affected sub-watersheds.

The following water quality management alternatives have been identified and a preliminary evaluation provided in **Table 5.4**.

Based on the evaluation presented in **Table 5.4**, **Alternative 1** presents the greatest opportunity for development potential as well as peak flow control, water quality protection potential and natural area enhancement. **Alternatives 2** and **3** would be considered complimentary to the final MDP Options and Preferred Alternative. These alternatives have been incorporated into the short-list of MDP Options identified and evaluated in **Chapter 6.0**.

Table 5.4: Water Quality Control Alternatives

	Alternative	Description	Advantages	Disadvantages
1.	Provide Enhanced Level extended detention SWMFs throughout the post development areas.	• Provide Enhanced Level water quality control in local wet pond, wetland or hybrid SWMFs throughout the post development areas.	• Achieve basic criteria for water quality control.	None.
2.	Alternative 1 with External Upstream Drainage Area At-Source TSS and TP Controls.	• Provide Alternative 1 for Post Development Areas of the Secondary Plan. • Provide at-source controls in external contributing drainage areas (e.g. Cattle Fencing, Conservation Tillage, etc.).	• Potential to achieve water quality targets.	May not be feasible due to cost and implementation.
3.	Implement reduction BMP's & LID Solutions	• Implementation of other reduction measures including Agricultural BMP's and LID SWM features for new development.	• Reduce downstream nutrient loading.	Can only enforce with new development.

6 IDENTIFICATION AND EVALUATION OF MDP OPTIONS

6.1 General

Based on the evaluation of general MDP and SWM Plan alternatives presented in **Chapter 5.0**, this Chapter identifies: the short-list of MDP Options and; presents an evaluation of the Options. It should be noted that the "Do Nothing" Option is not a feasible MDP alternative due to the expressed desire to proceed with additional development in the Study Area. As such, this Option was not considered further in this assessment.

6.2 Option MDP-1: Development within Existing Settlement Boundary with New SWMFs

Option MDP-1 is shown in **Figure A-6-1**, **Appendix MDP-A**, which limits development and therefore SWMF facilities to the existing Everett Community Settlement Boundaries. Option MDP-1 includes the following general characteristics:

- Six (6) SWMFs (Level Sizing Parameters are presented in **Table 6.1**) are proposed to provide storm water quality and quantity control on a local regional scale basis. Three (3) of these ponds are existing Facilities (1, 2 & 3) and three (3) are proposed (B, C &F). It should be noted that Existing Facility No. 3 (E-3) is not yet constructed but is part of an approved draft plan for the R&M Homes development. As such, it is also labelled as Proposed Facility A (P-A). The final location and sizing of all proposed SWMFs is subject to more detailed land use planning (i.e. draft plan and final design), however Concept level locations are presented in **Figure A-6-1**.

- Each SWMF is proposed with a wet pond volume designed to meet MOE Enhanced water quality protection levels.

- Each SWMF is proposed to have an extended detention volume and outlet structure that meets MOE water quality 24 hour release rate detention of the extended detention volume (40 m^3/contributing drainage area (ha)), 24 hour detention of the 25mm storm event for erosion control; and control of post development flows to pre-development levels for all storms up to and including the 100-Year event. SWMF sizing analysis details are provided in **Appendix MDP-F**for MOE water quality and erosion control volumes.

In essence, Option MDP-1 achieves the minimum water quality protection, erosion control, water quantity control and floodplain management requirements within the existing settlement boundaries of the Community of Everett. This option assumes that the portion of the Study Area which resides outside of existing settlement boundaries would remain undeveloped.

Table 6.1: Option MDP-1 SWMF Volume and Sizing Requirements

SWMF No.	Catchment No.	Total Drainage Area (ha)	Total Imperviousness (%)	Required Permanent Pool Volume (m^3)	Required[1] Extended Detention Volume (m^3)	Required[2] Land Area (ha)
1	15	13.5	65%	2,342	2,676	0.69
2	17	18.84	49%	2,536	3,197	0.76
A (3)	16	74.70	35%	10,286[3]	20,668[3]	1.10[3]
B	10	69.17	24.9%	5,261	5,756	1.04
C	20	44.27	16%	2,410	3,497	0.79
F	18	40.65	47%	5,275	12,724	1.69

NOTES:
1. Extended detention volume includes water quality, erosion control and peak flow control volumes.
2. Area estimates assume 3:1 (L:W) Extended Detention, 2.0 m Extended Detention Depth, 6:1 (H:V) Extended Detention Side Slopes, 8.0 m Buffer.
3. * = Actual designed value as per Approved Draft Plan.

The Option MDP-1 SWMFs were included in a post development VO2 hydrologic model. The model results are presented in **Appendix MDP-D** and the results of this modelling exercise are summarized in **Table 6.2**. The locations of the flow nodes are shown in the post development model schematic for Option MDP-1 in **Appendix MDP-D**, and are also described in **Chapter 2**.

As demonstrated in **Table 6.2**, the implementation of Option MDP-1 results in peak flows through the Study Area watercourses that are at or below existing peak flow levels.

Option MDP-1 as developed in this study is unable to achieve the stated goals of developing the Secondary Plan Area, as it is limited in scope to the existing settlement boundaries. As this option does appear to meet the required criteria from a design perspective (i.e. limitation of post development flows to pre-development levels, 24 hour detention of 25mm storm event etc.), <u>the Township could consider the implementation of this Option as a staging plan in support of buildout towards a preferred Option.</u>

Table 6.2: Option MDP-1 Post Development Hydrologic Flow Summary

	Storm Flow (m^3/s)									
Node & Location	Timmins		100-Yr (SCS)		25-Yr (SCS)		5-Yr (SCS)		2-Yr (SCS)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	18.36	17.39	11.38	11.10	8.35	8.19	5.40	5.31	3.71	3.66
Pine River Main Branch Node #200	16.45	16.24	8.49	8.37	5.76	5.68	3.20	3.15	1.83	1.81
Boyne River Tributary Node #300	18.47	17.24	9.66	9.33	6.69	6.48	3.81	3.69	2.24	2.14
Node & Location	100 yr (Chicago)		25 yr (Chicago)		5 yr (Chicago)		2 yr Chicago		4 hr 25mm Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	14.93	14.68	12.31	12.05	6.92	6.83	4.47	4.39	2.81	2.67
Pine River Main Branch Node #200	7.50	7.40	5.19	5.11	2.45	2.42	1.17	1.15	0.51	0.50
Boyne River Tributary Node #300	8.39	8.35	5.88	5.86	2.88	2.86	1.43	1.40	0.64	0.65

6.3 Option MDP-2: Full Development without Additional SWM Controls

Where Option MDP-1 does not address stormwater management for the development of the complete Secondary Plan Area, Option MDP-2 has taken full build-out of the proposed Secondary Plan Area into account. However Option MDP-2 assumes that no additional SWM Facilities would be constructed in support of the additional development. Option MDP-2 is depicted in **Figure A-6-2**.

As “uncontrolled” flows were developed for comparison purposes (see **Table 3.1**), this Option was included in the list, however as shown previously in **Chapter 3** of this report, post development flows will need additional controls to ensure that pre-development peaks are not exceeded, and on this basis, Option MDP-2 would not represent a feasible MDP Alternative.

6.4 Option MDP-3: Full Development of Plan Area with Local/Regional SWMFs

Option MDP-3 has the same characteristics as Option MDP-1, with the following differences:

- Option MDP-3 includes provision for development of the entire Secondary Plan area (as per Option MDP-2), as opposed to limiting development to the existing settlement boundary.

- This Option proposes that a total eight (8) SWMFs (Concept Level Sizing Parameters are presented in **Table 6.3**) will be used to provide storm water quality and quantity control on a local regional scale basis. Three (3) of these ponds are existing Facilities (1, 2 & 3) and five (5) are proposed (B, C, D, E &F). The final location and sizing of all proposed SWMFs is subject to more detailed land use planning (i.e. draft plan and final design), however Concept level locations and sizing parameters are presented in **Figure A-6-3.** Including the proposed R&M Homes SWMF, this option would include the construction of six (6) new SWMF’s in total.

Table 6.3: Option MDP-3 SWMF Volume and Sizing Requirements

SWMF No.	Catchment No.	Total Drainage Area (ha)	Total Imperviousness (%)	Required Permanent Pool Volume (m^3)	Required[1] Extended Detention Volume (m^3)	Required[2] Land Area (ha)
1	15	13.5	65%	2,342	2,677	0.69
2	17	18.84	49%	2,536	2,860	0.72
A (3)	16	74.70	35%	10,286[3]	20,668[3]	1.10[3]
B	10	69.17	46.8%	8,942	9,772	1.42
C	20	44.27	42%	5,207	9,970	1.44
D	11	76.47	29.2%	6,615	6,771	1.14
E	19	64.29	46.9%	8,323	12,177	1.64
F	18	40.65	47%	5,275	13,500	1.75

NOTES:
1. Extended detention volume includes water quality, erosion control and peak flow control volumes.
2. Area estimates assume 3:1 (L:W) Extended Detention, 2.0 m Extended Detention Depth, 6:1 (H:V) Extended Detention Side Slopes, 8.0 m Buffer.
3. Actual designed value as per Approved Draft Plan.

The Option MDP-3 SWMFs were included in a post development VO2 hydrologic model for Option MDP-3. The model results are presented in **Appendix MDP-D** and the results of this modelling exercise are summarized in **Table 6.4**. The locations of the flow nodes are shown in the post development model schematic for Option MDP-3 in **Appendix MDP-D**, and are also described in **Chapter 2**.
As demonstrated in **Table 6.4**, the implementation of Option MDP-3 results in peak flows through the Study Area watercourses that closely mimic existing peak flow levels.

Table 6.4: Option MDP-3 Post Development Hydrologic Flow Summary

	Storm Flow (m^3/s)									
Node & Location	Timmins		100-Yr (SCS)		25-Yr (SCS)		5-Yr (SCS)		2-Yr (SCS)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	18.36	17.28	11.38	11.17	8.35	8.26	5.40	5.43	3.71	3.79
Pine River Main Branch Node #200	16.45	15.47	8.49	8.02	5.76	5.45	3.20	3.02	1.83	1.73
Boyne River Tributary Node #300	18.47	16.07	9.66	8.92	6.69	6.04	3.81	3.50	2.24	2.07
Node & Location	100 yr (Chicago)		25 yr (Chicago)		5 yr (Chicago)		2 yr Chicago		4 hr 25mm Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	14.93	14.96	12.31	11.96	6.92	7.00	4.47	4.52	2.81	2.84
Pine River Main Branch Node #200	7.50	7.18	5.19	4.97	2.45	2.34	1.17	1.12	0.51	0.48
Boyne River Tributary Node #300	8.39	8.13	5.88	5.63	2.88	2.81	1.43	1.40	0.64	0.64

Option MDP-3 will require over-controlling of flows in all new development areas which drain to Node 100, as approximately 34 ha of additional developed land will drain to this Node under full Secondary Plan Area build-out. This option does not take improvements, consolidation, or expansion of existing SWMF's into account and assumes that all existing facilities will remain operational as per the existing conditions.

6.5 Option MDP-4: Common SWMF's With Connection of Ex. SWMF 2 & Prop. SWMF C

Option MDP-4 is identical to Option MDP-3 with the exception that existing SWMF 2 is proposed to drain into the proposed SWMF C. The intention of considering this options was to determine the impacts (if any) of consolidating existing flows into a new facility which would be located immediately downstream under the proposed development scenario. Concept level pond sizing calculations are provided in **Table 6.5.** Option MDP-4 is depicted in **Figure A-6-4.**

A comparison of these values with those presented in **Table 6.3** indicate that consolidation of these two (2) facilities would reduce the required extended detention volumes for other facilities which drain to Node 100 by a small amount. This change results in little benefit to downstream developments and watercourse health to justify the financial cost of implementing this Option. Modelling results for this option do indicate that it would be a viable option from a peak flow reduction perspective, as shown in **Table 6.6.**

Table 6.5: Option MDP-4 SWMF Volume and Sizing Requirements

SWMF No.	Catchment No.	Total Drainage Area (ha)	Total Imperviousness (%)	Required Permanent Pool Volume (m^3)	Required[1] Extended Detention Volume (m^3)	Required[2] Land Area (ha)
1	15	13.5	65%	2,342	2,676	0.69
2	17	18.84	49%	2,536	3,197	0.76
A (3)	16	74.70	35%	10,286*	20,668*	1.10*
B	10	69.17	46.8%	8,942	9,299	1.38
C	20	44.27	42%	5,207	10,291	1.47
D	11	76.47	29.2%	6,615	6,748	1.14
E	19	64.29	46.9%	8,327	11,979	1.62
F	18	40.65	47%	5,275	12,200	1.64

NOTES:
1. Extended detention volume includes water quality, erosion control and peak flow control volumes.
2. Area estimates assume 3:1 (L:W) Extended Detention, 2.0 m Extended Detention Depth, 6:1 (H:V) Extended Detention Side Slopes, 8.0 m Buffer.
3. Actual designed value as per Approved Draft Plan.

Table 6.6: Option MDP-4 Post Development Hydrologic Flow Summary

	Storm Flow (m^3/s)									
Node & Location	Timmins		100-Yr (SCS)		25-Yr (SCS)		5-Yr (SCS)		2-Yr (SCS)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	18.36	17.22	11.38	11.07	8.35	8.19	5.40	5.38	3.71	3.74
Pine River Main Branch Node #200	16.45	15.47	8.49	8.02	5.76	5.45	3.20	3.02	1.83	1.73
Boyne River Tributary Node #300	18.47	15.97	9.66	9.01	6.69	6.35	3.81	3.63	2.24	2.13
Node & Location	100 yr (Chicago)		25 yr (Chicago)		5 yr (Chicago)		2 yr Chicago		4 hr 25mm Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pine River Tributary Node #100	14.93	14.74	12.31	12.11	6.92	6.97	4.47	4.49	2.81	2.82
Pine River Main Branch Node #200	7.50	7.18	5.19	4.96	2.45	2.34	1.17	1.12	0.51	0.48
Boyne River Tributary Node #300	8.39	8.30	5.88	5.90	2.88	2.85	1.43	1.38	0.64	0.59

As the storage calculations presented in Option MDP-4 are based upon a “full build-out” scenario within the “Node 100” upstream drainage area, an established connection between Ex. SWMF 2 and Proposed SWMF C would be required prior to Construction of SWMF’s E or F, thus limiting development within these subcatchments. As there are no changes proposed to the R&M Homes SWMF under this option (Ex. SWMF 3 / Prop. SWMF A), this development could proceed prior to connecting Ex. SWMF 2 and Prop.SWMF C.

6.6 Option MDP-5: Individual SWMF’s for All Developable Land Parcels

There are currently eleven (11) undeveloped land parcels within the Secondary Plan Area. Of these properties, nine (9) parcels of land are “developable” with two (2) parcels falling within environmental blocks. Option MDP-5 would involve placing an individual SWMF in each property, which would involve the implementation of nine (9) New SWMF’s.

As this option would be far more expensive to construct as well as maintain than the other Options presented herein, which at maximum suggest the implementation of six (6) new SWMF’s to service the nine (9) developable parcels. As such, this Option was not pursued further as an MDP Preferred Option, as the inherently high capital costs and increased maintenance requirements would result in a poor ranking in the final Option assessment compared to previously presented options.

6.7 Additional Details Common to All MDP Options

6.7.1 <u>Water Balance and Infiltration</u>

No detailed water balance or infiltration assessment has been completed in support of this MDP, however The *Community of Everett Preliminary Hydrogeological Investigation (DRAFT November 2012)* completed by Golder Associates (Reference **Appendix MDP-C**) provides some details regarding hydrogeology in the Study Area. In General, the following infiltration measures should be considered for inclusion with any MDP option:

- In areas where soil/groundwater conditions permit, at source infiltration measures such as soakaway pits or equivalent measures installed at the lot level. In these areas, roof leaders and yard drainage should be directed to a soakaway pit or equivalent measure to promote infiltration.

- Road infiltration trenches should be installed where soil/groundwater conditions permit.

- End of Pipe SWMF infiltration and exfiltration systems should be installed where soil and groundwater conditions permit to promote infiltration and reduce thermal impacts of the proposed SWMFs.

6.7.2 Stormwater and Floodplain Management

The following attributes are consistent in all the MDP alternatives discussed herein with respect to Stormwater and Floodplain Management:

- All SWMFs proposed in the MDP provide 24 hour detention of the 25 mm storm SCS 24 hour storm, as shown to be applicable based on MOE recommended analysis (**Appendix MDP-F**).

- All Proposed SWMFs are located outside of the environmental hazard limits and wetland boundaries.

- All Proposed SWMFs provide a reduction of peak flows to pre-development levels.

6.8 EVALUATION CRITERIA FOR RECOMMENDED SOLUTION

Based on the evaluation procedure presented herein, Options MDP-3 and MDP-4 were considered feasible general alternatives for further evaluation. These “short listed” alternative solutions were assessed in terms of the colour coded evaluation criteria presented below.

Criteria highlighted in “green” represent the most preferred alternative, while “yellow” criteria represent less preferred alternatives and criteria in “red” represent the least preferred alternative.

The evaluation criteria used to select the recommended solution are as follows:

- Natural Environment Impacts:
  - Impacts of the option to vegetation, wildlife & the Natural Environment; and
  - Surface/groundwater quality and quantity implications;
- Social/Cultural Environment Impacts:
  - Land Use & Archaeological Considerations (Including First Nations);
  - Traffic impacts & interruption to residents; and
  - Visual landscape/Aesthetic impacts;
- Technical/Operational Considerations
  - Difficulty to construct or implement the Option relative to other alternatives; and
  - Operation & Maintenance Efficiency;
- Economic Impacts
  - Capital/construction costs;
  - Long term/operation & maintenance cost burden; and
  - Payment structure, cost recovery options for Municipality, Phasing Flexibility.

Table 6.7: Evaluation Criteria and Ranking Summary for MDP Options		
Evaluation Criteria	**Option MDP-3** Full Development of Plan Area with Local/Regional SWMFs	**Option MDP-4** Common SWMF's With Connection of Ex. SWMF 2 & Prop. SWMF C
Natural Environment Impacts		
Impacts of the option to vegetation, wildlife & the Natural Environment	This option will minimize the overall number of SWM Facilities and consequently result in the least possible disturbance to existing vegetation.	This option will also minimize disturbances to the natural environment but has the added benefit of potential improvements to existing pond plantings and vegetation in Ex. SWMF 2
Surface/groundwater quality and quantity implications	This option is able to meet required Water Quality and Quantity Control objectives for Georgian Bay and its tributary watercourses.	This option is able to meet required Water Quality and Quantity Control objectives for Georgian Bay and its tributary watercourses. Retrofits to Ex. SWMF 2 could provide added tertiary benefits.
Natural Environment Overall Rating		
Social / Cultural Environment Impacts		
Land Use & Archaeological Considerations (Including First Nations)	As per Archaeological Report (see **Appendix MDP-G**) No Known Archeological issues. Land use for SWMF's is minimized through use of regional facilities.	As per Archaeological Report (see **Appendix MDP-G**) No Known Archeological issues. Land use for SWMF's is minimized through use of regional facilities.
Traffic impacts & interruption to residents	Minimal traffic issues or interruptions to Existing Residents.	Pond retrofit operations & Construction Traffic may cause minor disruptions to residents in the vicinity of Ex. SWMF 2
Visual landscape/Aesthetic impacts	No major impacts.	No major impacts.
Social / Cultural Environment Overall Rating		

Table 6.7: Evaluation Criteria and Ranking Summary for MDP Options		
Evaluation Criteria	**Option MDP-3** Full Development of Plan Area with Local/Regional SWMFs	**Option MDP-4** Common SWMF's With Connection of Ex. SWMF 2 & Prop. SWMF C
Technical/Operational Considerations		
Difficulty to construct or implement the Option relative to other alternatives	This option minimizes the number of facilities which need to be Constructed.	Efforts required are similar to Option MDP-3, with the added difficulty of retrofitting Ex. SWMF 2. Retrofits will provides minimal SWMF volume reduction advantages downstream.
Operation & Maintenance Efficiency	Operation & Maintenance is Minimized by limiting the total number of SWMF's.	Operation & Maintenance is Minimized by limiting the total number of SWMF's.
Technical/Operational Considerations Rating		
Economic Impacts		
Capital/construction costs	Less expensive than Option MDP-4 as number of new facilities is the same, but no retrofits are being proposed.	More expensive than Option MDP-3 as retrofits will be implemented in addition to new facilities.
Long term/operation & maintenance cost burden	Maintenance costs minimized by limiting number of SWMF's	Maintenance costs minimized by limiting number of SWMF's
Payment structure, cost recovery options for Municipality, Phasing Flexibility	Facilities will be required as development proceeds on a regional basis, and will be the responsibility of the developer (s).	Similar flexibility to Option MDP-3, with the added difficulty of recovering additional costs of retrofitting Ex. SWMF 2
Economic Ranking		
Overall Ranking:		

7 SUMMARY OF PREFERRED MDP ALTERNATIVE

Based on the evaluation of MDP Options presented in **Chapter 6.0**, the general alternative Options 3 and 4 presented are viable MDP alternatives. The preferred MDP alternative was determined to be **Option MDP-3** (presented in **Figure A-6-3**, **Appendix MDP-A**)**,** with selected attributes from the other general and complimentary Options. **Option MDP-3** provides the net benefit of water quality enhancements to stormwater runoff draining to the receiving watercourses without significant changes to the normal hydrology of the Watershed, and without impacting the overall staging requirements for development within the Secondary Plan area.

The recommended preferred Master Drainage Plan for the Everett South Secondary Plan includes the following general characteristics:

- Six (6) new Stormwater Management Facilities (SWMFs) are proposed for the Secondary Plan, including the proposed R&M Homes SWMF.
- Each of the Six (6) Proposed Stormwater Management Facilities are proposed as wet pond facilities that meet <u>MOE Enhanced water quality control</u> requirements.
- Each of the six (6) Stormwater Management Facilities are proposed to <u>control post development flows to pre-development levels</u> for all storms up to and including the 100-Year storm event. All newly proposed facilities which ultimately drain to Node 100 shall be designed to overcontrol runoff to account for the increase in overall contributing area to this drainage node under post-development conditions.
- All Stormwater Management Facilities proposed in the MDP provide <u>24 hour detention of the 25 mm storm for erosion control purposes</u>.
- End of Pipe Stormwater Management Facility infiltration and exfiltration systems to promote infiltration and reduce thermal impacts are proposed in the MDP where soil and groundwater conditions permit.
- All development including Stormwater Management Facilities are proposed outside the Natural Environment Area land uses, including the Regional storm flood elevation, the erosion hazard set-back limit, wetland areas and the 30m natural heritage/fisheries set-back from the Secondary Plan natural heritage areas.
- In areas where soil/groundwater conditions permit, at source infiltration measures such as soakaway pits or equivalent measures are to be installed at lot level.
- Road infiltration trenches should be installed where soil/groundwater conditions permit.

8 IMPLEMENTATION STRATEGY/MONITORING PROGRAM

8.1 General

This Chapter presents the Implementation Strategy and Monitoring Program which is recommended to effectively implement the Master Drainage Plan. Components of the MDP, including the protection of natural heritage features, should be implemented under the Township's development approval process. Implementation of stormwater management controls will occur as lands are developed in the study area.

It must be recognized, however, that the recommended MDP is an overall "conceptual plan" and its implementation will require more detailed engineering and financial considerations for site-specific development proposals. Nevertheless, the other approach to address SWM requirements for small infill/expansion developments is still possible and would include setting a minimum threshold value as a "trigger" for the implementation of the MDP facilities, or the implementation of interim on-site stormwater management works. If feasible, this approach would also include the establishment of "per unit development area" release flows and detention storage volumes for the affected infill developments.

General details of the Implementation Strategy are presented in **Table 8.1**. Key components of the Monitoring Program for the recommended Master Drainage Plan are also presented. Final details would be confirmed following the additional consultations at future development stages.

Table 8.1: Implementation Strategy

Strategy Component	Lead Agency (Support Agency)	Implementation Mechanism(s)
Flooding and Erosion Hazards	NVCA (MNR, Township)	Confirm new flood line mapping for subject watercourses and individual future development applications. Identify hazardous lands as Hazard Prone Areas within Official Plan (OP) land use schedules and specify that no development is permitted in these areas. Finalize fill line mapping along watercourses and finalize erosion hazards (i.e. slope stability).
Protection/Enhancement of Significant Natural Heritage Features and Ecological Functions	Township (MNR)	Designate Natural Heritage Lands in OP land use schedules. Specify in policy that development within areas identified as natural heritage features is only permitted if it can be shown by EIS that there will be no negative impacts.
Preservation of Groundwater Quality and Quantity Construction	NVCA & Township (MOE & OMAFRA)	Preparation and submission of Storm Water Management Plans for new development. OMAFRA/NVCA/MNR staff to provide educational, technical assistance to farmers and rural community emphasizing principles of land stewardship. Also to provide BMPs for reduction in chemical spills and pollutant loadings for industrial and commercial property owners.
Reforestation, Natural Corridor and Terrestrial Habitat Restoration and Enhancement	MNR & NVCA (Township)	Regeneration and management plans prepared to target priority areas. Planting to be co-ordinated by NVCA/MNR programs emphasizing landowner, community group and associations, involvement and participation. Education campaigns and tax incentives for improved forest management.
Stream and Aquatic Habitat Restoration and Enhancement	MNR & NVCA (DFO, DOE, Township)	Rehabilitation plans prepared to target priority areas. Channel stabilization and planting to be co-ordinated by NVCA/MNR programs emphasizing landowner, community group and associations, involvement and participation. DFO authorization as required.
Agricultural and Rural Land Stewardship	NVCA (OMAFRA, MNR, MOE)	OMAFRA/NVCA/MNR staff to provide educational, technical assistance to farmers and rural community emphasizing principles of land stewardship and associated benefits.
Stormwater Management Practices	Township (NVCA, MNR, MOE) through plan review process Township (NVCA, MNR, MOE) through plan review process	Preparation and submission of Storm Water Management Plans in conformance with Master Drainage Plan. SWM Plans to adhere to MOE/MNR manual of practice, Township and NVCA standards and guideline requirements.
Erosion and Sediment Control During Construction	Township (NVCA, MNR, MOE) through plan review process	Preparation and submission of Erosion and Sediment Control Plans that accompany Storm Water Management Plans.

8.2 Implementation Agencies

Various agencies will be responsible for review and/or implementation of various aspects of the MDP, including:

- Township of Adjala-Tosorontio;
- County of Simcoe;
- NVCA;
- Ontario Ministry of Agriculture, Food and Rural Affairs;
- Ontario Ministry of the Environment;
- Ontario Ministry of Municipal Affairs;
- Ontario Ministry of Natural Resources; and
- Federal Department of Fisheries and Oceans;

The Implementation Strategy framework in **Table 8.1** recognizes the mechanisms or methods by which the various plan components will be implemented.

8.3 Public Involvement

In order to develop a workable Implementation Plan, there must be continuous dialogue with the public to insure that the plan is not only accepted, but willingly adhered to. Open dialogue and understanding will be critical to the successful implementation of many of the recommended agricultural/rural land use management strategies.

8.4 Monitoring Program for the Master Drainage Plan

Successful implementation of the MDP will require careful monitoring of implementation measures to ensure that the goals and objectives of the MDP are being achieved. The key components of the recommended monitoring program are presented as follows, while additional details for any constructed stormwater management works are discussed later in this Chapter:

- Perform water quality sampling at 3 stream locations within the subject watercourses at least once per year for wet and dry weather flows (not during the winter). Sample storm sewer outfalls once every 3 years for wet weather flows. Tested parameters should include typical PWQO parameters such as temperature, pH, turbidity, bacteria, dissolved oxygen, metals and nutrients.

- Assess fish and invertebrate populations and diversity once every 3 years at 3 locations within the watercourses, preferably the same locations used for water quality sampling.

- Monitor established erosion sites along the stream once every 5 years through stream morphology stability assessments.

- Monitor alterations to forest lands, hedgerows using aerial photographs once every 5 years.

- Monitor baseflow quantities periodically using a velocity metre approximately once every year following a brief dry period.

- Establish and maintain a database of septic systems and surface water taking permits as a means of monitoring potential groundwater impacts and water usage within the Subwatershed.

- Periodically perform visual inspections of SWMFs to ensure proper operation for stormwater control. This could be incorporated into the regular operation and maintenance schedule.

8.5 Stormwater Management Technical Requirements

8.5.1 Detailed Engineering Designs

In accordance with a new policy that would have to be adopted for the study area, a Functional Servicing Plan "brief" (FSP) should be submitted to the Town in support of each Draft Plan of Subdivision or site plan application. The purpose of each FSP will be to demonstrate that the proposed plan meets the general intent of the Master Drainage Plan with respect to servicing, grading and stormwater management.

We have compiled a "draft" list of objectives to be satisfied by each FSP for specifically the study area. While this list is not exhaustive for every site, it will give each proponent the minimum amount of information that should be supplied to the Township and NVCA for review. Final FSP requirements should be confirmed at the above recommended workshop meetings about the MDP's implementation requirements.

8.5.1.1 Servicing Information to be Provided

- The site should be identified within the context of the Master Drainage Plan and its respective drainage catchment.

- Upstream areas should be identified and the assumed design criteria for the upstream lands should be clearly stated.

- All outlets should be identified, including type, size and invert elevation.

- If there are external areas it should be demonstrated that the proposed inverts within the proponent's site can adequately service upstream lands, without adverse filling being required.

- External servicing requirements and improvements should be identified.

- Temporary servicing schemes that are required to service the proponent's lands should be identified.

8.5.1.2 Grading Information to be Provided

- A Conceptual Grading Plan should be prepared for the site. This plan should demonstrate that continuous major system flow routes have been provided and that they have sufficient capacity for the expected 100 year flows. This plan should also highlight any areas where retaining walls or significant sloping is required to match existing grades.

- Where the development abuts an existing residence, sufficient details should be provided to demonstrate that existing drainage patterns would not be impacted.

- Where the development abuts a buffer or corridor linkage, as identified in the Master Drainage Plan, it should be demonstrated how the grading ties into the grades of these areas. All proposed alterations should be identified.

- Where the development contains a channel that is designated for municipal drainage, a Conceptual Grading Plan should be prepared that confirms the channel geometry.

- Where a development contains a stormwater management (SWM) facility, a Conceptual Grading Plan should be prepared that confirms the pond block area required to meet the discharge-storage curve given in this report, as well as confirm that SWM pond design criteria of the municipality and regulatory agencies have been met.

- The SWM facility Grading Plan should also show all side slopes and demonstrate that adequate maintenance access has been provided. More details on the SWM facility requirements are given below.

8.5.1.3 Stormwater Management Information to be Provided

- Release rates for external areas should be specified.

- It should be demonstrated that the release rates at the site outlet are consistent with the release rates given in this report.

- Sufficient detail should be provided to demonstrate that all water quality control obligations have been met, as per the requirements of this report. A conceptual post construction monitoring plan should also be presented.

- The conceptual design of the SWM facility should include: storage volumes, water levels, water level fluctuations, inverts of inlets and outlets, berm elevations, and slope information. Also the relationship between the pond components (i.e. permanent pool, flood storage) should be identified. Finally, any other storage or pumping requirements needs for local fire flow provision should also be identified and incorporated into the design.

- The original assumptions pertaining to drainage area and land imperviousness should be checked to confirm whether the SWM facility volume requirements are valid.

- Any fencing requirements for the SWM facilities should be identified as well as screening requirements adjacent to existing residences.

- The location of the 100-Year and Regional Storm floodlines in relation to the SWM facility should be indicated.

- Where the existing riparian storage has been altered, it should be demonstrated that these alterations satisfy Floodplain Management Policies established by the Province of Ontario.

- Water levels within channels conveying municipal drainage should be presented and any impacts to upstream lands should be clarified.

- Guidelines for the location, design and construction of all road crossings of all channels should be provided in the FSP. A preliminary sizing of the crossings (i.e. culvert or span bridge) should also be provided.

8.6 MDP Facility Post-Construction Monitoring Requirements

Master drainage plans result in the construction of stormwater management (SWM) practices (e.g. retention ponds, drainage channels, etc.) to prevent/remedy the negative effects of urban runoff. Governments have a prime responsibility in the successful operation of SWM facilities, which are in turn, dependent on many factors. These factors include: 1) good original designs; 2) proper selection of facility types; and 3) understanding of the original management plan objectives.

The Township and NVCA should exercise “due diligence” and implement follow-up monitoring of the “performance” and “effectiveness” of the constructed works draining the study area and to the downstream watercourse receiver, since they require that these facilities are to be built, are responsible for the long-term operation and/or have mandates over receiving watercourses. This section discusses an “integrated” post-construction monitoring strategy to ensure that the proposed Master Drainage Plan will function as intended from this study. *It is anticipated that as the SWM systems and development matures, the monitoring and maintenance programs would require refinements. Any changes would be dictated by the observations noted during regular monitoring.*

The following principles were considered as the basis of a stormwater drainage monitoring framework for the study area:

- Monitoring must be directed at fulfilling one or more objective set, be subject to analysis and lead to potential actions;

- Monitoring of receiving watercourses should be for identifying problems, establishing background reference and evaluating effectiveness of the constructed mitigative controls;

- Technology performance monitoring should be undertaken to confirm that each SWM facility operates as designed, to determine if remedial design improvements are needed, to determine if it needs maintenance and to assist in improving future stormwater management designs;

- An ideal monitoring program should be directed at connecting receiving stream impact analysis with technology performance assessment in a subwatershed context;

- The monitoring program should recognize and incorporate existing programs; and,

- Reporting on results and taking appropriate follow-up action is a key component that fulfils "due diligence" expectations.

In accordance with the *Ontario Water Resources Act*, as administered by MOE, the approval process for each SWM facility would result in a "Certificate of Approval". This would include the operation of each facility, according to specific conditions regarding operational methods, required effluent quality, and required "performance" monitoring reporting. The monitoring locations should be established at both the inlet(s) to and outlet(s) from each facility. This type of approach will allow determination of the pollutant contribution from the development area draining to each facility, while at the same time determine the pollutant removal efficiency of the facility.

The monitoring of the water quality itself can be done by means of either grab samples or continuous sampling protocols/procedures, and must be taken during wet weather flow conditions to establish the increase in pollutant concentrations. The monitoring of rainfall will be essential to relate the increase in pollutants and flows in order to approximate mass loading rates. Instantaneous flow measurements will be necessary at the time of collecting the water quality samples. The following brief synopsis will serve as a "skeleton format" to later develop a step-by-step monitoring schedule at the time of the final design. The Town, NVCA and MOE should be consulted at the detailed design stage to determine if the monitoring program must be reviewed and approved prior to the issuance of the Certificate of Approval:

Finalize the monitoring objectives and relative importance of each and incorporate data with the overall MDP health monitoring program, as outlined above.

Express the objectives in statistical form. Each objective should be expressed as an average with an associated level of statistical significance. Often neglected, water quality monitoring is a statistical process with uncertainty associated with the final results.

Assign monitoring budget and fractions allocated to each objective. Realistic economic limits will be established on the number of samples, stations and parameters to be analyzed according to the monitoring objectives.

Monitoring parameters. Parameter selection must reflect the desired water enhancement purpose. Selection of the monitoring parameters must reflect seasonal relevance and applicability.

Finalize sampling times and frequencies. Sampling should be undertaken between April and November (and at the earliest in March if snow melt occurs earlier) in order to coincide with the critical periods of spring melt and wet weather flow. Measurements during these periods would give an indication of the critical water quality conditions in the serviced drainage area.

Recommend an operating plan and procedures. Sample collection procedures and schedule will be defined for co-ordination with laboratory, and other field operations (e.g. flow monitoring, data retrieval, etc.).

Recommend a reporting format. Data should be summarized and presented in a clear and concise manner to facilitate impact assessment.

A preliminary “outline” has been prepared to monitor “performance” of each SWM facility and overall “effectiveness” of the master drainage plan for the study area. Specific details should be finalized after this report is adopted by the Town. Each monitoring component will be in response to the stated objectives below, be subject to analysis and lead to a potential action as a result.

8.7 “Performance Assessment” of Proposed SWM Facilities

8.7.1 Objective

Determine performance of each control facility to: 1) meet design objective; 2) enhance design methods; and/or, 3) determine need for maintenance.

8.7.2 Analysis

Compare flood control and quality control pond hydraulics to design specifications for flow splitting, volume controlled, drawdown time and released flow rates. Compare total capture to expected volumetric control level (i.e. specified depth of runoff). Compare quantity control hydrology to expected as modelled performance. Computer models from this study may need to be applied for some analysis steps. Calculate removal rate of parameters and compare to design guidelines.

For maintenance, observation of sedimentation in channels, sediment build-up in ponds, berm erosion, litter build-up, clogging of inlet and outlet structures, free operation of moveable control elements, health of wetland plants, security fences and gratings intact etc.

8.7.3 Potential Action

Accept pond turn over from the proponent or developer to the Township; modify pond hydraulics; maintain pond; replant aquatic plants; remove sediment build-up; retrofit additional controls in pond or upstream in drainage area; modify design guidelines for future similar cases.

8.8 “Effectiveness Assessment” of Overall Master Drainage Plan

8.8.1 Objective

Determine in-stream effectiveness of all SWM practices (upstream control facilities and third pipe system) to confirm one or more of the following for the study area:

- Flow rates not increased over pre-development (flood and erosion objective);

- Current flow volume relationships are maintained (water budget objective);
- Flow velocities (impulse) not increased (erosion control objective);
- Channel and bank erosion not increased;
- Water quality improved;
- Aquatic habitat not adversely impacted;
- Biota diverse and healthy; and/or,
- Lack of toxicity.

8.8.2 Analysis

Compare observed conditions to baseline data from this study.

8.8.3 Potential Action

Implement remedial measures instream; additional controls upstream; retrofit control onto existing ponds; and/or modify control requirements for future sites.

9 CLOSING REMARKS

We trust that the foregoing Master Drainage Plan Study report meets with the requirements and the goals put forward by the Township moving forward.

We look forward to working with the Township to implement the strategies outlined herein.

Sincerely,

GREENLAND INTERNATIONAL CONSULTING LTD.

Jim Hartman, P.Eng.
Senior Associate

APPENDIX MDP-A

Report Figures

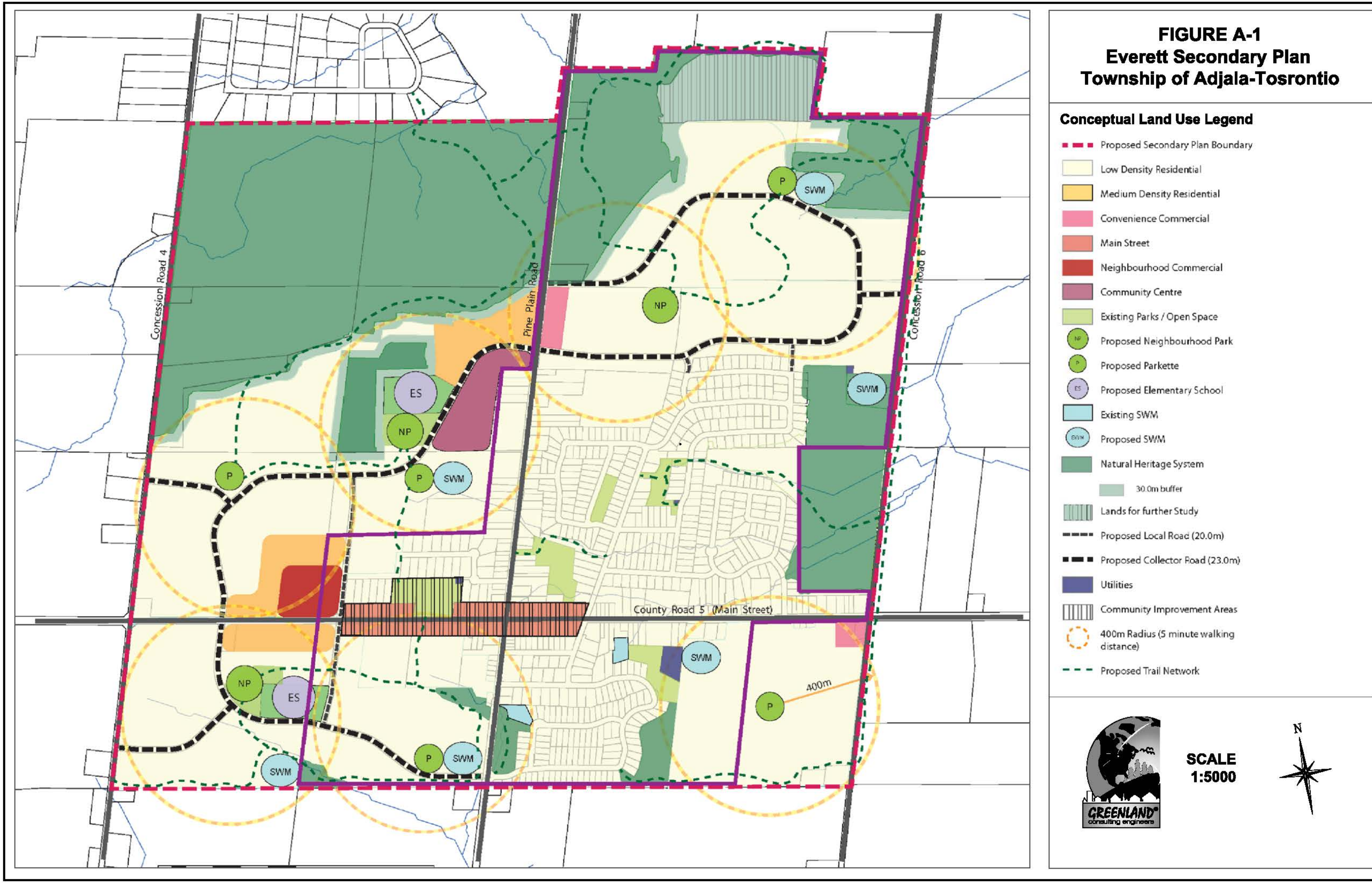


FIGURE A-1
Everett Secondary Plan
Township of Adjala-Tosrontio
Conceptual Land Use Legend
Proposed Secondary Plan Boundary
Low Density Residential
Medium Density Residential
Convenience Commercial
Main Street
Neighbourhood Commercial
Community Centre
Existing Parks / Open Space
Proposed Neighbourhood Park
Proposed Parkette
Proposed Elementary School
Existing SWM
Proposed SWM
Natural Heritage System
30.0m buffer
Lands for further Study
Proposed Local Road (20.0m)
Proposed Collector Road (23.0m)
Utilities
Community Improvement Areas
400m Radius (5 minute walking distance)
Proposed Trail Network
Concession Road 4
Pine Plain Road
Concession Road 6
County Road 5 (Main Street)
NP
P
ES
SWM
400m
GREENLAND consulting engineers
SCALE 1:5000
N

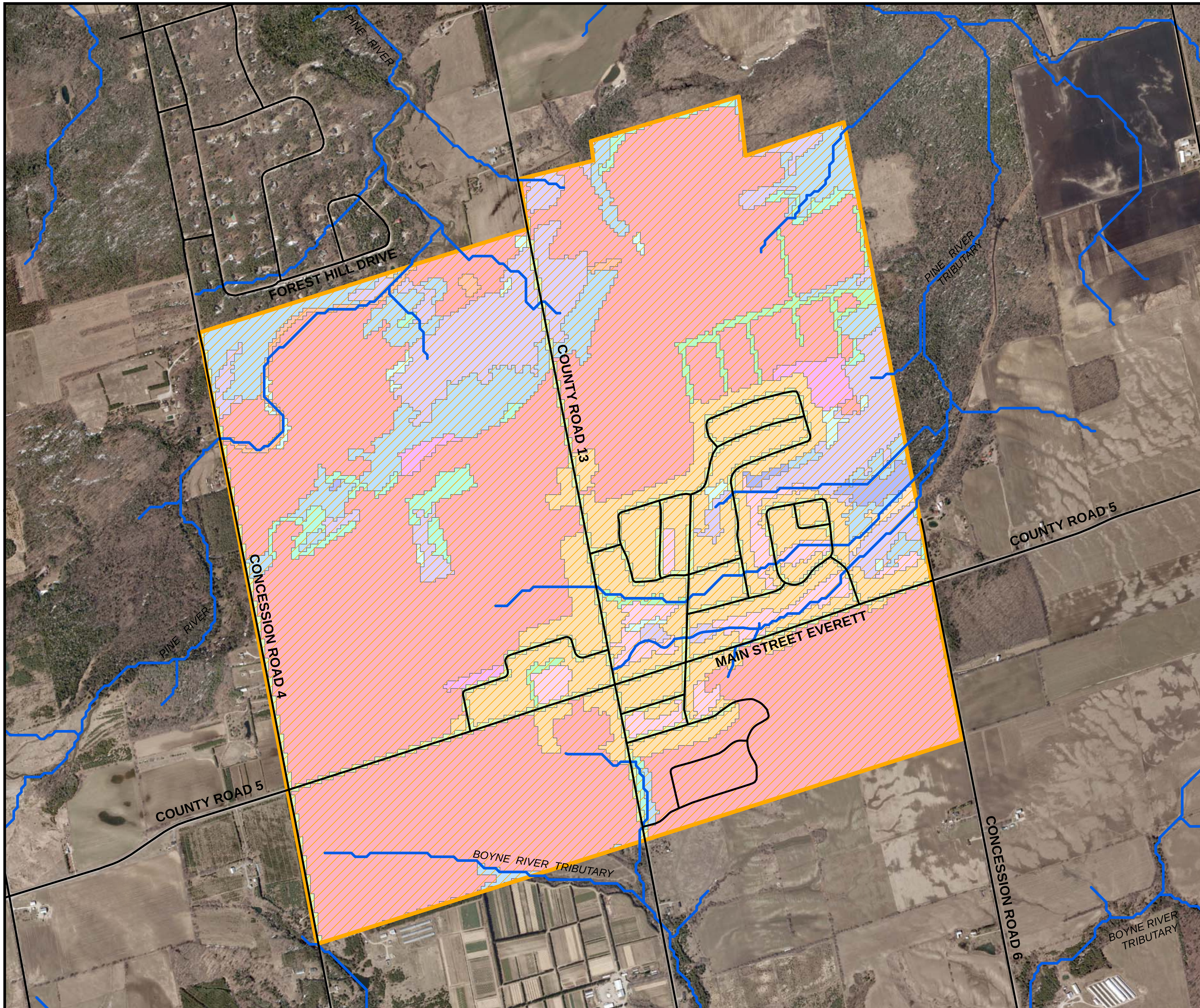


Figure A-2
Existing Landuse

Legend

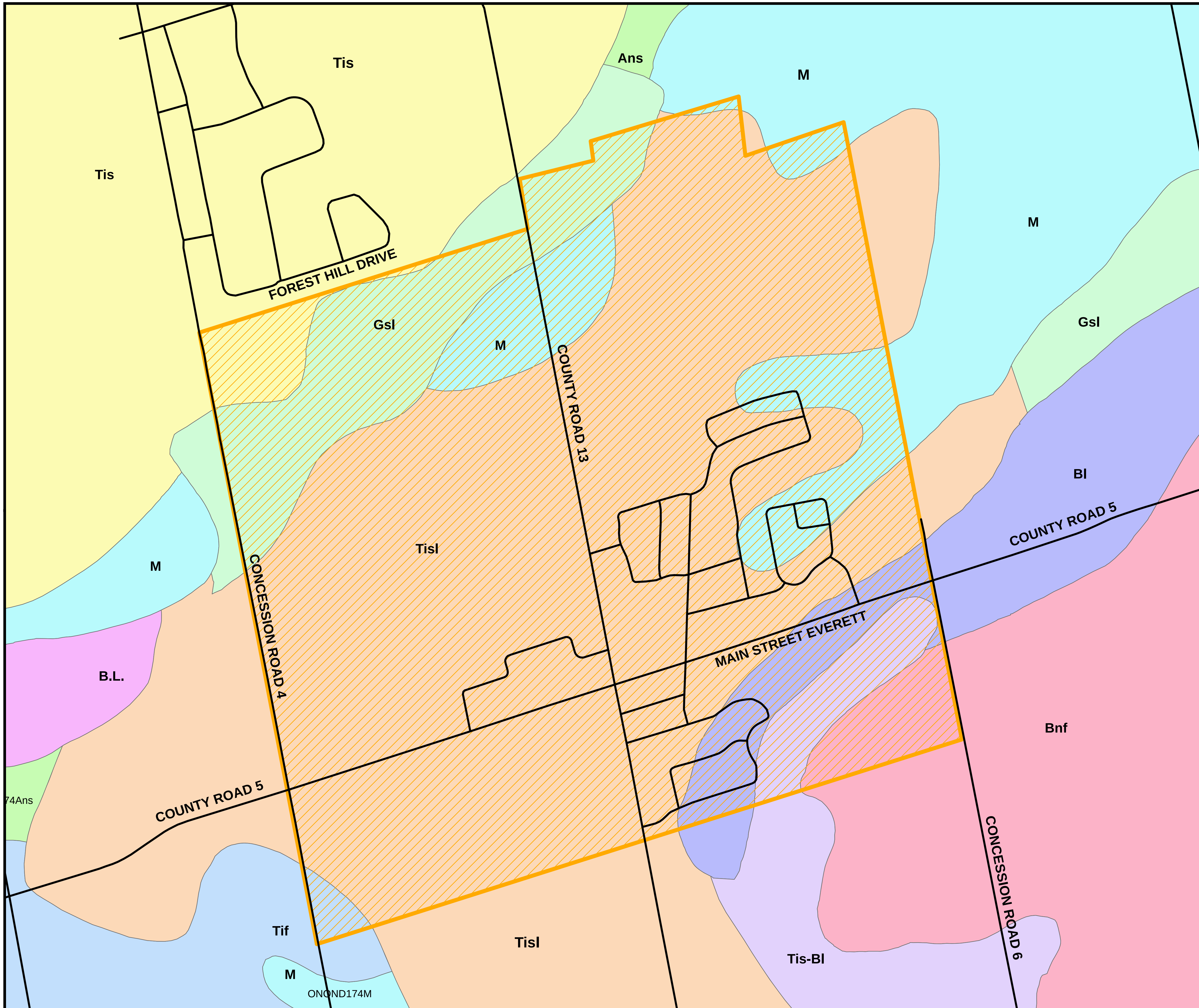
- Roads
- Watercourse
- Secondary Plan Boundary
- Built-up Area Impervious
- Built-up Area Pervious
- Coniferous Forest
- Deciduous Forest
- Forest
- Hedge Rows
- Marsh
- Mixed Forest
- Open Water
- Plantations - Trees Cultivated
- Swamp
- Transportation
- Agricultural

N

1:15,000

Notes:
1. Land uses provided by Simcoe County verified by Greenland in 2012.

Figure A-3
Simcoe County Soils Map for Everett Area



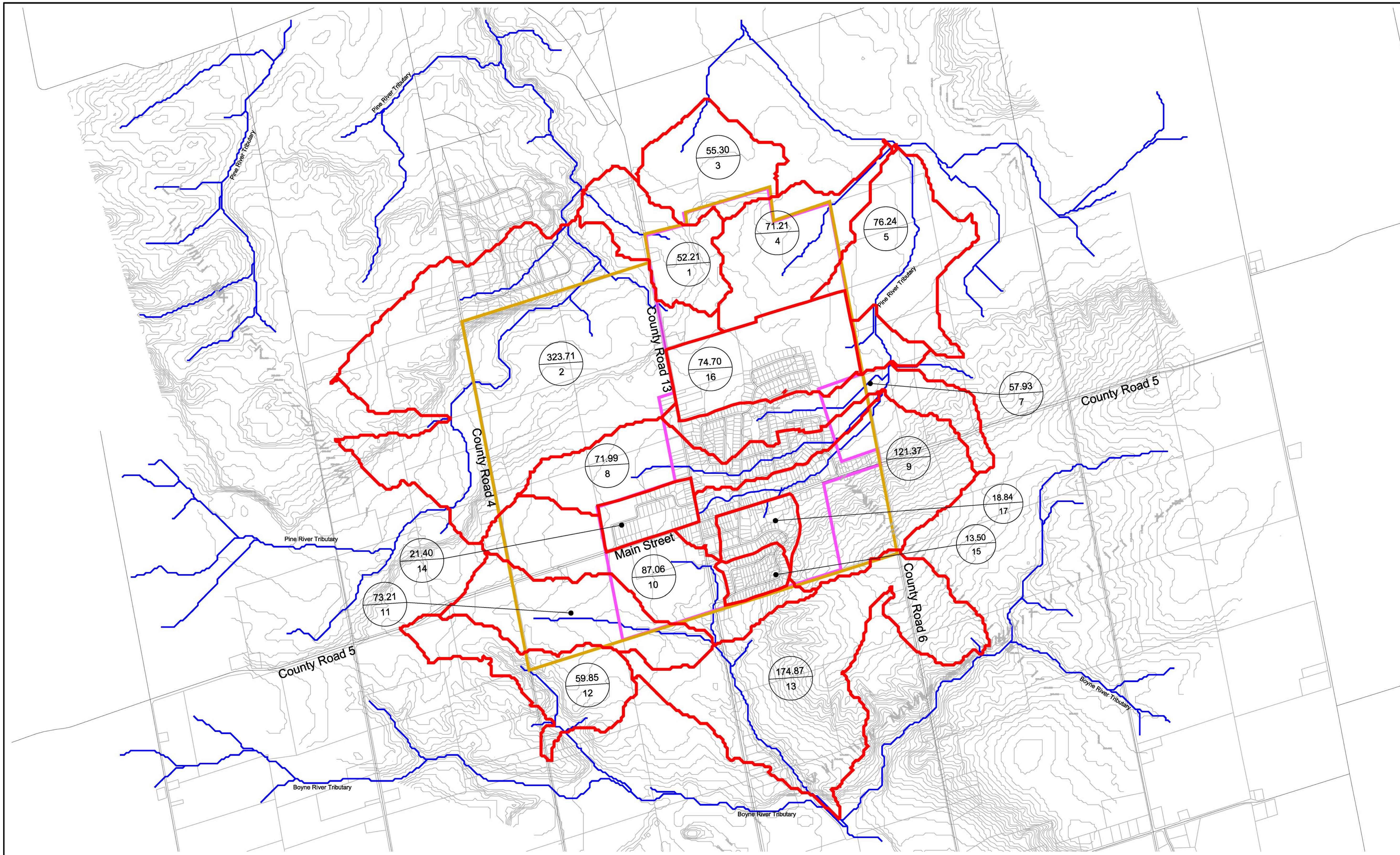
Legend

- Roads
- Secondary Plan Boundary
- Ans
- B.L.
- Bl
- Bnf
- Gsl
- M
- Tif
- Tis
- Tis-Bl
- Tisl

N

1:15,000

Notes:
1. Soil classification data provided by National Soil Database Soil Map of Simcoe County



1. This drawing is the exclusive property of Greenland Consulting Engineers and the reproduction of any part without prior written consent of this office is strictly prohibited.

2. Do not scale the drawings.

NOTES:

LEGEND:

- 244.000 CONTOURS ELEVATIONS
- WATERCOURSE
- CATCHMENT BOUNDARY
- 55.30 AREA (Ha) / 3 CATCHMENT ID
- ROADS
- SECONDARY PLAN BOUNDARY
- EXISTING SETTLEMENT BOUNDARY

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN

DRAWING TITLE

EXISTING CONDITION DRAINAGE MAP

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@grnland.com
Website: www.grnland.com

SCALE: 1:11,250 @ 24x36; 1:25,000 @ 11x17	PROJECT No.: 12-G-2804
DESIGN: J.M.	CHECKED: J. HARTMAN
DRAWN: K.L.	DATE: OCT. 2012
DWG No. FIGURE A-4	

T:\2804_Everett MSP\MSP In Progress\Report Figures\Figure Option 1-4&Existing.dwg

NOTTAWASAGA VALLEY CONSERVATION AUTHORITY
8195 CONCESSION LINE 8
UTOPIA, ONTARIO. L0M 1T0
TELEPHONE: (705) 424-1479
FAX: (705) 424-2115
www.nvca.on.ca

ONTARIO REGULATION 172/06

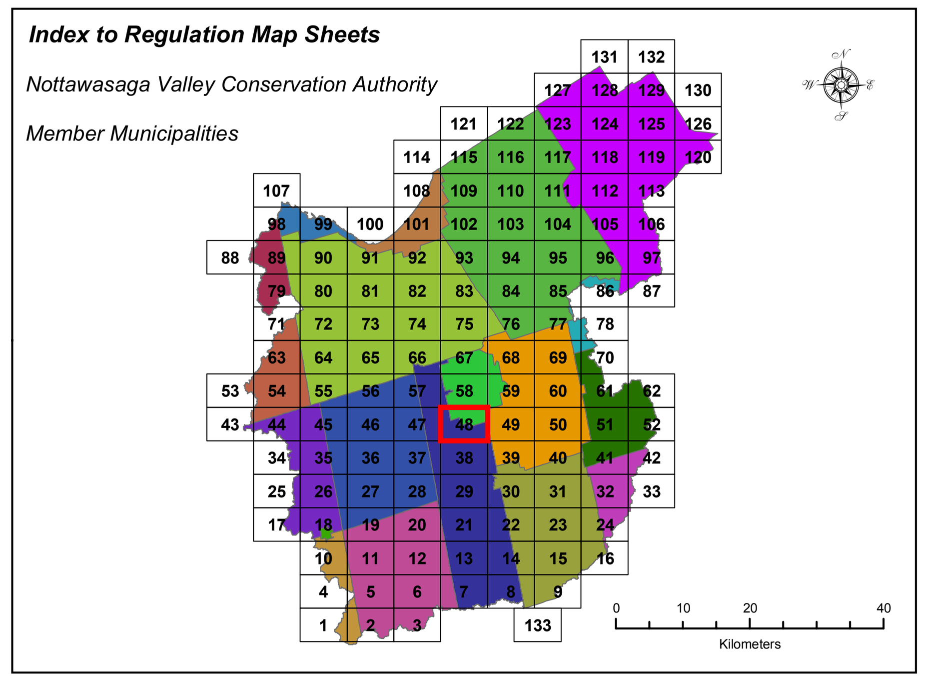
REGULATION FOR DEVELOPMENT, INTERFERENCE WITH WETLANDS, AND ALTERATIONS TO SHORELINES AND WATERCOURSES.

(IN CONFORMANCE WITH ONTARIO REGULATION 97/04)

N
W E
S

LEGEND

- MUNICIPAL BOUNDARY
- NVCA JURISDICTION
- REGULATION LIMIT
- LOT & CONCESSION FABRIC



In case of a conflict, the description of the areas provided in Section 2(1) of Ontario Regulation 172/06 prevails over the information shown on this map. Under Ontario Regulation 172/06 of the Conservation Authorities Act, the Nottawasaga Valley Conservation Authority regulates development in areas defined in Section 2, Subsection 1. The Regulation limit for riverine systems includes the greater (>) of the flood plain limit and the erosion hazard limit, plus an allowance of 15 metres. The Regulation limit for Lake Huron (Georgian Bay includes the high lake level (178.0 meters GSCD) plus an allowance of 45 metres (wave uprush, other water related hazards, dynamic beach). Provincially Significant Wetlands have been provided by the Ministry of Natural Resources. All other wetlands were delineated by the NVCA using the Ontario Wetland Evaluation System. The Regulation limit shown on this map includes wetlands greater than 2 hectares plus an allowance of 120 metres in order to identify lands where development could interfere with the function of a wetland. Ontario Regulation 172/06 applies to all wetlands and areas within the flooding hazard limit and erosion hazard limit shown and not shown on this map. Karst topography is a landscape created by groundwater dissolving sedimentary rock, such as limestone. This creates landforms such as shafts, tunnels, caves and sinkholes. Karst topography is considered to be a natural hazard. Further studies will be required for development proposals within areas where karst topography is suspected.

1:10,000

400 0 400 800 1,200
Meters

NO.	REVISIONS	DATE
2	REVISED FOLLOWING MUNICIPAL CONSULTATION	Feb 16, 2007
1	APPROVED, REGULATION NUMBER ADDED	May 4, 2006

CHECKED - PLANNING
CHECKED - REGULATIONS
CHECKED - ENGINEERING
APPROVED
DATE May 15, 2006
MAPPING BY: GIS DEPT

ONTARIO REGULATION 172/06

REGULATION FOR DEVELOPMENT, INTERFERENCE WITH WETLANDS, AND ALTERATIONS TO SHORELINES AND WATERCOURSES.

(IN CONFORMANCE WITH ONTARIO REGULATION 97/06)

PLOT DATE: February 2007

FILE: G:\NVCA_Data\Program_Data\GIS\Projects\GenericRegs

SHEET NO. 48 of 133

NOTTAWASAGA VALLEY CONSERVATION AUTHORITY
8195 CONCESSION LINE 8
UTOPIA, ONTARIO. L0M 1T0
TELEPHONE: (705) 424-1479
FAX: (705) 424-2115
www.nvca.on.ca

ONTARIO REGULATION 172/06

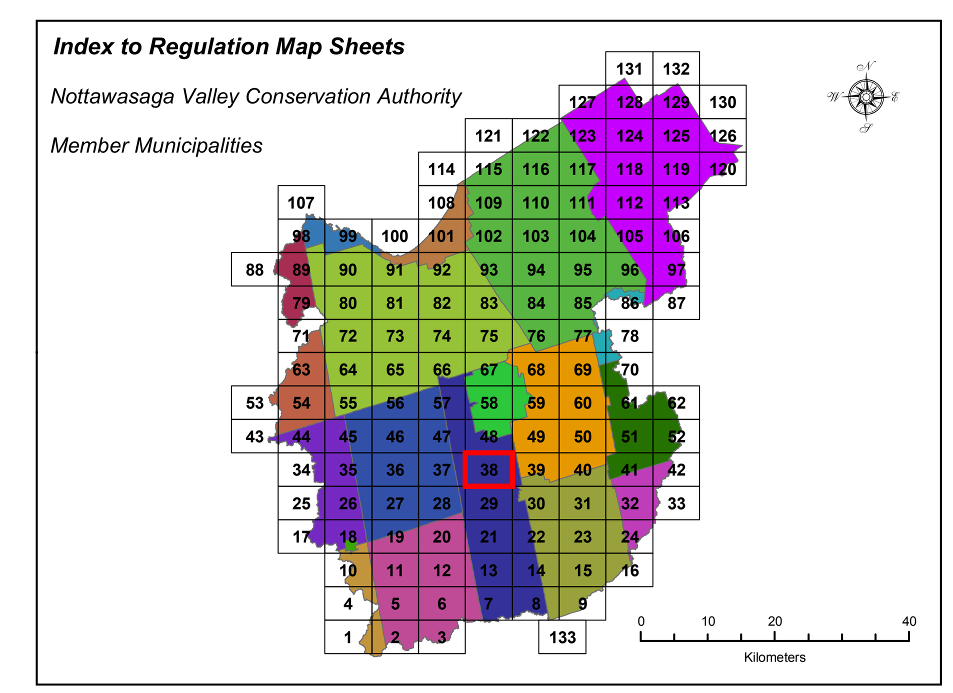
REGULATION FOR DEVELOPMENT, INTERFERENCE WITH WETLANDS, AND ALTERATIONS TO SHORELINES AND WATERCOURSES.

(IN CONFORMANCE WITH ONTARIO REGULATION 97/04)

N
W E
S

LEGEND

- MUNICIPAL BOUNDARY
- NVCA JURISDICTION
- REGULATION LIMIT
- LOT & CONCESSION FABRIC



In case of a conflict, the description of the areas provided in Section 2(1) of Ontario Regulation 172/06 prevails over the information shown on this map. Under Ontario Regulation 172/06 of the Conservation Authorities Act, the Nottawasaga Valley Conservation Authority regulates development in areas defined in Section 2, Subsection 1. The Regulation limit for riverine systems includes the greater (>) of the flood plain limit and the erosion hazard limit, plus an allowance of 15 metres. The Regulation limit for Lake Huron (Georgian Bay includes the high lake level (178.0 meters GSCD) plus an allowance of 45 metres (wave uprush, other water related hazards, dynamic beach). Provincially Significant Wetlands have been provided by the Ministry of Natural Resources. All other wetlands were delineated by the NVCA using the Ontario Wetland Evaluation System. The Regulation limit shown on this map includes wetlands greater than 2 hectares plus an allowance of 120 metres in order to identify lands where development could interfere with the function of a wetland. Ontario Regulation 172/06 applies to all wetlands and areas within the flooding hazard limit and erosion hazard limit shown and not shown on this map. Karst topography is a landscape created by groundwater dissolving sedimentary rock, such as limestone. This creates landforms such as shafts, tunnels, caves and sinkholes. Karst topography is considered to be a natural hazard. Further studies will be required for development proposals within areas where karst topography is suspected.

1:10,000

400 0 400 800 1,200
Meters

NO.	REVISIONS	DATE	
			CHECKED - PLANNING
			CHECKED - REGULATIONS
			CHECKED - ENGINEERING
2	REVISED FOLLOWING MUNICIPAL CONSULTATION	Feb 16, 2007	APPROVED
1	APPROVED, REGULATION NUMBER ADDED	May 4, 2006	DATE May 15, 2006
			MAPPING BY: GIS DEPT

ONTARIO REGULATION 172/06

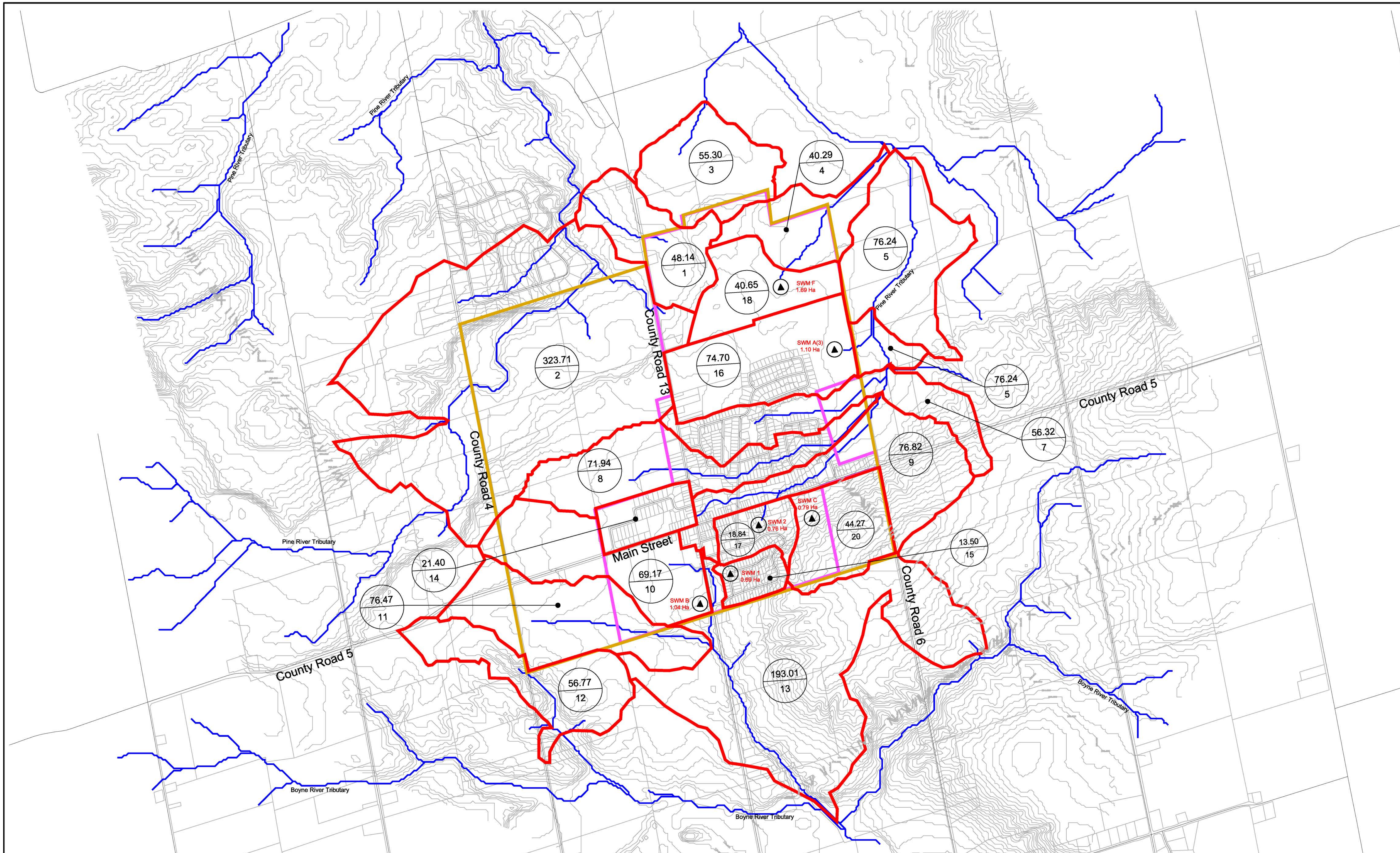
REGULATION FOR DEVELOPMENT, INTERFERENCE WITH WETLANDS, AND ALTERATIONS TO SHORELINES AND WATERCOURSES.

(IN CONFORMANCE WITH ONTARIO REGULATION 97/06)

PLOT DATE: February 2007

FILE: G:\NVCA_Data\Program_Data\GIS\Projects\GenericRegs

SHEET NO. 38 of 133



1. This drawing is the exclusive property of Greenland Consulting Engineers and the reproduction of any part without prior written consent of this office is strictly prohibited.

2. Do not scale the drawings.

NOTES:

LEGEND:

244.000	CONTOURS ELEVATIONS		ROADS
	WATERCOURSE		SECONDARY BOUNDARY
	CATCHMENT BOUNDARY		POND LOCATION
55.30 / 3	AREA (Ha) / CATCHMENT ID		EXISTING SETTLEMENT BOUNDARY

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN
MASTER DRAIN PLAN

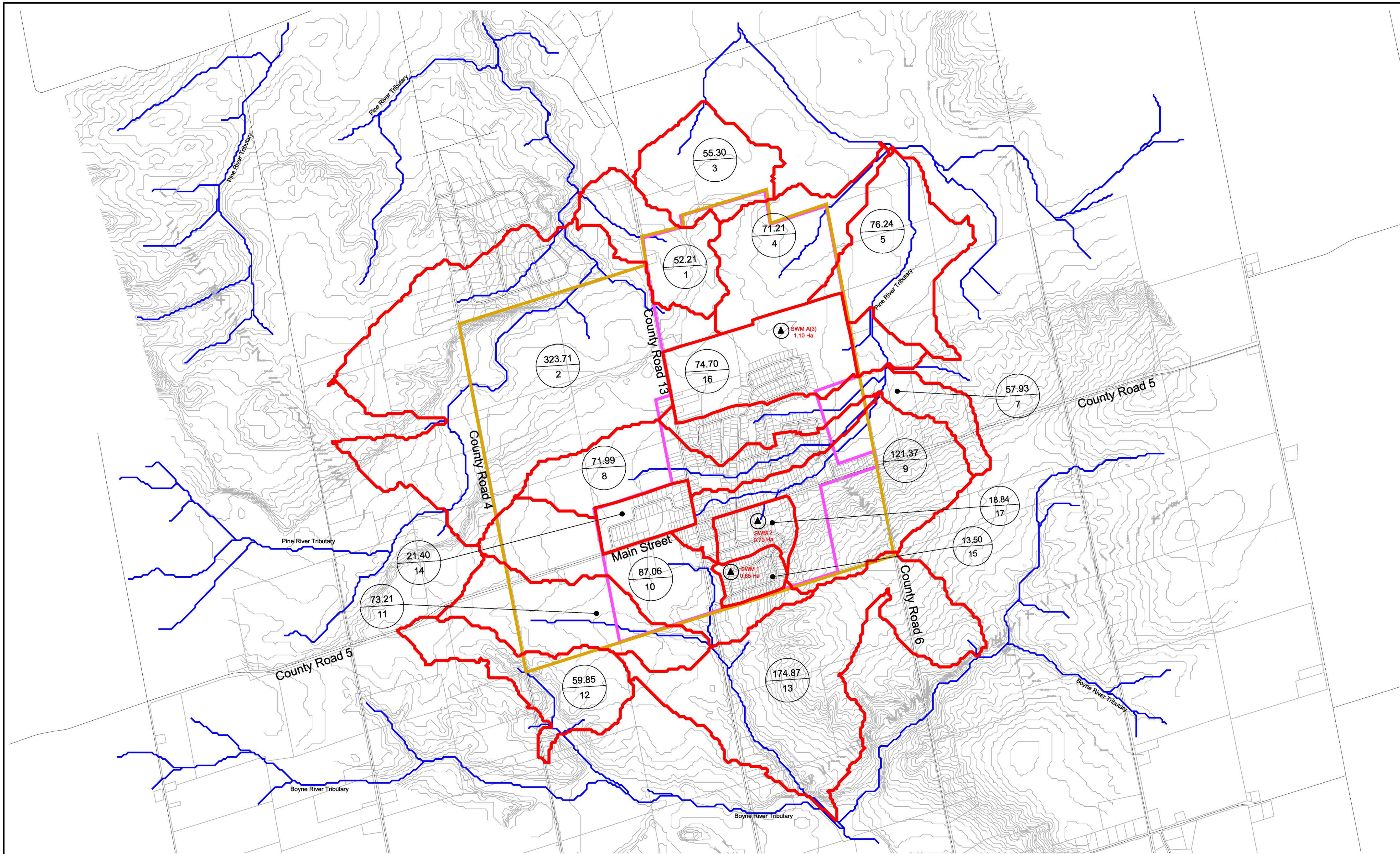
DRAWING TITLE

MDP OPTION 1
STORMWATER MANAGEMENT

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@grnland.com
Website: www.grnland.com

SCALE: 1:11,250 @ 24x36; 1:25,000 @ 11x17	PROJECT No.: 12-G-2804
DESIGN: J.M. / CHECKED: J. HARTMAN	DWG No. FIGURE A6-1
DRAWN: K.L. / DATE: OCT. 2012	

T:\2804_Everett MSP\MSP In Progress\Report Figures\Figure Option 1-4&Existing.dwg



1. This drawing is the exclusive property of Greenland Consulting Engineers and the reproduction of any part without prior written consent of this office is strictly prohibited.

2. Do not scale the drawings.

NOTES:

LEGEND:

- 244.000 CONTOURS ELEVATIONS
- WATERCOURSE
- CATCHMENT BOUNDARY
- 55.30 AREA (Ha) / 3 CATCHMENT ID
- ROADS
- EXISTING SETTLEMENT BOUNDARY

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN

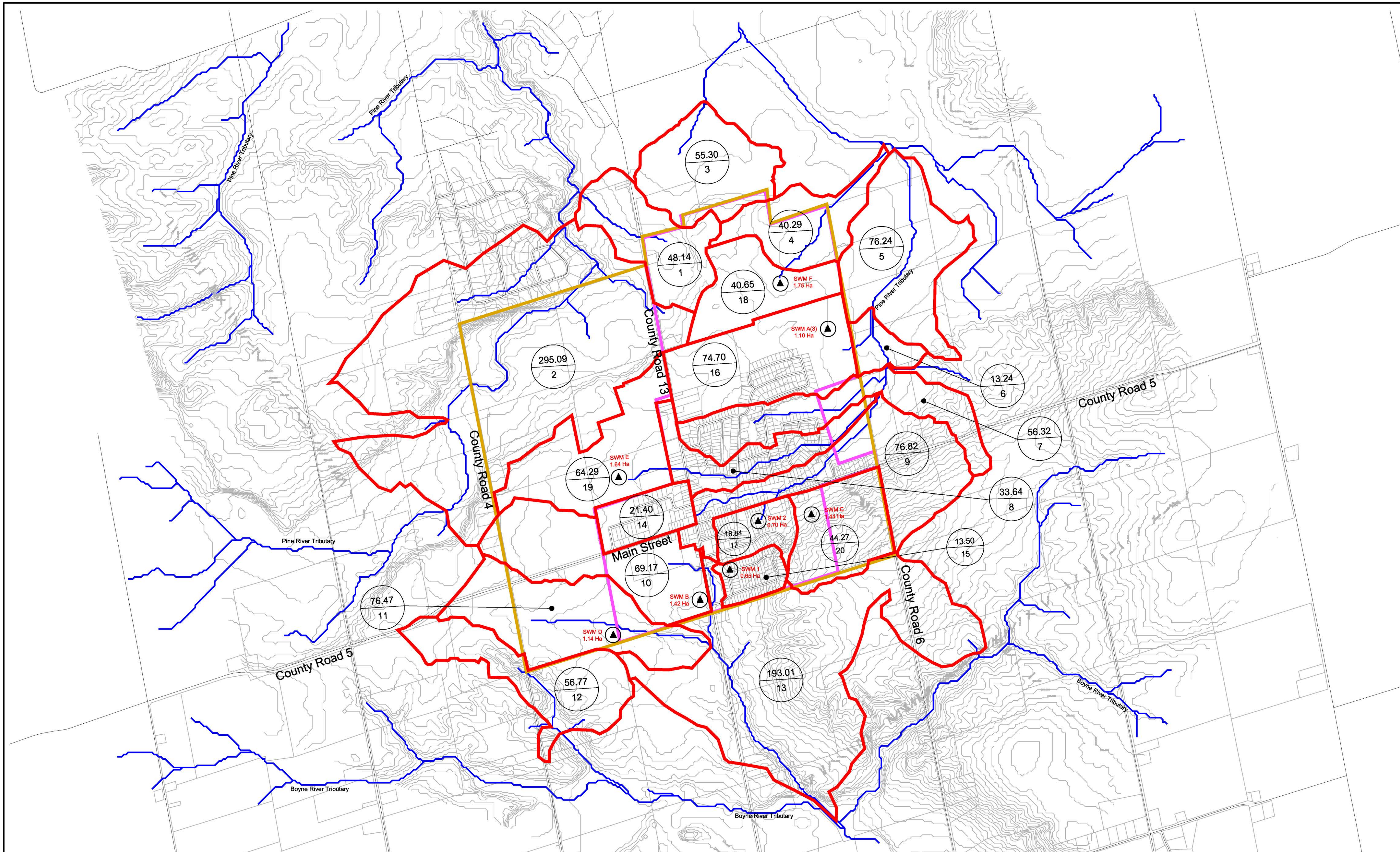
DRAWING TITLE

MDP OPTION 2
STORMWATER MANAGEMENT

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@gmland.com
Website: www.grnland.com

SCALE: 1:11,250 @ 24x36; 1:25,000 @ 11x17		PROJECT No.: 12-G-2804
DESIGN: J.M.	CHECKED: J. HARTMAN	DWG No. FIGURE A6-2
DRAWN: K.L.	DATE: OCT. 2012	

T:\2804_Everett MSP\MSP In Progress\Report Figures\Figure Option 1-4&Existing.dwg



1. This drawing is the exclusive property of Greenland Consulting Engineers and the reproduction of any part without prior written consent of this office is strictly prohibited.

2. Do not scale the drawings.

NOTES:

LEGEND:

244.000	CONTOURS ELEVATIONS
	WATERCOURSE
	CATCHMENT BOUNDARY
55.30 / 3	AREA (Ha) / CATCHMENT ID
	ROADS
	SECONDARY BOUNDARY
	POND LOCATION

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN
MASTER DRAIN PLAN

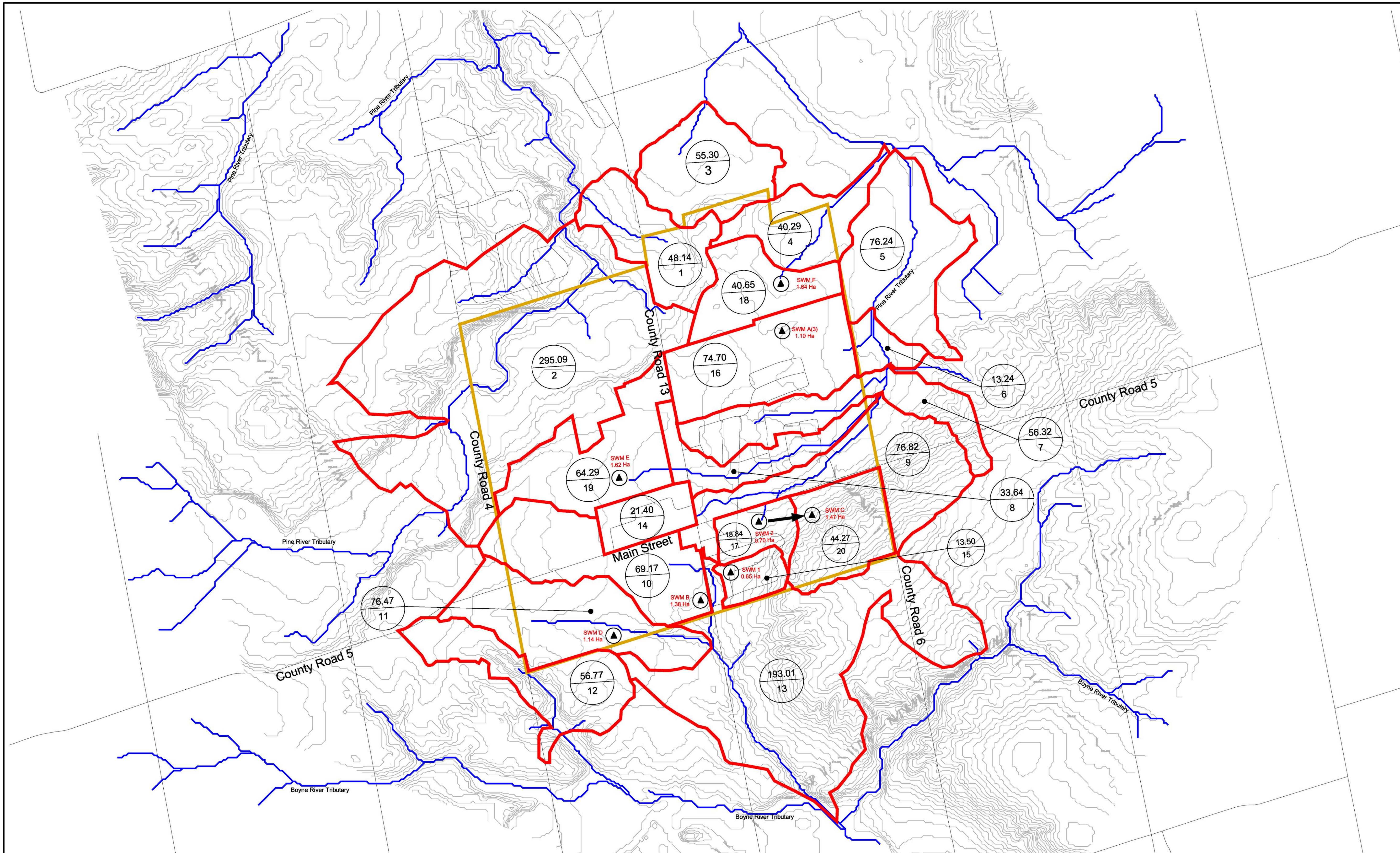
DRAWING TITLE

MDP OPTION 3
STORMWATER MANAGEMENT

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@gmland.com
Website: www.grnland.com

SCALE: 1:11,250 @ 24x36; 1:25,000 @ 11x17		PROJECT No.: 12-G-2804
DESIGN: J.M.	CHECKED: J. HARTMAN	DWG No. FIGURE A6 -3
DRAWN: K.L.	DATE: OCT. 2012	

T:\2804_Everett MSP\MSP In Progress\Report Figures\Figure Option 1-4&Existing.dwg



1. This drawing is the exclusive property of Greenland Consulting Engineers and the reproduction of any part without prior written consent of this office is strictly prohibited.

2. Do not scale the drawings.

NOTES:

LEGEND:

Symbol	Description
244.000	CONTOURS ELEVATIONS
	WATERCOURSE
	CATCHMENT BOUNDARY
55.30 / 3	AREA (Ha) / CATCHMENT ID
	ROADS
	SECONDARY BOUNDARY
	POND LOCATION
	FLOW DIRECTION

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN
MASTER DRAIN PLAN

DRAWING TITLE

MDP OPTION 4
STORMWATER MANAGEMENT

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@grnland.com
Website: www.grnland.com

SCALE: 1:11,250 @ 24x36; 1:25,000 @ 11x17		PROJECT No.: 12-G-2804
DESIGN: J.M.	CHECKED: J. HARTMAN	DWG No. FIGURE A6-4
DRAWN: K.L.	DATE: OCT. 2012	

T:\2804_Everett MSP\MSP In Progress\Report Figures\Figure Option 1-4&Existing.dwg

APPENDIX MDP-B

Plan B – Community of Everett Natural Heritage Study
(DRAFT August 2012)

GREENLAND®

Natural Environment – *Draft September 5th, 2012*

Introduction

The following Natural Environment Background Report has been prepared in conjunction with a proposed secondary plan for the Everett Community in the County of Simcoe. The study area encompasses the existing community of Everett and immediately adjacent lands (Figure 1). The background report provides the following information:

- A description and evaluation of the biophysical resource features within the study area based largely on existing background information and mapping;
- Confirmation of natural area boundaries, buffers and linkages through airphoto interpretation and windshield surveys;
- Identification of opportunities/constraints for future development within Everett;
- An evaluation of potential impacts for future development on core natural areas and linkage functions;
- Recommended mitigation/design measures, including buffers/setbacks to reduce development related impacts, protect sensitive environmental features and achieve habitat enhancement; and,
- Additional information, field inventories, and studies required at the development application stage.

The following tasks were completed as part of the analysis:

- Review of background reports and GIS mapping provided by MNR, County of Simcoe and NVCA;
- Consultation with NVCA staff;
- Review of aerial photography, topographic mapping, soils and physiographic mapping; and,
- Windshield survey of study area.

Existing Conditions Overview

The landscape associated with the village of Everett can be described as a mosaic of agricultural land interspersed with mature hedgerows, woodlots, thicket/meadow, and wetlands associated with the Pine River valleylands. The wetlands within the study area are regulated by the Nottawasaga Valley Conservation Authority under their *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* regulation. They occur in low lying

176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca

areas and floodplains, and consist primarily of mixed swamp communities dominated by a mixture of balsam fir, white spruce, eastern hemlock, eastern white cedar, trembling aspen, balsam poplar, white elm, yellow birch and black ash. Inclusions of cattail and reed canary grass marsh, willow/dogwood thicket swamp, cedar swamp, and deciduous swamp are associated with the mixed swamp features. Adjacent upland habitats support a mixture of mixed and deciduous forest associations. Typical species present include sugar maple, red maple, American beech, white ash, white pine, eastern hemlock, eastern white cedar, black cherry, ironwood, basswood and white birch. A rich, diverse native ground flora comprised of herbaceous plants, sedges/grasses, and ferns are associated with the large, intact wetland and forest blocks.

The upland and wetland communities associated with the Pine River are part of a larger core natural area and corridor that provides an important linkage connection between the Niagara Escarpment core natural areas to the west and the Minesing Swamp and Canadian Shield to the northeast. This provincial scale corridor is considered highly significant due to the connection it provides between major core natural areas within the landscape.

The community of Everett is located within the watersheds of the Pine River and Boyne River systems. The Pine River flows northerly through the northwest corner of the community. A broad floodplain and large expanses of connected forest and wetland habitat are associated with the Pine River, extending both upstream and downstream of the community. A small, intermittent headwater tributary of the Boyne River is located in the southwest corner of the community, in association with cultivated agricultural land. Several small, intermittent tributaries to a tributary of the Pine River are located within the village of Everett and drain easterly through an expansive block of forested wetland (swamp).

The Pine River is a permanent, coldwater stream that supports a variety of fish species, including resident and migratory trout species. Water quality within the Pine River is considered to be good (*NVCA Pine River Subwatershed Report Card*, NVCA 2007). Protection of the groundwater recharge/discharge regime within the community of Everett is of paramount importance to the protection of the ecological integrity and function of the Pine River and its associated wetland features.

Water quality in the Boyne River is rated as poor to fair due to the impacts of agricultural runoff and loss if riparian cover (*NVCA Boyne River Subwatershed Report Card*, NVCA 2007). The Boyne River supports a variety of warmwater and coldwater fish species, including trout.

Existing conditions within the study area are mapped on Figure 1.

176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca

Species-at-Risk

A list of species-at-risk for Simcoe County is presented in Table 1 (attached). The establishment of the natural heritage system for the Everett Community will provide for the protection and enhancement of existing and potential habitat for species-at-risk that may occur within the study area. The key habitat features within the community are primarily associated with the Pine River in the northwest and the large block of wetland and forest to the east. Large blocks of intact wetland and forest habitat occur to the north, south, east and west of Everett.

Wildlife

The large expanses of connected forest and wetland habitat within the community of Everett support a variety of important functions for wildlife including winter habitat for deer (conifer dominated areas), habitat for area sensitive forest interior birds, and dispersal corridor (Pine River, tributary system). Given the size and diversity of habitat conditions present, it is expected that a diverse wildlife community exists within the community of Everett. As noted above, the habitat features within Everett are part of a significant, provincial scale wildlife corridor.

Environmental Policy Areas

The study area contains numerous natural heritage features that are designated as environmental policy areas. These features include:

- Greenlands (County of Simcoe)
- Floodplains, slopes, watercourses and wetlands regulated by the NVCA

From a Provincial Policy Statement and Natural Heritage Reference Manual perspective, the large expanses of forest and wetland within and adjacent to Everett would be considered a "significant" woodland with other natural heritage features/functions associated with it such as significant wildlife habitat, significant valleylands, and significant fish habitat. Habitat for some of the species at risk listed for Simcoe County (refer to Table 1) is likely provided within the large wetland/forest blocks associated with the Pine River corridor. The County of Simcoe Greenlands designation encompasses the forest and wetland features within Everett, as well as the linkage corridor with enhancements.

Environmental policy areas within the study area are shown in Figure 2.

Physiography, Soils and Topography

The study area is primarily flat to gently undulating with relief associated with the Pine River in the northwest and sloping topography in the southeast associated with a remnant shoreline of former Lake Algonquin. From a physiographic standpoint, the study area is located within the Simcoe Lowlands. In the *Physiography of Southern Ontario 3rd Edition*, Chapman and Putnam

176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca

(1984) describe the study area as a gently undulating to flat outwash sand plain formed by glacio-fluvial till deposits.

According to the *Soil Survey of Simcoe County – Report No. 29 of the Ontario Soil Survey* (Hoffman et al., 1962), the soils within the study area are predominantly well drained Tioga sandy loam, Bondhead sandy loam, and Bennington fine sandy loam (Hoffman et al. 1962). Organic muck soils and poorly drained Granby sandy loam soils are associated with the Pine River and wetland areas. The soils of Simcoe County are underlain by rocks of the Ordivician, Silurian and Precambrian ages. Limestones of the Black River, Trenton, Medina, Cataract and Lockport formations and shales of the Utica, Queenston and Richmond formations are present (Hoffman et al., 1962).

The topography of the study area, including slopes and the NVCA Regulation Limit are presented in Figure 2.

Opportunities/Constraints – Natural Heritage System

The study area supports a mosaic of agricultural land interspersed with mature hedgerows, woodlots, and wetlands. Large expanses of forest and wetland (mixed swamp) are located in the northwest and east/northeast section of the study area, in association with the Pine River and tributaries, respectively. The remnant natural areas are primarily associated with valleylands and low-lying depressional areas with poorly drained, organic muck soils. Deciduous/mixed forest and cultural habitat features (thicket, woodland, old field meadow) occur in the upland areas adjacent to the wetlands.

The key natural heritage and hydrologic features within and in proximity to the study area include:

- Pine River – significant valleyland feature, major corridor function, coldwater fishery
- NVCA regulated wetlands – associated with Pine River and headwater tributaries
- Significant woodlands – associated with Pine River and headwater tributaries (Pine River)
- Intermittent headwater tributaries to the Pine River and the Boyne River
- Floodplains
- Habitat for species-at-risk
- Linkage connections among natural features (i.e. both within and in proximity to the study area)
- Simcoe County Greenlands – encompasses the above core natural areas and corridors with buffers/enhancements

Combined, these natural heritage features form the natural heritage system for the community of Everett (Figure 3). The system incorporates the key natural heritage and hydrologic features

176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca

noted above plus a minimum 30 m buffer, and enhancements to core area and corridor functions. The County of Simcoe Greenlands, floodplain areas, slopes and meander belt width have also been taken into account in determining the location of the natural heritage system. The application of a minimum 30 m buffer is consistent with current guidelines and policy practices within Southern Ontario, including the adjacent GreenBelt Plan area.

Given the significance and sensitivity of the natural environment features within the study area, appropriate stormwater and groundwater management measures are recommended to maintain and enhance water quality, sustain stream baseflow/temperature and protect wetland hydrology. Low impact development (LID) measures for stormwater management such as bio-swales, at-source infiltration of runoff, wetland storm ponds, and infiltration/cooling trench outlets, are recommended to protect the aquatic and wetland components of the natural heritage system. The predominantly well drained soils across the study area should be suitable for the application of LID stormwater management measures.

Naturalization of the buffers and storm ponds with native species is also recommended to enhance the function and integrity of the natural heritage system and increase its resilience to development of the landscape.

The key elements to be incorporated into the secondary plan with respect to environmental protection are as follows:

- Control of post-development runoff to pre-development levels with Enhanced (former Level 1) stormwater management facilities, constructed as wetland or hybrid type storm ponds;
- Cooling of runoff through a combination of outlet design (e.g. buried stone trench) and shade plantings along the receiving channel;
- Minimizing cut/fill requirements to reduce alterations to surface drainage and infiltration;
- Low Impact Development (LID) stormwater management measures such as landscaped bio-swales, perforated drain tiles, permeable pavement systems, rainwater collection cisterns for irrigation, and minimal or no grade changes within buffer areas;
- Naturalization of buffers and parkland with common, native species indicative of the surrounding landscape and existing site conditions;
- Low level lighting for sports fields and trails adjacent to natural areas;
- Minimal hedgerow tree removal to maintain micro-climate and linkges;

Other urban design criteria to be incorporated into the secondary plan to promote environmental protection include the use of single loaded roads adjacent to natural areas, positioning of parkettes and storm ponds between residential areas and features to be protected, large lots to promote at-source infiltration of runoff, and avoidance of areas with steep/sloping topography.

Buffers

As noted above, a 30 m buffer has been applied to the core environmental features within the study area. The secondary plan should be designed to respect the natural heritage features and the buffers. No roads or lots should be permitted within buffer areas.

Compatible uses within buffer areas include stormwater management facilities (provided a minimum 10 m "no touch" buffer is maintained to the feature), trails and passive/active park uses, such as the edges or rear of a sports field.

Larger buffers may be required in certain locations to accommodate areas of seasonal inundation with water (i.e. in the spring), sloping topography, and protection of the natural heritage system. In-season vegetation and wildlife surveys are recommended at the development application stage (EIS) to confirm and refine, where necessary, the buffers to the natural heritage system.

Environmental Protection Strategy

The above noted environmental protection measures are intended to be developed in greater detail as part of the individual EIS's to be submitted with a development application. Specific details related to the protection of stream baseflow/temperature, water quality, wetland hydrology, and the features/functions of the overall natural heritage system will be provided in the EIS. The environmental protection strategy will be developed in conjunction with the results of the hydrogeological investigation, stormwater management plan, geotechnical studies related to slopes and top of bank, fluvial geomorphological analysis of storm pond outlets and receiving channels. In addition, the EIS will confirm the appropriateness of the proposed buffers and make adjustments, where necessary, to ensure adequate protection is provided to the natural heritage system.

A key element of the EIS will be to provide recommendations for environmental stewardship and awareness for future residents of the Everett community (e.g. through Homeowners Manual, interpretative signage, community involvement in monitoring and enforcement). Recommendations for the naturalization of the buffers, including fencing and signage, will be provided with the goal of augmenting/supplementing existing habitat and deterring public/pedestrian access into sensitive environmental areas. This will be particularly important for the proposed residential areas that abut the natural heritage system as well as the sports fields, and trail connections to natural areas (where appropriate).

Landscape Ecology and Natural Heritage Planning

176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca

Depending on the results of the in-season field work completed at the EIS stage, refinements to the development concepts may be required to accommodate larger buffers/setbacks to provide long-term protection to the natural heritage system.

Follow-up Studies

The following studies will need to be completed as part of the next phase in the planning approval process for implementing the Secondary Plan (draft plan applications):

- A detailed hydrogeological investigation and water balance analysis will be required to confirm the pre-development pattern/volume of infiltration, impacts of development, and proposed mitigation measures to maintain and/or enhance the groundwater recharge function of the site;
- Detailed stormwater management plans, including outlet cooling design, landscaping plan and performance monitoring program, for proposed storm ponds. Where necessary, a fluvial geomorphological analysis should be completed for the pond outlets to ensure that any downstream erosion concerns are not exacerbated. A key component of this analysis will be to identify and map the locations of tile drain outlets and determine the most appropriate means of maintaining the pre-development contribution to wetland hydrology and stream baseflow;
- In-season field inventories (vegetation, wildlife, fisheries, species-at-risk screening) within the proposed natural heritage system to confirm opportunities/constraints, identify potential impacts and mitigating measures, including buffer/setback requirements and habitat compensation/restoration;
- Naturalization plans for buffer areas, floodplains (formerly farmed) and non-active portions of park uses;
- An EIS will be required for future draft plan of subdivisions. The study should demonstrate how the development plans conform with the environmental protection and enhancement objectives for the Secondary Plan, as outlined in this document;
- Overall environmental monitoring program to measure the effectiveness of the proposed mitigation/enhancement strategy and identify contingency actions (Adaptive Management Plan) to address unforeseen impacts and poor performance;
- Erosion and siltation control plan in accordance with the most stringent standards applied by the NVCAA for protecting the Pine River and Boyne River systems; and,
- Future residents of the community should be informed of the significance/sensitivity of the natural environment and appropriate stewardship behaviour. This can be accomplished through a variety of ways including; interpretative signage at trail heads, homeowners manual, school programs, and trail/nature watch volunteers.

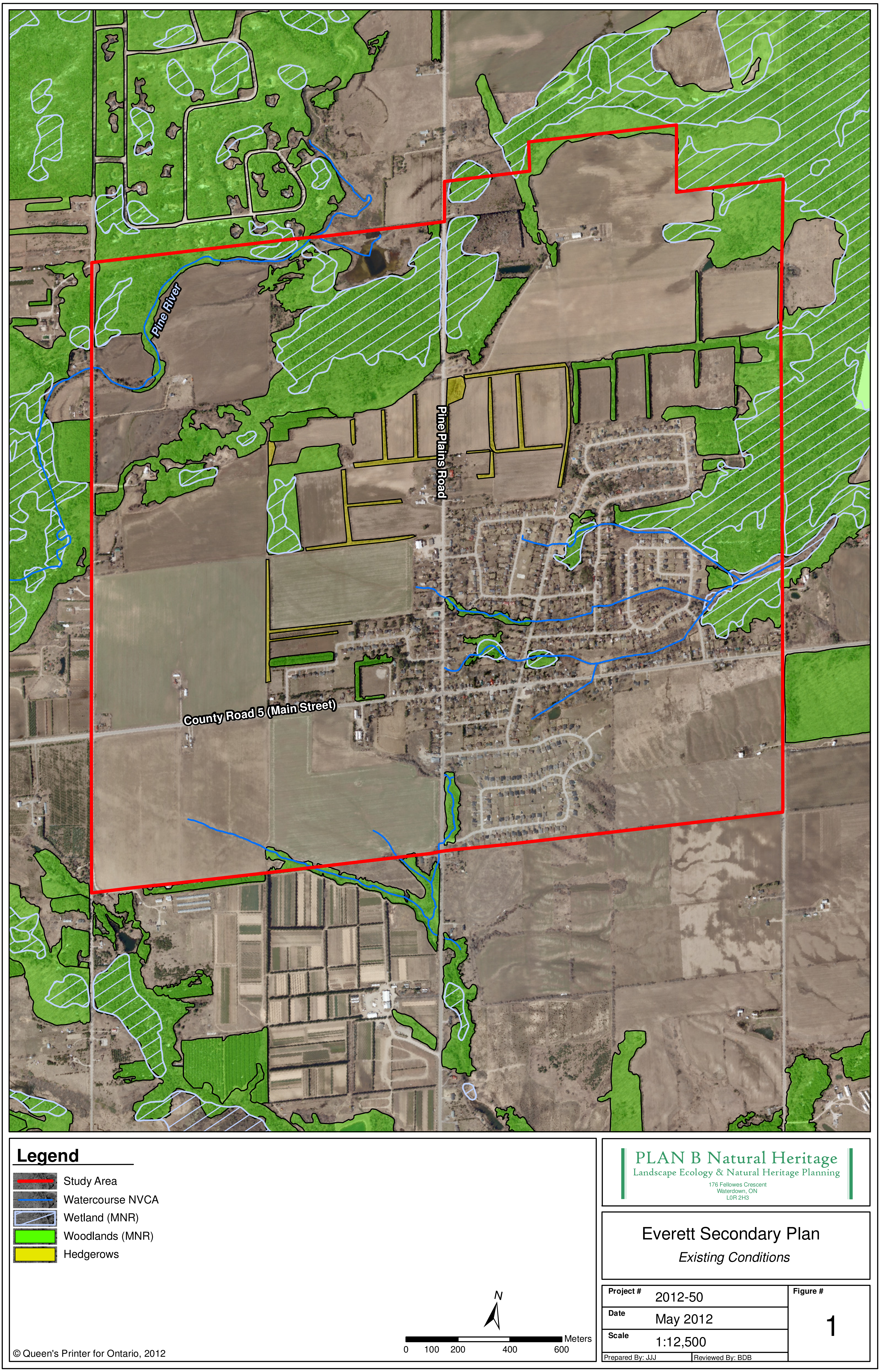
176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca

Servicing

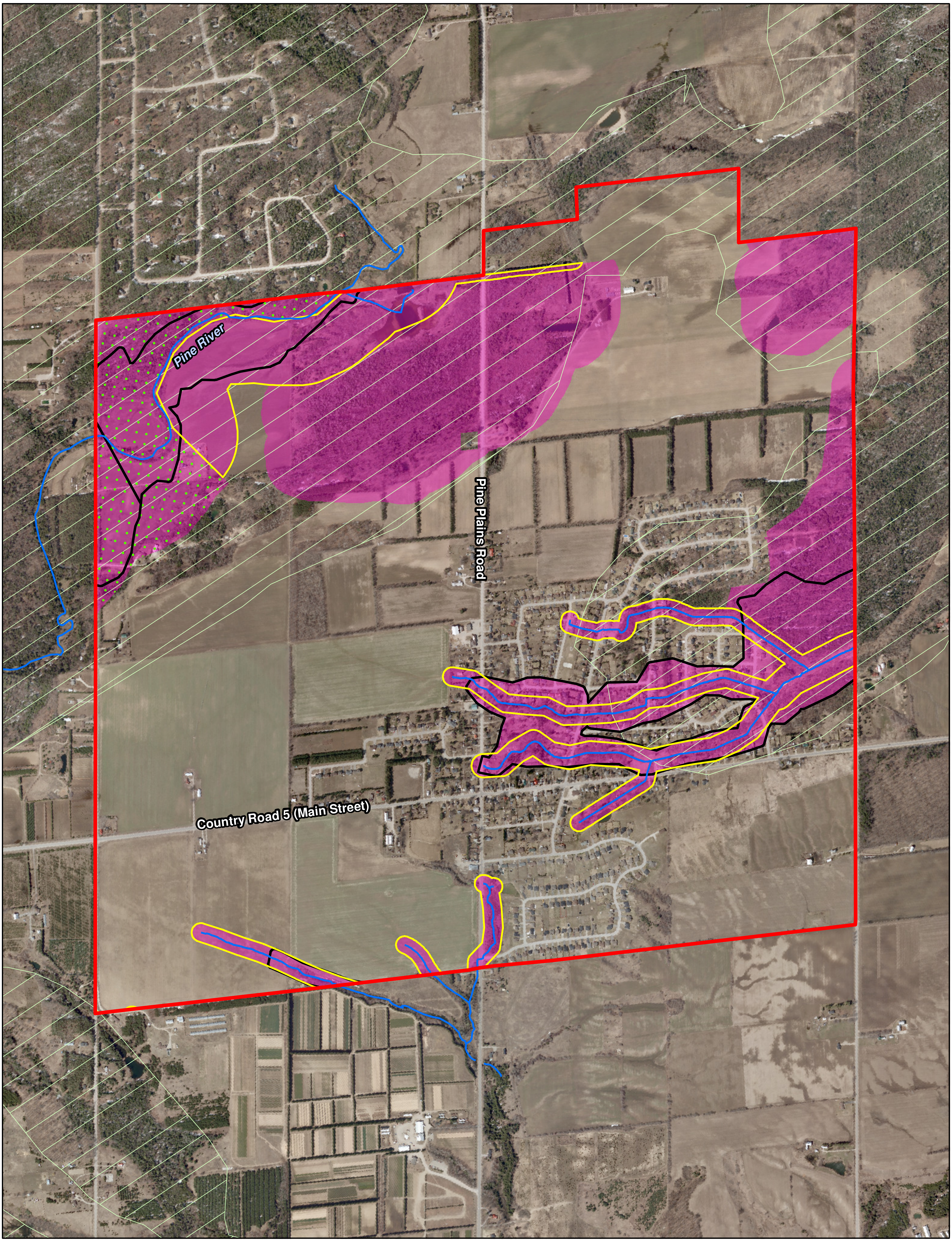
Details related to the master servicing scheme for the community of Everett are provided under separate cover by Greenland International. The environmental characterization and natural heritage system mapping provided in this background report will provide a framework for the stormwater management plan. It will also inform the identification of alternative locations for a sewage treatment facility and the selection of a preferred site, as part of a separate class environmental assessment process. Key environmental considerations with respect to the proposed sewage treatment facility include the following:

- Protection of water quality, baseflow, temperature and natural channel processes within the receiving Pine River;
- Protection of the groundwater regime (quality, quantity, discharge regime/pattern);
- Minimizing or avoiding removal of wetland/forest habitat, including habitat of species-at-risk protected under the *Endangered Species Act*, to accommodate the treatment facility, sewer connections and related infrastructure;
- Compensation for habitat loss/alteration; and,
- Restoration/enhancement of adjacent natural areas including receiving wetlands/watercourse.

176 Fellowes Crescent, Waterdown, ON, L0R 2H3
T: 905-689-0793 F: 905-689-9216 E: bbricker@planbnh.ca



Pine River
Pine Plains Road
County Road 5 (Main Street)
Legend
Study Area
Watercourse NVCA
Wetland (MNR)
Woodlands (MNR)
Hedgerows
© Queen's Printer for Ontario, 2012
N
Meters
0 100 200 400 600
PLAN B Natural Heritage
Landscape Ecology & Natural Heritage Planning
176 Fellowes Crescent
Waterdown, ON
L0R 2H3
Everett Secondary Plan
Existing Conditions
Project #
2012-50
Date
May 2012
Scale
1:12,500
Figure #
1
Prepared By: JJJ
Reviewed By: BDB



Legend

- Study Area
- Watercourse (NVCA)
- Meanderbelt (NVCA)
- Flood Lines (NVCA)
- Slope (NVCA)
- Regulated Area (NVCA)
- Greenland (Adjala Township, Simcoe County)

N

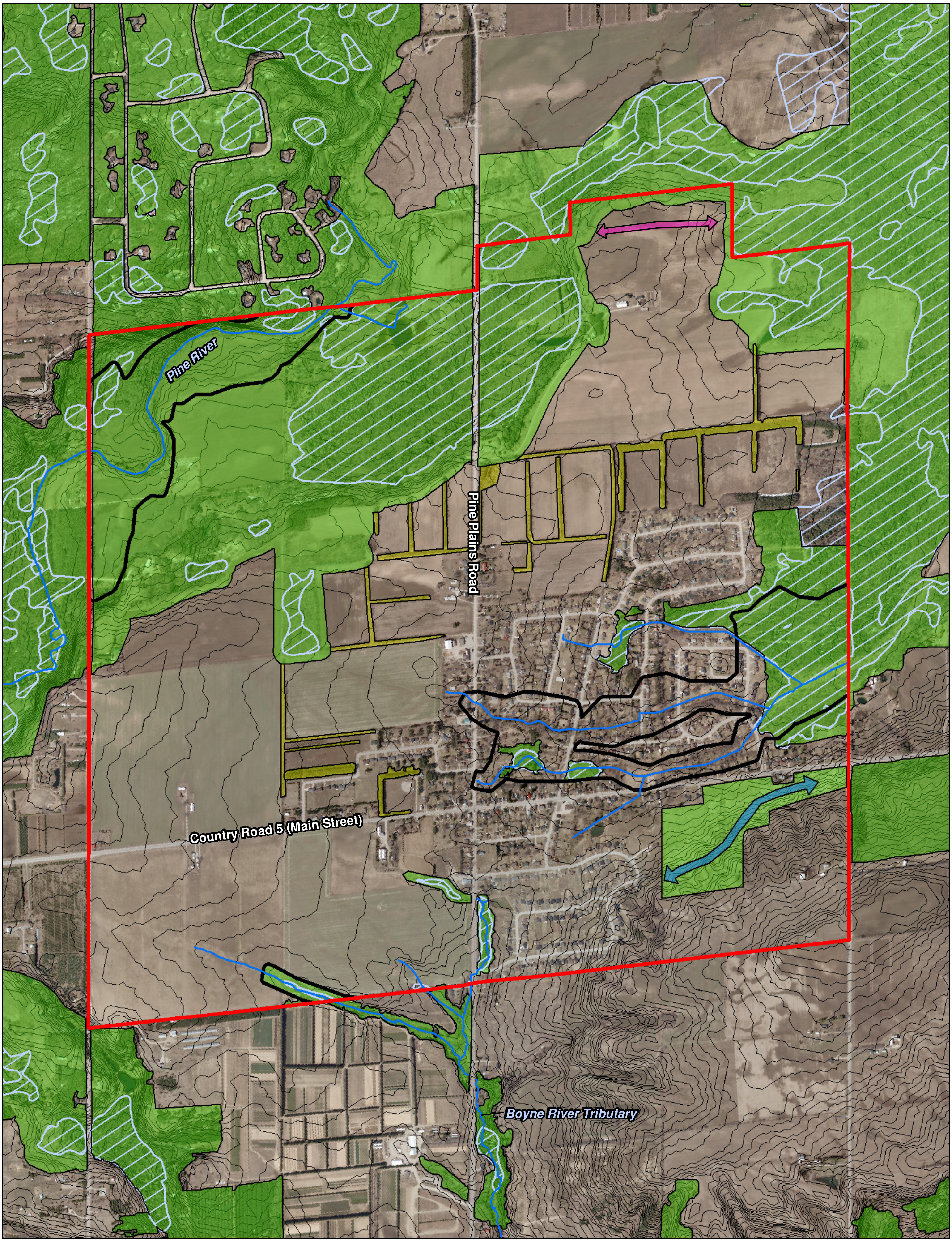
0 100 200 400 600 Meters

PLAN B Natural Heritage
Landscape Ecology & Natural Heritage Planning
176 Fellowes Crescent
Waterdown, ON
L0R 2H3

Everett Secondary Plan

Environmental Policy Areas

Project #	2012-50	Figure # 2
Date	May 2012	
Scale	1:12,500	
Prepared By: JJJ	Reviewed By: BDB	



Legend

- Study Area
- Watercourse (NVCA)
- Flood Lines (NVCA)
- Natural Heritage System* (Natural Heritage Feature plus 30 m buffer)
- Hedgerow (Mature, Planted Conifers), retain where feasible
- Sloping Topography with Ground Water Seepage, Wetlands and Erosion
- Corridor Enhancement Opportunity
- Wetlands (NVCA nd MNR))

* Natural Heritage System is comprised of Simcoe County Core Greenlands, NVCA regulated wetlands, woodlands, floodplain/meander belt, and linkages

N

0 95 190 380 570 Meters

PLAN B Natural Heritage
Landscape Ecology & Natural Heritage Planning
176 Fellowes Crescent
Waterdown, ON
L0R 2H3

Everett Secondary Plan

Natural Heritage System

Project #	2012-50	Figure #
Date	August 2012	3
Scale	1:12,500	
Prepared By: JJJ	Reviewed By: BDB	

SPECIES AT RISK IN SIMCOE COUNTY

Status for species as per the provincial ****Species at Risk in Ontario (SARO) List - February 2012.**
SARO List - http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/246809.html

END - Endangered, **THR** - Threatened, **SC** - Special Concern

TAXA	SPECIES	STATUS (as of Feb 2012)	DESCRIPTION OF HABITAT USED	HABITAT PROTECTION UNDER ESA**
Amphibian	Jefferson Salamander	THR	woodlands and vernal pools plus adjacent areas primarily along the Niagara Escarpment	Regulated
Bird	Bald Eagle	SC	typically found near the shorelines of lakes and large rivers, may also nest in large open wetlands	N/A
Birds	Barn Swallow	THR	nest on ledges or walls in and outside of barns and other man made structures including buildings and bridges, may also use natural cliffs and caves.	General
Bird	Black Tern	SC	large cattail marshes in wetlands	N/A
Bird	Bobolink	THR	grassland habitats, hayfields and some crop lands	General
Bird	Canada Warbler	SC	deciduous and coniferous forests, usually wet forest types with a well developed, dense shrub layer	N/A
Bird	Cerulean Warbler	SC	forest-interior birds that require large, relatively undisturbed tracts of mature, semi-open deciduous forest.	N/A
Bird	Chimney Swift	THR	in and around urban settlements where they nest and roost in chimneys and other vertical manmade structures, will also use hollow trees or tree cavities in older growth forests, often near water	General

Bird	Common Nighthawk	SC	open areas with little to no ground vegetation, such as forest clearings, rock barrens, peat bogs, lakeshores and logged or burned over areas	N/A
Birds	Eastern Meadowlark	THR	native grasslands, pastures, agricultural fields especially in alfalfa and hay, old fields, meadows	General
Bird	Golden-winged Warbler	SC	areas of early successional vegetation, found primarily on field edges, hydro or utility right-of-ways, or recently logged areas	N/A
Bird	Henslow's Sparrow	END	old fields, pastures and wet meadows, dense, tall grasses, and thatch	General
Bird	Hooded Warbler	SC	interiors of large upland tracts of mature deciduous and mixed forest, and in ravines	N/A
Bird	King Rail	END	shallow, densely vegetated freshwater marshes, marshy riparian shorelines	General
Bird	Least Bittern	THR	large, quiet marshes with cattails	Transition Species
Bird	Loggerhead Shrike	END	Pasture or other grassland with scattered low trees and shrubs. Marginal and abandoned farmlands with scattered hawthorn shrubs and nearby wetlands.	General
Bird	Louisiana Waterthrush	SC	steep, moist, forested ravines with fast flowing streams along Niagara Escarpment	N/A
Bird	Olive-sided Flycatcher	SC	coniferous or mixed forest adjacent to wetlands or rivers	N/A
Bird	Piping Plover	END	wide open beaches along Lake Huron and Southern Georgain Bay shoreline	General
Bird	Red-headed Woodpecker	SC	nests in cavities in dead or mature trees, open woodland and woodland edges, especially in oak savannahs and riparian forest and habitats which contain a high density of dead trees,	N/A
Bird	Short-eared Owl	SC	open areas such as grasslands, marshes, wet meadows, fields and forest clearings	N/A

Bird	Whip-poor-will	THR	open woodlands or openings in mixed forests, rock or sand barrens with scattered trees, savannahs	General
Bird	Yellow Rail	SC	lives deep in the reeds and marshes of shallow wetlands	N/A
Fish	Grass Pickerel	SC	in rivers or wetlands with warm, shallow water and an abundance of aquatic plants	N/A
Fish	Lake Sturgeon	THR	inhabits the bottoms of shallow areas of large freshwater lakes and rivers	General
Fish	Northern Brook Lamprey	SC	small rivers draining into Lake Huron, prefers warm water	N/A
Insect	Hine's Emerald	END	specialist of calcareous wetlands (marshes, sedge meadows and fens) dominated by graminoid vegetation and fed primarily by groundwater from intermittent seeps	General
Insect	Monarch Butterfly	SC	wherever there are milkweed plants and wildflowers, often found in old fields, abandoned farmland and roadsides	N/A
Insect	West Virginia White	SC	moist, deciduous woodlands, with toothwort which is a small, spring-blooming plant of the forest floor	N/A
Plant	*American Ginseng	END	rich, moist, mature deciduous forest	Transition Species
Plant	American Hart's-tongue Fern	SC	mostly on Niagara Escarpment in rocky areas, particularly on limestone rock outcrops in maple-beech forest	N/A
Plant	Butternut	END	found in variety of sites, commonly in forest openings, old fields, hedgerows, on floodplains, stream sides or gradual slopes.	Transition Species
Plant	Eastern Prairie-fringed Orchid	END	wetlands, fens, swamps and tall grass prarie.	Regulated
Plant	Engelmann's Quillwort	END	shallow water in the Severn River	Regulated
Plant	Forked Three-awned Grass	END	Open sand barrens or low sand ridges, sandy forest openings and fallow fields, sandy edges of roads and trails, abandoned sand pits	Transition Species
Plant	Hill's Thistle	THR	open sunny sites, including prairies and woodland alvars.	Transition Species

Plant	Spotted Wintergreen	END	dry, mixed coniferous and deciduous forests	Transition Species
Reptile	Blanding's Turtle	THR	network of lakes, streams, and wetlands, preferring shallow wetland areas with abundant vegetation	Transition Species
Reptile	Eastern Foxsnake (Georgian Bay Population)	THR	found near Georgian Bay shoreline in both marsh and woodland, and often near human habitation	General
Reptile	Eastern Hog-nosed Snake	THR	sandy, well-drained habitats such as beaches and dry woods	Transition Species
Reptile	Eastern Musk Turtle (Stinkpot)	THR	shallow, slow-moving water around Georgian Bay	Transition Species
Reptile	Eastern Ribbonsnake	SC	usually found in vegetated areas close to water bodies, such as marshes, swamps, bogs, ponds, and edges of streams	N/A
Reptile	Five-lined Skink (Georgian Bay Pop.)	SC	rocky outcrops in mixed coniferous and deciduous forests on the southern Shield	N/A
Reptile	Massasauga (Georgian Bay Pop.)	THR	open bedrock outcroppings, conifer swamps/swales	Transition Species
Reptile	Milksnake	SC	wide range of habitats, especially old fields and farm buildings	N/A
Reptile	Northern Map Turtle	SC	large rivers and lakes	N/A
Reptile	Snapping Turtle	SC	very aquatic species, spend most of their lives in water, prefers shallow water in wetland habitats.	N/A
Reptile	*Spotted Turtle	END	ponds, marshes, bogs and fens with an abundant supply of aquatic vegetation	Transition Species
Reptile	*Wood Turtle	END	clear rivers, streams or creeks with a moderate current and sandy or gravelly bottom.	Regulated

IMPORTANT NOTES AND DEFINITIONS:

This list is based on known occurrences of species at risk or species that MNR believes there is a strong likelihood of being present and may therefore not be completely exhaustive.

**Species at Risk in Ontario (SARO) List - This list is subject to change and should therefore be checked periodically for updates.

* Information for these species is provided on a County-wide basis only due to the sensitive nature of the specific locations. For additional information please contact Midhurst District SAR Biologists.

Transition Species - species that will receive general habitat protection in 2013 unless a species specific habitat regulation is developed beforehand.
General Habitat Protection - areas that a species currently depends on to carry out its life processes. These areas may include dens and nests, wetlands, forests and other areas essential for breeding, rearing, feeding, hibernation and migration.
Regulated Habitat - species specific habitat regulations can be found on MNR's Habitat Protection Page at http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/268554.html.
N/A = Habitat protection is not provided for Special Concern species under the *Endangered Species Act* however approval authorities should ensure that Planning Act decisions consider the significant habitat of Special Concern species as potential significant wildlife habitat (as per the Provincial Policy Statement).

**Under the PPS development and site alteration is not permitted in the significant habitat of endangered and threatened species regardless of the habitat provisions provided under the ESA. Planning authorities are required to ensure that Planning Act decisions are consistent with the PPS in this regard.

APPENDIX MDP-C

Everett Preliminary Hydrogeological Investigation
(DRAFT November 2012)

November 2012

COMMUNITY OF EVERETT CLASS EA: WATER SUPPLY

Preliminary Hydrogeological Investigation

Submitted to:
Township of Adjala - Tosorontio
C/O Greenland Consulting Engineers
120 Hume Street,
Collingwood, ON L9Y 1V5

REPORT

Report Number: 12-1170-0033

Distribution:

2 copies - Greenland Consulting Engineers

1 copy - Golder Associates Ltd.

Golder Associates

Table of Contents

1.0 INTRODUCTION

The purpose of this letter report is to provide a hydrogeological basis for the selection of the preferred alternative for an expansion of the existing groundwater supply in the Community of Everett (Everett). Everett currently obtains potable water supplies from two deep wells located within the Community boundaries. Wastewater servicing is currently via private on-site sewage waste disposal systems. Everett is located approximately four kilometers north west of the Community of Alliston and approximately 20 km south west of the City of Barrie.

Golder Associates Ltd (Golder) has been retained by Greenland Consulting Engineers (Greenland) to provide an assessment of the existing water supply, the potential for additional water supplies, the location of additional water supply wells, and to comment on the Source Water Protection issues.

1.1 Water Supply Requirements

Greenland has prepared an assessment of water supply demand for Everett (Attached in Appendix A). The population of Everett is currently 1,929. Their Maximum Day Demand (MDD) for the past three years was 939 m^3/day and the MDD peaking factor is 2.43 times the Average Day Demand (ADD).

The future water demand is divided into three phases with population thresholds of 3,500, 7,000 and 10,000 people. The future ADD and MDD are as follows:

Phase	Population	ADD (m^3/day)	MDD (m^3/day)
Phase 1	3,500	819	1,829
Phase 2	7,000	1,782	3,755
Phase 3	10,000	2,607	5,214

The MDD is typically required from the water supply source, while the Peak Hour Demand is provided from storage.

2.0 EXISTING WATER SUPPLIES

Everett is currently supplied by three wells constructed in a confined artesian aquifer and are located within the developed area of Everett (Figure 1). Two of the wells are located on Pine Park Blvd (Well 1 and Well 3) and one well is located on Main Street (Well 2). The well records are attached as Figures 2, 3 and 4. The former production wells (PWs 1-78 and 2-78) were constructed in the upper aquifer and have been abandoned due to elevated nitrate concentrations. The shallow aquifer is found in Everett at an elevation range of approximately 220 to 240 masl, which is at a maximum depth of approximately 20 metres below the ground surface.

Well 1 was constructed by Northern Well Drilling (License # 3903) in 1989. The well has a diameter of 254 mm and an overall depth of 62.2 m. The well is equipped with nominal 254 mm diameter telescoping well screen with 16 slot screen installed between 56 and 62.5 mbgl (metres below ground level). The 6.1 m long well screen has a theoretical transmitting capacity of approximately 25 L/sec. Well 1 was originally tested at a rate of 27.3 L/sec for a period of 24 hours, during which time water levels declined from 7.74 mbgl to 35.1 mbgl. A specific capacity of 1.0 L/sec per metre of drawdown is calculated from the original testing.

Testing done in 2011 by Stantec (2011) resulted in a specific capacity of 1.4 L/sec per metre of drawdown. The 2011 testing was done at a rate of 21.1 L/sec which accounts for the slightly higher specific capacity. The recent testing indicates that the performance of the well is similar to that noted during the original testing.

The primary limitations for higher well yields from all of the wells in Everett are the limited aquifer thickness and the relatively fine textured nature of the aquifer. The transmitting capacity of the well screen in Well 1 is relatively low at 25 L/sec. The transmitting capacity of a well screen is the pumping rate at which water passes through the well screen at a velocity of 3 cm/sec under ideal conditions. In naturally developed water wells a significant portion of the well screen is blocked by the aquifer materials; therefore the velocity of water across the well screen is greater than 3 cm/sec. For this reason, many well designers consider the safe yield for a well to be half of the theoretical transmitting capacity of the well screen.

Pumping wells at rates that result in water passing through the screen at velocities higher than 3 cm/sec can cause an increase in the rate of encrustation of the screen by carbonate minerals and an increased rate of corrosion of the well screen. Encrustation of the well screen will result in increased maintenance costs and corrosion of the well screen will reduce the well's useful life. Well 1 is currently operating at 21 L/sec and the well losses are similar to those recorded during the original construction of the well. The current yield of Well 1 is 84% of the maximum theoretical yield for the well screen. The well yield should not be increased over the permitted amount.

Well 2 was constructed by Lunny Well Drilling (License # 3406) in 1990. The well has a diameter of 254 mm and an overall depth of 61.0 m, including a 0.91 m sump at the base of the screen. The well is equipped with nominal 254 mm diameter telescoping well screen with 16, 30 and 50 slot well screen installed between 54.3 and 60.0 mbgl (Figure 3). The 5.5 m long screen has a theoretical transmitting capacity of approximately 30.5 L/sec. The well was originally tested at a rate of 22.7 L/sec for a period of 24 hours, during which time water levels declined from 12.94 m to 39.51 m. A specific capacity of 0.86 L/sec per metre of drawdown was calculated from the original test data.

Well 2 has similar limitations to Well 1, in that the limited aquifer thickness and fine texture of the aquifer limited results in small unit well yields. The transmitting capacity of the screen is approximately 30.5 L/sec and the current yield of Well 2 is 75% of the theoretical transmitting capacity of the well screen. Pumping wells close to or above their theoretical capacities can result in encrustation of the well resulting in increased maintenance and corrosion of the screen results in a shortened well life. Currently Well 2 is operating at approximately 22.7 L/sec, which appears to be acceptable; however the well yield should not be increased over the permitted amount.

Well 3 was constructed as a test well by Snider Well Drilling of Craighurst (License # 4816) in 1978. The well has a diameter of 152 mm and an overall depth of 57.9 m. The well is equipped with nominal 152 mm diameter telescoping well screen with 16 slot screen installed between 56 and 62.5 mbgl. The 4.6 m long well screen has a theoretical transmitting capacity of approximately 11.7 L/sec. The well was originally tested at a rate of 11.2 L/sec for a period of 24 hours, during which time water levels declined from 7.44 mbgl to 18.1 mbgl. A specific capacity of 1.1 L/sec per metre of drawdown is calculated from the original testing.

Well 3 has similar limitations to Wells 1 and 2 with respect to the limited aquifer thickness and fine texture of the aquifer plus the added limitation of a smaller casing diameter than the other two wells. The transmitting capacity of the screen is approximately 12.9 L/sec. Well 3 is currently permitted to take 11 L/sec, which is 85% of the theoretical transmitting capacity of the well screen. Operation of the well at this rate would result in screen entrance velocities in excess of 3 cm/sec, which as described above, could result in an increased rate of encrustation of the screen by carbonate minerals and an increased rate of corrosion of the well screen resulting in a shortened useful life for the well.

2.1 Existing and Future Aquifer Yield

The wells operate under PTTW 93-P-3011 and conditions included in the PTTW include the measuring of non-pumping water levels in production wells on a monthly basis. Golder has reviewed these data for the past three years and compared them to the as-built static water levels. The current non-pumping water levels in the production wells are within 0.5 m of the original water levels during low demand periods and within 2 m of the original static water levels during high water demand periods. It should be recognized that the water level monitoring is done manually and pumps are turned off for a relatively short period of time prior to measuring the static water level. These water levels may represent partially recovered water levels. It is therefore reasonable to conclude that there has been no significant reduction in the static water level in the aquifer at the Everett municipal water supply wells since their construction. The water use at Everett has been 368 to 400 m^3/day over the past three years with maximum day demands of 797 to 1045 m^3/day.

Golder and Waterloo Hydrogeologic conducted well head protection mapping in 2004 (Golder, 2004). This work involved the preparation of a ModFlow 3-D groundwater flow model. This modelling work indicated that an average day water demand of 2,500 m^3/day is available from groundwater resources in the area. The future average day water demand for the area is 2,607 m^3/day, which is expected to be available from the lower aquifer system.

Further work to develop water supplies that will increase the water supply above the current permit to take water maximums will be required. It is expected that this work will include the construction of an additional water supply that will be capable of providing a minimum of 16 L/sec.

3.0 FUTURE WATER SUPPLIES

3.1 Options for water:

There are limited options for additional water supplies in or near Everett. As noted earlier the upper aquifer in the Everett area currently has elevated nitrate concentrations and is unsuitable as a water supply source for municipal purposes. The source of the nitrate is not completely certain, however a combination of the application of agricultural fertilizer and private on-site sewage disposal systems are the likely sources.

The confined artesian aquifer that is being used to supply water to the Everett municipal water distribution system is currently unaffected by the elevated nitrate concentrations in the upper aquifer. This source of water supply continues to be the only viable groundwater source in the area of Everett.

3.2 Groundwater Supply Options

Golder has prepared a series of draft cross sections in the Everett area and two of these have been presented here as Figures 4 and 5. They were prepared using the Ontario Water Well Record database that is compiled and maintained by the Ontario Ministry of the Environment. The database that was used to prepare the maps and cross sections appearing herein was updated at the initiation of this study.

Figure 4 is oriented in an east – west orientation with the line of section along County Road 5 through Everett. The cross section shows the presence of a thick unconfined aquifer in the Everett area. This aquifer was intersected at Everett Wells 1 and 3, where it is approximately 20 m thick. In most areas there is a confined artesian aquifer with a limited thickness that is found at an elevation of approximately 200 metres above sea level (masl) in the Everett area. This aquifer is used by individuals as a source of water supply. The middle aquifer is relatively thin and as a result not useful as a municipal water supply aquifer. The confining layer between the middle and lower aquifer is 5 to 10 m thick in the Everett area.

The Municipal water supply in Everett is likely a lateral equivalent to Regional Aquifer A3 as identified in the Barrie Borden area. This aquifer is generally protected from contamination of surface activities. The area of Everett is similar to other areas in Simcoe County where the Regional A3 Aquifer has little evidence of the impact from surface activities, such as low nitrate concentrations.

The extent of Aquifer A3 is shown on Figures 4 and 5 as the shaded yellow pattern between the elevations of 175 and 190 masl. Aquifer A3 is found throughout the area and to the west of Everett in the Mansfield area Aquifer A3 may be hydraulically connected to Aquifer A2. Aquifer A3 appears to be thicker toward the north and east of Everett.

Figure 6 is a compilation of the well yields of wells within a 10 km radius of Everett. The pumping rates are represented as circles around the water well and are proportional to the yield of the well. High capacity municipal wells are present in Everett, Lisle and Alliston, while high capacity irrigation wells are found between Alliston and Everett, to the east of Everett and to the west of Lisle.

3.3 Future Water Well Drilling

The detailed data from the original testing for Well 1 (Grohal #2) and Well 2 (Ballpark) are not available; however it is clear from the water well records that the wells have similar drawdown and yield characteristics. The interference resulting from the pumping of these wells is not documented in the reports; therefore the Theis equation has been used to estimate the mutual interference among the wells.

The aquifer at Well 1 was intersected between 53.6 and 62.4 mbgl, resulting in 8.9 m of aquifer. The aquifer was relatively uniform and a 16 slot screen was installed in the well. The aquifer at Well 2 was intersected between 55.2 and 61.6 mbgl, resulting in 6.37 m of aquifer, which is 2.5 m thinner than at Well 1. On the basis of a slightly higher specific yield from Well 1 and a greater aquifer thickness, the site of Well 1 has been assessed for a new water supply well with a yield of 15.8 L/sec. Assuming Well 1 and Well 2 each yield 1,964 m^3/day, a well yield of approximately 15.8 L/sec would be required from a third well.

The zone of influenced may be governed by the lateral groundwater flow through the granular soils, based on the reported transmissivity from aquifer testing (Trow, 1990) of 205 m^2/day.

Applying the Theis analytical solution, the lateral extent of groundwater level drawdown can be estimated as follows:

$$s(r,t) = \frac{Q}{4\pi T} W\left(\frac{r^2 S}{4Tt}\right)$$

where $s(r,t)$ = drawdown at distance (r) and time (t) after the start of pumping,

Q = pumping rate required to supply the ADD potable water supply (2,600 m^3/day),

T = aquifer transmissivity (205 m^2/day – based on field study results),

S = aquifer storativity (1 x 10^{-4} – assumed for confined aquifer conditions), and,

W = Theis well function.

It is assumed that a new well would be constructed 100 m from Well 1 and would yield 15.8 L/sec (approximately 1,300 m^3/day). In combination with Well 1 and Well 3, the MDD well yield would be 5,214 m^3/day and the pumping levels following 90 days of pumping at the wells is calculated to be between 15 and 23 m above the well screens. Under ADD water demand of 2,606 m^3/day for 20 years, the pumping levels in the wells are calculated to be between 19 and 26 m above the well screens. The calculations are shown in Table 2 for both MDD conditions and ADD conditions. These calculations would have to be confirmed with the construction and testing of a 203 mm diameter well.

If an alternative location for a new water supply well is contemplated, sites to the north of Everett would be preferred. The aquifer appears to thicken toward the north and the location of a well offset from the existing wells toward the north would widen the zone of capture for the wells and increase the recharge area for the Everett water supply system. Locating a new well to the south is possible; however the potential for competing for water with the Alliston groundwater supply system increases.

4.0 SOURCE WATER PROTECTION

There are three Storm Water Management (SWM) ponds proposed in Everett (Figure 3). None of the SWM ponds is proposed for lands that fall within an area of high vulnerability or within WHPA-A or WHPA-B, as defined by Burnside (2010). One of the proposed SWM ponds is at the 25 year Time of Travel (ToT), a second pond is on the 10-year ToT, and a third SWM pond is located near between the 2-year and 10-year ToT (Figure 3).

Since the SWM ponds are located outside vulnerable areas in the WHPA for Everett, the potential vulnerability scores for pathogens, or chemical parameters do not represent a significant threat to the water supply system for Everett. If the SWM ponds are expected to hold water they will likely have to be lined, since the surficial soils are sandy and the water table is two to six metres below the ground surface.

5.0 SUMMARY AND CONCLUSION

The existing wells are currently being operated at or near their maximum well yields based on their construction.

A new source of water supply to augment the existing Everett municipal water supply could be obtained from a groundwater source in Everett. The Regional A3 aquifer provides the adequate unit well yields; good quality water, and a source water that is protection from direct contamination from surface activities.

Additional water supplies could be obtained either from twinning one of the existing wells or drilling a new well on a different property. Well construction and testing would be required to confirm the well yield and interference among wells.

The aquifer at Well 1 appears to be a slightly coarser and has a greater thickness than at Well 2. The Well 1 site would be the preferred site for water supply development, barring other site or pump house restrictions.

The construction of SWM ponds at the locations shown on Figure 3 should not pose a significant threat to the on-going operation of municipal water supply wells in Everett.

Report Signature Page

GOLDER ASSOCIATES LTD.

John Easton, M.Sc., P.Geo.
Senior Hydrogeologist, Associate

JAE/plc

6.0 REFERENCES

Burnside Associates, 2010.

Nottawasaga Valley Source Protection Area Approved Assessment Report. Chapter 8: The Township of Adjala -Tosorontio.

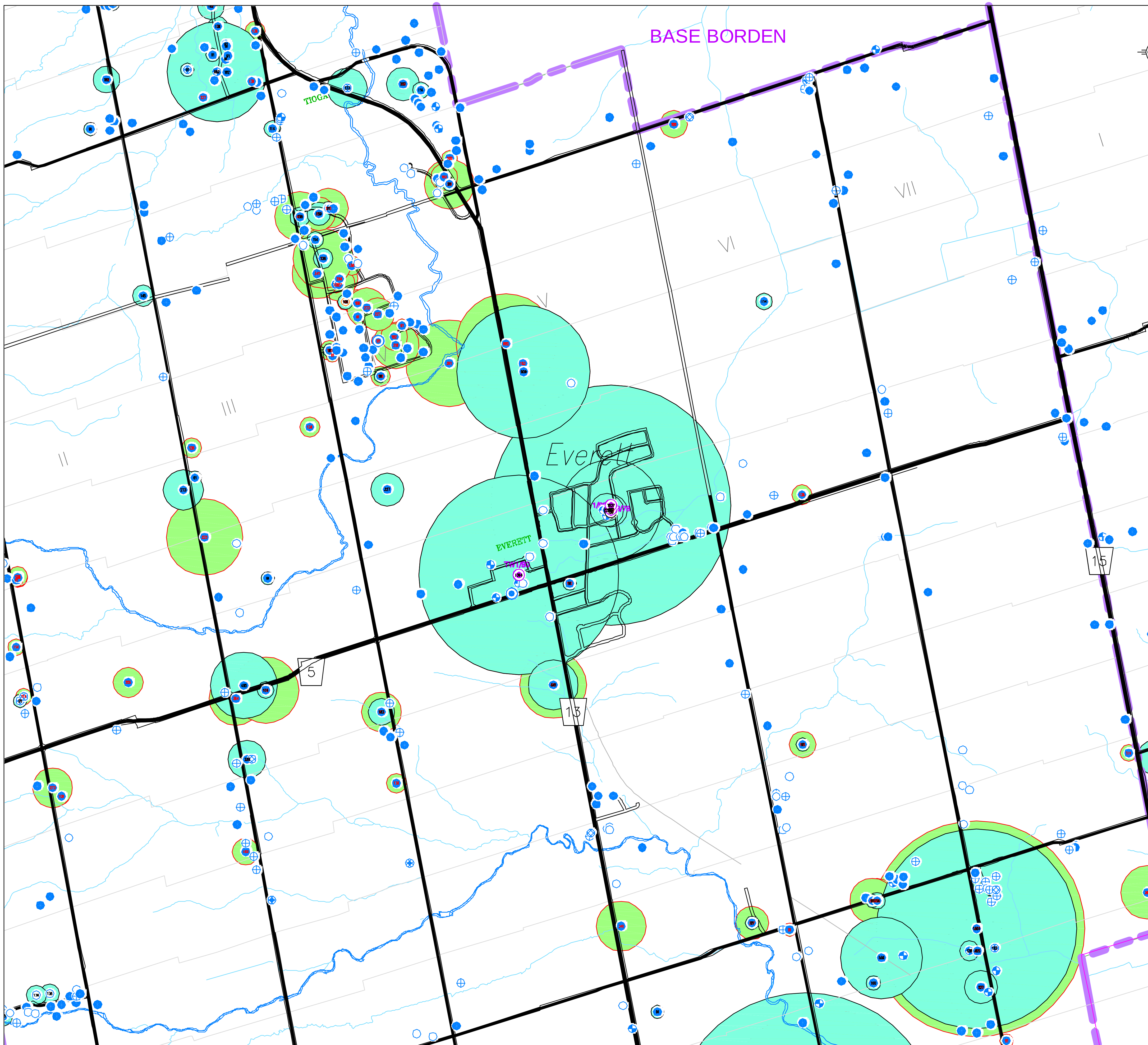
Golder Associates, 2004.

South Simcoe Municipal Groundwater Study. Golder Associates Ltd., Barrie.

Stantec, 2011.

Walton- Everett Phase 1 Lands- PW1/90 Municipal Well Pumping Test. Draft Plan of Subdivision Application – 254 Units, Township of Adjala-Tosorontio, County of Simcoe. Letter to Louise Foster, September 27, 2011, Stantec File: 1606-21773/02.

FIGURES



LEGEND:

Tested Rate (L/min) - Proportional to Recharge

Recommend Rate (L/min)

REFERENCES:

MAPPING BASED ON MOE WATER WELL RECORDS, QUEEN'S PRINTER

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

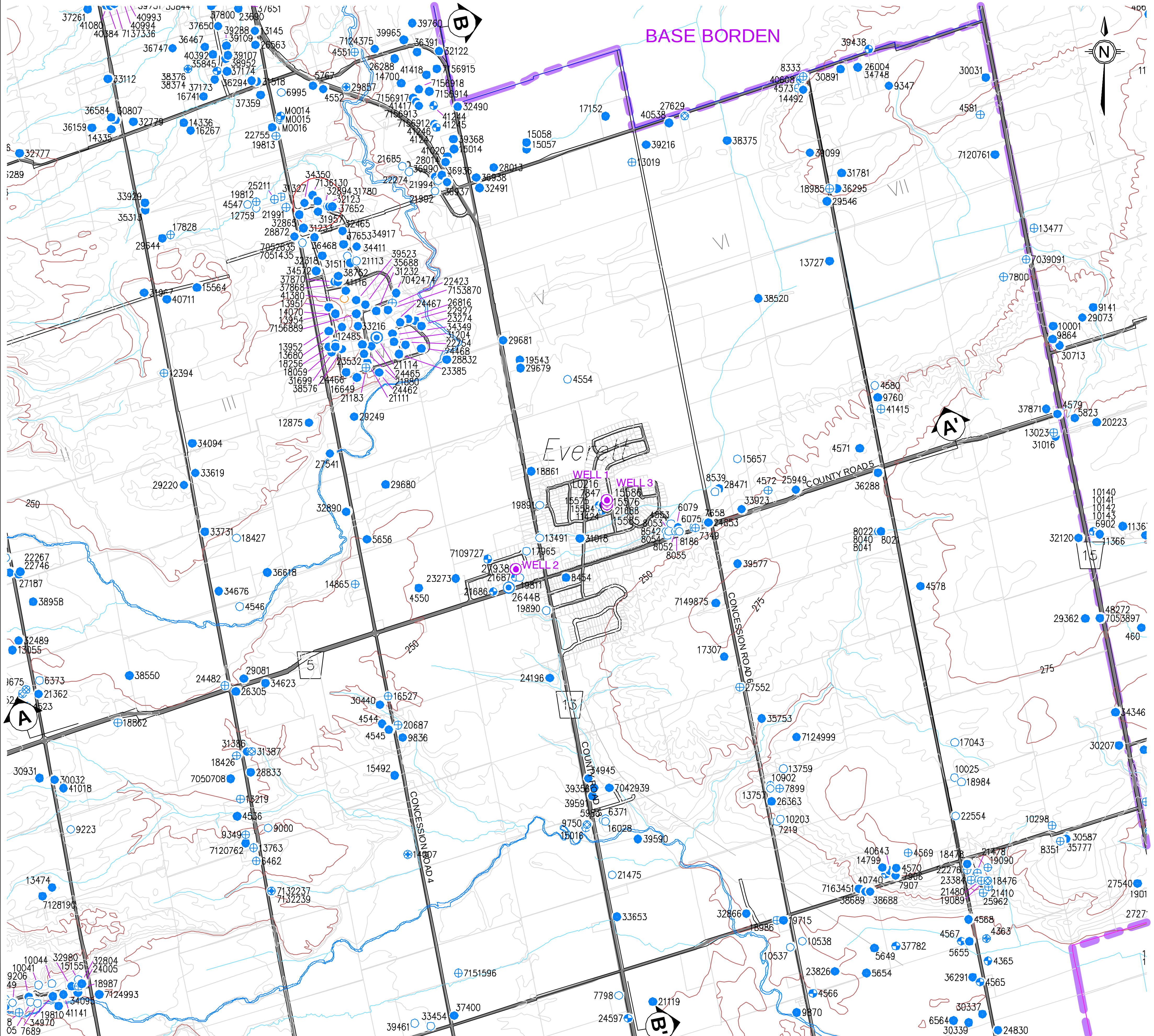
PUMPING RATES MAP

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FILE No.	1211700033ABRATE.dwg
PROJECT No.	12-1170-0033
REV.	
FIGURE	6

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABRATE.dwg1211700033ABRATE.dwg: [Figure 6]



LEGEND:

- Shallow Dug or Bored <10 m
- Deep Bored Well >10 m
- Drilled Overburden Well
- Test or Observation Well
- Drilled Bedrock Well
- Sandpoint
- Municipal / Public Supply

REFERENCES:

MAPPING BASED ON MOE WATER WELL RECORDS, QUEEN'S PRINTER

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

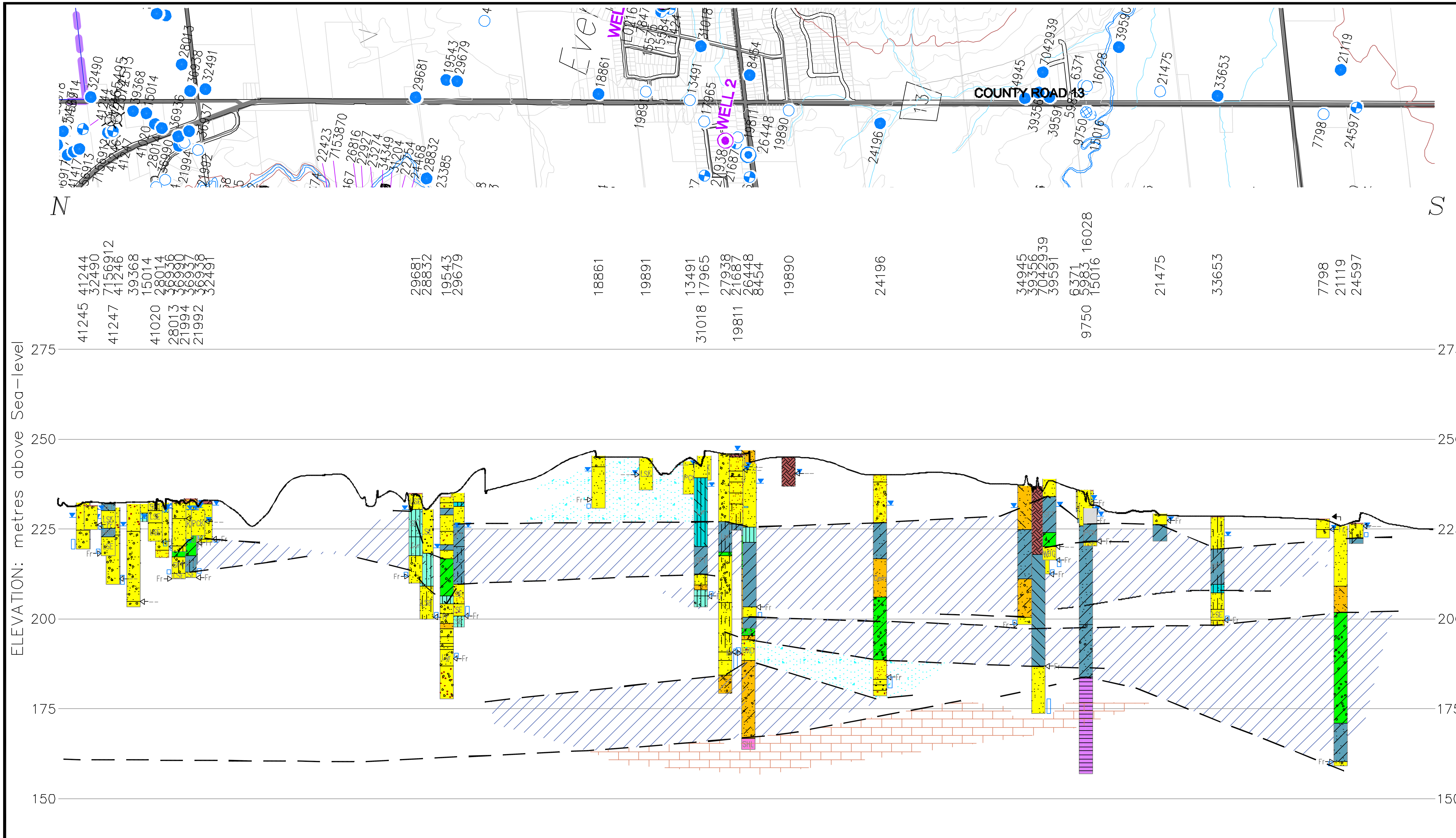
AREA LOCATION MAP

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FILE No.	1211700033ABMAP.dwg
PROJECT No.	12-1170-0033
REV.	
FIGURE	1

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA – Greenland)\–AB–\1211700033ABMAP.dwg\1211700033ABMAP.dwg [Figure 1]



0 100 250 500 1000

SCALE 1:20000 metres

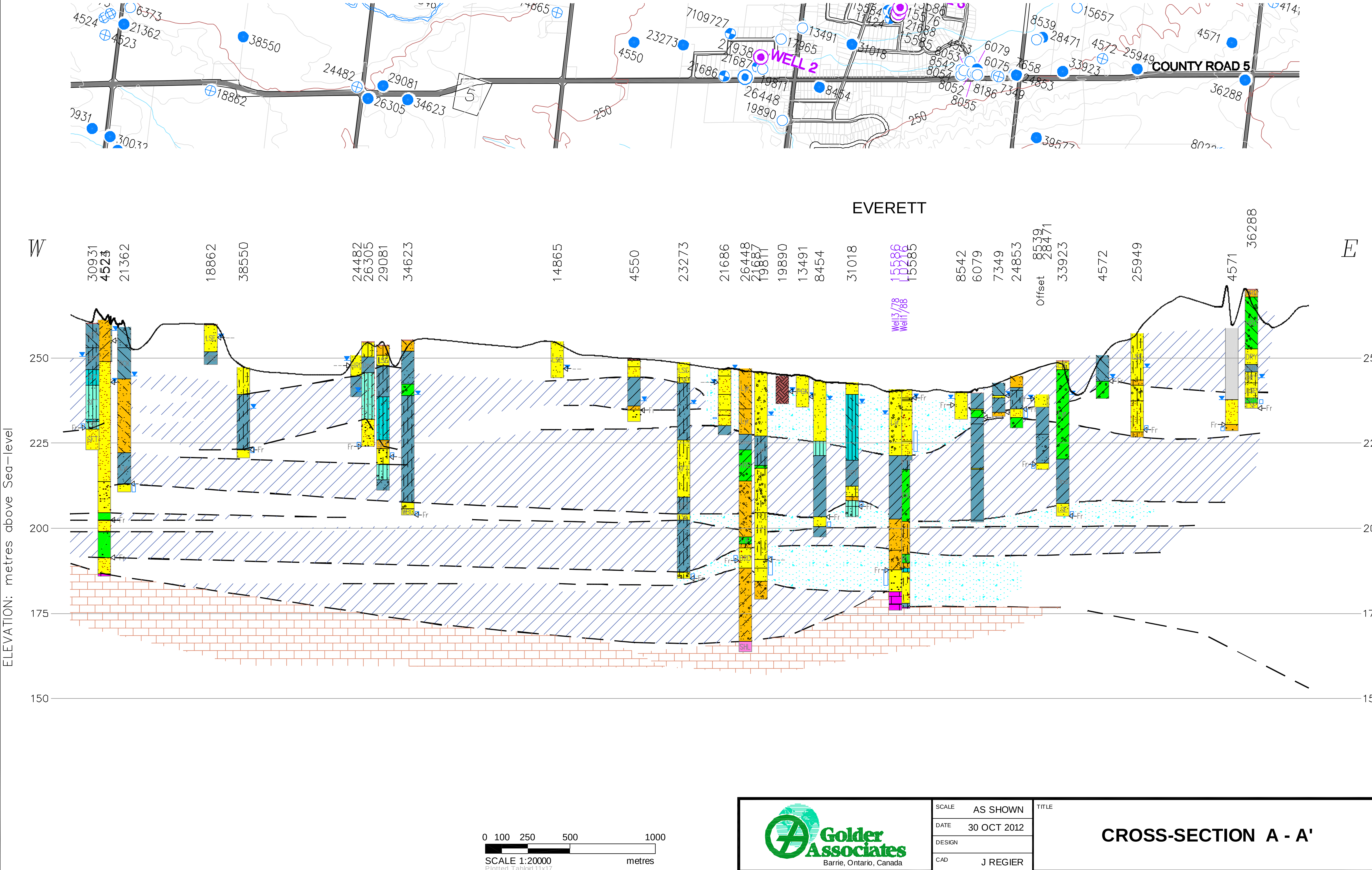
Plotted Tabloid 11x17

REFER TO FIGURE 7 FOR HYDROGEOLOGICAL SYMBOLS

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN	TITLE	CROSS-SECTION B - B'
DATE	30 OCT 2012		
DESIGN			
CAD	J REGIER		
FILE No.	1211700033ABMAP.dwg	CHECK	
PROJECT No.	12-1170-0033	REV.	
REVIEW		EVERETT CLASS EA: WATER SUPPLY	FIGURE 5

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA – Greenland)\-AB-\1211700033ABMAP.dwg



REFER TO FIGURE 7 FOR HYDROGEOLOGICAL SYMBOLS

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABMAP.dwg

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FILE No.	1211700033ABMAP.dwg
PROJECT No.	12-1170-0033
REV.	

TITLE

CROSS-SECTION A - A'

EVERETT CLASS EA: WATER SUPPLY

FIGURE 4

STRATIGRAPHIC PATTERN

- Unoxidized CLAY, Blue, Grey, White, or Undefined CLAY
- Oxidized CLAY, Brown, Red, Yellow
- SILT
- SAND
- GRAVEL
- STONES, Rounded GRAVEL, PEBBLES
- BOULDER
- TILL
- SHALE
- DOLOSTONE
- LIMESTONE
- CRYSTALLINE ROCK

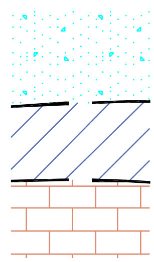
	SECONDARY/ SOME	TRACE	MINOR	
Clayey				Clay
Silty				Silt
Sandy				Granular

- Screen
- Recorded Static Water Level
- Water Producing Zone
- Flowing Well
- 23453 MOE Recorded Private Well

GENERIC MATERIALS

- UNKNOWN OR PREVIOUSLY DUG
- PEAT/LOAM
- SANDS & GRAVELS
- GRANULAR TILL
- SILT
- SILT CLAYEY
- CLAY
- TILL
- LIMESTONES
- SHALES

STRATIGRAPHY (see Notes)



AQUIFER

HYDROSTRATIGRAPHIC CONTACT

CONFINING MATERIAL

BEDROCK
LIMESTONE OR SHALE

MAP SYMBOLS

- Shallow Dug or Bored <10 m
- Deep Bored Well >10 m
- Drilled Overburden Well
- Test or Observation Well
- Test Pit
- Drilled Bedrock Well
- Sandpoint
- Municipal / Public Supply

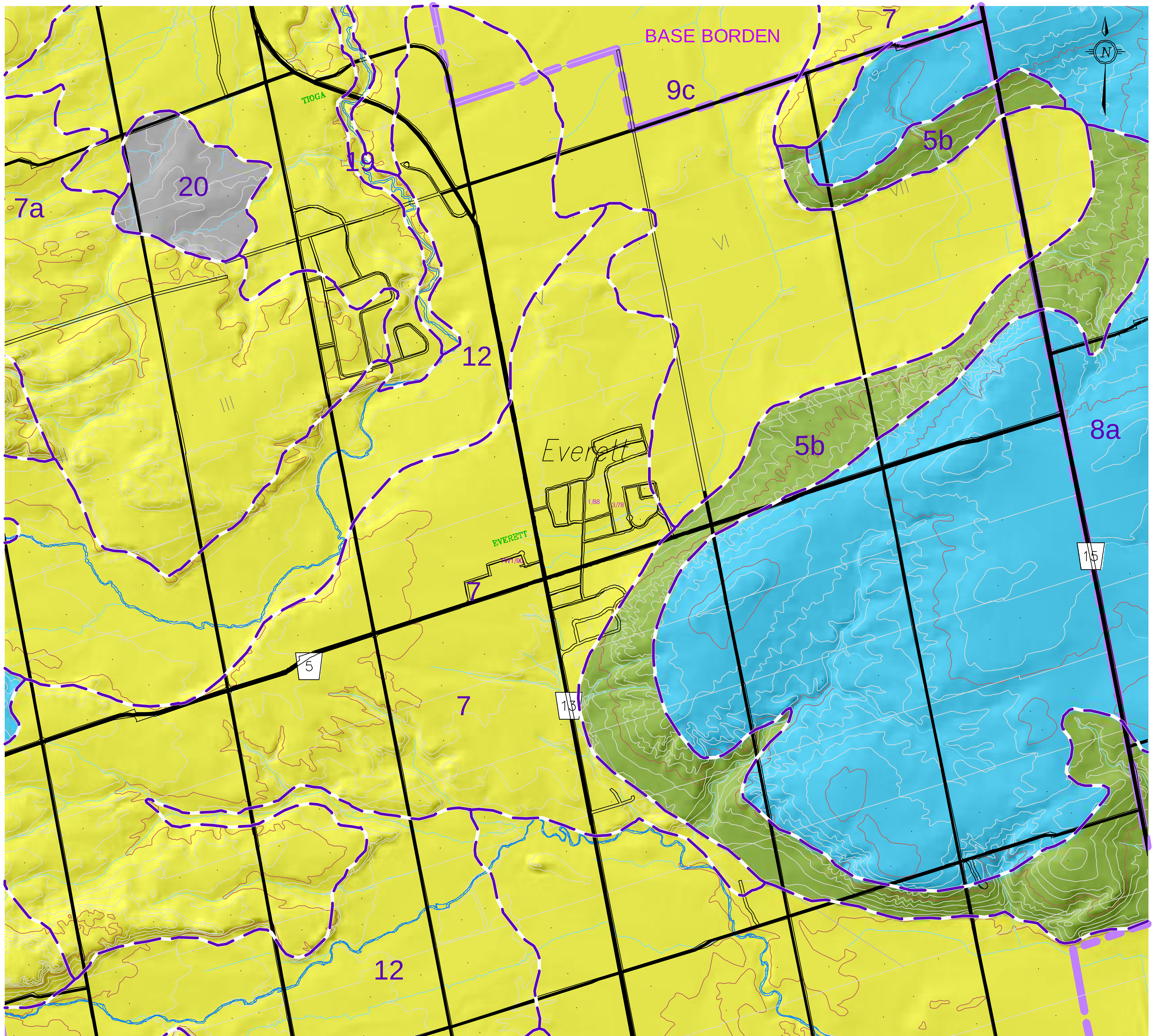
NOTES

On all sections, boundaries between soil strata have been determined only at well and test well locations. Between the wells and test wells, boundaries are not proven but are assumed from geological evidence.

Wells are located to MOE Water Well Bulletin Data. Locations and elevations are subject to field verification.

Golder Associates, Barrie, Ontario, Canada	SCALE: AS SHOWN	TITLE: HYDROGEOLOGICAL SYMBOLS
	DATE: 30 OCT 2012	
	DESIGN:	
	CAD: J REGIER	
FILE No. 1211700033ABMAP.dwg	CHECK:	EVERETT CLASS EA : WATER SUPPLY
PROJECT No. 12-1170-0033 REV.	REVIEW:	FIGURE 7

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABMAP.dwg



LEGEND:

20	Organic Deposits
19	Fluvial Silt, Sand, Gravel
12	Fluvial Sand
9c	Glaciolacustrine Silt & Sand Deposits
8a	Glaciolacustrine Deep Water Deposits
7	Glaciofluvial Outwash Sand & Gravel
7a	Distal Sand & Gravel
5b	Ablation Till

REFERENCES:

MAPPING BASED 2006 OGS/GSC DIGITAL COMPILATION, QUEEN'S PRINTER

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

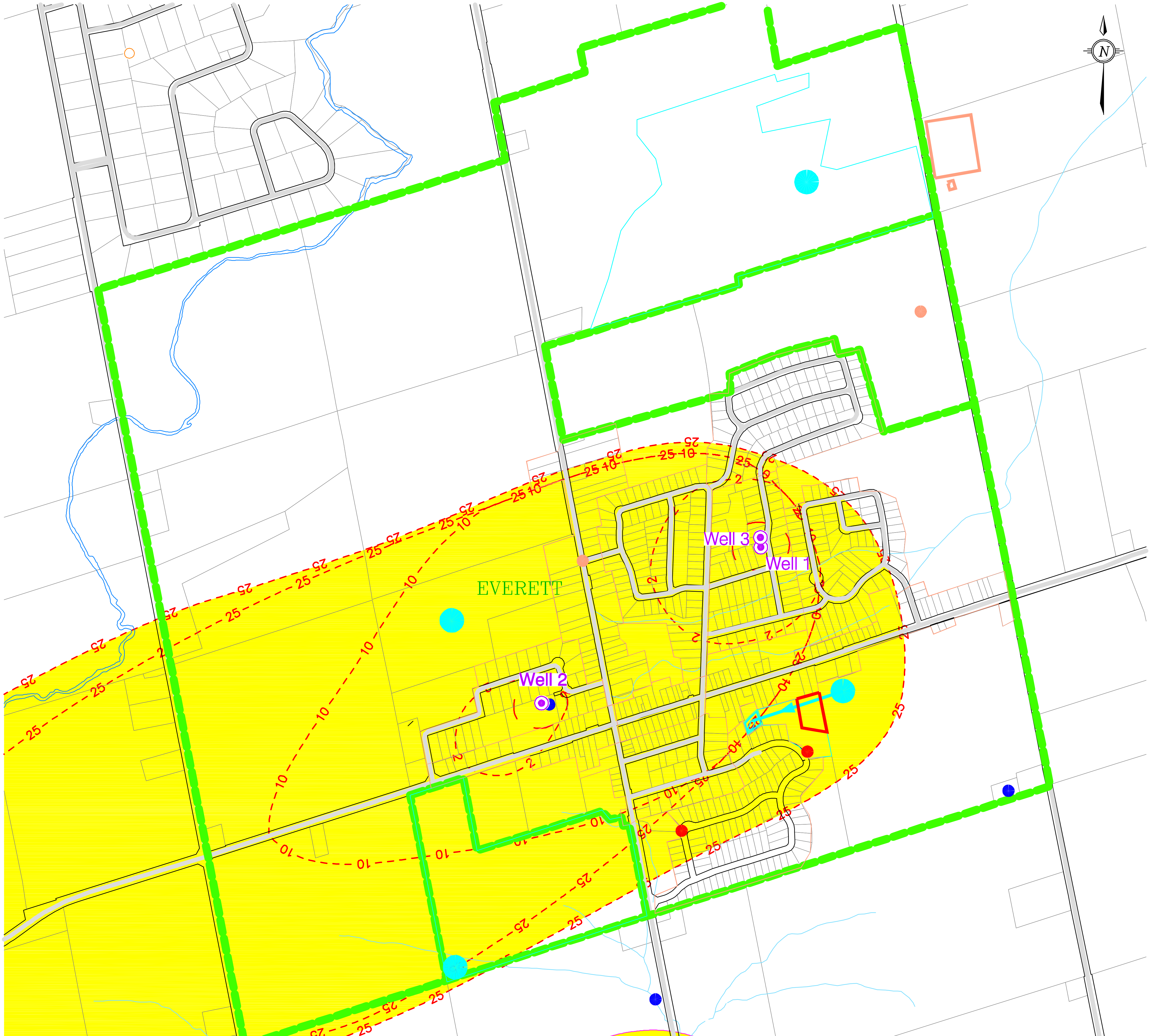
QUATERNARY GEOLOGY MAP

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN		
DATE	30 OCT 2012		
DESIGN			
CAD	J REGIER		
FILE No. 1211700033ABQUAT.dwg		CHECK	FIGURE
PROJECT No. 12-1170-0033	REV.	REVIEW	2

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA – Greenland)\-AB-\1211700033ABQUAT.dwg1211700033ABQUAT.dwg: [Figure 2]



LEGEND:

- Secondary Plan Boundary
- Proposed WWTP & Tile Bed
- Proposed Pumping Station
- Proposed Stormwater Pond
- Existing Municipal Water Well / Infrastructure
- Existing Septic Treatment Infrastructure
- 25 Municipal Water Well Capture Zone, Time of Travel

REFERENCES:

MAPPING BASED ON ESSA TOWNSHIP, PLANNING DEPARTMENT

CAPTURE ZONES, SIMCOE COUNTY GROUNDWATER STUDY, 2005

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

SITE LOCATION MAP CAPTURE ZONES

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN		
DATE	30 OCT 2012		
DESIGN			
CAD	J REGIER		
FILE No.	1211700033ABPLAN.dwg	CHECK	
PROJECT No.	12-1170-0033	REV.	
REVIEW		FIGURE	3

PLOT DATE: November 02, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABPLAN.dwg1211700033ABPLAN.dwg: [Figure 3]

TABLES

Table 2

Township of Adjala - Tosorontio, Everett Water Supply

Combined Interference Among Municipal Well

THEIS EQUATION: s = (Q/(4PIT) LN ((2.25Tt)/(r2S))

Q m3/day	Well discharge	s m	Drawdown at distance r
T m2/day	Aquifer Transmissivity	t days	Time since pumping started or stopped
S	Aquifer storativity	r m	Distance from well

Maxmum Day Demand

Q (m^3/day)	T (m^2/day)	S	t (days)	INTERFERENCE AT RADIUS SHOWN (m) r (m) =	0.3	100	750	1000	2000
Well 1 - (Grohal #1)									
1960	205	1.E-04	90		16.9	8.1	5.0	4.6	3.5
New Well 2 (Grohal #2)									
1294	205	1.E-04	90		11.2	5.3	3.3	3.0	2.3
Well 3 (Ballpark)									
1960	205	1.E-04	90		16.9	8.1	5.0	4.6	3.5

MDD = 5,214 m^3/day	Pumping Level	Interference From			Combined interference		
	(m)	Well 1	Well 2	Well 3	Pumping Level (m)	Depth to Top of Screen (m)	Pumping Level above Screen (m)
Well 1 - (Grohal #1)	27.4	0	8.1	5.0	40.5	56.0	15.5
New Well 2 (Grohal #2)	18.3	8.1	0	5.0	31.4	54.0	22.6
Well 3 (Ballpark)	26.5	5.0	3.3	0	34.8	56.0	21.2

Average Day Demand

Q (m^3/day)	T (m^2/day)	S	t (days)	INTERFERENCE AT RADIUS SHOWN (m) r (m) =	0.3	100	750	1000	2000
Well 1 - (Grohal #1)									
980	205	1.E-04	3650		9.9	5.5	3.9	3.7	3.2
New Well 2 (Grohal #2)									
647	205	1.E-04	3650		6.5	3.6	2.6	2.4	2.1
Well 3 (Ballpark)									
980	205	1.E-04	3650		9.9	5.5	3.9	3.7	3.2

ADD = 2,606 m^3/day	Pumping Level	Interference From			Combined interference		
	(m)	Well 1	Well 2	Well 3	Pumping Level (m)	Depth to Top of Screen (m)	Pumping Level above Screen (m)
Well 1 - (Grohal #1)	27.4	0	5.5	3.9	36.8	56.0	19.2
New Well 2 (Grohal #2)	18.3	5.5	0	3.9	27.7	54.0	26.3
Well 3 (Ballpark)	26.5	3.9	2.6	0	33.0	56.0	23.0

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

PW1-88 (TW2-88)

P.W.#1---1988.

County or District	Township, Borough, City, Town, Village	Con.	Lot
County of Simcoe	Township of Tosorontio(Everett)	Conc # 5	11

Owner	Address	Date Completed
Township of Tosorontio	R.R. # 3 Everett ,Ontario..	31 Jan 89

LOG OF OVERBURDEN AND BEDROCK MATERIALS

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
Brown	sand	clay streaks	layered	0	44
Brown	sand(silty)	clay seams	layered	44	63
Grey	clay	slit	soft	63	76
Grey	clay	stones gravel seams	hardpacked	76	127
Brown	sand(silty)	gravel,clay seams	layered	127	158
Grey	clay	stones	hard	158	167
Grey	sand	silty clay	layered	167	172
Grey	silt	sandy clay	layered	172	176
Brown	sand	fine gravel silt	layered	176	205
Grey	clay(sandy)	silt stones	hardpacked	205	210
Grey	rock	fractured	layered	210	216

K packer +header 5'-10"

WATER RECORD

Water found at feet	Kind of water
184-204	X Fresh

CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth From	Depth To
10	X Steel	.375	184	+2.4

SCREEN

Slot No.	Diameter	Length
	9 1/2 inches	20 feet

Material and type: S.S. wire wd — Depth to top of screen: 184 feet

PLUGGING & SEALING RECORD

Depth set at From	To	Material and type
184	91	drill cuttings
91	5	cement grout
5	0	backfill

PUMPING TEST

Pumping test method: X Pump
Pumping rate: 360 GPM
Duration of pumping: 24 hours 0 mins
Static level: 25.40 feet
Water level end of pumping: 115 feet
Pump intake set at: 160 feet
Water at end of test: X Clear
Recommended pump type: X Deep
Recommended pump setting: 150 feet
Recommended pumping rate: 350 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.

50493

FINAL STATUS OF WELL

X Water supply

WATER USE

X Municipal

METHOD OF CONSTRUCTION

X Rotary (conventional)

CONTRACTOR

Name of well contractor: Northern Well Drilling Limited — Well contractor's licence number: 3903
Address: P.O. Box 358 Unionville,Ont.
Name of well technician: Jerry W. Fenwick — Well technician's licence number: T-0001
Signature of technician/contractor — Submission date: 31 mar. 89

OFFICE USE ONLY

CONTRACTOR'S COPY

TABLE C

Geologic Units at Borehole 5 (Everett Ball Park Well)

Geologic Unit	Depth (m)	Elevation (m a.m.s.l.)	Description
Sand	0-17.1	247.4-230.3	Shallow aquifer
Clay	17.1-22.0	230.3-225.4	
Clayey gravel	22.0-28.1	225.4-219.3	
Sand and gravel	28.1-44.2	219.3-203.2	Middle aquifer
Clay	44.2-47.3	203.2-200.1	
Silty sand	47.3-49.7	200.1-197.7	
Clay	49.7-51.5	197.7-195.9	
Sand	51.5-57.3	195.9-190.1	Deep aquifer
Clay	57.3-58.0	190.1-189.4	
Sand with silt	58.0-69.5	189.4-177.9	Deep aquifer
Clay	69.5-74.7	177.9-172.7	

Everett Well 3 (PW3/78)

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Simcoe	Tosorontio	V	11

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Twp. of Tosorontio	Everett, R. R. #3	DAY 28 MO 08 YR 78

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
	sand	streaks of gravel		0	64
	clay			64	125
	sand	clay		125	155
	sand	gravel, clay		155	174
	coarse sand			174	195
	limestone		broken	196	207
	limestone			207	213

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
174-195	☒ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL

CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
6	☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE	0.188	+ 1	178
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE			
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE			

SCREEN

SIZE OF OPENING	DIAMETER	LENGTH
10ft. x 14 slot 5ft. x 16 slot	6 INCHES	15 FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN	
stainless steel wire wound	packer: 174 FEET	

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE	CEMENT GROUT, LEAD PACKER, ETC.

PUMPING TEST

PUMPING TEST METHOD: ☒ PUMP ☐ BAILER		PUMPING RATE: 148 GPM		DURATION OF PUMPING: 24 HOURS ___ MINS.	
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING ☒ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
24.42 FEET	59.27 FEET	45.64 FEET	46.28 FEET	46.56 FEET	46.76 FEET
IF FLOWING GIVE RATE: ___ GPM		PUMP INTAKE SET AT: 154 FEET		WATER AT END OF TEST: ☒ CLEAR ☐ CLOUDY	
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP		RECOMMENDED PUMP SETTING: 100 FEET		RECOMMENDED PUMPING RATE: 150 GPM	

FINAL STATUS OF WELL

☒ WATER SUPPLY
☐ OBSERVATION WELL
☐ TEST HOLE
☐ RECHARGE WELL
☐ ABANDONED, INSUFFICIENT SUPPLY
☐ ABANDONED, POOR QUALITY
☐ UNFINISHED

WATER USE

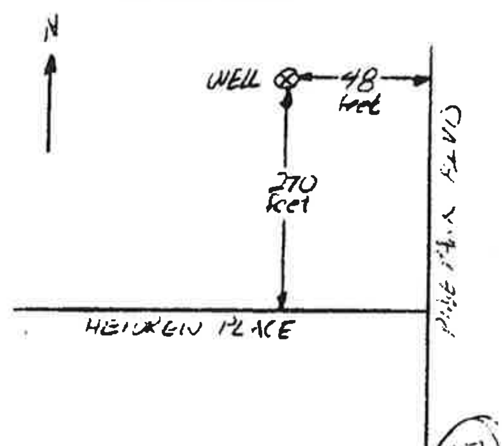
☐ DOMESTIC
☐ STOCK
☐ IRRIGATION
☐ INDUSTRIAL
☐ OTHER
☐ COMMERCIAL
☐ MUNICIPAL
☐ PUBLIC SUPPLY
☐ COOLING OR AIR CONDITIONING
☒ NOT USED

METHOD OF DRILLING

☐ CABLE TOOL
☒ ROTARY (CONVENTIONAL)
☐ ROTARY (REVERSE)
☐ ROTARY (AIR)
☐ AIR PERCUSSION
☐ BORING
☐ DIAMOND
☐ JETTING
☐ DRIVING

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW



DRILLER'S REMARKS: PW-3

42

CONTRACTOR

NAME OF WELL CONTRACTOR: Snider Drilling Limited, LICENCE NUMBER: 4816

ADDRESS: Craighurst, Ontario.

NAME OF DRILLER OR BORER: Phillip Brown. LICENCE NUMBER:

SIGNATURE OF CONTRACTOR: Ralph Snider. SUBMISSION DATE: DAY ___ MO ___ YR ___

OFFICE USE ONLY

OWNER'S COPY

FORM NO. 0506 4

APPENDIX A

Water and Sewage: Demands/Flows

From Greenland Consulting Engineers, 2012.

Water and Sewage Demands/Flows

A. Historical Water Demands, Peaking Factors and Per Capita Daily Demands

Year	*Average Daily Demand (m^3/d)	*Maximum Daily Demand (m^3/d)	Maximum Daily Demand Peaking Factor	**Peak Hour Peaking Factor (For Population 2,000)
2009	399.50	1,044.90	2.62	3.75
2010	394.20	976.30	2.48	3.75
2011	368.20	796.80	2.16	3.75
Total	1,161.90	2,818.00		
Average	**387.30**	**939.33**	**2.43**	**3.75**
Connections	643.00			
Persons Per Unit	3.00			
Population	1,929.00			
Per Capita Day Demand (L/c/d)	200.78	486.95		

***Source: Burnside Technical Memorandum (16 August 2011) re. R&M Homes Subdivsion Review**
**** Source: Peak Hour Peaking Factor form MOE Guidelines**

B. Historical Sewage Flow

New Horizons is the only Subdivison in Everett with existing muncipal sewage collection/treatment.
Remaining existing areas serviced by septic systems.

Historcial Average Daily Flow	74.00	m^3/d
Service Population	300.00	persons
Average Flow Per Capita	246.67	L/c/d

***Source: County Simcoe Visioning Strategy**

C. Future Water Distribution and Treatment Data

Since the historical per capita average daily demand is low when compared with MOE values,
future development per capita flow is based on the following (for average daily demand)

246.67	L/c/d average sewage flow in New Horizon Sewage Plant
10.00	% Increase for Water Use over Sewage Use
271.33	L/c/d average daily water useage
275.00	L/c/d average daily water useage (rounded)
Varies	Maximum Daily Demand Peaking Factor Per MOE Guidelines

For existing areas the historical average daily demand water data will be used.
As such the following presents water demands for future existing and future growth scenarios:

Average Daily Demand	Population	Maximum Daily Demand Peaking Factor	Maximum Daily Demand Existing Areas (m^3/d)	Maximum Daily Demand Future Areas (m^3/d)	Total (m^3/d)
Existing	1,929.00	1.00	387.30	0.00	387.30
Phase 1	3,500.00	1.00	387.30	432.03	819.33
Phase 2	7,000.00	1.00	387.30	1,394.53	1,781.83
Phase 3	10,000.00	1.00	387.30	2,219.53	2,606.83

Maximum Daily Demand	Population	Maximum Daily Demand Peaking Factor	Maximum Daily Demand Existing Areas (m^3/d)	Maximum Daily Demand Future Areas (m^3/d)	Total (m^3/d)
Existing	1,929.00	2.43	939.33	0.00	939.33
Phase 1	3,500.00	2.23	864.51	964.34	1,828.85
Phase 2	7,000.00	2.11	816.10	2,938.46	3,754.56
Phase 3	10,000.00	2.00	774.60	4,439.05	5,213.65

Peak Hour Demand	Population	Maximum Daily Demand Peaking Factor	Maximum Daily Demand Existing Areas (m^3/d)	Maximum Daily Demand Future Areas (m^3/d)	Total (m^3/d)
Existing	1,929.00	3.75	1,452.38	0.00	1,452.38
Phase 1	3,500.00	3.35	1,298.56	1,448.52	2,747.08
Phase 2	7,000.00	3.16	1,224.97	4,410.68	5,635.66
Phase 3	10,000.00	3.00	1,161.90	6,658.58	7,820.48

D. Future Sewage Collection and Treatment Data

Sewage Collection for New and Existing Areas Based Upon		450 L/c/d average daily flow * Harmon Peaking Factor + I/I Allowance
Sewage Treatment	Existing Per Capita Avg. Flow	246 L/c/d average daily flow from New Horizon Subdivsion
		248 L/c/d average daily flow (90% Water Average Daily Demand)
		247 Average L/c/d
		90 L/c/d extraneous flow allowance
		337 Total L/c/d
		340 Total L/c/d - to be used in Study.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
121 Commerce Park Drive, Unit L
Barrie, Ontario, L4N 8X1
Canada
T: +1 (705) 722 4492

Golder Associates

APPENDIX MDP-D

MDP Hydrological Analysis

Exsiting Conditon

Nash HYD	Area	Length	Area - Imp	Hmax	Hmin	Height Diff.	Slope	AveSlope	V/S^0.5	CN	Runoff Coef.	tc (min)	tc (min)	tc (h)	tp (h)	IA	IA_Perv	IA_Imp	XIMP	TIMP	Max Inf Rate	Min Inf Rate	Decay	Manning's n	
												B-W	Upland				DSPerv	DSImperv	%	%	fo (mm/hr)	fc (mm/hr)	K (1/hr)	Nperv	Nimp
1	52.21	1150	8.359783			0	0.00	2.51	2.18	62.4	0.24	36.71	55.371	0.923	0.615	6.41	7.3	2.00	16.0	16.0	234	21.3	2	0.013	0.25
2	323.71	2200	69.87771615			0	0.00	5.16	2.19	52.5	0.18	50.67	73.768	1.229	0.820	7.00	8.4	2.00	21.4	21.6	240	22.6	2	0.013	0.25
3	55.32	766	12.203188			0	0.00	1.49	2.32	57.0	0.18	26.97	44.939	0.749	0.499	6.53	7.8	2.00	22.1	22.1	234	21.1	2	0.013	0.25
4	71.21	1500	14.620325			0	0.00	1.32	2.31	54.9	0.16	52.80	94.413	1.574	1.049	6.44	7.6	2.00	20.5	20.5	250	25.0	2	0.013	0.25
5	78.49	1240	51.340119			0	0.00	1.19	4.41	51.5	0.10	44.09	42.843	0.735	0.490	4.05	7.9	2.00	65.4	65.4	248	24.5	2	0.013	0.25
6	13.22	420	10.4332968			0	0.00	1.06	5.11	51.9	0.08	18.29	13.329	0.305	0.203	3.12	7.3	2.00	78.9	78.9	250	25.0	2	0.013	0.25
7	57.93	950	26.09212542			0	0.00	1.34	4.01	66.4	0.35	34.02	34.073	0.568	0.379	4.82	7.2	2.00	37.2	45.0	239	22.3	2	0.013	0.25
8	71.99	2540	19.10662313			0	0.00	1.16	3.14	65.2	0.32	91.62	125.111	2.085	1.390	5.61	6.9	2.00	19.5	26.5	250	25.0	2	0.013	0.25
9	121.37	1480	26.03943161			0	0.00	5.17	2.66	67.3	0.33	37.58	40.797	0.680	0.453	6.14	7.3	2.00	17.4	21.5	227	19.6	2	0.013	0.25
10	87.06	1970	5.2197311			0	0.00	2.02	1.82	64.1	0.27	62.41	127.029	2.117	1.411	6.75	7.1	2.00	5.2	6.0	246	24.0	2	0.013	0.25
11	73.22	1720	2.1934575			0	0.00	1.72	1.61	61.9	0.24	57.28	135.583	2.260	1.506	6.96	7.1	2.00	3.0	3.0	250	25.0	2	0.013	0.25
12	59.85	1100	4.6790967			0	0.00	5.51	1.72	57.4	0.21	29.60	45.309	0.755	0.503	7.09	7.5	2.00	7.8	7.8	250	25.0	2	0.013	0.25
13	174.87	1750	6.7635609			0	0.00	6.05	1.62	64.1	0.26	41.52	73.155	1.219	0.813	7.03	7.2	2.00	3.9	3.9	237	21.9	2	0.013	0.25
14	21.17	660	10.6170227			0	0.00	1.16	4.74	72.3	0.47	26.90	21.553	0.448	0.299	4.20	6.5	2.00	35.7	50.1	250	25.0	2	0.013	0.25
15	13.48	720	8.7600643			0	0.00	2.02	6.10	82.9	0.57	27.49	13.840	0.458	0.305	3.05	5.0	2.00	40.0	65.0	213	16.1	2	0.013	0.25
16	72.85	1300	19.55730625			0	0.00	1.06	2.92	60.8	0.27	47.73	72.157	1.203	0.802	5.96	7.4	2.00	22.2	26.8	250	25.0	2	0.013	0.25
17	18.85	720	7.09074939			0	0.00	2.02	3.98	75.0	0.45	26.58	21.206	0.443	0.295	4.72	6.4	2.00	26.6	37.6	232	20.6	2	0.013	0.25

Option 1

Nash HYD	Area	Length	Hmax	Hmin	Height Diff.	Slope	AveSlope	V/S^0.5	CN	Runoff Coef.	tc (h)	tp (h)	IA	IA_Perv	IA_Imp	XIMP	TIMP	Max Inf	Min Inf	Decay	Manning's n	
														DSPerv	DSImpe	%	%	fo (mm/l	fc (mm/l	K (1/hr)	Nperv	Nimp
1	48.14	1150			0	0.00	2.51	2.25	62.5	0.24	0.896	0.597	6.35	7.3	2.00	17.53	17.5	233	20.9	2	0.013	0.25
2	319.67	2200			0	0.00	5.16	2.31	53.2	0.19	1.164	0.776	6.83	8.3	2.00	21.72	22.7	240	22.5	2	0.013	0.25
3	55.30	766			0	0.00	1.49	2.32	57.0	0.18	0.749	0.499	6.53	7.8	2.00	22.07	22.1	234	21.1	2	0.013	0.25
4	40.29	1110			0	0.00	1.32	2.92	50.1	0.12	0.919	0.613	5.97	8.2	2.00	35.82	35.8	250	25.0	2	0.013	0.25
5	76.24	1240			0	0.00	1.19	4.51	51.4	0.10	0.737	0.491	3.94	7.9	2.00	67.33	67.3	248	24.5	2	0.013	0.25
6	13.24	420			0	0.00	1.06	5.11	51.9	0.08	0.305	0.203	3.12	7.3	2.00	78.95	78.9	250	25.0	2	0.013	0.25
7	57.73	950			0	0.00	1.34	4.04	66.4	0.35	0.567	0.378	4.79	7.2	2.00	37.43	45.5	239	22.3	2	0.013	0.25
8	71.94	2540			0	0.00	1.16	3.18	65.2	0.32	2.058	1.372	5.58	6.9	2.00	19.84	27.1	250	25.0	2	0.013	0.25
9	76.82	1480			0	0.00	5.17	3.27	66.0	0.35	0.656	0.437	5.70	7.6	2.00	26.40	32.8	230	20.3	2	0.013	0.25
10	69.17	1670			0	0.00	2.02	3.27	61.7	0.29	0.997	0.665	5.27	6.4	2.00	14.94	24.9	250	25.0	2	0.013	0.25
11	76.47	1720			0	0.00	1.72	1.92	61.8	0.25	1.903	1.269	6.65	7.0	2.00	5.16	7.0	250	25.0	2	0.013	0.25
12	56.77	1100			0	0.00	5.51	1.73	57.2	0.21	0.753	0.502	7.10	7.6	2.00	8.10	8.1	250	25.0	2	0.013	0.25
13	193.01	1750			0	0.00	6.05	1.64	64.2	0.27	1.205	0.803	7.02	7.3	2.00	4.23	4.3	237	21.8	2	0.013	0.25
14	21.40	660			0	0.00	1.16	5.37	71.2	0.48	0.448	0.299	3.57	5.9	2.00	40.09	58.6	250	25.0	2	0.013	0.25
15	13.50	505			0	0.00	2.02	6.09	82.9	0.57	0.321	0.214	3.06	5.0	2.00	39.93	64.9	213	16.1	2	0.013	0.25
16	72.88	1300					1.06	5.14	61.2	0.34	0.796	0.530	3.58	5.5	2.00	36.10	54.6	250	25.0	2	0.013	0.25
17	18.84	510					2.02	4.80	76.7	0.49	0.314	0.209	4.00	6.0	2.00	33.53	49.0	232	20.6	2	0.013	0.25
18	40.65	880					1.32	5.00	57.0	0.30	0.546	0.364	3.59	5.0	2.00	0.43	47.0	250	25.0	2	0.013	0.25
20	44.27	752			0	0.00	5.17	2.65	68.5	0.32	0.352	0.235	5.87	6.6	2.00	9.33	16.0	222	18.3	2	0.013	0.25

Option 2

Nash HYD	Area	Length	Area - Imp	Hmax	Hmin	Height Diff.	Slope	AveSlope	V/S^0.5	CN	Runoff Coef.	tc (min)	tc (min)	tc (h)	tp (h)	IA	IA_Perv	IA_Imp	XIMP	TIMP	Max Inf Rate	Min Inf Rate	Decay	Manning's n	
												B-W	Upland				DSPerv	DSImperv	%	%	fo (mm/hr)	fc (mm/hr)	K (1/hr)	Nperv	Nimp
1	48.14	1150	8.4397987			0	0.00	2.51	2.25	62.5	0.24	37.01	53.775	0.896	0.597	6.35	7.3	2.00	17.5	17.5	233	20.9	2	0.013	0.25
2	295.09	2200	71.98727606			0	0.00	5.16	2.37	52.4	0.19	51.14	68.205	1.137	0.758	6.83	8.4	2.00	23.4	24.4	239	22.3	2	0.013	0.25
3	55.30	766	12.204133			0	0.00	1.49	2.32	57.0	0.18	26.97	44.936	0.749	0.499	6.53	7.8	2.00	22.1	22.1	234	21.1	2	0.013	0.25
4	40.29	1110	14.433719			0	0.00	1.32	2.92	50.1	0.12	41.36	55.145	0.919	0.613	5.97	8.2	2.00	35.8	35.8	250	25.0	2	0.013	0.25
5	76.24	1240	51.33309719			0	0.00	1.19	4.51	51.4	0.10	44.22	41.965	0.737	0.491	3.94	7.9	2.00	67.3	67.3	248	24.5	2	0.013	0.25
6	13.24	420	10.45166			0	0.00	1.06	5.11	51.9	0.08	18.29	13.326	0.305	0.203	3.12	7.3	2.00	78.9	78.9	250	25.0	2	0.013	0.25
7	56.32	950	25.36770678			0	0.00	1.34	4.00	66.2	0.35	34.12	34.178	0.570	0.380	4.83	7.2	2.00	37.3	45.0	238	22.2	2	0.013	0.25
8	33.64	1830	19.70237142			0	0.00	1.16	5.22	70.1	0.46	71.22	54.172	1.187	0.791	3.83	6.5	2.00	41.7	58.6	250	25.0	2	0.013	0.25
9	76.82	1480	25.33203489			0	0.00	5.17	3.29	66.0	0.35	39.34	33.006	0.656	0.437	5.69	7.5	2.00	26.5	33.0	230	20.3	2	0.013	0.25
10	69.17	1670	32.39817099			0	0.00	2.02	4.90	59.4	0.33	54.13	39.914	0.902	0.601	3.68	5.2	2.00	26.6	46.8	250	25.0	2	0.013	0.25
11	76.47	1720	22.33969675			0	0.00	1.72	3.57	59.5	0.29	57.03	61.217	1.020	0.680	5.03	6.3	2.00	17.0	29.2	250	25.0	2	0.013	0.25
12	56.77	1100	4.60168153			0	0.00	5.51	1.73	57.2	0.21	29.76	45.153	0.753	0.502	7.10	7.6	2.00	8.1	8.1	250	25.0	2	0.013	0.25
13	193.01	1750	8.28457905			0	0.00	6.05	1.64	64.2	0.27	41.11	72.280	1.205	0.803	7.02	7.3	2.00	4.2	4.3	237	21.8	2	0.013	0.25
14	21.40	660	12.60599404			0	0.00	1.16	5.39	71.2	0.48	26.88	18.929	0.448	0.299	3.55	5.9	2.00	40.2	58.9	250	25.0	2	0.013	0.25
15	13.50	505	8.75832945			0	0.00	2.02	6.09	82.9	0.57	19.28	9.718	0.321	0.214	3.06	5.0	2.00	39.9	64.9	213	16.1	2	0.013	0.25
16	72.88	1300	39.80845053					1.06	5.14	61.2	0.34	47.73	41.016	0.796	0.530	3.58	5.5	2.00	36.1	54.6	250	25.0	2	0.013	0.25
17	18.84	510	9.23797163					2.02	4.80	76.7	0.49	18.83	12.466	0.314	0.209	4.00	6.0	2.00	33.5	49.0	232	20.6	2	0.013	0.25
18	40.65	880	19.10381035					1.32	5.00	57.0	0.30	32.76	25.538	0.546	0.364	3.59	5.0	2.00	25.0	47.0	250	25.0	2	0.013	0.25
19	64.29	1230	30.14532567			0	0.00	1.16	4.92	57.1	0.30	44.87	38.643	0.748	0.499	3.67	5.1	2.00	26.0	46.9	250	25.0	2	0.013	0.25
20	44.27	752	18.58249449			0	0.00	5.17	4.59	66.6	0.36	21.12	12.014	0.352	0.235	3.99	5.4	2.00	23.1	42.0	222	18.3	2	0.013	0.25

Option 3

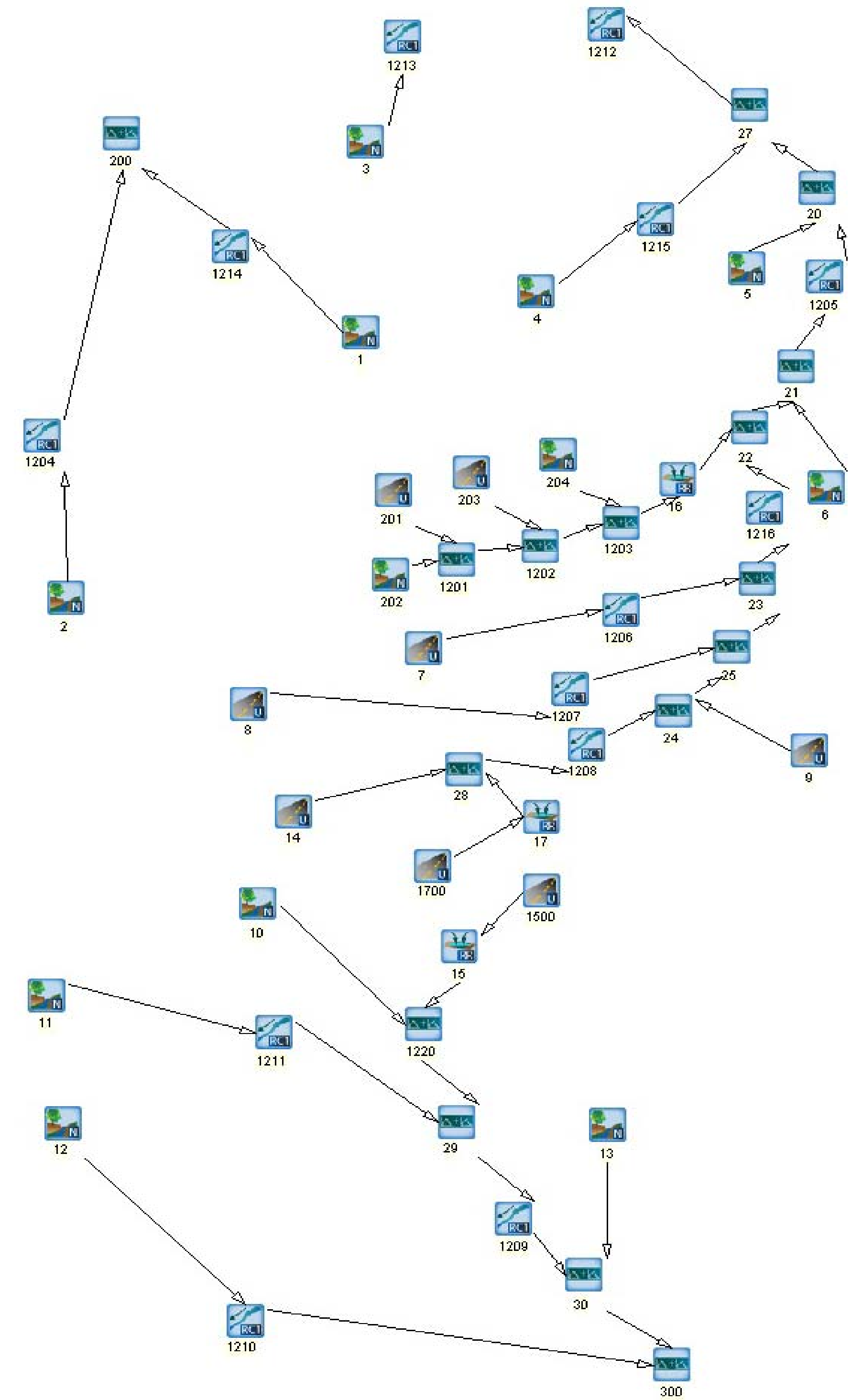
Nash HYD	Area	Length	Hmax	Hmin	Height Diff.	Slope	AveSlope	V/S^0.5	CN	Runoff Coef.	tc (h)	tp (h)	IA	IA_Perv	IA_Imp	XIMP	TIMP	Max Inf	Min Inf	Decay	Manning's n	
														DSPerv	DSImpe	%	%	fo (mm/l	fc (mm/l	K (1/hr)	Nperv	Nimp
1	48.14	1150			0	0.00	2.51	2.25	62.5	0.24	0.896	0.597	6.35	7.3	2.00	17.53	17.5	233	20.9	2	0.013	0.25
2	319.67	2200			0	0.00	5.16	2.31	53.2	0.19	1.164	0.776	6.83	8.3	2.00	21.72	22.7	240	22.5	2	0.013	0.25
3	55.30	766			0	0.00	1.49	2.32	57.0	0.18	0.749	0.499	6.53	7.8	2.00	22.07	22.1	234	21.1	2	0.013	0.25
4	40.29	1110			0	0.00	1.32	2.92	50.1	0.12	0.919	0.613	5.97	8.2	2.00	35.82	35.8	250	25.0	2	0.013	0.25
5	76.24	1240			0	0.00	1.19	4.51	51.4	0.10	0.737	0.491	3.94	7.9	2.00	67.33	67.3	248	24.5	2	0.013	0.25
6	13.24	420			0	0.00	1.06	5.11	51.9	0.08	0.305	0.203	3.12	7.3	2.00	78.95	78.9	250	25.0	2	0.013	0.25
7	57.73	950			0	0.00	1.34	4.04	66.4	0.35	0.567	0.378	4.79	7.2	2.00	37.43	45.5	239	22.3	2	0.013	0.25
8	71.94	2540			0	0.00	1.16	3.18	65.2	0.32	2.058	1.372	5.58	6.9	2.00	19.84	27.1	250	25.0	2	0.013	0.25
9	76.82	1480			0	0.00	5.17	3.27	66.0	0.35	0.656	0.437	5.70	7.6	2.00	26.40	32.8	230	20.3	2	0.013	0.25
10	69.17	1670			0	0.00	2.02	3.27	61.7	0.29	0.997	0.665	5.27	6.4	2.00	14.94	24.9	250	25.0	2	0.013	0.25
11	76.47	1720			0	0.00	1.72	1.92	61.8	0.25	1.903	1.269	6.65	7.0	2.00	5.16	7.0	250	25.0	2	0.013	0.25
12	56.77	1100			0	0.00	5.51	1.73	57.2	0.21	0.753	0.502	7.10	7.6	2.00	8.10	8.1	250	25.0	2	0.013	0.25
13	193.01	1750			0	0.00	6.05	1.64	64.2	0.27	1.205	0.803	7.02	7.3	2.00	4.23	4.3	237	21.8	2	0.013	0.25
14	21.40	660			0	0.00	1.16	5.37	71.2	0.48	0.448	0.299	3.57	5.9	2.00	40.09	58.6	250	25.0	2	0.013	0.25
15	13.50	505			0	0.00	2.02	6.09	82.9	0.57	0.321	0.214	3.06	5.0	2.00	39.93	64.9	213	16.1	2	0.013	0.25
16	72.88	1300					1.06	5.14	61.2	0.34	0.796	0.530	3.58	5.5	2.00	36.10	54.6	250	25.0	2	0.013	0.25
17	18.84	510					2.02	4.80	76.7	0.49	0.314	0.209	4.00	6.0	2.00	33.53	49.0	232	20.6	2	0.013	0.25
18	40.65	880					1.32	5.00	57.0	0.30	0.546	0.364	3.59	5.0	2.00	0.43	47.0	250	25.0	2	0.013	0.25
20	44.27	752			0	0.00	5.17	2.65	68.5	0.32	0.352	0.235	5.87	6.6	2.00	9.33	16.0	222	18.3	2	0.013	0.25

Option 4

Nash HYD	Area	Length	Hmax	Hmin	Height Diff.	Slope	AveSlope	V/S^0.5	CN	Runoff Coef.	tc (h)	tp (h)	IA	IA_Perv	IA_Imp	XIMP	TIMP	Max Inf	Min Inf	Decay	Manning's n	
														DSPerv	DSImpe	%	%	fo (mm/l	fc (mm/l	K (1/hr)	Nperv	Nimp
1	48.14	1150			0	0.00	2.51	2.25	62.5	0.24	0.896	0.597	6.35	7.3	2.00	17.53	17.5	233	20.9	2	0.013	0.25
2	319.67	2200			0	0.00	5.16	2.31	53.2	0.19	1.164	0.776	6.83	8.3	2.00	21.72	22.7	240	22.5	2	0.013	0.25
3	55.30	766			0	0.00	1.49	2.32	57.0	0.18	0.749	0.499	6.53	7.8	2.00	22.07	22.1	234	21.1	2	0.013	0.25
4	40.29	1110			0	0.00	1.32	2.92	50.1	0.12	0.919	0.613	5.97	8.2	2.00	35.82	35.8	250	25.0	2	0.013	0.25
5	76.24	1240			0	0.00	1.19	4.51	51.4	0.10	0.737	0.491	3.94	7.9	2.00	67.33	67.3	248	24.5	2	0.013	0.25
6	13.24	420			0	0.00	1.06	5.11	51.9	0.08	0.305	0.203	3.12	7.3	2.00	78.95	78.9	250	25.0	2	0.013	0.25
7	57.73	950			0	0.00	1.34	4.04	66.4	0.35	0.567	0.378	4.79	7.2	2.00	37.43	45.5	239	22.3	2	0.013	0.25
8	71.94	2540			0	0.00	1.16	3.18	65.2	0.32	2.058	1.372	5.58	6.9	2.00	19.84	27.1	250	25.0	2	0.013	0.25
9	76.82	1480			0	0.00	5.17	3.27	66.0	0.35	0.656	0.437	5.70	7.6	2.00	26.40	32.8	230	20.3	2	0.013	0.25
10	69.17	1670			0	0.00	2.02	3.27	61.7	0.29	0.997	0.665	5.27	6.4	2.00	14.94	24.9	250	25.0	2	0.013	0.25
11	76.47	1720			0	0.00	1.72	1.92	61.8	0.25	1.903	1.269	6.65	7.0	2.00	5.16	7.0	250	25.0	2	0.013	0.25
12	56.77	1100			0	0.00	5.51	1.73	57.2	0.21	0.753	0.502	7.10	7.6	2.00	8.10	8.1	250	25.0	2	0.013	0.25
13	193.01	1750			0	0.00	6.05	1.64	64.2	0.27	1.205	0.803	7.02	7.3	2.00	4.23	4.3	237	21.8	2	0.013	0.25
14	21.40	660			0	0.00	1.16	5.37	71.2	0.48	0.448	0.299	3.57	5.9	2.00	40.09	58.6	250	25.0	2	0.013	0.25
15	13.50	505			0	0.00	2.02	6.09	82.9	0.57	0.321	0.214	3.06	5.0	2.00	39.93	64.9	213	16.1	2	0.013	0.25
16	72.88	1300					1.06	5.14	61.2	0.34	0.796	0.530	3.58	5.5	2.00	36.10	54.6	250	25.0	2	0.013	0.25
17	18.84	510					2.02	4.80	76.7	0.49	0.314	0.209	4.00	6.0	2.00	33.53	49.0	232	20.6	2	0.013	0.25
18	40.65	880					1.32	5.00	57.0	0.30	0.546	0.364	3.59	5.0	2.00	0.43	47.0	250	25.0	2	0.013	0.25
20	44.27	752			0	0.00	5.17	2.65	68.5	0.32	0.352	0.235	5.87	6.6	2.00	9.33	16.0	222	18.3	2	0.013	0.25

MDP EXISTING CONDITIONS

MDP EXISTING CONDITION VO2 MODEL 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    TM, Version 2.1
       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
```

Developed and Distributed by Clarifica Inc.


```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files\Visual OTTHYMO 2.3.1\voin.dat
  Output  filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Exsiting Condition.out
  Summary filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Exsiting Condition.sum


DATE: 31/10/2012                           TIME: 2:28:58 PM

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                 60.0
      [ Ptot=193.00 mm ]
      fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Timmins Storm.stm
      remark: Timmins Storm
*
  **  CALIB NASHYD       0003  1 10.0   55.30    3.12  7.17  90.95  .47    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  **  CALIB NASHYD       0004  1 10.0   71.21    2.87  8.00  87.22  .45    .000
      [CN=54.9         ]
      [ N = 3.0:Tp 1.05]
*
  **  CALIB NASHYD       0005  1 10.0   76.24    3.78  7.17  80.50  .42    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  **  CALIB NASHYD       0006  1 10.0   13.24     .78  7.00  79.87  .41    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB STANDHYD     0007  1  5.0   57.93    2.57  7.00  71.05  .37    .000
      [I%=37.2:S%= 1.34]
*
  *   CALIB STANDHYD     0009  1  5.0  121.37    2.52  7.00  34.20  .18    .000
      [I%=17.4:S%= 5.17]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84     .78  7.00  76.01  .39    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.03  7.00  84.27  .44    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     0008  1  5.0   71.99    3.08  9.00 116.28  .60    .000
      [I%=19.5:S%= 1.16]
*
  *   CALIB NASHYD       0204  1  8.0   10.89     .49  7.47  84.40  .44    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  *   CALIB STANDHYD     0203  1  5.0   14.52    1.09  7.00 114.72  .59    .000
      [I%=25.0:S%= 2.00]
*
  *   CALIB STANDHYD     0201  1  5.0   47.41    3.87  7.00 126.68  .66    .000
      [I%=35.0:S%= 2.00]
```

```
*
 *   CALIB NASHYD       0202  1  5.0    1.87     .09  7.17  78.13  .40    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
 *   CALIB NASHYD       0001  1 10.0   52.21    3.07  7.33 101.76  .53    .000
     [CN=62.4         ]
     [ N = 3.0:Tp  .62]
*
 *   CALIB NASHYD       0002  1 10.0  323.71   13.53  7.50  82.22  .43    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
 *   CALIB NASHYD       0012  1 10.0   59.85    3.40  7.17  91.93  .48    .000
     [CN=57.4         ]
     [ N = 3.0:Tp  .50]
*
 *   CALIB NASHYD       0010  1 10.0   87.06    3.97  9.17 105.31  .55    .000
     [CN=64.1         ]
     [ N = 3.0:Tp 1.41]
*
 *   CALIB STANDHYD     1500  1  5.0   13.50    1.01  7.00 114.62  .59    .000
     [I%=40.0:S%= 2.02]
*
 *   CALIB NASHYD       0011  1 10.0   73.21    3.16  9.33 100.98  .52    .000
     [CN=61.9         ]
     [ N = 3.0:Tp 1.51]
*
 *   CALIB NASHYD       0013  1 10.0  174.87    9.59  7.50 105.22  .55    .000
     [CN=64.1         ]
     [ N = 3.0:Tp  .81]
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    3.07  7.25  90.95  n/a    .000
*
     CHANNEL[ 2 : 0004] 1215  1  5.0   71.21    2.86  8.08  87.22  n/a    .000
*
     CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    2.57  7.00  71.05  n/a    .000
*
     RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .52  7.25  75.92  n/a    .000
     {ST=   .40 ha.m }
*
     ADD [0017 + 0014]  0028  3  5.0   40.24    1.53  7.00  80.36  n/a    .000
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    3.05  9.08 116.28  n/a    .000
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    3.95  7.00 124.83  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   52.21    3.07  7.33 101.76  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71   13.52  7.58  82.22  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   59.85    3.11  7.42  91.92  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .59  9.08 114.60  n/a    .000
     {ST=   .56 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   73.21    3.16  9.42 100.97  n/a    .000
*
     CHANNEL[ 2 : 0028] 1208  1  5.0   40.24    1.49  7.00  80.36  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    5.04  7.00 122.53  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  375.92   16.45  7.50  84.93  n/a    .000
*
     ADD [0010 + 0015]  1220  3  5.0  100.56    4.56  9.17 106.56  n/a    .000
*
     ADD [1220 + 1211]  0029  3  5.0  173.77    7.71  9.25 104.20  n/a    .000
*
     ADD [0009 + 1208]  0024  3  5.0  161.61    4.01  7.00  45.69  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    5.47  7.00 116.97  n/a    .000
*
     CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    7.70  9.33 104.20  n/a    .000
*
     ADD [0024 + 1207]  0025  3  5.0  233.60    6.29  7.00  67.45  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69    3.38  9.08 116.91  n/a    .000
     {ST=  3.68 ha.m }
*
     ADD [1209 + 0013]  0030  3  5.0  348.64   15.75  9.17 104.71  n/a    .000
*
     ADD [1206 + 0025]  0023  3  5.0  291.53    8.85  7.00  68.16  n/a    .000
*
     ADD [1210 + 0030]  0300  3  5.0  408.49   18.47  7.75 102.84  n/a    .000
*
     CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    8.80  7.00  68.16  n/a    .000
*
     ADD [1216 + 0016]  0022  3  5.0  366.23   10.23  9.00  78.10  n/a    .000
*
```

```
     ADD [0006 + 0022]  0021  3  5.0  379.47   10.74  9.00  78.17  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47   10.61  9.08  78.17  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71   14.02  7.17  78.56  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92   16.23  9.08  79.73  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92   15.96  9.25  79.73  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22   18.36  7.33  80.79  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha      cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                  10.0
     [ Ptot=105.16 mm ]
*
 **  CALIB NASHYD       0003  1 10.0   55.30    1.67 12.67  32.78  .31    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21    1.45 13.33  31.08  .30    .000
     [CN=54.9         ]
     [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24    1.95 12.67  28.01  .27    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
 **  CALIB NASHYD       0006  1 10.0   13.24     .41 12.33  28.03  .27    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB STANDHYD     0007  1  5.0   57.93    2.43 12.08  38.38  .36    .000
     [I%=37.2:S%= 1.34]
*
  *  CALIB STANDHYD     0009  1  5.0  121.37    2.42 12.08  17.95  .17    .000
     [I%=17.4:S%= 5.17]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .73 12.08  34.56  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .99 12.08  41.37  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     0008  1  5.0   71.99    1.66 12.17  49.98  .48    .000
     [I%=19.5:S%= 1.16]
*
  *  CALIB NASHYD       0204  1  8.0   10.89     .25 13.07  29.31  .28    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .67 12.33  50.22  .48    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    2.65 12.25  58.23  .55    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .05 12.75  27.52  .26    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB NASHYD       0001  1 10.0   52.21    1.72 12.83  38.15  .36    .000
     [CN=62.4         ]
     [ N = 3.0:Tp  .62]
*
  *  CALIB NASHYD       0002  1 10.0  323.71    6.87 13.17  28.67  .27    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
  *  CALIB NASHYD       0012  1 10.0   59.85    1.83 12.67  33.30  .32    .000
     [CN=57.4         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0010  1 10.0   87.06    1.95 13.83  40.01  .38    .000
     [CN=64.1         ]
     [ N = 3.0:Tp 1.41]
*
  *  CALIB STANDHYD     1500  1  5.0   13.50     .65 12.00  43.58  .41    .000
     [I%=40.0:S%= 2.02]
*
  *  CALIB NASHYD       0011  1 10.0   73.21    1.48 14.00  37.80  .36    .000
```

```
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
  *   CALIB NASHYD       0013  1 10.0  174.87    5.32 13.00  39.94  .38    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.64 12.83  32.77  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21    1.43 13.50  31.08  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    2.37 12.17  38.37  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .35 12.83  34.46  n/a    .000
      {ST=   .32 ha.m }
*
      ADD [0017 + 0014]  0028  3  5.0   40.24    1.19 12.17  38.14  n/a    .000
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    1.61 12.33  49.98  n/a    .000
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.68 12.25  57.06  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   52.21    1.71 12.92  38.15  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    6.86 13.17  28.67  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   59.85    1.62 13.00  33.29  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .18 13.17  43.55  n/a    .000
      {ST=   .27 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   73.21    1.47 14.08  37.79  n/a    .000
*
      CHANNEL[ 2 : 0028] 1208  1  5.0   40.24    1.15 12.33  38.13  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    3.34 12.25  55.50  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  375.92    8.49 13.08  29.98  n/a    .000
*
      ADD [0010 + 0015]  1220  3  5.0  100.56    2.12 13.83  40.49  n/a    .000
*
      ADD [1220 + 1211]  0029  3  5.0  173.77    3.58 13.92  39.35  n/a    .000
*
      ADD [0009 + 1208]  0024  3  5.0  161.61    3.46 12.17  22.98  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    3.48 12.25  51.69  n/a    .000
*
      CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    3.56 14.08  39.35  n/a    .000
*
      ADD [0024 + 1207]  0025  3  5.0  233.60    5.03 12.17  31.30  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .70 14.50  51.62  n/a    .000
      {ST=  2.28 ha.m }
*
      ADD [1209 + 0013]  0030  3  5.0  348.64    8.15 13.33  39.65  n/a    .000
*
      ADD [1206 + 0025]  0023  3  5.0  291.53    7.40 12.17  32.70  n/a    .000
*
      ADD [1210 + 0030]  0300  3  5.0  408.49    9.66 13.33  38.72  n/a    .000
*
      CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    7.38 12.25  32.70  n/a    .000
*
      ADD [1216 + 0016]  0022  3  5.0  366.23    7.62 12.25  36.56  n/a    .000
*
      ADD [0006 + 0022]  0021  3  5.0  379.47    8.02 12.25  36.26  n/a    .000
*
      CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    7.60 12.42  36.26  n/a    .000
*
      ADD [0005 + 1205]  0020  3  5.0  455.71    9.42 12.50  34.88  n/a    .000
*
      ADD [1215 + 0020]  0027  3  5.0  526.92   10.18 12.58  34.37  n/a    .000
*
      CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    9.75 12.92  34.37  n/a    .000
*
      ADD [1213 + 1212]  0100  3  5.0  582.22   11.38 12.92  34.21  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm           cms

      START @   .00 hrs
      --------------------
      MASS STORM                  10.0
      [ Ptot= 86.04 mm ]
*
  **  CALIB NASHYD       0003  1 10.0   55.30    1.14 12.67  22.67  .26    .000
```

```
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  **  CALIB NASHYD       0004  1 10.0   71.21     .98 13.33  21.43  .25    .000
      [CN=54.9         ]
      [ N = 3.0:Tp 1.05]
*
  **  CALIB NASHYD       0005  1 10.0   76.24    1.32 12.67  19.17  .22    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  **  CALIB NASHYD       0006  1 10.0   13.24     .28 12.33  19.25  .22    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
   *  CALIB STANDHYD     0007  1  5.0   57.93    1.97 12.08  31.26  .36    .000
      [I%=37.2:S%= 1.34]
*
   *  CALIB STANDHYD     0009  1  5.0  121.37    1.97 12.08  14.62  .17    .000
      [I%=17.4:S%= 5.17]
*
   *  CALIB STANDHYD     1700  1  5.0   18.84     .59 12.08  28.15  .33    .000
      [I%=33.5:S%= 2.02]
*
   *  CALIB STANDHYD     0014  1  5.0   21.40     .80 12.08  33.70  .39    .000
      [I%=40.1:S%= 1.16]
*
   *  CALIB STANDHYD     0008  1  5.0   71.99    1.31 12.17  36.17  .42    .000
      [I%=19.5:S%= 1.16]
*
   *  CALIB NASHYD       0204  1  8.0   10.89     .17 13.07  19.95  .23    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
   *  CALIB STANDHYD     0203  1  5.0   14.52     .50 12.17  38.06  .44    .000
      [I%=25.0:S%= 2.00]
*
   *  CALIB STANDHYD     0201  1  5.0   47.41    1.98 12.25  44.94  .52    .000
      [I%=35.0:S%= 2.00]
*
   *  CALIB NASHYD       0202  1  5.0    1.87     .03 12.75  19.01  .22    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
   *  CALIB NASHYD       0001  1 10.0   52.21    1.19 12.83  26.74  .31    .000
      [CN=62.4         ]
      [ N = 3.0:Tp  .62]
*
   *  CALIB NASHYD       0002  1 10.0  323.71    4.65 13.17  19.60  .23    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
   *  CALIB NASHYD       0012  1 10.0   59.85    1.25 12.67  23.08  .27    .000
      [CN=57.4         ]
      [ N = 3.0:Tp  .50]
*
   *  CALIB NASHYD       0010  1 10.0   87.06    1.36 13.83  28.17  .33    .000
      [CN=64.1         ]
      [ N = 3.0:Tp 1.41]
*
   *  CALIB STANDHYD     1500  1  5.0   13.50     .53 12.00  33.62  .39    .000
      [I%=40.0:S%= 2.02]
*
   *  CALIB NASHYD       0011  1 10.0   73.21    1.03 14.00  26.49  .31    .000
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
   *  CALIB NASHYD       0013  1 10.0  174.87    3.70 13.17  28.11  .33    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.12 12.83  22.66  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .98 13.58  21.43  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    1.92 12.17  31.26  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .26 12.92  28.06  n/a    .000
      {ST=   .28 ha.m }
*
      ADD [0017 + 0014]  0028  3  5.0   40.24     .91 12.17  31.06  n/a    .000
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    1.26 12.33  36.17  n/a    .000
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.01 12.25  43.96  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   52.21    1.19 12.92  26.74  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    4.63 13.17  19.60  n/a    .000
```

```
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   59.85    1.09 13.08  23.07  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .14 13.08  33.59  n/a    .000
     {ST=   .22 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   73.21    1.02 14.08  26.48  n/a    .000
*
     CHANNEL[ 2 : 0028] 1208  1  5.0   40.24     .88 12.33  31.06  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    2.50 12.17  42.61  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  375.92    5.76 13.17  20.59  n/a    .000
*
     ADD [0010 + 0015]  1220  3  5.0  100.56    1.50 13.83  28.90  n/a    .000
*
     ADD [1220 + 1211]  0029  3  5.0  173.77    2.50 14.00  27.88  n/a    .000
*
     ADD [0009 + 1208]  0024  3  5.0  161.61    2.76 12.17  18.72  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    2.59 12.25  39.32  n/a    .000
*
     CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    2.48 14.08  27.88  n/a    .000
*
     ADD [0024 + 1207]  0025  3  5.0  233.60    3.98 12.17  24.09  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .53 14.58  39.25  n/a    .000
     {ST=  1.77 ha.m }
*
     ADD [1209 + 0013]  0030  3  5.0  348.64    5.66 13.33  28.00  n/a    .000
*
     ADD [1206 + 0025]  0023  3  5.0  291.53    5.90 12.17  25.52  n/a    .000
*
     ADD [1210 + 0030]  0300  3  5.0  408.49    6.69 13.33  27.27  n/a    .000
*
     CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    5.89 12.25  25.52  n/a    .000
*
     ADD [1216 + 0016]  0022  3  5.0  366.23    6.03 12.25  28.32  n/a    .000
*
     ADD [0006 + 0022]  0021  3  5.0  379.47    6.31 12.25  28.00  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    5.94 12.42  28.00  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71    7.17 12.50  26.54  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92    7.65 12.58  25.85  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    7.24 12.75  25.85  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22    8.35 12.75  25.54  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   4 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                 min     ha      cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot= 64.53 mm ]
*
 **  CALIB NASHYD       0003  1 10.0   55.30     .64 12.83  12.95  .20    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21     .55 13.50  12.20  .19    .000
     [CN=54.9         ]
     [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24     .73 12.83  10.80  .17    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
 **  CALIB NASHYD       0006  1 10.0   13.24     .15 12.33  10.92  .17    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB STANDHYD     0007  1  5.0   57.93    1.45 12.08  23.26  .36    .000
     [I%=37.2:S%= 1.34]
*
  *  CALIB STANDHYD     0009  1  5.0  121.37    1.46 12.08  10.88  .17    .000
     [I%=17.4:S%= 5.17]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .44 12.08  20.95  .32    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .60 12.08  25.07  .39    .000
```

```
     [I%=40.1:S%= 1.16]
*
 *   CALIB STANDHYD     0008  1  5.0   71.99     .94 12.17  21.22  .33    .000
     [I%=19.5:S%= 1.16]
*
 *   CALIB NASHYD       0204  1  8.0   10.89     .09 13.07  11.08  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 *   CALIB STANDHYD     0203  1  5.0   14.52     .33 12.17  25.57  .40    .000
     [I%=25.0:S%= 2.00]
*
 *   CALIB STANDHYD     0201  1  5.0   47.41    1.35 12.17  31.02  .48    .000
     [I%=35.0:S%= 2.00]
*
 *   CALIB NASHYD       0202  1  5.0    1.87     .02 12.75  10.94  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
 *   CALIB NASHYD       0001  1 10.0   52.21     .68 12.83  15.57  .24    .000
     [CN=62.4         ]
     [ N = 3.0:Tp  .62]
*
 *   CALIB NASHYD       0002  1 10.0  323.71    2.57 13.17  11.02  .17    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
 *   CALIB NASHYD       0012  1 10.0   59.85     .71 12.83  13.24  .21    .000
     [CN=57.4         ]
     [ N = 3.0:Tp  .50]
*
 *   CALIB NASHYD       0010  1 10.0   87.06     .78 13.83  16.52  .26    .000
     [CN=64.1         ]
     [ N = 3.0:Tp 1.41]
*
 *   CALIB STANDHYD     1500  1  5.0   13.50     .39 12.00  25.01  .39    .000
     [I%=40.0:S%= 2.02]
*
 *   CALIB NASHYD       0011  1 10.0   73.21     .59 14.00  15.43  .24    .000
     [CN=61.9         ]
     [ N = 3.0:Tp 1.51]
*
 *   CALIB NASHYD       0013  1 10.0  174.87    2.14 13.17  16.47  .26    .000
     [CN=64.1         ]
     [ N = 3.0:Tp  .81]
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .63 12.92  12.95  n/a    .000
*
     CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .54 13.67  12.20  n/a    .000
*
     CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    1.42 12.25  23.26  n/a    .000
*
     RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .15 13.08  20.85  n/a    .000
     {ST=   .23 ha.m }
*
     ADD [0017 + 0014]  0028  3  5.0   40.24     .61 12.08  23.10  n/a    .000
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.99     .89 12.33  21.22  n/a    .000
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    1.36 12.17  30.26  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   52.21     .68 13.00  15.57  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    2.55 13.25  11.02  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   59.85     .59 13.17  13.23  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11 13.08  24.98  n/a    .000
     {ST=   .16 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   73.21     .58 14.17  15.42  n/a    .000
*
     CHANNEL[ 2 : 0028] 1208  1  5.0   40.24     .58 12.33  23.10  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    1.69 12.17  29.19  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  375.92    3.20 13.17  11.65  n/a    .000
*
     ADD [0010 + 0015]  1220  3  5.0  100.56     .89 13.83  17.65  n/a    .000
*
     ADD [1220 + 1211]  0029  3  5.0  173.77    1.46 14.00  16.71  n/a    .000
*
     ADD [0009 + 1208]  0024  3  5.0  161.61    2.00 12.17  13.92  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    1.73 12.17  26.55  n/a    .000
*
     CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    1.44 14.17  16.71  n/a    .000
*
     ADD [0024 + 1207]  0025  3  5.0  233.60    2.84 12.25  16.17  n/a    .000
```

```
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .25 15.25  26.49  n/a    .000
     {ST=  1.28 ha.m }
*
     ADD [1209 + 0013]  0030  3  5.0  348.64    3.25 13.50  16.59  n/a    .000
*
     ADD [1206 + 0025]  0023  3  5.0  291.53    4.26 12.25  17.58  n/a    .000
*
     ADD [1210 + 0030]  0300  3  5.0  408.49    3.81 13.33  16.10  n/a    .000
*
     CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    4.24 12.25  17.58  n/a    .000
*
     ADD [1216 + 0016]  0022  3  5.0  366.23    4.30 12.25  19.40  n/a    .000
*
     ADD [0006 + 0022]  0021  3  5.0  379.47    4.46 12.25  19.10  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    4.18 12.50  19.10  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71    4.86 12.50  17.71  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92    5.11 12.58  16.97  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    4.78 12.83  16.97  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22    5.40 12.83  16.58  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   5 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot= 50.19 mm ]
*
 **  CALIB NASHYD       0003  1 10.0   55.30     .37 12.83   7.67  .15    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21     .32 13.50   7.22  .14    .000
     [CN=54.9         ]
     [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24     .42 12.83   6.33  .13    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
 **  CALIB NASHYD       0006  1 10.0   13.24     .09 12.33   6.45  .13    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
 *   CALIB STANDHYD     0007  1  5.0   57.93    1.11 12.17  17.93  .36    .000
     [I%=37.2:S%= 1.34]
*
 *   CALIB STANDHYD     0009  1  5.0  121.37    1.12 12.08   8.39  .17    .000
     [I%=17.4:S%= 5.17]
*
 *   CALIB STANDHYD     1700  1  5.0   18.84     .34 12.08  16.14  .32    .000
     [I%=33.5:S%= 2.02]
*
 *   CALIB STANDHYD     0014  1  5.0   21.40     .46 12.08  19.32  .39    .000
     [I%=40.1:S%= 1.16]
*
 *   CALIB STANDHYD     0008  1  5.0   71.99     .71 12.17  11.95  .24    .000
     [I%=19.5:S%= 1.16]
*
 *   CALIB NASHYD       0204  1  8.0   10.89     .05 13.20   6.36  .13    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 *   CALIB STANDHYD     0203  1  5.0   14.52     .23 12.08  18.10  .36    .000
     [I%=25.0:S%= 2.00]
*
 *   CALIB STANDHYD     0201  1  5.0   47.41     .98 12.17  22.48  .45    .000
     [I%=35.0:S%= 2.00]
*
 *   CALIB NASHYD       0202  1  5.0    1.87     .01 12.75   6.60  .13    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
 *   CALIB NASHYD       0001  1 10.0   52.21     .40 13.00   9.38  .19    .000
     [CN=62.4         ]
     [ N = 3.0:Tp  .62]
*
 *   CALIB NASHYD       0002  1 10.0  323.71    1.46 13.17   6.43  .13    .000
     [CN=52.5         ]
```

```
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   59.85     .42 12.83   7.88  .16    .000
      [CN=57.4         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0010  1 10.0   87.06     .47 14.00  10.02  .20    .000
      [CN=64.1         ]
      [ N = 3.0:Tp 1.41]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .30 12.00  19.28  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   73.21     .35 14.00   9.31  .19    .000
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
  *   CALIB NASHYD       0013  1 10.0  174.87    1.27 13.17   9.98  .20    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .36 12.92   7.67  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .31 13.75   7.22  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    1.08 12.33  17.92  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .07 13.67  16.05  n/a    .000
      {ST=   .20 ha.m }
*
      ADD [0017 + 0014]  0028  3  5.0   40.24     .47 12.08  17.79  n/a    .000
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.99     .67 12.33  11.95  n/a    .000
*
      ADD [0201 + 0202]  1201  3  5.0   49.28     .99 12.17  21.88  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   52.21     .40 13.00   9.38  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    1.45 13.33   6.43  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   59.85     .32 13.25   7.87  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08 13.17  19.25  n/a    .000
      {ST=   .13 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   73.21     .34 14.25   9.31  n/a    .000
*
      CHANNEL[ 2 : 0028] 1208  1  5.0   40.24     .45 12.25  17.79  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.22 12.17  21.02  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  375.92    1.83 13.25   6.84  n/a    .000
*
      ADD [0010 + 0015]  1220  3  5.0  100.56     .54 13.83  11.26  n/a    .000
*
      ADD [1220 + 1211]  0029  3  5.0  173.77     .88 14.00  10.44  n/a    .000
*
      ADD [0009 + 1208]  0024  3  5.0  161.61    1.55 12.17  10.73  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    1.23 12.17  18.88  n/a    .000
*
      CHANNEL[ 2 : 0029] 1209  1  5.0  173.77     .87 14.33  10.44  n/a    .000
*
      ADD [0024 + 1207]  0025  3  5.0  233.60    2.18 12.25  11.10  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .15 16.42  18.83  n/a    .000
      {ST=   .96 ha.m }
*
      ADD [1209 + 0013]  0030  3  5.0  348.64    1.93 13.50  10.21  n/a    .000
*
      ADD [1206 + 0025]  0023  3  5.0  291.53    3.26 12.25  12.46  n/a    .000
*
      ADD [1210 + 0030]  0300  3  5.0  408.49    2.24 13.50   9.86  n/a    .000
*
      CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    3.24 12.33  12.46  n/a    .000
*
      ADD [1216 + 0016]  0022  3  5.0  366.23    3.29 12.33  13.76  n/a    .000
*
      ADD [0006 + 0022]  0021  3  5.0  379.47    3.38 12.33  13.50  n/a    .000
*
      CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    3.12 12.50  13.50  n/a    .000
*
      ADD [0005 + 1205]  0020  3  5.0  455.71    3.51 12.58  12.30  n/a    .000
*
      ADD [1215 + 0020]  0027  3  5.0  526.92    3.64 12.58  11.61  n/a    .000
*
      CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    3.35 12.83  11.61  n/a    .000
*
      ADD [1213 + 1212]  0100  3  5.0  582.22    3.71 12.83  11.24  n/a    .000
```

```
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha      cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      CHIC STORM                  10.0
      [ Ptot= 77.31 mm ]
*
  **  CALIB NASHYD       0003  1 10.0   55.30    1.65  1.83  18.49  .24    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  **  CALIB NASHYD       0004  1 10.0   71.21    1.24  2.67  17.46  .23    .000
      [CN=54.9         ]
      [ N = 3.0:Tp 1.05]
*
  **  CALIB NASHYD       0005  1 10.0   76.24    1.92  1.83  15.55  .20    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  **  CALIB NASHYD       0006  1 10.0   13.24     .57  1.50  15.65  .20    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB STANDHYD     0007  1  5.0   57.93    8.48  1.33  28.02  .36    .000
      [I%=37.2:S%= 1.34]
*
  *   CALIB STANDHYD     0009  1  5.0  121.37    8.71  1.33  13.10  .17    .000
      [I%=17.4:S%= 5.17]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    2.64  1.33  28.09  .36    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    3.59  1.33  31.63  .41    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     0008  1  5.0   71.99    5.40  1.33  43.96  .57    .000
      [I%=19.5:S%= 1.16]
*
  *   CALIB NASHYD       0204  1  8.0   10.89     .22  2.27  16.12  .21    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  *   CALIB STANDHYD     0203  1  5.0   14.52    1.76  1.33  32.83  .42    .000
      [I%=25.0:S%= 2.00]
*
  *   CALIB STANDHYD     0201  1  5.0   47.41    7.35  1.33  39.15  .51    .000
      [I%=35.0:S%= 2.00]
*
  *   CALIB NASHYD       0202  1  5.0    1.87     .05  1.92  15.53  .20    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB NASHYD       0001  1 10.0   52.21    1.65  2.00  21.58  .28    .000
      [CN=62.4         ]
      [ N = 3.0:Tp  .62]
*
  *   CALIB NASHYD       0002  1 10.0  323.71    6.00  2.33  15.59  .20    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   59.85    1.82  1.83  18.51  .24    .000
      [CN=57.4         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0010  1 10.0   87.06    1.65  3.17  22.79  .30    .000
      [CN=64.1         ]
      [ N = 3.0:Tp 1.41]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    2.39  1.33  37.62  .49    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   73.21    1.24  3.33  21.37  .28    .000
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
  *   CALIB NASHYD       0013  1 10.0  174.87    4.86  2.33  22.74  .30    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.61  2.00  18.48  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21    1.22  2.83  17.45  n/a    .000
*
```

```
     CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    6.85  1.42  28.01  n/a    .000
*
     RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .34  1.92  28.00  n/a    .000
     {ST=   .31 ha.m }
*
     ADD [0017 + 0014]  0028  3  5.0   40.24    3.63  1.33  29.93  n/a    .000
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    4.05  1.42  43.96  n/a    .000
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    7.36  1.33  38.25  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   52.21    1.64  2.08  21.57  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    5.98  2.42  15.59  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   59.85    1.46  2.25  18.50  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .21  2.83  37.59  n/a    .000
     {ST=   .32 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   73.21    1.24  3.42  21.37  n/a    .000
*
     CHANNEL[ 2 : 0028] 1208  1  5.0   40.24    2.66  1.42  29.93  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    9.11  1.33  37.01  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  375.92    7.50  2.33  16.42  n/a    .000
*
     ADD [0010 + 0015]  1220  3  5.0  100.56    1.86  3.17  24.78  n/a    .000
*
     ADD [1220 + 1211]  0029  3  5.0  173.77    3.09  3.25  23.34  n/a    .000
*
     ADD [0009 + 1208]  0024  3  5.0  161.61   11.04  1.33  17.29  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    9.13  1.33  33.97  n/a    .000
*
     CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    3.06  3.42  23.34  n/a    .000
*
     ADD [0024 + 1207]  0025  3  5.0  233.60   14.43  1.33  25.51  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .61  4.00  33.93  n/a    .000
     {ST=  1.99 ha.m }
*
     ADD [1209 + 0013]  0030  3  5.0  348.64    7.05  2.67  23.04  n/a    .000
*
     ADD [1206 + 0025]  0023  3  5.0  291.53   21.23  1.33  26.01  n/a    .000
*
     ADD [1210 + 0030]  0300  3  5.0  408.49    8.39  2.50  22.37  n/a    .000
*
     CHANNEL[ 2 : 0023] 1216  1  5.0  291.53   21.04  1.42  26.01  n/a    .000
*
     ADD [1216 + 0016]  0022  3  5.0  366.23   21.14  1.42  27.62  n/a    .000
*
     ADD [0006 + 0022]  0021  3  5.0  379.47   21.65  1.42  27.30  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47   15.21  1.67  27.30  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71   16.92  1.67  25.39  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92   17.16  1.67  24.31  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92   13.32  2.08  24.31  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22   14.93  2.08  23.76  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   7 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 63.96 mm ]
*
 **  CALIB NASHYD       0003  1 10.0   55.30    1.15  2.00  12.72  .20    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21     .86  2.67  11.98  .19    .000
     [CN=54.9         ]
     [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24    1.32  2.00  10.60  .17    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
```

```
  **  CALIB NASHYD       0006  1 10.0   13.24     .39  1.50  10.72  .17    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB STANDHYD     0007  1  5.0   57.93    6.77  1.33  23.05  .36    .000
      [I%=37.2:S%= 1.34]
*
  *   CALIB STANDHYD     0009  1  5.0  121.37    6.98  1.33  10.78  .17    .000
      [I%=17.4:S%= 5.17]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    2.12  1.33  20.76  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    2.88  1.33  24.84  .39    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     0008  1  5.0   71.99    4.29  1.33  32.86  .51    .000
      [I%=19.5:S%= 1.16]
*
  *   CALIB NASHYD       0204  1  8.0   10.89     .15  2.27  10.87  .17    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  *   CALIB STANDHYD     0203  1  5.0   14.52    1.38  1.33  25.26  .39    .000
      [I%=25.0:S%= 2.00]
*
  *   CALIB STANDHYD     0201  1  5.0   47.41    5.79  1.33  30.67  .48    .000
      [I%=35.0:S%= 2.00]
*
  *   CALIB NASHYD       0202  1  5.0    1.87     .03  1.92  10.75  .17    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB NASHYD       0001  1 10.0   52.21    1.16  2.00  15.05  .24    .000
      [CN=62.4         ]
      [ N = 3.0:Tp  .62]
*
  *   CALIB NASHYD       0002  1 10.0  323.71    4.13  2.33  10.62  .17    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   59.85    1.27  2.00  12.78  .20    .000
      [CN=57.4         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0010  1 10.0   87.06    1.17  3.17  15.97  .25    .000
      [CN=64.1         ]
      [ N = 3.0:Tp 1.41]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.92  1.33  28.84  .45    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   73.21     .87  3.33  14.91  .24    .000
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
  *   CALIB NASHYD       0013  1 10.0  174.87    3.44  2.33  15.92  .25    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.11  2.08  12.71  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .85  2.83  11.98  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    5.55  1.42  23.05  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .24  2.00  20.66  n/a    .000
      {ST=   .27 ha.m }
*
      ADD [0017 + 0014]  0028  3  5.0   40.24    2.90  1.33  22.89  n/a    .000
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    3.21  1.42  32.86  n/a    .000
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    5.80  1.33  29.91  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   52.21    1.15  2.17  15.04  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    4.11  2.42  10.62  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   59.85     .99  2.33  12.77  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .16  2.67  28.81  n/a    .000
      {ST=   .24 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   73.21     .87  3.42  14.91  n/a    .000
*
      CHANNEL[ 2 : 0028] 1208  1  5.0   40.24    2.11  1.42  22.89  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    7.18  1.33  28.85  n/a    .000
```

```
*
     ADD [1214 + 1204]  0200  3  5.0  375.92    5.19  2.42  11.24  n/a    .000
*
     ADD [0010 + 0015]  1220  3  5.0  100.56    1.33  3.17  17.69  n/a    .000
*
     ADD [1220 + 1211]  0029  3  5.0  173.77    2.18  3.25  16.52  n/a    .000
*
     ADD [0009 + 1208]  0024  3  5.0  161.61    8.79  1.33  13.79  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    7.19  1.33  26.23  n/a    .000
*
     CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    2.16  3.42  16.52  n/a    .000
*
     ADD [0024 + 1207]  0025  3  5.0  233.60   11.43  1.33  19.67  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .43  4.00  26.20  n/a    .000
     {ST=  1.59 ha.m }
*
     ADD [1209 + 0013]  0030  3  5.0  348.64    4.97  2.67  16.22  n/a    .000
*
     ADD [1206 + 0025]  0023  3  5.0  291.53   16.75  1.33  20.34  n/a    .000
*
     ADD [1210 + 0030]  0300  3  5.0  408.49    5.88  2.58  15.71  n/a    .000
*
     CHANNEL[ 2 : 0023] 1216  1  5.0  291.53   16.18  1.42  20.34  n/a    .000
*
     ADD [1216 + 0016]  0022  3  5.0  366.23   16.24  1.42  21.53  n/a    .000
*
     ADD [0006 + 0022]  0021  3  5.0  379.47   16.58  1.42  21.22  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47   12.35  1.67  21.22  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71   13.49  1.67  19.45  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92   13.63  1.67  18.44  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92   11.25  1.92  18.44  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22   12.31  1.92  17.89  n/a    .000
*
 ***************************
 ** SIMULATION NUMBER:   8 **
 ***************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha      cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                 10.0
     [ Ptot= 45.64 mm ]
*
 **  CALIB NASHYD       0003  1 10.0   55.30     .55  2.00   6.23  .14    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21     .41  2.67   5.86  .13    .000
     [CN=54.9         ]
     [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24     .62  2.00   5.12  .11    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
 **  CALIB NASHYD       0006  1 10.0   13.24     .18  1.50   5.24  .11    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB STANDHYD     0007  1  5.0   57.93    4.77  1.33  16.23  .36    .000
     [I%=37.2:S%= 1.34]
*
  *  CALIB STANDHYD     0009  1  5.0  121.37    4.95  1.33   7.59  .17    .000
     [I%=17.4:S%= 5.17]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84    1.51  1.33  14.62  .32    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    2.05  1.33  17.50  .38    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     0008  1  5.0   71.99    2.69  1.42  18.81  .41    .000
     [I%=19.5:S%= 1.16]
*
  *  CALIB NASHYD       0204  1  8.0   10.89     .07  2.40   5.09  .11    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .95  1.33  15.89  .35    .000
     [I%=25.0:S%= 2.00]
```

```
*
  *   CALIB STANDHYD      0201  1  5.0   47.41    3.98  1.33  19.92  .44    .000
      [I%=35.0:S%= 2.00]
*
  *   CALIB NASHYD        0202  1  5.0    1.87     .02  1.92   5.41  .12    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB NASHYD        0001  1 10.0   52.21     .57  2.17   7.54  .17    .000
      [CN=62.4         ]
      [ N = 3.0:Tp  .62]
*
  *   CALIB NASHYD        0002  1 10.0  323.71    1.94  2.50   5.09  .11    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD        0012  1 10.0   59.85     .61  2.00   6.29  .14    .000
      [CN=57.4         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD        0010  1 10.0   87.06     .58  3.17   8.07  .18    .000
      [CN=64.1         ]
      [ N = 3.0:Tp 1.41]
*
  *   CALIB STANDHYD      1500  1  5.0   13.50    1.38  1.33  17.45  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD        0011  1 10.0   73.21     .44  3.33   7.48  .17    .000
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
  *   CALIB NASHYD        0013  1 10.0  174.87    1.70  2.33   8.03  .18    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .52  2.08   6.23  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .41  2.92   5.86  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    3.88  1.42  16.23  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .11  2.33  14.52  n/a    .000
      {ST=   .21 ha.m }
*
      ADD [0017 + 0014]  0028  3  5.0   40.24    2.07  1.33  16.11  n/a    .000
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    2.14  1.50  18.81  n/a    .000
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.98  1.33  19.37  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   52.21     .56  2.17   7.53  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    1.93  2.50   5.09  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   59.85     .43  2.42   6.28  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11  2.17  17.43  n/a    .000
      {ST=   .16 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   73.21     .43  3.50   7.48  n/a    .000
*
      CHANNEL[ 2 : 0028] 1208  1  5.0   40.24    1.45  1.42  16.10  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    4.94  1.33  18.58  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  375.92    2.45  2.42   5.43  n/a    .000
*
      ADD [0010 + 0015]  1220  3  5.0  100.56     .69  3.17   9.32  n/a    .000
*
      ADD [1220 + 1211]  0029  3  5.0  173.77    1.11  3.33   8.55  n/a    .000
*
      ADD [0009 + 1208]  0024  3  5.0  161.61    6.15  1.33   9.71  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    4.94  1.33  16.61  n/a    .000
*
      CHANNEL[ 2 : 0029] 1209  1  5.0  173.77    1.09  3.50   8.54  n/a    .000
*
      ADD [0024 + 1207]  0025  3  5.0  233.60    7.35  1.33  12.52  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .18  4.08  16.58  n/a    .000
      {ST=  1.08 ha.m }
*
      ADD [1209 + 0013]  0030  3  5.0  348.64    2.45  2.75   8.29  n/a    .000
*
      ADD [1206 + 0025]  0023  3  5.0  291.53   10.90  1.33  13.25  n/a    .000
*
      ADD [1210 + 0030]  0300  3  5.0  408.49    2.88  2.67   7.99  n/a    .000
*
      CHANNEL[ 2 : 0023] 1216  1  5.0  291.53   10.79  1.42  13.25  n/a    .000
```

```
*
     ADD [1216 + 0016]  0022  3  5.0  366.23   10.84  1.42  13.93  n/a    .000
*
     ADD [0006 + 0022]  0021  3  5.0  379.47   11.00  1.42  13.63  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    8.13  1.58  13.63  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71    8.57  1.58  12.20  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92    8.59  1.58  11.35  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    6.49  1.83  11.35  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22    6.92  1.83  10.86  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 33.77 mm ]
*
 **  CALIB NASHYD       0003  1 10.0   55.30     .26  2.00   3.10  .09    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21     .20  2.83   2.92  .09    .000
     [CN=54.9         ]
     [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24     .30  2.00   2.51  .07    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
 **  CALIB NASHYD       0006  1 10.0   13.24     .09  1.50   2.61  .08    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB STANDHYD     0007  1  5.0   57.93    3.11  1.42  11.82  .35    .000
     [I%=37.2:S%= 1.34]
*
  *  CALIB STANDHYD     0009  1  5.0  121.37    3.65  1.33   5.53  .16    .000
     [I%=17.4:S%= 5.17]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84    1.11  1.33  10.64  .32    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    1.52  1.33  12.74  .38    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     0008  1  5.0   71.99    1.96  1.42  11.29  .33    .000
     [I%=19.5:S%= 1.16]
*
  *  CALIB NASHYD       0204  1  8.0   10.89     .03  2.40   2.38  .07    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .70  1.33  10.57  .31    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    2.89  1.33  13.61  .40    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .01  1.92   2.82  .08    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB NASHYD       0001  1 10.0   52.21     .28  2.17   3.83  .11    .000
     [CN=62.4         ]
     [ N = 3.0:Tp  .62]
*
  *  CALIB NASHYD       0002  1 10.0  323.71     .92  2.50   2.47  .07    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
  *  CALIB NASHYD       0012  1 10.0   59.85     .30  2.00   3.15  .09    .000
     [CN=57.4         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0010  1 10.0   87.06     .30  3.33   4.13  .12    .000
     [CN=64.1         ]
     [ N = 3.0:Tp 1.41]
*
  *  CALIB STANDHYD     1500  1  5.0   13.50    1.03  1.33  12.71  .38    .000
```

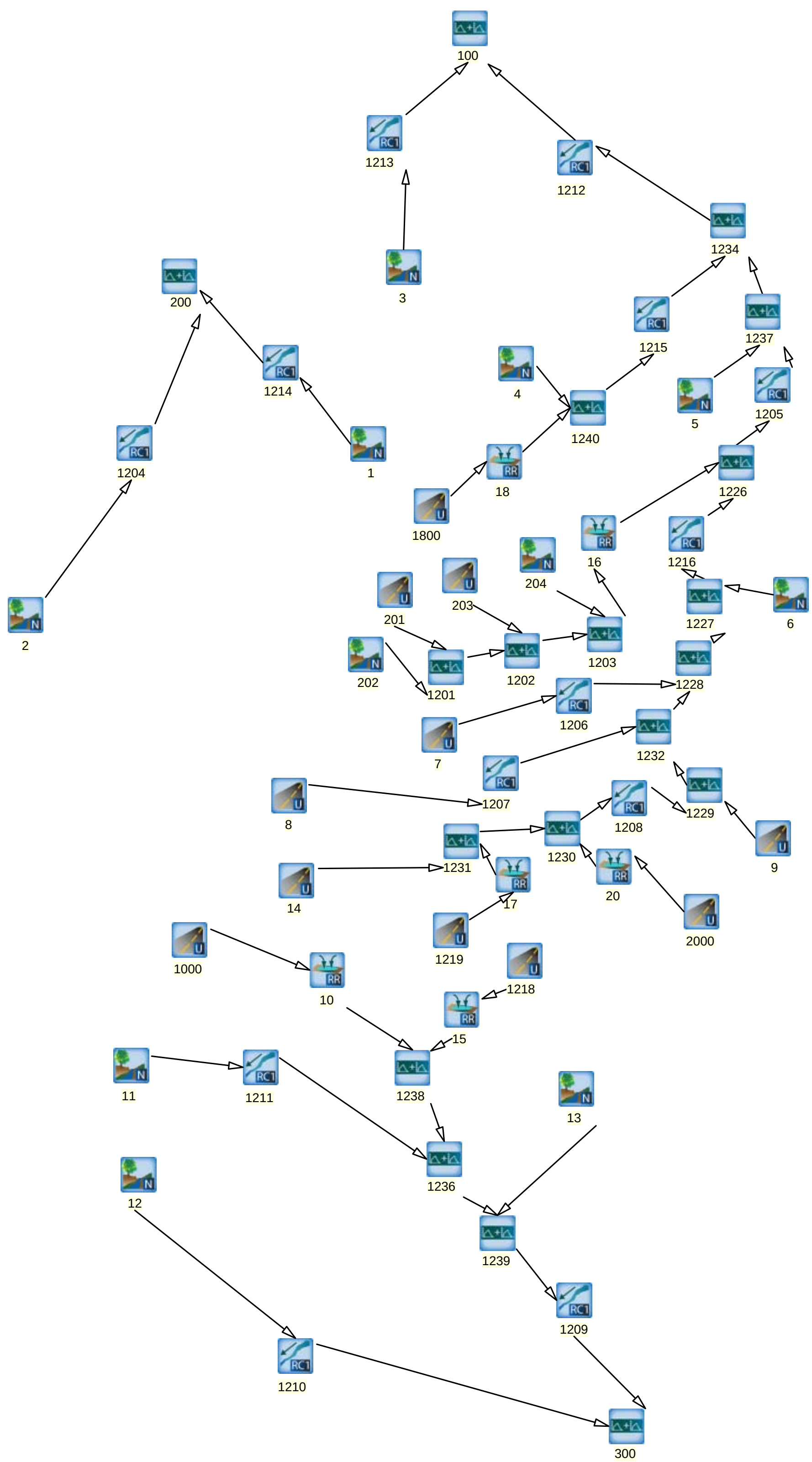
```
     [I%=40.0:S%= 2.02]
*
  *  CALIB NASHYD       0011  1 10.0   73.21     .22  3.33   3.81  .11    .000
     [CN=61.9         ]
     [ N = 3.0:Tp 1.51]
*
  *  CALIB NASHYD       0013  1 10.0  174.87     .85  2.50   4.10  .12    .000
     [CN=64.1         ]
     [ N = 3.0:Tp  .81]
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .24  2.17   3.09  n/a    .000
*
     CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .20  3.00   2.91  n/a    .000
*
     CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    2.65  1.50  11.82  n/a    .000
*
     RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .03  3.92  10.55  n/a    .000
     {ST=   .18 ha.m }
*
     ADD [0017 + 0014]  0028  3  5.0   40.24    1.53  1.33  11.71  n/a    .000
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    1.51  1.50  11.29  n/a    .000
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    2.89  1.33  13.20  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   52.21     .28  2.25   3.82  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71     .91  2.58   2.47  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   59.85     .19  2.58   3.14  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08  2.17  12.68  n/a    .000
     {ST=   .12 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   73.21     .22  3.58   3.81  n/a    .000
*
     CHANNEL[ 2 : 0028] 1208  1  5.0   40.24    1.03  1.42  11.71  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    3.59  1.33  12.60  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  375.92    1.17  2.50   2.66  n/a    .000
*
     ADD [0010 + 0015]  1220  3  5.0  100.56     .37  3.17   5.28  n/a    .000
*
     ADD [1220 + 1211]  0029  3  5.0  173.77     .58  3.33   4.66  n/a    .000
*
     ADD [0009 + 1208]  0024  3  5.0  161.61    4.45  1.33   7.07  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.59  1.33  11.11  n/a    .000
*
     CHANNEL[ 2 : 0029] 1209  1  5.0  173.77     .57  3.67   4.66  n/a    .000
*
     ADD [0024 + 1207]  0025  3  5.0  233.60    5.22  1.33   8.37  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .07  4.25  11.08  n/a    .000
     {ST=   .75 ha.m }
*
     ADD [1209 + 0013]  0030  3  5.0  348.64    1.24  2.83   4.38  n/a    .000
*
     ADD [1206 + 0025]  0023  3  5.0  291.53    7.44  1.42   9.05  n/a    .000
*
     ADD [1210 + 0030]  0300  3  5.0  408.49    1.43  2.75   4.20  n/a    .000
*
     CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    7.30  1.50   9.05  n/a    .000
*
     ADD [1216 + 0016]  0022  3  5.0  366.23    7.34  1.50   9.47  n/a    .000
*
     ADD [0006 + 0022]  0021  3  5.0  379.47    7.43  1.50   9.23  n/a    .000
*
     CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    5.50  1.67   9.23  n/a    .000
*
     ADD [0005 + 1205]  0020  3  5.0  455.71    5.74  1.67   8.12  n/a    .000
*
     ADD [1215 + 0020]  0027  3  5.0  526.92    5.76  1.67   7.41  n/a    .000
*
     CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    4.27  1.83   7.41  n/a    .000
*
     ADD [1213 + 1212]  0100  3  5.0  582.22    4.47  1.92   7.00  n/a    .000
*
  ***************************
  ** SIMULATION NUMBER:  10 **
  ***************************

  W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha      cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                  10.0
```

```
      [ Ptot= 24.99 mm ]
      fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Owen-4hrC25mm.stm
      remark: 25mm - 4hr CHICAGO STORM - OWEN SOUND RAINFALL
*
 **  CALIB NASHYD       0003  1 10.0   55.30     .12  2.00   1.41  .06    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
 **  CALIB NASHYD       0004  1 10.0   71.21     .09  2.83   1.34  .05    .000
      [CN=54.9         ]
      [ N = 3.0:Tp 1.05]
*
 **  CALIB NASHYD       0005  1 10.0   76.24     .13  2.00   1.13  .05    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
 **  CALIB NASHYD       0006  1 10.0   13.24     .04  1.50   1.21  .05    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *  CALIB STANDHYD     0007  1  5.0   57.93    2.23  1.42   8.55  .34    .000
      [I%=37.2:S%= 1.34]
*
  *  CALIB STANDHYD     0009  1  5.0  121.37    2.61  1.33   4.00  .16    .000
      [I%=17.4:S%= 5.17]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .80  1.33   7.70  .31    .000
      [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    1.09  1.33   9.22  .37    .000
      [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     0008  1  5.0   71.99    1.40  1.42   6.50  .26    .000
      [I%=19.5:S%= 1.16]
*
  *  CALIB NASHYD       0204  1  8.0   10.89     .01  2.53    .98  .04    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .50  1.33   7.06  .28    .000
      [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    2.06  1.33   9.33  .37    .000
      [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .00  2.00   1.41  .06    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *  CALIB NASHYD       0001  1 10.0   52.21     .13  2.17   1.79  .07    .000
      [CN=62.4         ]
      [ N = 3.0:Tp  .62]
*
  *  CALIB NASHYD       0002  1 10.0  323.71     .40  2.50   1.09  .04    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *  CALIB NASHYD       0012  1 10.0   59.85     .13  2.00   1.45  .06    .000
      [CN=57.4         ]
      [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0010  1 10.0   87.06     .14  3.33   1.96  .08    .000
      [CN=64.1         ]
      [ N = 3.0:Tp 1.41]
*
  *  CALIB STANDHYD     1500  1  5.0   13.50     .75  1.33   9.20  .37    .000
      [I%=40.0:S%= 2.02]
*
  *  CALIB NASHYD       0011  1 10.0   73.21     .10  3.50   1.80  .07    .000
      [CN=61.9         ]
      [ N = 3.0:Tp 1.51]
*
  *  CALIB NASHYD       0013  1 10.0  174.87     .39  2.50   1.94  .08    .000
      [CN=64.1         ]
      [ N = 3.0:Tp  .81]
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .10  2.33   1.41  n/a    .000
*
      CHANNEL[ 2 : 0004] 1215  1  5.0   71.21     .09  3.17   1.33  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   57.93    1.90  1.50   8.55  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .02  4.08   7.61  n/a    .000
      {ST=   .13 ha.m }
*
      ADD [0017 + 0014]  0028  3  5.0   40.24    1.10  1.33   8.47  n/a    .000
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.99    1.02  1.50   6.50  n/a    .000
*
```

```
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.06  1.33   9.03  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   52.21     .13  2.33   1.79  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71     .39  2.67   1.09  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   59.85     .07  2.92   1.44  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .06  2.17   9.17  n/a    .000
      {ST=   .09 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   73.21     .10  3.67   1.79  n/a    .000
*
      CHANNEL[ 2 : 0028] 1208  1  5.0   40.24     .69  1.42   8.46  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.56  1.33   8.58  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  375.92     .51  2.58   1.19  n/a    .000
*
      ADD [0010 + 0015]  1220  3  5.0  100.56     .19  3.17   2.93  n/a    .000
*
      ADD [1220 + 1211]  0029  3  5.0  173.77     .29  3.50   2.45  n/a    .000
*
      ADD [0009 + 1208]  0024  3  5.0  161.61    3.11  1.33   5.11  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    2.56  1.33   7.47  n/a    .000
*
      CHANNEL[ 2 : 0029] 1209  1  5.0  173.77     .28  3.83   2.45  n/a    .000
*
      ADD [0024 + 1207]  0025  3  5.0  233.60    3.57  1.33   5.54  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .05  4.25   7.44  n/a    .000
      {ST=   .50 ha.m }
*
      ADD [1209 + 0013]  0030  3  5.0  348.64     .58  2.83   2.19  n/a    .000
*
      ADD [1206 + 0025]  0023  3  5.0  291.53    5.19  1.42   6.14  n/a    .000
*
      ADD [1210 + 0030]  0300  3  5.0  408.49     .64  2.83   2.08  n/a    .000
*
      CHANNEL[ 2 : 0023] 1216  1  5.0  291.53    5.12  1.50   6.14  n/a    .000
*
      ADD [1216 + 0016]  0022  3  5.0  366.23    5.15  1.50   6.40  n/a    .000
*
      ADD [0006 + 0022]  0021  3  5.0  379.47    5.19  1.50   6.22  n/a    .000
*
      CHANNEL[ 2 : 0021] 1205  1  5.0  379.47    3.74  1.67   6.22  n/a    .000
*
      ADD [0005 + 1205]  0020  3  5.0  455.71    3.83  1.67   5.37  n/a    .000
*
      ADD [1215 + 0020]  0027  3  5.0  526.92    3.83  1.67   4.83  n/a    .000
*
      CHANNEL[ 2 : 0027] 1212  1  5.0  526.92    2.75  1.92   4.83  n/a    .000
*
      ADD [1213 + 1212]  0100  3  5.0  582.22    2.81  1.92   4.50  n/a    .000
*
 FINISH

==========================================================================================================
```

MDP OPTION 1 NEW SWMFs WITHIN EXSITING SETTLEMENT BOUNDARY

MDP OPTION 1 VO2 MODEL 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    TM, Version 2.1
       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

Developed and Distributed by Clarifica Inc.
Copyright 1996, 2007 Clarifica Inc.
All rights reserved.


                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files\Visual OTTHYMO 2.3.1\voin.dat
  Output  filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 1 Development within Existing
Settlement Boundary
  Summary filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 1 Development within Existing
Settlement Boundary


DATE: 27/11/2012                           TIME: 3:29:28 PM

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                 60.0
      [ Ptot=193.00 mm ]
      fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Timmins Storm.stm
      remark: Timmins Storm
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .49  7.47  84.40  .44    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  **  CALIB STANDHYD     0203  1  5.0   14.52    1.09  7.00 114.72  .59    .000
      [I%=25.0:S%= 2.00]
*
  **  CALIB STANDHYD     0201  1  5.0   47.41    3.87  7.00 126.68  .66    .000
      [I%=35.0:S%= 2.00]
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .09  7.17  78.13  .40    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27     .49  7.00  18.60  .10    .000
      [I%= 9.3:S%= 5.00]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.03  7.00  84.27  .44    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1219  1  5.0   18.84     .78  7.00  76.01  .39    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.43  7.00  50.61  .26    .000
      [I%=26.5:S%= 5.17]
*
  *   CALIB STANDHYD     0008  1  5.0   71.94    1.70  7.00  37.82  .20    .000
      [I%=19.8:S%= 1.16]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    2.51  7.00  71.24  .37    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .78  7.00  79.87  .41    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    3.78  7.17  80.50  .42    .000
      [CN=51.4         ]
```

```
       [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    2.06  7.00  81.17  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29    1.78  7.33  77.98  .40    .000
      [CN=50.1        ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    3.12  7.17  90.95  .47    .000
      [CN=57.0        ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    2.87  7.17 101.95  .53    .000
      [CN=62.5        ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  323.71   13.53  7.50  82.22  .43    .000
      [CN=52.5        ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    3.22  7.17  91.85  .48    .000
      [CN=57.2        ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01   10.66  7.50 105.34  .55    .000
      [CN=64.2        ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.22  7.00  28.46  .15    .000
      [I%=14.9:S%= 2.00]
*
  *   CALIB STANDHYD     1218  1  5.0   13.50    1.01  7.00 114.62  .59    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   76.47    3.41  9.00 100.89  .52    .000
      [CN=61.8        ]
      [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.95  7.00 124.83  n/a    .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .04 12.25  17.55  n/a    .000
      {ST=   .72 ha.m }
*
      RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .52  7.08  75.92  n/a    .000
      {ST=   .41 ha.m }
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    1.68  7.00  37.81  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.50  7.00  71.24  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .58 11.08  79.22  n/a    .000
      {ST=  2.31 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    2.06  7.33  78.60  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    3.07  7.25  90.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    2.87  7.25 101.95  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71   13.52  7.58  82.22  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    2.94  7.42  91.84  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .54  9.17  28.44  n/a    .000
      {ST=   .84 ha.m }
*
      RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .59  9.08 114.60  n/a    .000
      {ST=   .56 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47    3.41  9.17 100.89  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    5.04  7.00 122.53  n/a    .000
*
      ADD [0014 + 0017]  1231  3  5.0   40.24    1.54  7.00  80.36  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    2.03  7.42  78.59  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  371.85   16.24  7.50  84.78  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67    1.13  9.08  42.51  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    4.54  9.08  70.56  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    5.47  7.00 116.97  n/a    .000
*
      ADD [0020 + 1231]  1230  3  5.0   84.51    1.56  7.00  47.46  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15   14.51  7.67  89.62  n/a    .000
```

```
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69    3.38  9.08 116.91  n/a    .000
     {ST=  3.68 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.53  7.00  47.45  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15   14.45  7.75  89.62  n/a    .000
*
     ADD [1208 + 0009]  1229  3  5.0  161.33    3.96  7.00  48.96  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92   17.24  7.67  89.93  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  233.27    5.64  7.00  45.52  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  289.59    8.14  7.00  50.52  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  302.83    8.92  7.00  51.81  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    8.89  7.00  51.81  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  377.53    9.80  7.00  64.69  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    9.55  7.08  64.68  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77   13.27  7.08  67.34  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71   15.13  7.17  69.04  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71   14.36  7.33  69.03  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01   17.39  7.33  71.09  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                  10.0
     [ Ptot=105.16 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .25 13.07  29.31  .28    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .67 12.33  50.22  .48    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41    2.65 12.25  58.23  .55    .000
     [I%=35.0:S%= 2.00]
*
  ** CALIB NASHYD       0202  1  5.0    1.87     .05 12.75  27.52  .26    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .48 12.00   9.59  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .99 12.08  41.37  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1219  1  5.0   18.84     .75 12.00  34.56  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.39 12.00  27.34  .26    .000
     [I%=26.5:S%= 5.17]
*
  *  CALIB STANDHYD     0008  1  5.0   71.94    1.58 12.08  20.43  .19    .000
     [I%=19.8:S%= 1.16]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.37 12.08  38.48  .37    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .41 12.33  28.03  .27    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24    1.95 12.67  28.01  .27    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    1.93 12.08  43.84  .42    .000
     [I%=42.5:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .91 12.83  26.86  .26    .000
     [CN=50.1         ]
```

```
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.67 12.67  32.78  .31    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.61 12.83  38.25  .36    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  323.71    6.87 13.17  28.67  .27    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74 12.67  33.35  .32    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.92 13.00  39.98  .38    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.13 12.08  15.37  .15    .000
      [I%=14.9:S%= 2.00]
*
  *   CALIB STANDHYD     1218  1  5.0   13.50     .65 12.00  43.58  .41    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   76.47    1.72 13.67  37.79  .36    .000
      [CN=61.8         ]
      [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.68 12.25  57.06  n/a    .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .02 22.58   8.99  n/a    .000
      {ST=   .35 ha.m }
*
      RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .36 12.75  34.47  n/a    .000
      {ST=   .32 ha.m }
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    1.52 12.25  20.42  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.31 12.17  38.48  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .21 14.58  41.95  n/a    .000
      {ST=  1.27 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    1.10 12.83  34.44  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.64 12.83  32.77  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.60 12.92  38.25  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    6.86 13.17  28.67  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.53 13.00  33.34  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .38 13.17  15.35  n/a    .000
      {ST=   .58 ha.m }
*
      RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .18 13.17  43.55  n/a    .000
      {ST=   .27 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47    1.71 13.75  37.78  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    3.34 12.25  55.50  n/a    .000
*
      ADD [0014 + 0017]  1231  3  5.0   40.24    1.22 12.17  38.14  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.07 13.08  34.42  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  371.85    8.37 13.08  29.91  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .55 13.17  19.95  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    2.24 13.67  28.52  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    3.48 12.25  51.69  n/a    .000
*
      ADD [0020 + 1231]  1230  3  5.0   84.51    1.23 12.17  22.87  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    7.94 13.17  34.80  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .70 14.50  51.62  n/a    .000
      {ST=  2.28 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.19 12.33  22.87  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    7.85 13.25  34.80  n/a    .000
```

```
*
     ADD [1208 + 0009]  1229  3  5.0  161.33    3.40 12.17  25.00  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    9.33 13.25  34.60  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  233.27    4.90 12.17  23.58  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  289.59    7.21 12.17  26.48  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  302.83    7.60 12.17  26.55  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    7.53 12.25  26.55  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  377.53    7.77 12.25  31.51  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    7.36 12.42  31.50  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77    9.15 12.50  30.92  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71    9.87 12.50  31.45  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    9.47 12.75  31.44  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01   11.10 12.75  31.56  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND            HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                 min     ha     cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot= 86.04 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .17 13.07  19.95  .23    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .50 12.17  38.06  .44    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41    1.98 12.25  44.94  .52    .000
     [I%=35.0:S%= 2.00]
*
  ** CALIB NASHYD       0202  1  5.0    1.87     .03 12.75  19.01  .22    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
   * CALIB STANDHYD     2000  1  5.0   44.27     .39 12.08   7.82  .09    .000
     [I%= 9.3:S%= 5.00]
*
   * CALIB STANDHYD     0014  1  5.0   21.40     .80 12.08  33.70  .39    .000
     [I%=40.1:S%= 1.16]
*
   * CALIB STANDHYD     1219  1  5.0   18.84     .61 12.00  28.15  .33    .000
     [I%=33.5:S%= 2.02]
*
   * CALIB STANDHYD     0009  1  5.0   76.82    1.92 12.08  22.27  .26    .000
     [I%=26.5:S%= 5.17]
*
   * CALIB STANDHYD     0008  1  5.0   71.94    1.28 12.08  16.64  .19    .000
     [I%=19.8:S%= 1.16]
*
   * CALIB STANDHYD     0007  1  5.0   56.32    1.92 12.08  31.35  .36    .000
     [I%=37.3:S%= 1.34]
*
   * CALIB NASHYD       0006  1 10.0   13.24     .28 12.33  19.25  .22    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
   * CALIB NASHYD       0005  1 10.0   76.24    1.32 12.67  19.17  .22    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
   * CALIB STANDHYD     1800  1  5.0   40.65    1.56 12.08  35.72  .42    .000
     [I%=42.5:S%= 2.02]
*
   * CALIB NASHYD       0004  1 10.0   40.29     .61 12.83  18.31  .21    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
   * CALIB NASHYD       0003  1 10.0   55.30    1.14 12.67  22.67  .26    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
   * CALIB NASHYD       0001  1 10.0   48.14    1.12 12.83  26.81  .31    .000
```

```
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  323.71    4.65 13.17  19.60  .23    .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.19 12.67  23.15  .27    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    4.11 13.00  28.13  .33    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17     .91 12.17  12.52  .15    .000
      [I%=14.9:S%= 2.00]
*
  *   CALIB STANDHYD     1218  1  5.0   13.50     .53 12.00  33.62  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   76.47    1.19 13.67  26.49  .31    .000
      [CN=61.8         ]
      [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.01 12.25  43.96  n/a    .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 22.67   7.33  n/a    .000
      {ST=   .28 ha.m }
*
      RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .26 12.83  28.06  n/a    .000
      {ST=   .28 ha.m }
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    1.22 12.25  16.64  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.87 12.17  31.34  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .18 14.50  33.83  n/a    .000
      {ST=  1.08 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .73 13.25  26.10  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.12 12.83  22.66  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.11 12.92  26.81  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    4.63 13.17  19.60  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.03 13.08  23.14  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .29 13.33  12.50  n/a    .000
      {ST=   .49 ha.m }
*
      RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .14 13.08  33.59  n/a    .000
      {ST=   .22 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47    1.18 13.83  26.48  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.50 12.17  42.61  n/a    .000
*
      ADD [0014 + 0017]  1231  3  5.0   40.24     .94 12.17  31.06  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .69 13.33  26.09  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  371.85    5.68 13.17  20.54  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .43 13.33  15.94  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    1.60 13.75  21.01  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    2.59 12.25  39.33  n/a    .000
*
      ADD [0020 + 1231]  1230  3  5.0   84.51     .95 12.17  18.63  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    5.55 13.17  24.91  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .53 14.58  39.26  n/a    .000
      {ST=  1.77 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .91 12.33  18.62  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    5.49 13.33  24.91  n/a    .000
*
      ADD [1208 + 0009]  1229  3  5.0  161.33    2.73 12.17  20.36  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    6.48 13.25  24.67  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  233.27    3.93 12.17  19.21  n/a    .000
*
```

```
     ADD [1232 + 1206]  1228  3  5.0  289.59    5.80 12.17  21.57  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  302.83    6.07 12.17  21.47  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    6.06 12.25  21.47  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  377.53    6.20 12.25  24.99  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    5.83 12.42  24.99  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77    7.05 12.50  24.02  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71    7.52 12.50  24.34  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    7.08 12.75  24.33  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01    8.19 12.75  24.17  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   4 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                 min     ha     cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot= 64.53 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .09 13.07  11.08  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .33 12.17  25.57  .40    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    1.35 12.17  31.02  .48    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .02 12.75  10.94  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
 *   CALIB STANDHYD     2000  1  5.0   44.27     .29 12.08   5.82  .09    .000
     [I%= 9.3:S%= 5.00]
*
 *   CALIB STANDHYD     0014  1  5.0   21.40     .60 12.08  25.07  .39    .000
     [I%=40.1:S%= 1.16]
*
 *   CALIB STANDHYD     1219  1  5.0   18.84     .45 12.00  20.95  .32    .000
     [I%=33.5:S%= 2.02]
*
 *   CALIB STANDHYD     0009  1  5.0   76.82    1.42 12.08  16.57  .26    .000
     [I%=26.5:S%= 5.17]
*
 *   CALIB STANDHYD     0008  1  5.0   71.94     .94 12.17  12.38  .19    .000
     [I%=19.8:S%= 1.16]
*
 *   CALIB STANDHYD     0007  1  5.0   56.32    1.42 12.08  23.32  .36    .000
     [I%=37.3:S%= 1.34]
*
 *   CALIB NASHYD       0006  1 10.0   13.24     .15 12.33  10.92  .17    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
 *   CALIB NASHYD       0005  1 10.0   76.24     .73 12.83  10.80  .17    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
 *   CALIB STANDHYD     1800  1  5.0   40.65    1.15 12.17  26.58  .41    .000
     [I%=42.5:S%= 2.02]
*
 *   CALIB NASHYD       0004  1 10.0   40.29     .34 12.83  10.25  .16    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
 *   CALIB NASHYD       0003  1 10.0   55.30     .64 12.83  12.95  .20    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
 *   CALIB NASHYD       0001  1 10.0   48.14     .64 12.83  15.62  .24    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
 *   CALIB NASHYD       0002  1 10.0  323.71    2.57 13.17  11.02  .17    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
```

```
  *   CALIB NASHYD       0012  1 10.0   56.77     .68 12.83  13.32  .21    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    2.37 13.17  16.47  .26    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17     .67 12.17   9.32  .14    .000
      [I%=14.9:S%= 2.00]
*
  *   CALIB STANDHYD     1218  1  5.0   13.50     .39 12.00  25.01  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   76.47     .68 13.67  15.45  .24    .000
      [CN=61.8         ]
      [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.36 12.17  30.26  n/a    .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 22.67   5.45  n/a    .000
      {ST=   .21 ha.m }
*
      RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .15 13.00  20.85  n/a    .000
      {ST=   .23 ha.m }
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.94     .89 12.33  12.38  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.38 12.25  23.32  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .04 22.83  24.90  n/a    .000
      {ST=   .89 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .37 13.00  17.61  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .63 12.92  12.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .63 12.92  15.62  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    2.55 13.25  11.02  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .56 13.17  13.31  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .18 13.58   9.29  n/a    .000
      {ST=   .39 ha.m }
*
      RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .11 13.08  24.98  n/a    .000
      {ST=   .16 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .68 13.92  15.44  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.69 12.17  29.19  n/a    .000
*
      ADD [0014 + 0017]  1231  3  5.0   40.24     .62 12.25  23.10  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .36 13.08  17.60  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  371.85    3.15 13.17  11.61  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .29 13.50  11.86  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14     .96 13.83  13.58  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    1.73 12.17  26.55  n/a    .000
*
      ADD [0020 + 1231]  1230  3  5.0   84.51     .62 12.25  13.85  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    3.21 13.25  15.16  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .25 15.25  26.49  n/a    .000
      {ST=  1.28 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .60 12.42  13.85  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    3.16 13.42  15.16  n/a    .000
*
      ADD [1208 + 0009]  1229  3  5.0  161.33    1.97 12.08  15.15  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    3.69 13.33  14.91  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  233.27    2.81 12.25  14.29  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  289.59    4.19 12.25  16.05  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  302.83    4.34 12.25  15.82  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    4.33 12.25  15.82  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  377.53    4.39 12.25  17.93  n/a    .000
```

```
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    4.11 12.50  17.93  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77    4.79 12.50  16.73  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71    5.05 12.58  16.86  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    4.70 12.75  16.86  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01    5.31 12.83  16.49  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   5 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot= 50.19 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .05 13.20   6.36  .13    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .23 12.08  18.10  .36    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41     .98 12.17  22.48  .45    .000
     [I%=35.0:S%= 2.00]
*
  ** CALIB NASHYD       0202  1  5.0    1.87     .01 12.75   6.60  .13    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
   * CALIB STANDHYD     2000  1  5.0   44.27     .22 12.08   4.48  .09    .000
     [I%= 9.3:S%= 5.00]
*
   * CALIB STANDHYD     0014  1  5.0   21.40     .46 12.08  19.32  .39    .000
     [I%=40.1:S%= 1.16]
*
   * CALIB STANDHYD     1219  1  5.0   18.84     .34 12.08  16.14  .32    .000
     [I%=33.5:S%= 2.02]
*
   * CALIB STANDHYD     0009  1  5.0   76.82    1.10 12.08  12.77  .25    .000
     [I%=26.5:S%= 5.17]
*
   * CALIB STANDHYD     0008  1  5.0   71.94     .72 12.17   9.54  .19    .000
     [I%=19.8:S%= 1.16]
*
   * CALIB STANDHYD     0007  1  5.0   56.32    1.08 12.17  17.97  .36    .000
     [I%=37.3:S%= 1.34]
*
   * CALIB NASHYD       0006  1 10.0   13.24     .09 12.33   6.45  .13    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
   * CALIB NASHYD       0005  1 10.0   76.24     .42 12.83   6.33  .13    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
   * CALIB STANDHYD     1800  1  5.0   40.65     .88 12.17  20.48  .41    .000
     [I%=42.5:S%= 2.02]
*
   * CALIB NASHYD       0004  1 10.0   40.29     .19 13.00   5.98  .12    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
   * CALIB NASHYD       0003  1 10.0   55.30     .37 12.83   7.67  .15    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
   * CALIB NASHYD       0001  1 10.0   48.14     .38 12.83   9.42  .19    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
   * CALIB NASHYD       0002  1 10.0  323.71    1.46 13.17   6.43  .13    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
   * CALIB NASHYD       0012  1 10.0   56.77     .40 12.83   7.96  .16    .000
     [CN=57.2         ]
     [ N = 3.0:Tp  .50]
*
   * CALIB NASHYD       0013  1 10.0  193.01    1.41 13.17   9.97  .20    .000
     [CN=64.2         ]
     [ N = 3.0:Tp  .80]
```

```
*
 *   CALIB STANDHYD     1000  1  5.0   69.17     .51 12.25   7.18  .14    .000
     [I%=14.9:S%= 2.00]
*
 *   CALIB STANDHYD     1218  1  5.0   13.50     .30 12.00  19.28  .38    .000
     [I%=40.0:S%= 2.02]
*
 *   CALIB NASHYD       0011  1 10.0   76.47     .40 13.83   9.33  .19    .000
     [CN=61.8         ]
     [ N = 3.0:Tp 1.27]
*
     ADD [0201 + 0202]  1201  3  5.0   49.28     .99 12.17  21.88  n/a    .000
*
     RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 22.75   4.20  n/a    .000
     {ST=   .16 ha.m }
*
     RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .07 13.58  16.05  n/a    .000
     {ST=   .20 ha.m }
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.94     .68 12.33   9.54  n/a    .000
*
     CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.05 12.33  17.97  n/a    .000
*
     RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .03 22.83  19.19  n/a    .000
     {ST=   .69 ha.m }
*
     ADD [0018 + 0004]  1240  3  5.0   80.94     .22 13.00  12.61  n/a    .000
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .36 12.92   7.67  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .37 13.00   9.41  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    1.45 13.33   6.43  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .31 13.25   7.95  n/a    .000
*
     RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .09 14.17   7.16  n/a    .000
     {ST=   .33 ha.m }
*
     RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .08 13.17  19.25  n/a    .000
     {ST=   .13 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .40 14.00   9.33  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    1.22 12.17  21.02  n/a    .000
*
     ADD [0014 + 0017]  1231  3  5.0   40.24     .47 12.08  17.79  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .21 13.17  12.60  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  371.85    1.81 13.25   6.82  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .17 14.00   9.13  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .57 14.00   9.23  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    1.23 12.17  18.88  n/a    .000
*
     ADD [0020 + 1231]  1230  3  5.0   84.51     .48 12.08  10.67  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    1.88 13.33   9.63  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .15 16.42  18.83  n/a    .000
     {ST=   .96 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .45 12.25  10.67  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.84 13.50   9.63  n/a    .000
*
     ADD [1208 + 0009]  1229  3  5.0  161.33    1.52 12.17  11.67  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    2.14 13.50   9.40  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  233.27    2.16 12.25  11.01  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  289.59    3.21 12.25  12.37  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  302.83    3.30 12.25  12.11  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    3.28 12.33  12.11  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  377.53    3.33 12.33  13.44  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    3.07 12.50  13.44  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77    3.46 12.58  12.24  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71    3.60 12.58  12.30  n/a    .000
*
```

```
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    3.31 12.83  12.29  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01    3.66 12.83  11.86  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha      cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 77.31 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .22  2.27  16.12  .21    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52    1.76  1.33  32.83  .42    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    7.35  1.33  39.15  .51    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .05  1.92  15.53  .20    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27    1.75  1.33   7.00  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    3.59  1.33  31.63  .41    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1219  1  5.0   18.84    2.74  1.33  28.09  .36    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    8.63  1.33  19.96  .26    .000
     [I%=26.5:S%= 5.17]
*
  *  CALIB STANDHYD     0008  1  5.0   71.94    5.43  1.33  14.91  .19    .000
     [I%=19.8:S%= 1.16]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    8.29  1.33  28.09  .36    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .57  1.50  15.36  .20    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24    1.92  1.83  15.26  .20    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    6.67  1.33  32.01  .41    .000
     [I%=42.5:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .84  2.00  14.54  .19    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
  *  CALIB NASHYD       0003  1 10.0   55.30    1.65  1.83  18.15  .24    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0001  1 10.0   48.14    1.56  2.00  21.64  .28    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
  *  CALIB NASHYD       0002  1 10.0  323.71    6.00  2.33  15.59  .20    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
  *  CALIB NASHYD       0012  1 10.0   56.77    1.74  1.83  18.58  .24    .000
     [CN=57.2         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0013  1 10.0  193.01    5.41  2.33  22.75  .30    .000
     [CN=64.2         ]
     [ N = 3.0:Tp  .80]
*
  *  CALIB STANDHYD     1000  1  5.0   69.17    3.77  1.33  11.22  .15    .000
     [I%=14.9:S%= 2.00]
*
  *  CALIB STANDHYD     1218  1  5.0   13.50    2.39  1.33  37.62  .49    .000
     [I%=40.0:S%= 2.02]
*
```

```
  *   CALIB NASHYD       0011  1 10.0   76.47    1.46  3.00  21.38  .28    .000
      [CN=61.8         ]
      [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    7.36  1.33  38.25  n/a    .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  4.08   6.64  n/a    .000
      {ST=   .30 ha.m }
*
      RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .34  1.83  28.00  n/a    .000
      {ST=   .31 ha.m }
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    4.06  1.42  14.91  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    6.68  1.42  28.09  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .19  4.00  30.64  n/a    .000
      {ST=  1.15 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    1.01  2.17  22.62  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.61  2.00  18.15  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.55  2.08  21.64  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    5.98  2.42  15.59  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.39  2.33  18.57  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .35  2.25  11.20  n/a    .000
      {ST=   .55 ha.m }
*
      RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .21  2.83  37.59  n/a    .000
      {ST=   .32 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47    1.45  3.08  21.38  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    9.11  1.33  37.01  n/a    .000
*
      ADD [0014 + 0017]  1231  3  5.0   40.24    3.65  1.33  29.93  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .97  2.25  22.62  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  371.85    7.40  2.33  16.38  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .56  2.42  15.51  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    1.99  3.00  18.33  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    9.13  1.33  33.97  n/a    .000
*
      ADD [0020 + 1231]  1230  3  5.0   84.51    3.66  1.33  17.73  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    7.09  2.50  20.75  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .61  4.00  33.93  n/a    .000
      {ST=  1.99 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    2.68  1.42  17.73  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    7.03  2.58  20.75  n/a    .000
*
      ADD [1208 + 0009]  1229  3  5.0  161.33   10.97  1.33  18.79  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    8.35  2.50  20.45  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  233.27   14.40  1.33  17.59  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  289.59   21.03  1.33  19.63  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  302.83   21.48  1.33  19.45  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  302.83   21.21  1.42  19.45  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  377.53   21.32  1.42  22.31  n/a    .000
*
      CHANNEL[ 2 : 1226] 1205  1  5.0  377.53   14.82  1.67  22.31  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  453.77   16.52  1.67  21.13  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  534.71   16.94  1.67  21.35  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  534.71   13.07  2.08  21.35  n/a    .000
*
      ADD [1212 + 1213]  0100  3  5.0  590.01   14.68  2.08  21.05  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   7 **
  ****************************
```

```
  W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha      cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      CHIC STORM              10.0
      [ Ptot= 63.96 mm ]
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .15  2.27  10.87  .17     .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  *   CALIB STANDHYD     0203  1  5.0   14.52    1.38  1.33  25.26  .39     .000
      [I%=25.0:S%= 2.00]
*
  *   CALIB STANDHYD     0201  1  5.0   47.41    5.79  1.33  30.67  .48     .000
      [I%=35.0:S%= 2.00]
*
  *   CALIB NASHYD       0202  1  5.0    1.87     .03  1.92  10.75  .17     .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.40  1.33   5.76  .09     .000
      [I%= 9.3:S%= 5.00]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    2.88  1.33  24.84  .39     .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1219  1  5.0   18.84    2.21  1.33  20.76  .32     .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    6.94  1.33  16.42  .26     .000
      [I%=26.5:S%= 5.17]
*
  *   CALIB STANDHYD     0008  1  5.0   71.94    4.32  1.33  12.27  .19     .000
      [I%=19.8:S%= 1.16]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    6.62  1.33  23.11  .36     .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .39  1.50  10.53  .17     .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.32  2.00  10.41  .16     .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    5.31  1.33  26.33  .41     .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .58  2.17   9.89  .16     .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.15  2.00  12.50  .20     .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.10  2.00  15.09  .24     .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  323.71    4.13  2.33  10.62  .17     .000
      [CN=52.5         ]
      [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.21  2.00  12.86  .20     .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    3.82  2.33  15.92  .25     .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.69  1.42   9.23  .14     .000
      [I%=14.9:S%= 2.00]
*
  *   CALIB STANDHYD     1218  1  5.0   13.50    1.92  1.33  28.84  .45     .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   76.47    1.03  3.00  14.93  .24     .000
      [CN=61.8         ]
      [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    5.80  1.33  29.91  n/a     .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  4.08   5.47  n/a     .000
```

```
    {ST=   .24 ha.m }
*
    RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .24  1.92  20.66  n/a    .000
    {ST=   .27 ha.m }
*
    CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    3.23  1.42  12.26  n/a    .000
*
    CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    5.42  1.42  23.11  n/a    .000
*
    RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .17  3.83  25.01  n/a    .000
    {ST=  1.00 ha.m }
*
    ADD [0018 + 0004]  1240  3  5.0   80.94     .62  2.17  17.48  n/a    .000
*
    CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.11  2.08  12.49  n/a    .000
*
    CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.09  2.08  15.09  n/a    .000
*
    CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    4.11  2.42  10.62  n/a    .000
*
    CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .94  2.33  12.85  n/a    .000
*
    RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .27  2.33   9.21  n/a    .000
    {ST=   .47 ha.m }
*
    RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .16  2.67  28.81  n/a    .000
    {ST=   .24 ha.m }
*
    CHANNEL[ 2 : 0011] 1211  1  5.0   76.47    1.03  3.08  14.92  n/a    .000
*
    ADD [0203 + 1201]  1202  3  5.0   63.80    7.18  1.33  28.85  n/a    .000
*
    ADD [0014 + 0017]  1231  3  5.0   40.24    2.90  1.33  22.89  n/a    .000
*
    CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .59  2.25  17.47  n/a    .000
*
    ADD [1214 + 1204]  0200  3  5.0  371.85    5.11  2.42  11.20  n/a    .000
*
    ADD [0010 + 0015]  1238  3  5.0   82.67     .43  2.42  12.41  n/a    .000
*
    ADD [1238 + 1211]  1236  3  5.0  159.14    1.44  3.00  13.62  n/a    .000
*
    ADD [0204 + 1202]  1203  3  5.0   74.69    7.19  1.33  26.23  n/a    .000
*
    ADD [0020 + 1231]  1230  3  5.0   84.51    2.91  1.33  13.76  n/a    .000
*
    ADD [0013 + 1236]  1239  3  5.0  352.15    5.05  2.50  14.88  n/a    .000
*
    RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .43  4.00  26.20  n/a    .000
    {ST=  1.59 ha.m }
*
    CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    2.12  1.42  13.76  n/a    .000
*
    CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    4.97  2.58  14.88  n/a    .000
*
    ADD [1208 + 0009]  1229  3  5.0  161.33    8.75  1.33  15.03  n/a    .000
*
    ADD [1210 + 1209]  0300  3  5.0  408.92    5.86  2.58  14.60  n/a    .000
*
    ADD [1229 + 1207]  1232  3  5.0  233.27   11.43  1.33  14.17  n/a    .000
*
    ADD [1232 + 1206]  1228  3  5.0  289.59   16.61  1.33  15.91  n/a    .000
*
    ADD [1228 + 0006]  1227  3  5.0  302.83   16.90  1.33  15.68  n/a    .000
*
    CHANNEL[ 2 : 1227] 1216  1  5.0  302.83   16.23  1.42  15.68  n/a    .000
*
    ADD [0016 + 1216]  1226  3  5.0  377.53   16.29  1.42  17.76  n/a    .000
*
    CHANNEL[ 2 : 1226] 1205  1  5.0  377.53   12.47  1.67  17.76  n/a    .000
*
    ADD [1205 + 0005]  1237  3  5.0  453.77   13.61  1.67  16.52  n/a    .000
*
    ADD [1237 + 1215]  1234  3  5.0  534.71   13.87  1.67  16.67  n/a    .000
*
    CHANNEL[ 2 : 1234] 1212  1  5.0  534.71   10.98  1.92  16.66  n/a    .000
*
    ADD [1212 + 1213]  0100  3  5.0  590.01   12.05  1.92  16.27  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                 min     ha      cms   hrs     mm           cms

    START @   .00 hrs
    --------------------
    CHIC STORM                  10.0
```

```
     [ Ptot= 45.64 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .07  2.40   5.09  .11    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .95  1.33  15.89  .35    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    3.98  1.33  19.92  .44    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .02  1.92   5.41  .12    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27    1.00  1.33   4.06  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    2.05  1.33  17.50  .38    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1219  1  5.0   18.84    1.58  1.33  14.62  .32    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    4.95  1.33  11.56  .25    .000
     [I%=26.5:S%= 5.17]
*
  *  CALIB STANDHYD     0008  1  5.0   71.94    2.71  1.42   8.64  .19    .000
     [I%=19.8:S%= 1.16]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    4.66  1.33  16.28  .36    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .18  1.50   5.14  .11    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24     .62  2.00   5.02  .11    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    3.32  1.42  18.55  .41    .000
     [I%=42.5:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .27  2.17   4.73  .10    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
  *  CALIB NASHYD       0003  1 10.0   55.30     .55  2.00   6.12  .14    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0001  1 10.0   48.14     .53  2.00   7.56  .17    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
  *  CALIB NASHYD       0002  1 10.0  323.71    1.94  2.50   5.09  .11    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
  *  CALIB NASHYD       0012  1 10.0   56.77     .59  2.00   6.37  .14    .000
     [CN=57.2         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0013  1 10.0  193.01    1.89  2.33   8.02  .18    .000
     [CN=64.2         ]
     [ N = 3.0:Tp  .80]
*
  *  CALIB STANDHYD     1000  1  5.0   69.17    1.89  1.42   6.50  .14    .000
     [I%=14.9:S%= 2.00]
*
  *  CALIB STANDHYD     1218  1  5.0   13.50    1.38  1.33  17.45  .38    .000
     [I%=40.0:S%= 2.02]
*
  *  CALIB NASHYD       0011  1 10.0   76.47     .51  3.00   7.51  .17    .000
     [CN=61.8         ]
     [ N = 3.0:Tp 1.27]
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    3.98  1.33  19.37  n/a    .000
*
     RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  4.08   3.85  n/a    .000
     {ST=   .17 ha.m }
*
     RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .11  2.33  14.52  n/a    .000
     {ST=   .21 ha.m }
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    2.16  1.50   8.64  n/a    .000
*
```

```
     CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    3.79  1.42  16.27  n/a    .000
*
     RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .04  4.25  17.59  n/a    .000
     {ST=   .72 ha.m }
*
     ADD [0018 + 0004]  1240  3  5.0   80.94     .30  2.17  11.19  n/a    .000
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .52  2.08   6.11  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .53  2.17   7.56  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71    1.93  2.50   5.09  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .42  2.42   6.36  n/a    .000
*
     RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .13  2.75   6.48  n/a    .000
     {ST=   .36 ha.m }
*
     RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .11  2.17  17.43  n/a    .000
     {ST=   .16 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .51  3.17   7.50  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    4.94  1.33  18.58  n/a    .000
*
     ADD [0014 + 0017]  1231  3  5.0   40.24    2.07  1.33  16.11  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .28  2.33  11.18  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  371.85    2.42  2.42   5.41  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .24  2.58   8.27  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .74  3.08   7.90  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    4.94  1.33  16.61  n/a    .000
*
     ADD [0020 + 1231]  1230  3  5.0   84.51    2.07  1.33   9.69  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    2.51  2.50   7.96  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .18  4.08  16.58  n/a    .000
     {ST=  1.08 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.45  1.42   9.68  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    2.45  2.67   7.96  n/a    .000
*
     ADD [1208 + 0009]  1229  3  5.0  161.33    6.15  1.33  10.58  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    2.86  2.67   7.74  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  233.27    7.37  1.33   9.98  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  289.59   10.84  1.33  11.20  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  302.83   10.96  1.33  10.94  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  302.83   10.78  1.42  10.94  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  377.53   10.82  1.42  12.05  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    7.95  1.58  12.05  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77    8.39  1.58  10.88  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71    8.44  1.58  10.93  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    6.39  1.83  10.93  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01    6.83  1.83  10.47  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   9 **
  ****************************

  W/E COMMAND             HYD ID   DT     AREA    Qpeak Tpeak    R.V. R.C.    Qbase
                                   min     ha      cms   hrs      mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                   10.0
     [ Ptot= 33.77 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .03  2.40   2.38  .07    .000
     [CN=54.3          ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .70  1.33  10.57  .31    .000
```

```
       [I%=25.0:S%= 2.00]
*
  *   CALIB STANDHYD     0201  1  5.0   47.41    2.89  1.33  13.61  .40    .000
       [I%=35.0:S%= 2.00]
*
  *   CALIB NASHYD       0202  1  5.0    1.87     .01  1.92   2.82  .08    .000
       [CN=49.0        ]
       [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27     .74  1.33   2.95  .09    .000
       [I%= 9.3:S%= 5.00]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.52  1.33  12.74  .38    .000
       [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1219  1  5.0   18.84    1.18  1.33  10.64  .32    .000
       [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    3.67  1.33   8.42  .25    .000
       [I%=26.5:S%= 5.17]
*
  *   CALIB STANDHYD     0008  1  5.0   71.94    1.99  1.42   6.29  .19    .000
       [I%=19.8:S%= 1.16]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    3.03  1.42  11.85  .35    .000
       [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .09  1.50   2.56  .08    .000
       [CN=51.9        ]
       [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .30  2.00   2.46  .07    .000
       [CN=51.4        ]
       [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    2.44  1.42  13.50  .40    .000
       [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .13  2.17   2.30  .07    .000
       [CN=50.1        ]
       [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .26  2.00   3.03  .09    .000
       [CN=57.0        ]
       [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .26  2.17   3.84  .11    .000
       [CN=62.5        ]
       [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  323.71     .92  2.50   2.47  .07    .000
       [CN=52.5        ]
       [ N = 3.0:Tp  .82]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .29  2.00   3.21  .10    .000
       [CN=57.2        ]
       [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .94  2.33   4.09  .12    .000
       [CN=64.2        ]
       [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.38  1.42   4.73  .14    .000
       [I%=14.9:S%= 2.00]
*
  *   CALIB STANDHYD     1218  1  5.0   13.50    1.03  1.33  12.71  .38    .000
       [I%=40.0:S%= 2.02]
*
  *   CALIB NASHYD       0011  1 10.0   76.47     .26  3.00   3.83  .11    .000
       [CN=61.8        ]
       [ N = 3.0:Tp 1.27]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.89  1.33  13.20  n/a    .000
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  4.08   2.80  n/a    .000
       {ST=   .13 ha.m }
*
      RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .03  3.83  10.55  n/a    .000
       {ST=   .18 ha.m }
*
      CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    1.53  1.50   6.29  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.58  1.50  11.85  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .03  4.25  12.81  n/a    .000
       {ST=   .52 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .15  2.17   7.58  n/a    .000
*
```

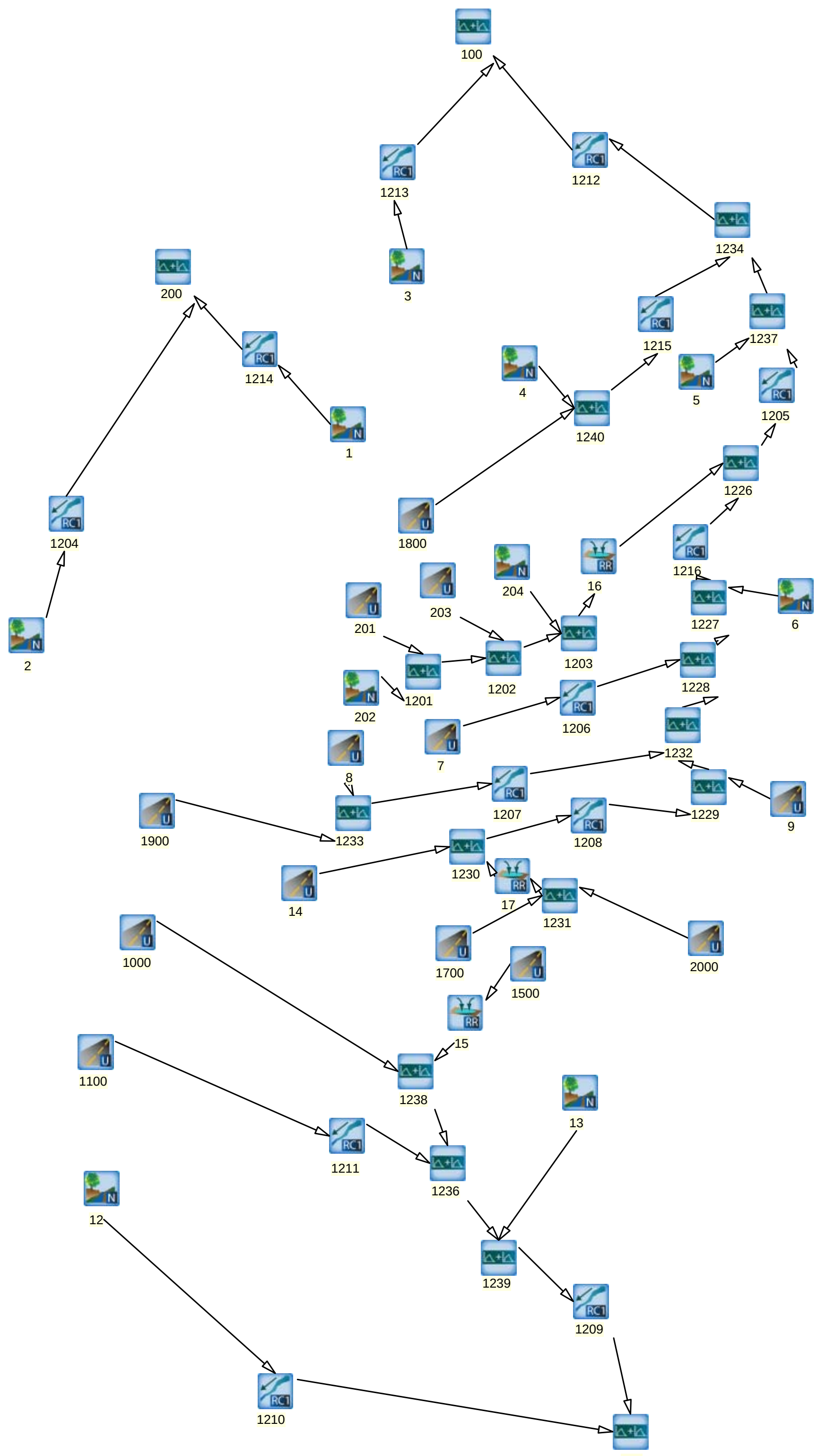
```
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .24  2.17   3.03  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .26  2.25   3.84  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71     .91  2.58   2.47  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .19  2.58   3.20  n/a    .000
*
     RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .05  4.00   4.71  n/a    .000
     {ST=   .28 ha.m }
*
     RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .08  2.17  12.68  n/a    .000
     {ST=   .12 ha.m }
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .26  3.25   3.83  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    3.59  1.33  12.60  n/a    .000
*
     ADD [0014 + 0017]  1231  3  5.0   40.24    1.53  1.33  11.71  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .14  2.50   7.57  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  371.85    1.15  2.50   2.65  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .12  2.50   6.01  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .38  3.17   4.96  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.59  1.33  11.11  n/a    .000
*
     ADD [0020 + 1231]  1230  3  5.0   84.51    1.53  1.33   7.05  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    1.25  2.50   4.48  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .07  4.25  11.08  n/a    .000
     {ST=   .75 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.03  1.42   7.05  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.21  2.83   4.48  n/a    .000
*
     ADD [1208 + 0009]  1229  3  5.0  161.33    4.47  1.33   7.70  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    1.40  2.75   4.31  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  233.27    5.26  1.33   7.26  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  289.59    7.26  1.42   8.16  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  302.83    7.33  1.42   7.91  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    7.21  1.50   7.91  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  377.53    7.25  1.50   8.54  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    5.38  1.67   8.54  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  453.77    5.62  1.67   7.52  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  534.71    5.65  1.67   7.52  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    4.20  1.83   7.52  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  590.01    4.39  1.92   7.10  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:  10 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                 10.0
     [ Ptot= 24.99 mm ]
     fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Owen-4hrC25mm.stm
     remark: 25mm - 4hr CHICAGO STORM - OWEN SOUND RAINFALL
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .01  2.53    .98  .04    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .50  1.33   7.06  .28    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    2.06  1.33   9.33  .37    .000
     [I%=35.0:S%= 2.00]
*
```

```
  ** CALIB NASHYD       0202  1  5.0    1.87     .00  2.00   1.41  .06    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .53  1.33   2.14  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    1.09  1.33   9.22  .37    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1219  1  5.0   18.84     .85  1.33   7.70  .31    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.64  1.33   6.09  .24    .000
     [I%=26.5:S%= 5.17]
*
  *  CALIB STANDHYD     0008  1  5.0   71.94    1.42  1.42   4.55  .18    .000
     [I%=19.8:S%= 1.16]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.18  1.42   8.58  .34    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .04  1.50   1.18  .05    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24     .13  2.00   1.11  .04    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    1.75  1.42   9.77  .39    .000
     [I%=42.5:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .05  2.17   1.02  .04    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
  *  CALIB NASHYD       0003  1 10.0   55.30     .12  2.00   1.38  .06    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0001  1 10.0   48.14     .12  2.17   1.80  .07    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
  *  CALIB NASHYD       0002  1 10.0  323.71     .40  2.50   1.09  .04    .000
     [CN=52.5         ]
     [ N = 3.0:Tp  .82]
*
  *  CALIB NASHYD       0012  1 10.0   56.77     .13  2.00   1.51  .06    .000
     [CN=57.2         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0013  1 10.0  193.01     .43  2.50   1.92  .08    .000
     [CN=64.2         ]
     [ N = 3.0:Tp  .80]
*
  *  CALIB STANDHYD     1000  1  5.0   69.17     .98  1.42   3.43  .14    .000
     [I%=14.9:S%= 2.00]
*
  *  CALIB STANDHYD     1218  1  5.0   13.50     .75  1.33   9.20  .37    .000
     [I%=40.0:S%= 2.02]
*
  *  CALIB NASHYD       0011  1 10.0   76.47     .12  3.17   1.82  .07    .000
     [CN=61.8         ]
     [ N = 3.0:Tp 1.27]
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    2.06  1.33   9.03  n/a    .000
*
     RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .00  4.17   2.02  n/a    .000
     {ST=   .09 ha.m }
*
     RESRVR [ 2 : 1219] 0017  1  5.0   18.84     .02  4.00   7.61  n/a    .000
     {ST=   .13 ha.m }
*
     CHANNEL[ 2 : 0008] 1207  1  5.0   71.94    1.04  1.50   4.55  n/a    .000
*
     CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.85  1.50   8.57  n/a    .000
*
     RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .02  4.25   9.27  n/a    .000
     {ST=   .38 ha.m }
*
     ADD [0018 + 0004]  1240  3  5.0   80.94     .07  2.33   5.16  n/a    .000
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .10  2.33   1.38  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .12  2.33   1.80  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  323.71     .39  2.67   1.09  n/a    .000
```

```
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .06  2.92   1.49  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .03  4.00   3.40  n/a    .000
      {ST=   .21 ha.m }
*
      RESRVR [ 2 : 1218] 0015  1  5.0   13.50     .06  2.17   9.17  n/a    .000
      {ST=   .09 ha.m }
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .12  3.25   1.81  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.56  1.33   8.58  n/a    .000
*
      ADD [0014 + 0017]  1231  3  5.0   40.24    1.10  1.33   8.47  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .06  2.83   5.16  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  371.85     .50  2.58   1.18  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .09  2.50   4.35  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14     .21  3.25   3.13  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    2.56  1.33   7.47  n/a    .000
*
      ADD [0020 + 1231]  1230  3  5.0   84.51    1.10  1.33   5.09  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15     .60  2.67   2.47  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .05  4.25   7.44  n/a    .000
      {ST=   .50 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .69  1.42   5.09  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15     .58  3.00   2.47  n/a    .000
*
      ADD [1208 + 0009]  1229  3  5.0  161.33    3.14  1.33   5.57  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92     .65  3.00   2.33  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  233.27    3.61  1.33   5.25  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  289.59    5.08  1.42   5.90  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  302.83    5.11  1.42   5.69  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  302.83    5.05  1.50   5.69  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  377.53    5.07  1.50   6.04  n/a    .000
*
      CHANNEL[ 2 : 1226] 1205  1  5.0  377.53    3.65  1.67   6.04  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  453.77    3.75  1.67   5.21  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  534.71    3.76  1.67   5.20  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  534.71    2.70  1.92   5.20  n/a    .000
*
      ADD [1212 + 1213]  0100  3  5.0  590.01    2.76  1.92   4.84  n/a    .000
*
 FINISH

==========================================================================================================
```

MDP OPTION 2 FULL DEVELOPMENT WITHOUT SWM

MDP OPTION 2 VO2 MODEL 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    TM, Version 2.1
       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
```

Developed and Distributed by Clarifica Inc.


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files\Visual OTTHYMO 2.3.1\voin.dat
  Output  filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 2 Full Development without
Addtional Controls.out
  Summary filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 2 Full Development without
Addtional Controls.sum


DATE: 31/10/2012                           TIME: 2:35:03 PM

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                 60.0
      [ Ptot=193.00 mm ]
      fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Timmins Storm.stm
      remark: Timmins Storm
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .49  7.47  84.40  .44    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  **  CALIB STANDHYD     0203  1  5.0   14.52    1.07  7.00 114.72  .59    .000
      [I%=25.0:S%= 2.00]
*
  **  CALIB STANDHYD     0201  1  5.0   47.41    3.78  7.00 126.68  .66    .000
      [I%=35.0:S%= 2.00]
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .09  7.17  78.13  .40    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.41  7.00  50.42  .26    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.03  7.00  84.27  .44    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27     .49  7.00  19.61  .10    .000
      [I%= 9.3:S%= 5.00]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84     .78  7.00  76.01  .39    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    2.00  7.00  56.39  .29    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    1.66  7.00  83.46  .43    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    2.51  7.00  71.24  .37    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .78  7.00  79.87  .41    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
```

```
*
  *   CALIB NASHYD       0005  1 10.0   76.24    3.78  7.17  80.50  .42    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.22  7.00  55.94  .29    .000
      [I%=25.0:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29    1.78  7.33  77.98  .40    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    3.12  7.17  90.95  .47    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    2.87  7.17 101.95  .53    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09   12.70  7.50  82.04  .43    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    3.22  7.17  91.85  .48    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01   10.66  7.50 105.34  .55    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.19  7.00  56.59  .29    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.01  7.00 114.62  .59    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.54  7.00  32.47  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.87  7.00 124.83  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11    1.27  7.00  36.45  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    3.66  7.00  65.69  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.50  7.00  71.24  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    2.88  7.00  66.91  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    3.07  7.25  90.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    2.87  7.25 101.95  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09   12.68  7.50  82.03  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    2.94  7.42  91.84  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .59  9.08 114.60  n/a    .000
      {ST=   .56 ha.m }
*
      CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    1.52  7.00  32.47  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    4.93  7.00 122.53  n/a    .000
*
      RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .85  7.17  36.42  n/a    .000
      {ST=   .54 ha.m }
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    3.64  7.00  65.69  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    2.80  7.08  66.91  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23   15.47  7.42  84.83  n/a    .000
*
      ADD [1000 + 0015]  1238  3  5.0   82.67    2.48  7.00  66.06  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    4.01  7.00  49.92  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    5.36  7.00 116.97  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   84.51    1.86  7.00  48.54  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15   13.56  7.17  80.29  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69    3.37  9.08 116.91  n/a    .000
      {ST=  3.68 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.81  7.08  48.53  n/a    .000
```

```
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15   13.44  7.33  80.29  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    4.22  7.00  49.43  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92   16.37  7.33  81.89  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    7.85  7.00  55.57  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   10.35  7.00  58.37  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   11.13  7.00  59.24  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   11.08  7.00  59.24  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   11.95  7.00  69.91  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   11.65  7.17  69.91  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   15.43  7.17  71.59  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   18.20  7.17  70.92  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   17.24  7.33  70.92  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   20.27  7.25  72.72  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                  10.0
     [ Ptot=105.16 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .25 13.07  29.31  .28    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .68 12.25  50.22  .48    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    2.55 12.25  58.23  .55    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .05 12.75  27.52  .26    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.25 12.08  27.23  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .99 12.08  41.37  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .48 12.00   9.59  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .73 12.08  34.56  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.83 12.08  26.82  .26    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.58 12.08  42.60  .41    .000
     [I%=41.3:S%= 1.34]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.37 12.08  38.48  .37    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .41 12.33  28.03  .27    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24    1.95 12.67  28.01  .27    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    1.13 12.08  25.79  .25    .000
     [I%=25.0:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .91 12.83  26.86  .26    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
```

```
  *   CALIB NASHYD       0003  1 10.0   55.30    1.67 12.67  32.78  .31    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.61 12.83  38.25  .36    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    6.50 13.00  28.58  .27    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74 12.67  33.35  .32    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.92 13.00  39.98  .38    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.01 12.08  27.44  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .65 12.00  43.58  .41    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.41 12.17  17.54  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.58 12.25  57.06  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11    1.20 12.00  17.05  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    3.42 12.08  32.24  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.31 12.17  38.48  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    1.71 12.42  26.32  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.64 12.83  32.77  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.60 12.92  38.25  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    6.47 13.08  28.58  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.53 13.00  33.34  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .18 13.17  43.55  n/a    .000
      {ST=   .27 ha.m }
*
      CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    1.36 12.33  17.53  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    3.26 12.25  55.50  n/a    .000
*
      RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .67 12.75  17.02  n/a    .000
      {ST=   .46 ha.m }
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    3.30 12.25  32.24  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.69 12.50  26.32  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23    8.02 13.08  29.94  n/a    .000
*
      ADD [1000 + 0015]  1238  3  5.0   82.67    2.13 12.17  30.07  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    3.45 12.25  24.05  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    3.41 12.33  51.69  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   84.51    1.49 12.17  23.18  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    8.04 12.83  32.78  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .70 14.58  51.62  n/a    .000
      {ST=  2.28 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.45 12.33  23.18  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    7.97 12.83  32.78  n/a    .000
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    3.62 12.17  25.11  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    9.48 12.92  32.86  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  259.26    6.91 12.17  27.81  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  315.58    9.22 12.17  29.71  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  328.82    9.62 12.17  29.64  n/a    .000
```

```
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    9.61 12.25  29.64  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    9.83 12.25  33.71  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    9.33 12.42  33.71  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   11.13 12.50  32.80  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   12.82 12.50  31.87  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   12.02 12.75  31.87  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   13.65 12.75  31.95  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                   10.0
     [ Ptot= 86.04 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .17 13.07  19.95  .23    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .49 12.25  38.06  .44    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41    1.95 12.25  44.94  .52    .000
     [I%=35.0:S%= 2.00]
*
  ** CALIB NASHYD       0202  1  5.0    1.87     .03 12.75  19.01  .22    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    1.82 12.08  22.19  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .80 12.08  33.70  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .39 12.08   7.82  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .59 12.08  28.15  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.48 12.17  21.85  .25    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.28 12.08  34.71  .40    .000
     [I%=41.3:S%= 1.34]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    1.92 12.08  31.35  .36    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .28 12.33  19.25  .22    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24    1.32 12.67  19.17  .22    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65     .92 12.08  21.01  .24    .000
     [I%=25.0:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .61 12.83  18.31  .21    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
  *  CALIB NASHYD       0003  1 10.0   55.30    1.14 12.67  22.67  .26    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0001  1 10.0   48.14    1.12 12.83  26.81  .31    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
  *  CALIB NASHYD       0002  1 10.0  295.09    4.39 13.00  19.54  .23    .000
     [CN=52.4         ]
     [ N = 3.0:Tp  .76]
*
```

```
  *   CALIB NASHYD       0012  1 10.0   56.77    1.19 12.67  23.15  .27    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    4.11 13.00  28.13  .33    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.62 12.17  22.35  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .53 12.00  33.62  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.14 12.17  14.29  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.98 12.25  43.96  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11     .98 12.08  13.89  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    2.74 12.17  26.27  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.87 12.17  31.34  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    1.29 12.33  19.67  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.12 12.83  22.66  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.11 12.92  26.81  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    4.37 13.17  19.54  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.03 13.08  23.14  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .14 13.08  33.59  n/a    .000
      {ST=   .22 ha.m }
*
      CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    1.10 12.33  14.28  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.47 12.25  42.61  n/a    .000
*
      RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .52 12.75  13.86  n/a    .000
      {ST=   .39 ha.m }
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    2.66 12.25  26.26  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.27 12.50  19.66  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23    5.45 13.08  20.56  n/a    .000
*
      ADD [1000 + 0015]  1238  3  5.0   82.67    1.73 12.17  24.19  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    2.81 12.25  19.43  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    2.56 12.33  39.31  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   84.51    1.17 12.25  18.88  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    5.96 12.83  24.20  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .53 14.67  39.25  n/a    .000
      {ST=  1.77 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.14 12.42  18.88  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    5.89 12.83  24.20  n/a    .000
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    2.89 12.25  20.46  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    6.90 12.92  24.05  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  259.26    5.55 12.25  22.65  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  315.58    7.41 12.25  24.20  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  328.82    7.68 12.25  24.00  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    7.66 12.25  24.00  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  403.52    7.78 12.25  26.82  n/a    .000
*
      CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    7.38 12.50  26.82  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  479.76    8.62 12.50  25.62  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  560.70    9.90 12.50  24.76  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    9.37 12.75  24.76  n/a    .000
```

```
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   10.48 12.75  24.57  n/a    .000
*
  ***************************
  ** SIMULATION NUMBER:   4 **
  ***************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                   10.0
     [ Ptot= 64.53 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .09 13.07  11.08  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .32 12.25  25.57  .40    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41    1.33 12.33  31.02  .48    .000
     [I%=35.0:S%= 2.00]
*
  ** CALIB NASHYD       0202  1  5.0    1.87     .02 12.75  10.94  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
   * CALIB STANDHYD     0009  1  5.0   76.82    1.34 12.17  16.51  .26    .000
     [I%=26.4:S%= 1.34]
*
   * CALIB STANDHYD     0014  1  5.0   21.40     .60 12.08  25.07  .39    .000
     [I%=40.1:S%= 1.16]
*
   * CALIB STANDHYD     2000  1  5.0   44.27     .29 12.08   5.82  .09    .000
     [I%= 9.3:S%= 5.00]
*
   * CALIB STANDHYD     1700  1  5.0   18.84     .44 12.08  20.95  .32    .000
     [I%=33.5:S%= 2.02]
*
   * CALIB STANDHYD     1900  1  5.0   64.29    1.09 12.17  16.26  .25    .000
     [I%=26.0:S%= 2.02]
*
   * CALIB STANDHYD     0008  1  5.0   33.64     .95 12.08  25.82  .40    .000
     [I%=41.3:S%= 1.34]
*
   * CALIB STANDHYD     0007  1  5.0   56.32    1.42 12.08  23.32  .36    .000
     [I%=37.3:S%= 1.34]
*
   * CALIB NASHYD       0006  1 10.0   13.24     .15 12.33  10.92  .17    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
   * CALIB NASHYD       0005  1 10.0   76.24     .73 12.83  10.80  .17    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
   * CALIB STANDHYD     1800  1  5.0   40.65     .68 12.17  15.63  .24    .000
     [I%=25.0:S%= 2.02]
*
   * CALIB NASHYD       0004  1 10.0   40.29     .34 12.83  10.25  .16    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
   * CALIB NASHYD       0003  1 10.0   55.30     .64 12.83  12.95  .20    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
   * CALIB NASHYD       0001  1 10.0   48.14     .64 12.83  15.62  .24    .000
     [CN=62.5         ]
     [ N = 3.0:Tp  .60]
*
   * CALIB NASHYD       0002  1 10.0  295.09    2.41 13.17  10.98  .17    .000
     [CN=52.4         ]
     [ N = 3.0:Tp  .76]
*
   * CALIB NASHYD       0012  1 10.0   56.77     .68 12.83  13.32  .21    .000
     [CN=57.2         ]
     [ N = 3.0:Tp  .50]
*
   * CALIB NASHYD       0013  1 10.0  193.01    2.37 13.17  16.47  .26    .000
     [CN=64.2         ]
     [ N = 3.0:Tp  .80]
*
   * CALIB STANDHYD     1000  1  5.0   69.17    1.19 12.17  16.63  .26    .000
     [I%=26.6:S%= 2.02]
*
   * CALIB STANDHYD     1500  1  5.0   13.50     .39 12.00  25.01  .39    .000
```

```
       [I%=40.0:S%= 2.02]
*
  *    CALIB STANDHYD      1100  1  5.0   76.47     .84 12.17  10.63  .16    .000
       [I%=17.0:S%= 2.02]
*
       ADD [0201 + 0202]  1201  3  5.0   49.28    1.35 12.33  30.26  n/a    .000
*
       ADD [2000 + 1700]  1231  3  5.0   63.11     .73 12.08  10.33  n/a    .000
*
       ADD [1900 + 0008]  1233  3  5.0   97.93    2.03 12.17  19.54  n/a    .000
*
       CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.38 12.25  23.32  n/a    .000
*
       ADD [1800 + 0004]  1240  3  5.0   80.94     .89 12.33  12.96  n/a    .000
*
       CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .63 12.92  12.95  n/a    .000
*
       CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .63 12.92  15.62  n/a    .000
*
       CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    2.41 13.17  10.98  n/a    .000
*
       CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .56 13.17  13.31  n/a    .000
*
       RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11 13.08  24.98  n/a    .000
       {ST=   .16 ha.m }
*
       CHANNEL[ 2 : 1100] 1211  1  5.0   76.47     .81 12.33  10.63  n/a    .000
*
       ADD [0203 + 1201]  1202  3  5.0   63.80    1.67 12.33  29.19  n/a    .000
*
       RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .35 12.83  10.30  n/a    .000
       {ST=   .32 ha.m }
*
       CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.96 12.25  19.54  n/a    .000
*
       CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .86 12.50  12.95  n/a    .000
*
       ADD [1214 + 1204]  0200  3  5.0  343.23    3.02 13.08  11.63  n/a    .000
*
       ADD [1000 + 0015]  1238  3  5.0   82.67    1.27 12.25  18.00  n/a    .000
*
       ADD [1238 + 1211]  1236  3  5.0  159.14    2.07 12.25  14.46  n/a    .000
*
       ADD [0204 + 1202]  1203  3  5.0   74.69    1.72 12.33  26.55  n/a    .000
*
       ADD [0014 + 0017]  1230  3  5.0   84.51     .81 12.25  14.04  n/a    .000
*
       ADD [0013 + 1236]  1239  3  5.0  352.15    3.80 12.67  15.56  n/a    .000
*
       RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .25 15.33  26.49  n/a    .000
       {ST=  1.28 ha.m }
*
       CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .79 12.42  14.04  n/a    .000
*
       CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    3.73 12.83  15.56  n/a    .000
*
       ADD [0009 + 1208]  1229  3  5.0  161.33    2.08 12.25  15.22  n/a    .000
*
       ADD [1210 + 1209]  0300  3  5.0  408.92    4.25 12.92  15.25  n/a    .000
*
       ADD [1229 + 1207]  1232  3  5.0  259.26    4.03 12.25  16.85  n/a    .000
*
       ADD [1232 + 1206]  1228  3  5.0  315.58    5.42 12.25  18.01  n/a    .000
*
       ADD [1228 + 0006]  1227  3  5.0  328.82    5.57 12.25  17.72  n/a    .000
*
       CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    5.55 12.33  17.72  n/a    .000
*
       ADD [0016 + 1216]  1226  3  5.0  403.52    5.62 12.33  19.34  n/a    .000
*
       CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    5.28 12.50  19.34  n/a    .000
*
       ADD [1205 + 0005]  1237  3  5.0  479.76    5.96 12.50  17.98  n/a    .000
*
       ADD [1237 + 1215]  1234  3  5.0  560.70    6.82 12.50  17.26  n/a    .000
*
       CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    6.39 12.75  17.26  n/a    .000
*
       ADD [1212 + 1213]  0100  3  5.0  616.00    7.00 12.75  16.87  n/a    .000
*
  ***************************
  ** SIMULATION NUMBER:   5 **
  ***************************

  W/E COMMAND              HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha      cms   hrs     mm           cms

       START @   .00 hrs
       --------------------
```

```
      MASS STORM                   10.0
      [ Ptot= 50.19 mm ]
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .05 13.20   6.36  .13    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  **  CALIB STANDHYD     0203  1  5.0   14.52     .23 12.17  18.10  .36    .000
      [I%=25.0:S%= 2.00]
*
  **  CALIB STANDHYD     0201  1  5.0   47.41     .95 12.33  22.48  .45    .000
      [I%=35.0:S%= 2.00]
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .01 12.75   6.60  .13    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
   *  CALIB STANDHYD     0009  1  5.0   76.82    1.02 12.17  12.72  .25    .000
      [I%=26.4:S%= 1.34]
*
   *  CALIB STANDHYD     0014  1  5.0   21.40     .46 12.08  19.32  .39    .000
      [I%=40.1:S%= 1.16]
*
   *  CALIB STANDHYD     2000  1  5.0   44.27     .22 12.08   4.48  .09    .000
      [I%= 9.3:S%= 5.00]
*
   *  CALIB STANDHYD     1700  1  5.0   18.84     .34 12.08  16.14  .32    .000
      [I%=33.5:S%= 2.02]
*
   *  CALIB STANDHYD     1900  1  5.0   64.29     .83 12.25  12.53  .25    .000
      [I%=26.0:S%= 2.02]
*
   *  CALIB STANDHYD     0008  1  5.0   33.64     .73 12.08  19.90  .40    .000
      [I%=41.3:S%= 1.34]
*
   *  CALIB STANDHYD     0007  1  5.0   56.32    1.08 12.17  17.97  .36    .000
      [I%=37.3:S%= 1.34]
*
   *  CALIB NASHYD       0006  1 10.0   13.24     .09 12.33   6.45  .13    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
   *  CALIB NASHYD       0005  1 10.0   76.24     .42 12.83   6.33  .13    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
   *  CALIB STANDHYD     1800  1  5.0   40.65     .52 12.17  12.05  .24    .000
      [I%=25.0:S%= 2.02]
*
   *  CALIB NASHYD       0004  1 10.0   40.29     .19 13.00   5.98  .12    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
   *  CALIB NASHYD       0003  1 10.0   55.30     .37 12.83   7.67  .15    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
   *  CALIB NASHYD       0001  1 10.0   48.14     .38 12.83   9.42  .19    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
   *  CALIB NASHYD       0002  1 10.0  295.09    1.38 13.17   6.41  .13    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
   *  CALIB NASHYD       0012  1 10.0   56.77     .40 12.83   7.96  .16    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
   *  CALIB NASHYD       0013  1 10.0  193.01    1.41 13.17   9.97  .20    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
   *  CALIB STANDHYD     1000  1  5.0   69.17     .91 12.25  12.82  .26    .000
      [I%=26.6:S%= 2.02]
*
   *  CALIB STANDHYD     1500  1  5.0   13.50     .30 12.00  19.28  .38    .000
      [I%=40.0:S%= 2.02]
*
   *  CALIB STANDHYD     1100  1  5.0   76.47     .64 12.25   8.19  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28     .96 12.33  21.88  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11     .56 12.08   7.96  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    1.56 12.17  15.06  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.05 12.33  17.97  n/a    .000
```

```
*
     ADD [1800 + 0004]  1240  3  5.0   80.94     .63 12.33   9.02  n/a    .000
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .36 12.92   7.67  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .37 13.00   9.41  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    1.37 13.25   6.41  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .31 13.25   7.95  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08 13.17  19.25  n/a    .000
     {ST=   .13 ha.m }
*
     CHANNEL[ 2 : 1100] 1211  1  5.0   76.47     .62 12.42   8.19  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    1.18 12.25  21.02  n/a    .000
*
     RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .24 13.00   7.94  n/a    .000
     {ST=   .27 ha.m }
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.50 12.33  15.06  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .61 12.50   9.02  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    1.73 13.17   6.83  n/a    .000
*
     ADD [1000 + 0015]  1238  3  5.0   82.67     .98 12.25  13.87  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.58 12.33  11.14  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    1.20 12.33  18.88  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   84.51     .56 12.33  10.82  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    2.55 12.67  10.50  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .15 16.50  18.83  n/a    .000
     {ST=   .96 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .55 12.50  10.82  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    2.50 12.83  10.50  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    1.53 12.33  11.72  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    2.76 12.92  10.14  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    3.02 12.33  12.98  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    4.08 12.33  13.87  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    4.17 12.33  13.58  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    4.15 12.33  13.58  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    4.20 12.33  14.55  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    3.93 12.58  14.55  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    4.33 12.58  13.24  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    4.94 12.58  12.63  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    4.58 12.83  12.63  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    4.93 12.83  12.19  n/a    .000
*
  ***************************
  ** SIMULATION NUMBER:   6 **
  ***************************

  W/E COMMAND              HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                    min    ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                    10.0
     [ Ptot= 77.31 mm ]
*
  **  CALIB NASHYD      0204  1  8.0   10.89     .22  2.27  16.12  .21    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *   CALIB STANDHYD    0203  1  5.0   14.52    1.68  1.33  32.83  .42    .000
     [I%=25.0:S%= 2.00]
*
  *   CALIB STANDHYD    0201  1  5.0   47.41    6.79  1.33  39.15  .51    .000
     [I%=35.0:S%= 2.00]
```

```
*
  *   CALIB NASHYD       0202  1  5.0    1.87     .05  1.92  15.53  .20    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    7.68  1.33  19.88  .26    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    3.59  1.33  31.63  .41    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.75  1.33   7.00  .09    .000
      [I%= 9.3:S%= 5.00]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    2.64  1.33  28.09  .36    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    6.17  1.33  20.96  .27    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    5.64  1.33  31.52  .41    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    8.29  1.33  28.09  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .57  1.50  15.36  .20    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.92  1.83  15.26  .20    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    3.92  1.33  20.61  .27    .000
      [I%=25.0:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .84  2.00  14.54  .19    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.65  1.83  18.15  .24    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.56  2.00  21.64  .28    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    5.73  2.33  15.55  .20    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74  1.83  18.58  .24    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.41  2.33  22.75  .30    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    6.73  1.33  21.13  .27    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    2.39  1.33  37.62  .49    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    4.71  1.33  12.80  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    6.80  1.33  38.25  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11    4.39  1.33  13.30  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93   11.81  1.33  24.59  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    6.68  1.42  28.09  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    4.07  1.33  17.59  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.61  2.00  18.15  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.55  2.08  21.64  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    5.72  2.33  15.55  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.39  2.33  18.57  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .21  2.83  37.59  n/a    .000
```

```
     {ST=   .32 ha.m }
*
     CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    3.67  1.42  12.80  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    8.48  1.33  37.01  n/a    .000
*
     RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .72  1.75  13.27  n/a    .000
     {ST=   .48 ha.m }
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    9.31  1.42  24.59  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    3.08  1.42  17.59  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    7.18  2.25  16.40  n/a    .000
*
     ADD [1000 + 0015]  1238  3  5.0   82.67    6.84  1.33  23.82  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14   10.01  1.33  18.52  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    8.50  1.33  33.97  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   84.51    3.90  1.33  17.92  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15   10.64  1.33  20.84  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .61  4.00  33.93  n/a    .000
     {ST=  1.99 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    2.88  1.42  17.92  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    8.73  1.50  20.84  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33   10.09  1.33  18.85  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    8.90  1.50  20.52  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   18.37  1.33  21.02  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   25.01  1.33  22.28  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   25.45  1.33  22.00  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   23.86  1.42  22.00  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   23.94  1.42  24.21  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   17.52  1.75  24.21  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   19.33  1.75  22.79  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   21.12  1.75  22.04  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   16.32  1.92  22.04  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   17.89  1.92  21.69  n/a    .000
*
  ***************************
  ** SIMULATION NUMBER:   7 **
  ***************************

  W/E COMMAND              HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha      cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                    10.0
     [ Ptot= 63.96 mm ]
*
  **  CALIB NASHYD      0204  1  8.0   10.89     .15  2.27  10.87  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52    1.31  1.33  25.26  .39    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    5.32  1.33  30.67  .48    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .03  1.92  10.75  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    6.11  1.33  16.36  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    2.88  1.33  24.85  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27    1.40  1.33   5.76  .09    .000
```

```
      [I%= 9.3:S%= 5.00]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    2.12  1.33  20.76  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    4.39  1.42  16.11  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    4.52  1.33  25.59  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    6.62  1.33  23.11  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .39  1.50  10.53  .17    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.32  2.00  10.41  .16    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    3.13  1.33  15.49  .24    .000
      [I%=25.0:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .58  2.17   9.89  .16    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.15  2.00  12.50  .20    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.10  2.00  15.09  .24    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    3.96  2.33  10.59  .17    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.21  2.00  12.86  .20    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    3.82  2.33  15.92  .25    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    4.80  1.42  16.48  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.92  1.33  28.84  .45    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    3.36  1.42  10.53  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    5.33  1.33  29.91  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11    3.52  1.33  10.24  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    8.71  1.33  19.37  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    5.42  1.42  23.11  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    3.22  1.33  12.70  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.11  2.08  12.49  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.09  2.08  15.09  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    3.93  2.33  10.59  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .94  2.33  12.85  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .16  2.67  28.81  n/a    .000
      {ST=   .24 ha.m }
*
      CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    2.81  1.50  10.53  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    6.64  1.33  28.85  n/a    .000
*
      RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .56  1.83  10.21  n/a    .000
      {ST=   .41 ha.m }
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    7.15  1.42  19.36  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    2.44  1.42  12.70  n/a    .000
```

```
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    4.97  2.33  11.22  n/a    .000
*
     ADD [1000 + 0015]  1238  3  5.0   82.67    4.91  1.42  18.49  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    7.58  1.42  14.67  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    6.65  1.33  26.23  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   84.51    3.06  1.33  13.92  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    8.37  1.42  15.35  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .43  4.00  26.20  n/a    .000
     {ST=  1.59 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    2.26  1.42  13.92  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    7.03  1.58  15.35  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    7.97  1.33  15.08  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    7.22  1.58  15.00  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   13.80  1.42  16.70  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   19.22  1.42  17.84  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   19.56  1.42  17.55  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   20.05  1.50  17.55  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   20.12  1.50  19.15  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   14.68  1.75  19.15  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   15.91  1.75  17.76  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   17.37  1.75  17.03  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   13.44  1.92  17.03  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   14.51  1.92  16.62  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha      cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 45.64 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .07  2.40   5.09  .11    .000
     [CN=54.3          ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .89  1.33  15.89  .35    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    3.31  1.42  19.92  .44    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .02  1.92   5.41  .12    .000
     [CN=49.0          ]
     [ N = 3.0:Tp  .48]
*
 *   CALIB STANDHYD     0009  1  5.0   76.82    3.84  1.42  11.52  .25    .000
     [I%=26.4:S%= 1.34]
*
 *   CALIB STANDHYD     0014  1  5.0   21.40    2.05  1.33  17.50  .38    .000
     [I%=40.1:S%= 1.16]
*
 *   CALIB STANDHYD     2000  1  5.0   44.27    1.00  1.33   4.06  .09    .000
     [I%= 9.3:S%= 5.00]
*
 *   CALIB STANDHYD     1700  1  5.0   18.84    1.51  1.33  14.62  .32    .000
     [I%=33.5:S%= 2.02]
*
 *   CALIB STANDHYD     1900  1  5.0   64.29    3.09  1.42  11.35  .25    .000
     [I%=26.0:S%= 2.02]
*
 *   CALIB STANDHYD     0008  1  5.0   33.64    3.20  1.33  18.02  .39    .000
     [I%=41.3:S%= 1.34]
*
 *   CALIB STANDHYD     0007  1  5.0   56.32    4.66  1.33  16.28  .36    .000
```

```
     [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .18  1.50   5.14  .11    .000
     [CN=51.9          ]
     [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .62  2.00   5.02  .11    .000
     [CN=51.4          ]
     [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.95  1.42  10.91  .24    .000
     [I%=25.0:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .27  2.17   4.73  .10    .000
     [CN=50.1          ]
     [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .55  2.00   6.12  .14    .000
     [CN=57.0          ]
     [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .53  2.00   7.56  .17    .000
     [CN=62.5          ]
     [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    1.86  2.33   5.07  .11    .000
     [CN=52.4          ]
     [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .59  2.00   6.37  .14    .000
     [CN=57.2          ]
     [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    1.89  2.33   8.02  .18    .000
     [CN=64.2          ]
     [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    3.38  1.42  11.61  .25    .000
     [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.38  1.33  17.45  .38    .000
     [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    2.36  1.42   7.42  .16    .000
     [I%=17.0:S%= 2.02]
*
     ADD [0201 + 0202]  1201  3  5.0   49.28    3.32  1.42  19.37  n/a    .000
*
     ADD [2000 + 1700]  1231  3  5.0   63.11    2.51  1.33   7.21  n/a    .000
*
     ADD [1900 + 0008]  1233  3  5.0   97.93    6.09  1.33  13.64  n/a    .000
*
     CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    3.79  1.42  16.27  n/a    .000
*
     ADD [1800 + 0004]  1240  3  5.0   80.94    2.03  1.42   7.83  n/a    .000
*
     CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .52  2.08   6.11  n/a    .000
*
     CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .53  2.17   7.56  n/a    .000
*
     CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    1.84  2.42   5.07  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .42  2.42   6.36  n/a    .000
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11  2.17  17.43  n/a    .000
     {ST=   .16 ha.m }
*
     CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    1.94  1.50   7.42  n/a    .000
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    3.98  1.33  18.58  n/a    .000
*
     RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .32  1.92   7.18  n/a    .000
     {ST=   .30 ha.m }
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    4.84  1.42  13.64  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.62  1.50   7.83  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    2.34  2.33   5.42  n/a    .000
*
     ADD [1000 + 0015]  1238  3  5.0   82.67    3.46  1.42  12.56  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    5.23  1.42  10.09  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.98  1.33  16.61  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   84.51    2.07  1.33   9.79  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    5.58  1.42   8.95  n/a    .000
```

```
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .18  4.17  16.58  n/a    .000
     {ST=  1.08 ha.m }
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.48  1.42   9.79  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    4.50  1.58   8.95  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    5.32  1.42  10.62  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    4.56  1.58   8.59  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   10.16  1.42  11.76  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   13.95  1.42  12.56  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   14.11  1.42  12.26  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   13.31  1.50  12.26  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   13.36  1.50  13.06  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   10.85  1.67  13.06  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   11.37  1.67  11.79  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   12.66  1.67  11.22  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    9.75  1.92  11.22  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   10.23  1.92  10.76  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha      cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                 10.0
     [ Ptot= 32.66 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .03  2.40   2.17  .07    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .62  1.33  10.10  .31    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    2.26  1.42  13.04  .40    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .01  2.00   2.62  .08    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.70  1.42   8.09  .25    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    1.46  1.33  12.29  .38    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .71  1.33   2.85  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84    1.07  1.33  10.27  .31    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    2.17  1.42   7.97  .24    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    2.26  1.33  12.66  .39    .000
     [I%=41.3:S%= 1.34]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.92  1.42  11.43  .35    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .08  1.50   2.36  .07    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24     .27  2.00   2.26  .07    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    1.38  1.42   7.66  .23    .000
     [I%=25.0:S%= 2.02]
```

```
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .12  2.17   2.11  .07    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .24  2.00   2.79  .09    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .24  2.17   3.54  .11    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09     .80  2.33   2.26  .07    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .27  2.00   2.97  .09    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .86  2.33   3.77  .12    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.37  1.42   8.15  .25    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .99  1.33  12.26  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.66  1.42   5.21  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.26  1.42  12.65  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11    1.79  1.33   5.07  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    4.26  1.33   9.58  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.49  1.50  11.43  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    1.41  1.42   4.90  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .22  2.25   2.79  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .24  2.25   3.54  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09     .79  2.50   2.26  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .17  2.58   2.96  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08  2.17  12.23  n/a    .000
      {ST=   .12 ha.m }
*
      CHANNEL[ 2 : 1100] 1211  1  5.0   76.47    1.32  1.50   5.21  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.71  1.33  12.07  n/a    .000
*
      RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .16  2.17   5.04  n/a    .000
      {ST=   .23 ha.m }
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    3.30  1.50   9.58  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.09  1.50   4.90  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23    1.02  2.42   2.44  n/a    .000
*
      ADD [1000 + 0015]  1238  3  5.0   82.67    2.42  1.42   8.82  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    3.58  1.42   7.09  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    2.72  1.33  10.63  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   84.51    1.47  1.33   6.87  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    3.72  1.42   5.27  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .07  4.42  10.59  n/a    .000
      {ST=   .72 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .99  1.42   6.87  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    2.89  1.58   5.27  n/a    .000
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    3.69  1.42   7.45  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    2.92  1.67   4.95  n/a    .000
*
```

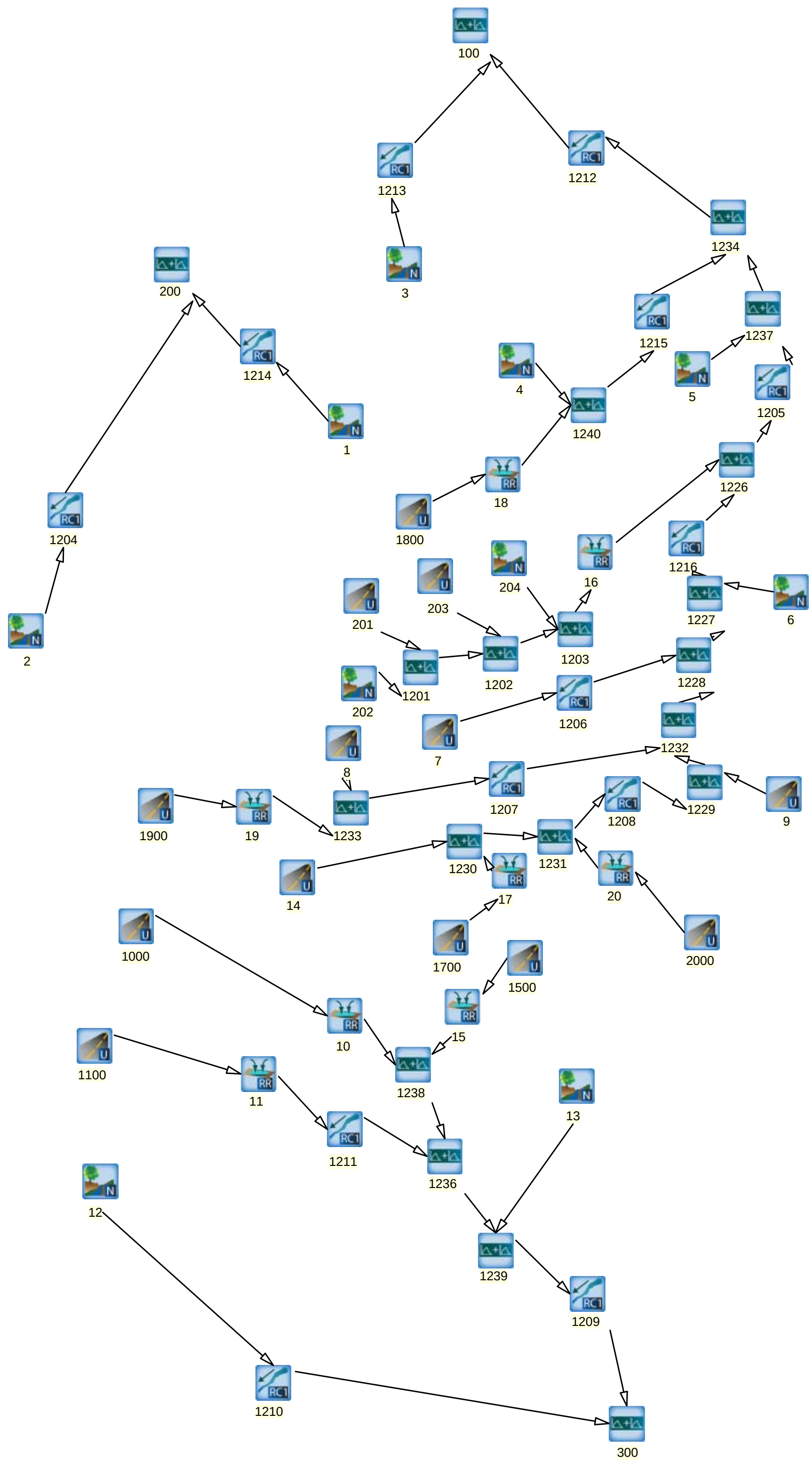
```
     ADD [1229 + 1207]  1232  3  5.0  259.26    6.96  1.42   8.26  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    9.41  1.42   8.82  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    9.48  1.42   8.56  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    9.27  1.50   8.56  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    9.30  1.50   8.94  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    6.81  1.67   8.94  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    7.02  1.67   7.88  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    7.92  1.67   7.45  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    5.99  1.83   7.45  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    6.15  1.83   7.03  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:  10 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     READ STORM                 10.0
     [ Ptot= 24.99 mm ]
     fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Owen-4hrC25mm.stm
     remark: 25mm - 4hr CHICAGO STORM - OWEN SOUND RAINFALL
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .01  2.53    .98  .04    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .46  1.33   7.06  .28    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    1.66  1.42   9.33  .37    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .00  2.00   1.41  .06    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.01  1.42   6.07  .24    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    1.09  1.33   9.22  .37    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .53  1.33   2.14  .09    .000
     [I%= 9.3:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .80  1.33   7.70  .31    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.61  1.42   5.98  .24    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.49  1.42   9.50  .38    .000
     [I%=41.3:S%= 1.34]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.18  1.42   8.58  .34    .000
     [I%=37.3:S%= 1.34]
*
  *  CALIB NASHYD       0006  1 10.0   13.24     .04  1.50   1.18  .05    .000
     [CN=51.9         ]
     [ N = 3.0:Tp  .20]
*
  *  CALIB NASHYD       0005  1 10.0   76.24     .13  2.00   1.11  .04    .000
     [CN=51.4         ]
     [ N = 3.0:Tp  .49]
*
  *  CALIB STANDHYD     1800  1  5.0   40.65    1.03  1.42   5.75  .23    .000
     [I%=25.0:S%= 2.02]
*
  *  CALIB NASHYD       0004  1 10.0   40.29     .05  2.17   1.02  .04    .000
     [CN=50.1         ]
     [ N = 3.0:Tp  .61]
*
  *  CALIB NASHYD       0003  1 10.0   55.30     .12  2.00   1.38  .06    .000
     [CN=57.0         ]
     [ N = 3.0:Tp  .50]
*
  *  CALIB NASHYD       0001  1 10.0   48.14     .12  2.17   1.80  .07    .000
```

```
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09     .38  2.50   1.09  .04    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .13  2.00   1.51  .06    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .43  2.50   1.92  .08    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.75  1.42   6.12  .24    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .75  1.33   9.20  .37    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.11  1.50   3.91  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.66  1.42   9.03  n/a    .000
*
      ADD [2000 + 1700]  1231  3  5.0   63.11    1.33  1.33   3.80  n/a    .000
*
      ADD [1900 + 0008]  1233  3  5.0   97.93    3.10  1.42   7.19  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.85  1.50   8.57  n/a    .000
*
      ADD [1800 + 0004]  1240  3  5.0   80.94    1.04  1.42   3.39  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .10  2.33   1.38  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .12  2.33   1.80  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09     .37  2.58   1.09  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .06  2.92   1.49  n/a    .000
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .06  2.17   9.17  n/a    .000
      {ST=   .09 ha.m }
*
      CHANNEL[ 2 : 1100] 1211  1  5.0   76.47     .90  1.58   3.91  n/a    .000
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.99  1.42   8.58  n/a    .000
*
      RESRVR [ 2 : 1231] 0017  1  5.0   63.11     .07  2.67   3.77  n/a    .000
      {ST=   .19 ha.m }
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    2.47  1.50   7.18  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .77  1.50   3.39  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23     .48  2.50   1.19  n/a    .000
*
      ADD [1000 + 0015]  1238  3  5.0   82.67    1.79  1.42   6.61  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14    2.33  1.42   5.31  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    1.99  1.42   7.47  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   84.51    1.10  1.33   5.15  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    2.40  1.50   3.45  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .05  4.33   7.44  n/a    .000
      {ST=   .50 ha.m }
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .69  1.42   5.15  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.95  1.67   3.45  n/a    .000
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    2.70  1.42   5.59  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    1.96  1.67   3.18  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  259.26    4.85  1.42   6.19  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  315.58    6.63  1.50   6.62  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  328.82    6.67  1.50   6.40  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    6.61  1.50   6.40  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  403.52    6.64  1.50   6.59  n/a    .000
*
```

```
      CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    4.78  1.67   6.59  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  479.76    4.87  1.67   5.72  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  560.70    5.54  1.67   5.38  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    4.09  1.92   5.38  n/a    .000
*
      ADD [1212 + 1213]  0100  3  5.0  616.00    4.15  1.92   5.02  n/a    .000
*
 FINISH
==========================================================================================================
```

MDP OPTION 3 FULL DEVELOPMENT WITH LOCAL/REGIONAL SWMFs

MDP OPTION 3 VO2 MODEL 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    TM, Version 2.1
       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

Developed and Distributed by Clarifica Inc.
Copyright 1996, 2007 Clarifica Inc.
All rights reserved.


                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files\Visual OTTHYMO 2.3.1\voin.dat
  Output  filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 3 Full Development with Local and
Regional SWMFs.
  Summary filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 3 Full Development with Local and
Regional SWMFs.


DATE: 27/11/2012                           TIME: 3:27:29 PM

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak  Tpeak   R.V.  R.C.   Qbase
                                   min    ha     cms    hrs     mm           cms

      START @   .00 hrs
      --------------------
      READ STORM                 60.0
      [ Ptot=193.00 mm ]
      fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Timmins Storm.stm
      remark: Timmins Storm
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .49  7.47  84.40  .44    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  **  CALIB STANDHYD     0203  1  5.0   14.52    1.07  7.00 114.72  .59    .000
      [I%=25.0:S%= 2.00]
*
  **  CALIB STANDHYD     0201  1  5.0   47.41    3.78  7.00 126.68  .66    .000
      [I%=35.0:S%= 2.00]
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .09  7.17  78.13  .40    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.41  7.00  50.42  .26    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.03  7.00  84.27  .44    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84     .78  7.00  76.01  .39    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.29  7.00  63.73  .33    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    2.00  7.00  56.39  .29    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    1.66  7.00  83.46  .43    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    2.51  7.00  71.24  .37    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .78  7.00  79.87  .41    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
```

```
*
  *   CALIB NASHYD       0005  1 10.0   76.24    3.78  7.17  80.50  .42    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    2.06  7.00  81.17  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29    1.78  7.33  77.98  .40    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    3.12  7.17  90.95  .47    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    2.87  7.17 101.95  .53    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09   12.70  7.50  82.04  .43    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    3.22  7.17  91.85  .48    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01   10.66  7.50 105.34  .55    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.19  7.00  56.59  .29    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.01  7.00 114.62  .59    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.54  7.00  32.47  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.87  7.00 124.83  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .53  7.17  75.98  n/a    .000
      {ST=   .37 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .19 12.42  45.69  n/a    .000
      {ST=  2.49 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .26 12.33  56.38  n/a    .000
      {ST=  2.83 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.81  7.00  65.68  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.50  7.00  71.24  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .25 12.17  80.46  n/a    .000
      {ST=  2.75 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    1.92  7.33  79.23  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    3.07  7.25  90.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    2.87  7.25 101.95  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09   12.68  7.50  82.03  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    2.94  7.42  91.84  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17    1.42  7.25  56.57  n/a    .000
      {ST=  1.21 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .59  9.08 114.60  n/a    .000
      {ST=   .56 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .81  7.58  32.45  n/a    .000
      {ST=   .87 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    4.93  7.00 122.53  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   40.24    1.54  7.00  80.39  n/a    .000
*
      ADD [1230 + 0020]  1231  3  5.0   84.51    1.56  7.00  62.21  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.80  7.00  65.68  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.89  7.42  79.22  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23   15.47  7.42  84.83  n/a    .000
```

```
*
     ADD [0010 + 0015]  1238  3  5.0   82.67    1.84  9.00  66.05  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .80  7.83  32.45  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    5.36  7.00 116.97  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51    1.52  7.00  62.19  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    2.64  9.08  49.90  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69    3.37  9.08 116.91  n/a    .000
     {ST=  3.68 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    3.93  7.00  56.59  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15   13.28  7.50  80.29  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    5.73  7.00  60.02  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15   13.19  7.58  80.29  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    8.23  7.00  62.02  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92   16.07  7.58  81.89  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    9.01  7.00  62.74  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    8.97  7.00  62.74  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    9.83  7.00  72.77  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    9.61  7.08  72.75  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   13.34  7.08  73.98  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   15.11  7.17  74.74  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   14.29  7.33  74.72  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   17.32  7.33  76.18  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha    cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     MASS STORM                  10.0
     [ Ptot=105.16 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .25 13.07  29.31  .28    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .68 12.25  50.22  .48    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    2.55 12.25  58.23  .55    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .05 12.75  27.52  .26    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.25 12.08  27.23  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .99 12.08  41.37  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .73 12.08  34.56  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27    1.20 12.00  23.83  .23    .000
     [I%=23.1:S%= 5.00]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.83 12.08  26.82  .26    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.58 12.08  42.60  .41    .000
     [I%=41.3:S%= 1.34]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.37 12.08  38.48  .37    .000
     [I%=37.3:S%= 1.34]
*
```

```
  *   CALIB NASHYD       0006  1 10.0   13.24     .41 12.33  28.03  .27    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.95 12.67  28.01  .27    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.93 12.08  43.84  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .91 12.83  26.86  .26    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.67 12.67  32.78  .31    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.61 12.83  38.25  .36    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    6.50 13.00  28.58  .27    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74 12.67  33.35  .32    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.92 13.00  39.98  .38    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.01 12.08  27.44  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .65 12.00  43.58  .41    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.41 12.17  17.54  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.58 12.25  57.06  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .35 12.83  34.53  n/a    .000
      {ST=   .29 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 24.08  11.80  n/a    .000
      {ST=  1.00 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .13 16.50  26.80  n/a    .000
      {ST=  1.21 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.67 12.08  32.23  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.31 12.17  38.48  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .09 17.25  43.30  n/a    .000
      {ST=  1.35 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    1.00 12.83  35.12  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.64 12.83  32.77  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.60 12.92  38.25  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    6.47 13.08  28.58  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.53 13.00  33.34  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .89 13.00  27.42  n/a    .000
      {ST=   .98 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .18 13.17  43.55  n/a    .000
      {ST=   .27 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .54 13.17  17.52  n/a    .000
      {ST=   .68 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    3.26 12.25  55.50  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   40.24    1.17 12.17  38.17  n/a    .000
*
      ADD [1230 + 0020]  1231  3  5.0   84.51    1.18 12.17  24.35  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.60 12.25  32.23  n/a    .000
*
```

```
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .98 13.00  35.11  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    8.02 13.08  29.94  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67    1.06 13.00  30.06  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .53 13.33  17.52  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.41 12.33  51.69  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51    1.14 12.33  24.34  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.57 13.08  24.03  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .70 14.58  51.62  n/a    .000
     {ST=  2.28 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    3.33 12.17  25.72  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    7.49 13.00  32.77  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    4.92 12.17  28.18  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    7.41 13.17  32.77  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    7.23 12.17  30.02  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    8.92 13.17  32.85  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    7.63 12.17  29.94  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    7.61 12.25  29.93  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    7.83 12.25  33.95  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    7.41 12.42  33.94  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    9.23 12.50  33.00  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    9.99 12.50  33.30  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    9.55 12.75  33.29  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   11.18 12.75  33.24  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak    R.V. R.C.    Qbase
                                 min     ha     cms   hrs      mm           cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot= 86.04 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .17 13.07  19.95  .23    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .49 12.25  38.06  .44    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    1.95 12.25  44.94  .52    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .03 12.75  19.01  .22    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    1.82 12.08  22.19  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .80 12.08  33.70  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .59 12.08  28.15  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .96 12.08  19.41  .23    .000
     [I%=23.1:S%= 5.00]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.48 12.17  21.85  .25    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.28 12.08  34.71  .40    .000
     [I%=41.3:S%= 1.34]
*
```

```
  *   CALIB STANDHYD     0007  1  5.0   56.32    1.92 12.08  31.35  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .28 12.33  19.25  .22    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.32 12.67  19.17  .22    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.56 12.08  35.72  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .61 12.83  18.31  .21    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.14 12.67  22.67  .26    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.12 12.83  26.81  .31    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    4.39 13.00  19.54  .23    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.19 12.67  23.15  .27    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    4.11 13.00  28.13  .33    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.62 12.17  22.35  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .53 12.00  33.62  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.14 12.17  14.29  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.98 12.25  43.96  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .26 12.92  28.12  n/a    .000
      {ST=   .25 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 24.17   9.23  n/a    .000
      {ST=   .82 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .11 16.33  21.83  n/a    .000
      {ST=   .97 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.37 12.08  26.26  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.87 12.17  31.34  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .09 17.08  35.25  n/a    .000
      {ST=  1.08 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .69 12.83  26.82  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.12 12.83  22.66  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.11 12.92  26.81  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    4.37 13.17  19.54  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.03 13.08  23.14  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .46 13.42  22.34  n/a    .000
      {ST=   .86 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .14 13.08  33.59  n/a    .000
      {ST=   .22 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .41 13.25  14.27  n/a    .000
      {ST=   .57 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.47 12.25  42.61  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   40.24     .90 12.25  31.09  n/a    .000
*
      ADD [1230 + 0020]  1231  3  5.0   84.51     .90 12.25  19.64  n/a    .000
```

```
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.30 12.25  26.26  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .68 13.00  26.82  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    5.45 13.08  20.56  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .61 13.42  24.18  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .40 13.50  14.27  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    2.56 12.33  39.33  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51     .88 12.33  19.62  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.01 13.42  19.42  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .53 14.67  39.26  n/a    .000
     {ST=  1.77 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    2.65 12.17  20.84  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    5.10 13.17  24.19  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    3.94 12.17  22.89  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    5.04 13.25  24.19  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    5.81 12.17  24.40  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    6.04 13.25  24.04  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    6.08 12.17  24.19  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    6.08 12.25  24.19  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    6.20 12.25  26.98  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    5.84 12.42  26.97  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    7.08 12.50  25.75  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    7.60 12.50  25.90  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    7.16 12.75  25.89  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    8.27 12.75  25.60  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha     cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     MASS STORM                   10.0
     [ Ptot= 64.53 mm ]
*
  **  CALIB NASHYD      0204  1  8.0   10.89     .09 13.07  11.08  .17    .000
     [CN=54.3        ]
     [ N = 3.0:Tp  .73]
*
  **  CALIB STANDHYD    0203  1  5.0   14.52     .32 12.25  25.57  .40    .000
     [I%=25.0:S%= 2.00]
*
  **  CALIB STANDHYD    0201  1  5.0   47.41    1.33 12.33  31.02  .48    .000
     [I%=35.0:S%= 2.00]
*
  **  CALIB NASHYD      0202  1  5.0    1.87     .02 12.75  10.94  .17    .000
     [CN=49.0        ]
     [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD    0009  1  5.0   76.82    1.34 12.17  16.51  .26    .000
     [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD    0014  1  5.0   21.40     .60 12.08  25.07  .39    .000
     [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD    1700  1  5.0   18.84     .44 12.08  20.95  .32    .000
     [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD    2000  1  5.0   44.27     .72 12.08  14.44  .22    .000
     [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD    1900  1  5.0   64.29    1.09 12.17  16.26  .25    .000
     [I%=26.0:S%= 2.02]
*
```

```
  *   CALIB STANDHYD     0008  1  5.0   33.64     .95 12.08  25.82  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    1.42 12.08  23.32  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .15 12.33  10.92  .17    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .73 12.83  10.80  .17    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.15 12.17  26.58  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .34 12.83  10.25  .16    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .64 12.83  12.95  .20    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .64 12.83  15.62  .24    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    2.41 13.17  10.98  .17    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .68 12.83  13.32  .21    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    2.37 13.17  16.47  .26    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.19 12.17  16.63  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .39 12.00  25.01  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47     .84 12.17  10.63  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.35 12.33  30.26  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .15 13.08  20.92  n/a    .000
      {ST=   .20 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 24.17   6.77  n/a    .000
      {ST=   .61 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .10 15.17  16.24  n/a    .000
      {ST=   .71 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.02 12.08  19.53  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.38 12.25  23.32  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .08 16.75  26.19  n/a    .000
      {ST=   .79 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .41 13.00  18.26  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .63 12.92  12.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .63 12.92  15.62  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    2.41 13.17  10.98  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .56 13.17  13.31  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .30 13.67  16.62  n/a    .000
      {ST=   .67 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11 13.08  24.98  n/a    .000
      {ST=   .16 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .27 13.42  10.61  n/a    .000
      {ST=   .45 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.67 12.33  29.19  n/a    .000
*
```

```
    ADD [0014 + 0017]  1230  3  5.0   40.24     .65 12.08  23.13  n/a    .000
*
    ADD [1230 + 0020]  1231  3  5.0   84.51     .65 12.08  14.56  n/a    .000
*
    CHANNEL[ 2 : 1233] 1207  1  5.0   97.93     .97 12.25  19.53  n/a    .000
*
    CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .40 13.08  18.26  n/a    .000
*
    ADD [1214 + 1204]  0200  3  5.0  343.23    3.02 13.08  11.63  n/a    .000
*
    ADD [0010 + 0015]  1238  3  5.0   82.67     .41 13.58  17.98  n/a    .000
*
    CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .27 13.58  10.61  n/a    .000
*
    ADD [0204 + 1202]  1203  3  5.0   74.69    1.72 12.33  26.55  n/a    .000
*
    CHANNEL[ 2 : 1231] 1208  1  5.0   84.51     .62 12.25  14.55  n/a    .000
*
    ADD [1238 + 1211]  1236  3  5.0  159.14     .67 13.58  14.44  n/a    .000
*
    RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .25 15.33  26.49  n/a    .000
    {ST=  1.28 ha.m }
*
    ADD [0009 + 1208]  1229  3  5.0  161.33    1.94 12.17  15.48  n/a    .000
*
    ADD [0013 + 1236]  1239  3  5.0  352.15    3.02 13.17  15.56  n/a    .000
*
    ADD [1229 + 1207]  1232  3  5.0  259.26    2.92 12.25  17.01  n/a    .000
*
    CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    2.96 13.33  15.56  n/a    .000
*
    ADD [1232 + 1206]  1228  3  5.0  315.58    4.30 12.25  18.14  n/a    .000
*
    ADD [1210 + 1209]  0300  3  5.0  408.92    3.50 13.33  15.25  n/a    .000
*
    ADD [1228 + 0006]  1227  3  5.0  328.82    4.45 12.25  17.85  n/a    .000
*
    CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    4.42 12.33  17.85  n/a    .000
*
    ADD [0016 + 1216]  1226  3  5.0  403.52    4.48 12.33  19.45  n/a    .000
*
    CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    4.20 12.50  19.44  n/a    .000
*
    ADD [1205 + 0005]  1237  3  5.0  479.76    4.88 12.50  18.07  n/a    .000
*
    ADD [1237 + 1215]  1234  3  5.0  560.70    5.18 12.58  18.09  n/a    .000
*
    CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    4.82 12.83  18.09  n/a    .000
*
    ADD [1212 + 1213]  0100  3  5.0  616.00    5.44 12.83  17.63  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   5 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha     cms   hrs     mm           cms

    START @   .00 hrs
    --------------------
    MASS STORM                  10.0
    [ Ptot= 50.19 mm ]
*
 ** CALIB NASHYD       0204  1  8.0   10.89     .05 13.20   6.36  .13    .000
    [CN=54.3         ]
    [ N = 3.0:Tp  .73]
*
 ** CALIB STANDHYD     0203  1  5.0   14.52     .23 12.17  18.10  .36    .000
    [I%=25.0:S%= 2.00]
*
 ** CALIB STANDHYD     0201  1  5.0   47.41     .95 12.33  22.48  .45    .000
    [I%=35.0:S%= 2.00]
*
 ** CALIB NASHYD       0202  1  5.0    1.87     .01 12.75   6.60  .13    .000
    [CN=49.0         ]
    [ N = 3.0:Tp  .48]
*
 *  CALIB STANDHYD     0009  1  5.0   76.82    1.02 12.17  12.72  .25    .000
    [I%=26.4:S%= 1.34]
*
 *  CALIB STANDHYD     0014  1  5.0   21.40     .46 12.08  19.32  .39    .000
    [I%=40.1:S%= 1.16]
*
 *  CALIB STANDHYD     1700  1  5.0   18.84     .34 12.08  16.14  .32    .000
    [I%=33.5:S%= 2.02]
*
 *  CALIB STANDHYD     2000  1  5.0   44.27     .55 12.08  11.13  .22    .000
    [I%=23.1:S%= 5.00]
*
```

```
  *   CALIB STANDHYD     1900  1  5.0   64.29     .83 12.25  12.53  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64     .73 12.08  19.90  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    1.08 12.17  17.97  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .09 12.33   6.45  .13    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .42 12.83   6.33  .13    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65     .88 12.17  20.48  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .19 13.00   5.98  .12    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .37 12.83   7.67  .15    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .38 12.83   9.42  .19    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    1.38 13.17   6.41  .13    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .40 12.83   7.96  .16    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    1.41 13.17   9.97  .20    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17     .91 12.25  12.82  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .30 12.00  19.28  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47     .64 12.25   8.19  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28     .96 12.33  21.88  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .07 13.67  16.11  n/a    .000
      {ST=   .17 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01 24.25   5.22  n/a    .000
      {ST=   .47 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .09 14.92  12.51  n/a    .000
      {ST=   .54 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93     .79 12.08  15.05  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.05 12.33  17.97  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .07 16.25  20.15  n/a    .000
      {ST=   .60 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .26 13.00  13.09  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .36 12.92   7.67  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .37 13.00   9.41  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    1.37 13.25   6.41  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .31 13.25   7.95  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .19 13.92  12.80  n/a    .000
      {ST=   .54 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08 13.17  19.25  n/a    .000
      {ST=   .13 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .18 13.67   8.18  n/a    .000
      {ST=   .37 ha.m }
```

```
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    1.18 12.25  21.02  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   40.24     .50 12.08  17.82  n/a    .000
*
     ADD [1230 + 0020]  1231  3  5.0   84.51     .50 12.08  11.22  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93     .75 12.33  15.05  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .25 13.17  13.09  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    1.73 13.17   6.83  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .27 13.75  13.85  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .17 13.92   8.17  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    1.20 12.33  18.88  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51     .48 12.33  11.21  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .45 13.83  11.13  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .15 16.50  18.83  n/a    .000
     {ST=   .96 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    1.49 12.25  11.93  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    1.81 13.17  10.49  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    2.24 12.25  13.11  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.77 13.42  10.49  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    3.30 12.25  13.98  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    2.07 13.42  10.14  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    3.38 12.25  13.67  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    3.37 12.33  13.67  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    3.42 12.33  14.63  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    3.16 12.58  14.62  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    3.56 12.58  13.30  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    3.75 12.58  13.27  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    3.45 12.83  13.27  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    3.81 12.83  12.77  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha      cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 77.31 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .22  2.27  16.12  .21    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52    1.68  1.33  32.83  .42    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    6.79  1.33  39.15  .51    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .05  1.92  15.53  .20    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    7.68  1.33  19.88  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    3.59  1.33  31.63  .41    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84    2.64  1.33  28.09  .36    .000
     [I%=33.5:S%= 2.02]
*
```

```
  *   CALIB STANDHYD     2000  1  5.0   44.27    4.34  1.33  19.96  .26    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    6.17  1.33  20.96  .27    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    5.64  1.33  31.52  .41    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    8.29  1.33  28.09  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .57  1.50  15.36  .20    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.92  1.83  15.26  .20    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    6.67  1.33  32.01  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .84  2.00  14.54  .19    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.65  1.83  18.15  .24    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.56  2.00  21.64  .28    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    5.73  2.33  15.55  .20    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74  1.83  18.58  .24    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.41  2.33  22.75  .30    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    6.73  1.33  21.13  .27    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    2.39  1.33  37.62  .49    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    4.71  1.33  12.80  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    6.80  1.33  38.25  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .38  1.83  28.06  n/a    .000
      {ST=   .30 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  9.92   9.99  n/a    .000
      {ST=   .84 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .13  4.08  20.94  n/a    .000
      {ST=  1.15 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    5.72  1.33  24.58  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    6.68  1.42  28.09  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .09  4.08  31.65  n/a    .000
      {ST=  1.21 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .92  2.00  23.13  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.61  2.00  18.15  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.55  2.08  21.64  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    5.72  2.33  15.55  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.39  2.33  18.57  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .79  2.08  21.11  n/a    .000
      {ST=   .96 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .21  2.83  37.59  n/a    .000
      {ST=   .32 ha.m }
```

```
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .52  2.08  12.79  n/a    .000
     {ST=   .66 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    8.48  1.33  37.01  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   40.24    3.68  1.33  29.96  n/a    .000
*
     ADD [1230 + 0020]  1231  3  5.0   84.51    3.68  1.33  19.50  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    4.22  1.42  24.58  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .89  2.25  23.13  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    7.18  2.25  16.40  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .99  2.08  23.80  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .51  2.33  12.79  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    8.50  1.33  33.97  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51    2.71  1.42  19.48  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.49  2.17  18.51  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .61  4.00  33.93  n/a    .000
     {ST=  1.99 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33   10.04  1.33  19.67  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    6.87  2.33  20.83  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   13.76  1.33  21.53  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    6.76  2.42  20.83  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   20.39  1.33  22.70  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    8.13  2.42  20.52  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   20.84  1.33  22.40  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   19.41  1.50  22.40  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   19.55  1.50  24.53  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   15.19  1.67  24.53  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   16.90  1.67  23.05  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   17.36  1.67  23.06  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   13.38  2.08  23.06  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   14.98  2.08  22.62  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   7 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 63.96 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .15  2.27  10.87  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52    1.31  1.33  25.26  .39    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    5.32  1.33  30.67  .48    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .03  1.92  10.75  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    6.11  1.33  16.36  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40    2.88  1.33  24.84  .39    .000
     [I%=40.1:S%= 1.16]
*
```

```
  *   CALIB STANDHYD     1700  1  5.0   18.84    2.12  1.33  20.76  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    3.49  1.33  14.31  .22    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    4.39  1.42  16.11  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    4.52  1.33  25.59  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    6.62  1.33  23.11  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .39  1.50  10.53  .17    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.32  2.00  10.41  .16    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    5.31  1.33  26.33  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .58  2.17   9.89  .16    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.15  2.00  12.50  .20    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.10  2.00  15.09  .24    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    3.96  2.33  10.59  .17    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.21  2.00  12.86  .20    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    3.82  2.33  15.92  .25    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    4.80  1.42  16.48  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.92  1.33  28.84  .45    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    3.36  1.42  10.53  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    5.33  1.33  29.91  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .28  1.92  20.73  n/a    .000
      {ST=   .26 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  4.17   7.05  n/a    .000
      {ST=   .63 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .11  4.08  16.09  n/a    .000
      {ST=   .92 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    4.58  1.33  19.35  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    5.42  1.42  23.11  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .08  4.08  26.02  n/a    .000
      {ST=   .99 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .65  2.17  17.99  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.11  2.08  12.49  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.09  2.08  15.09  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    3.93  2.33  10.59  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .94  2.33  12.85  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .45  2.42  16.46  n/a    .000
      {ST=   .84 ha.m }
```

```
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .16  2.67  28.81  n/a    .000
     {ST=   .24 ha.m }
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .40  2.25  10.52  n/a    .000
     {ST=   .56 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    6.64  1.33  28.85  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   40.24    2.95  1.33  22.92  n/a    .000
*
     ADD [1230 + 0020]  1231  3  5.0   84.51    2.95  1.33  14.61  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    3.38  1.42  19.35  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .63  2.25  17.98  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    4.96  2.33  11.22  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .61  2.50  18.48  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .39  2.50  10.52  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    6.65  1.33  26.23  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51    2.15  1.42  14.60  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.00  2.50  14.65  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .43  4.00  26.20  n/a    .000
     {ST=  1.59 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    7.96  1.33  15.43  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    4.82  2.33  15.35  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   10.86  1.33  16.91  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    4.72  2.50  15.35  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   16.05  1.33  18.02  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    5.63  2.50  15.00  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   16.33  1.33  17.72  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   16.17  1.42  17.72  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   16.23  1.42  19.29  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   12.18  1.67  19.28  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   13.33  1.67  17.87  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   13.62  1.67  17.89  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   10.87  2.00  17.88  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   11.98  2.00  17.40  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

 W/E COMMAND              HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha      cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 45.63 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .07  2.40   5.09  .11    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .89  1.33  15.89  .35    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    3.31  1.42  19.92  .44    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .02  1.92   5.41  .12    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
 *   CALIB STANDHYD     0009  1  5.0   76.82    3.84  1.42  11.52  .25    .000
     [I%=26.4:S%= 1.34]
*
```

```
  *   CALIB STANDHYD     0014  1  5.0   21.40    2.05  1.33  17.50  .38    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    1.51  1.33  14.62  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    2.49  1.33  10.08  .22    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    3.09  1.42  11.34  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    3.20  1.33  18.02  .39    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    4.66  1.33  16.28  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .18  1.50   5.14  .11    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .62  2.00   5.02  .11    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    3.32  1.42  18.54  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .27  2.17   4.73  .10    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .55  2.00   6.12  .14    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .53  2.00   7.56  .17    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    1.86  2.33   5.07  .11    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .59  2.00   6.37  .14    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    1.89  2.33   8.02  .18    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    3.38  1.42  11.61  .25    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.38  1.33  17.45  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    2.36  1.42   7.42  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.32  1.42  19.37  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .13  2.17  14.59  n/a    .000
      {ST=   .20 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .01  4.25   4.97  n/a    .000
      {ST=   .44 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .09  4.08  11.33  n/a    .000
      {ST=   .63 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    3.24  1.33  13.63  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    3.79  1.42  16.27  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .07  4.08  18.28  n/a    .000
      {ST=   .68 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .34  2.17  11.54  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .52  2.08   6.11  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .53  2.17   7.56  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    1.84  2.42   5.07  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .42  2.42   6.36  n/a    .000
```

```
*
     RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .26  2.67  11.59  n/a    .000
     {ST=   .61 ha.m }
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11  2.17  17.43  n/a    .000
     {ST=   .16 ha.m }
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .23  2.42   7.40  n/a    .000
     {ST=   .42 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    3.98  1.33  18.58  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   40.24    2.10  1.33  16.14  n/a    .000
*
     ADD [1230 + 0020]  1231  3  5.0   84.51    2.10  1.33  10.28  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    2.33  1.42  13.63  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .32  2.33  11.54  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    2.34  2.33   5.42  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .36  2.58  12.54  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .23  2.75   7.40  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.98  1.33  16.61  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51    1.48  1.42  10.28  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .59  2.67  10.07  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .18  4.17  16.58  n/a    .000
     {ST=  1.08 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    5.31  1.42  10.87  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    2.46  2.33   8.95  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    7.64  1.42  11.91  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    2.40  2.58   8.95  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   11.43  1.42  12.69  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    2.81  2.58   8.59  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   11.58  1.42  12.38  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   10.97  1.42  12.38  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   11.01  1.42  13.16  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    8.22  1.58  13.16  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    8.66  1.58  11.88  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    8.73  1.58  11.83  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    6.58  1.83  11.83  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    7.01  1.83  11.31  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   9 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak   R.V. R.C.    Qbase
                                 min     ha      cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                 10.0
     [ Ptot= 33.77 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .03  2.40   2.38  .07    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .65  1.33  10.57  .31    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    2.35  1.42  13.61  .40    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .01  1.92   2.82  .08    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
```

```
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.81  1.42   8.39  .25    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.52  1.33  12.74  .38    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    1.11  1.33  10.64  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.84  1.33   7.34  .22    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    2.26  1.42   8.26  .24    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    2.35  1.33  13.12  .39    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    3.03  1.42  11.85  .35    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .09  1.50   2.56  .08    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .30  2.00   2.46  .07    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    2.44  1.42  13.50  .40    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .13  2.17   2.30  .07    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .26  2.00   3.03  .09    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .26  2.17   3.84  .11    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09     .88  2.33   2.46  .07    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .29  2.00   3.21  .10    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .94  2.33   4.09  .12    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.46  1.42   8.45  .25    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.03  1.33  12.71  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.72  1.42   5.40  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.36  1.42  13.20  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .06  2.50  10.61  n/a    .000
      {ST=   .15 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .00  4.25   3.62  n/a    .000
      {ST=   .32 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .08  4.00   8.24  n/a    .000
      {ST=   .45 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    2.37  1.33   9.92  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.58  1.50  11.85  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .07  4.08  13.28  n/a    .000
      {ST=   .48 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .19  2.17   7.81  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .24  2.17   3.03  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .26  2.25   3.84  n/a    .000
*
```

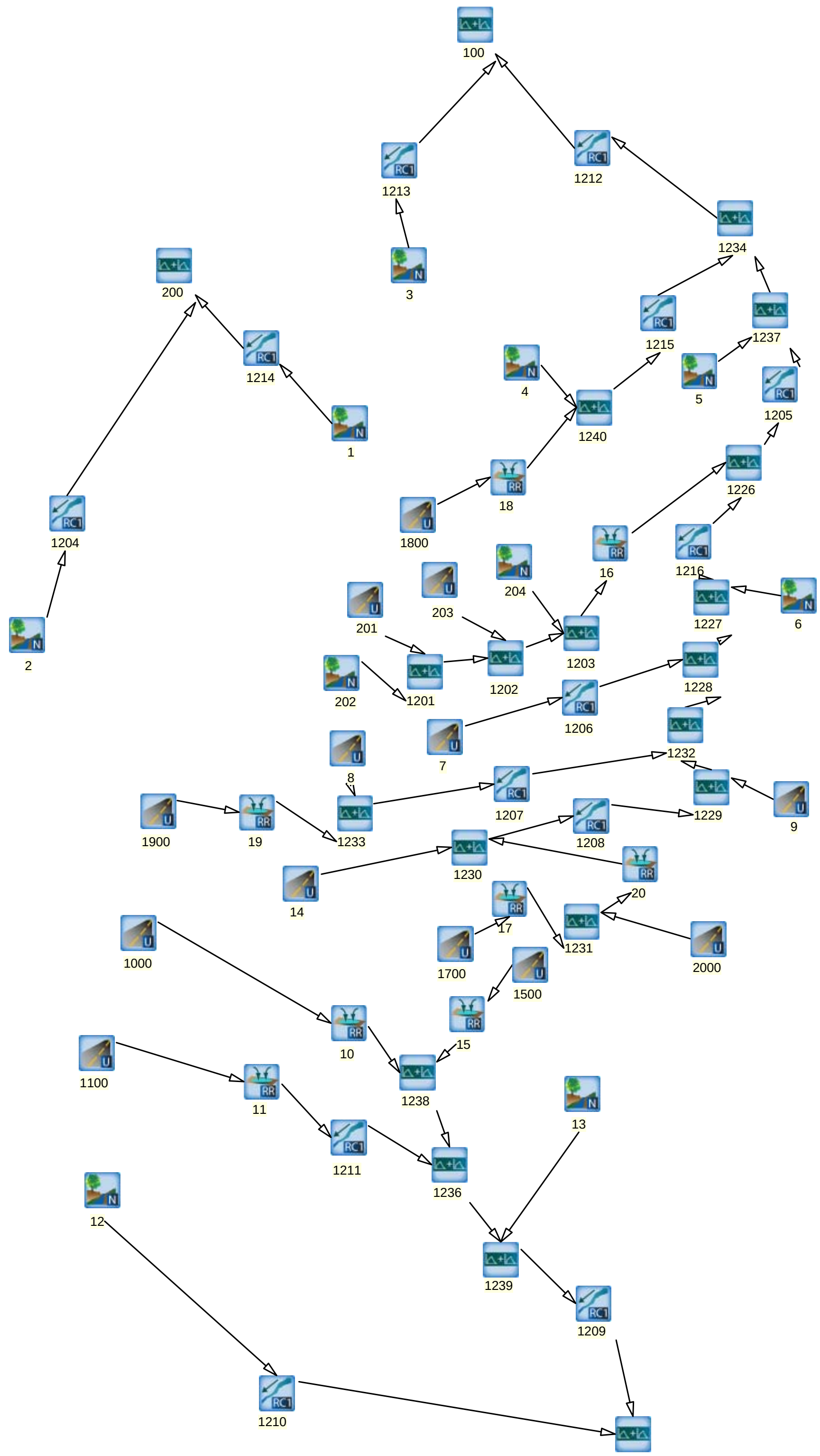
```
     CHANNEL[ 2 : 0002] 1204  1  5.0  295.09     .87  2.50   2.46  n/a    .000
*
     CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .19  2.58   3.20  n/a    .000
*
     RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .14  3.08   8.44  n/a    .000
     {ST=   .47 ha.m }
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08  2.17  12.68  n/a    .000
     {ST=   .12 ha.m }
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .13  2.75   5.38  n/a    .000
     {ST=   .32 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    2.83  1.33  12.60  n/a    .000
*
     ADD [0014 + 0017]  1230  3  5.0   40.24    1.55  1.33  11.74  n/a    .000
*
     ADD [1230 + 0020]  1231  3  5.0   84.51    1.55  1.33   7.49  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.65  1.42   9.92  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .18  2.50   7.81  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    1.12  2.42   2.65  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .21  2.83   9.13  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .12  3.00   5.38  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    2.83  1.33  11.11  n/a    .000
*
     CHANNEL[ 2 : 1231] 1208  1  5.0   84.51    1.05  1.42   7.48  n/a    .000
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .34  2.92   7.33  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .07  4.33  11.08  n/a    .000
     {ST=   .75 ha.m }
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    3.86  1.42   7.91  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    1.26  2.50   5.55  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    5.51  1.42   8.67  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.21  2.75   5.55  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    8.07  1.42   9.24  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    1.40  2.75   5.23  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    8.14  1.42   8.97  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    7.83  1.50   8.97  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    7.87  1.50   9.36  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    5.60  1.67   9.36  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    5.84  1.67   8.26  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    5.89  1.67   8.20  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    4.33  1.92   8.19  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    4.53  1.92   7.73  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:  10 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA    Qpeak Tpeak    R.V. R.C.    Qbase
                                 min     ha      cms   hrs      mm           cms

     START @   .00 hrs
     --------------------
     READ STORM                 10.0
     [ Ptot= 24.99 mm ]
     fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Owen-4hrC25mm.stm
     remark: 25mm - 4hr CHICAGO STORM - OWEN SOUND RAINFALL
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .01  2.53    .98  .04    .000
     [CN=54.3          ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .46  1.33   7.06  .28    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    1.66  1.42   9.33  .37    .000
     [I%=35.0:S%= 2.00]
```

```
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .00  2.00   1.41  .06    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.01  1.42   6.07  .24    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.09  1.33   9.22  .37    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84     .80  1.33   7.70  .31    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.33  1.33   5.31  .21    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    1.61  1.42   5.98  .24    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    1.49  1.42   9.50  .38    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    2.18  1.42   8.58  .34    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .04  1.50   1.18  .05    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .13  2.00   1.11  .04    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.75  1.42   9.77  .39    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .05  2.17   1.02  .04    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .12  2.00   1.38  .06    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .12  2.17   1.80  .07    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09     .38  2.50   1.09  .04    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .13  2.00   1.51  .06    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .43  2.50   1.92  .08    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.75  1.42   6.12  .24    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .75  1.33   9.20  .37    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.11  1.50   3.91  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.66  1.42   9.03  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .05  2.50   7.67  n/a    .000
      {ST=   .11 ha.m }
*
      RESRVR [ 2 : 2000] 0020  1  5.0   44.27     .00  4.25   2.62  n/a    .000
      {ST=   .23 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .07  3.67   5.96  n/a    .000
      {ST=   .32 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.52  1.42   7.18  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.85  1.50   8.57  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .06  4.00   9.57  n/a    .000
      {ST=   .34 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .11  2.33   5.31  n/a    .000
```

```
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .10  2.33   1.38  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .12  2.33   1.80  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09     .37  2.58   1.09  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .06  2.92   1.49  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .08  3.50   6.10  n/a    .000
      {ST=   .35 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .06  2.17   9.17  n/a    .000
      {ST=   .09 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .05  3.83   3.89  n/a    .000
      {ST=   .25 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.99  1.42   8.58  n/a    .000
*
      ADD [0014 + 0017]  1230  3  5.0   40.24    1.11  1.33   8.50  n/a    .000
*
      ADD [1230 + 0020]  1231  3  5.0   84.51    1.11  1.33   5.42  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.12  1.50   7.17  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .11  2.58   5.31  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23     .48  2.50   1.19  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .13  2.67   6.60  n/a    .000
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .05  4.17   3.89  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    1.99  1.42   7.47  n/a    .000
*
      CHANNEL[ 2 : 1231] 1208  1  5.0   84.51     .70  1.42   5.41  n/a    .000
*
      ADD [1238 + 1211]  1236  3  5.0  159.14     .18  3.50   5.30  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .05  4.33   7.44  n/a    .000
      {ST=   .50 ha.m }
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    2.71  1.42   5.73  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15     .60  2.50   3.45  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  259.26    3.65  1.42   6.27  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15     .57  2.83   3.45  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  315.58    5.41  1.42   6.68  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92     .64  2.83   3.18  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  328.82    5.44  1.42   6.46  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    5.32  1.50   6.46  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  403.52    5.35  1.50   6.64  n/a    .000
*
      CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    3.73  1.67   6.64  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  479.76    3.82  1.67   5.76  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  560.70    3.85  1.67   5.70  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    2.78  2.00   5.69  n/a    .000
*
      ADD [1212 + 1213]  0100  3  5.0  616.00    2.85  2.00   5.31  n/a    .000
*
 FINISH

=============================================================================================================
```

MDP OPTION 4 SWMFs WITH CONSOLIDATION OF SWMF 2 & PROPOSED SWMF C

MDP OPTION 4 VO2 MODEL 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    TM, Version 2.1
       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

Developed and Distributed by Clarifica Inc.
Copyright 1996, 2007 Clarifica Inc.
All rights reserved.


                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files\Visual OTTHYMO 2.3.1\voin.dat
  Output  filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 4 Common SWMFs With Connection of
Ex. SWMF 2 & Pr
  Summary filename: T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model_WithChecks\Option 4 Common SWMFs With Connection of
Ex. SWMF 2 & Pr


DATE: 27/11/2012                           TIME: 3:30:42 PM

USER:


COMMENTS: ____________________________________________________________


  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha     cms   hrs     mm          cms

      START @   .00 hrs
      --------------------
      READ STORM                  60.0
      [ Ptot=193.00 mm ]
      fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Timmins Storm.stm
      remark: Timmins Storm
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .49  7.47  84.40  .44    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
  **  CALIB STANDHYD     0203  1  5.0   14.52    1.09  7.00 114.72  .59    .000
      [I%=25.0:S%= 2.00]
*
  **  CALIB STANDHYD     0201  1  5.0   47.41    3.87  7.00 126.68  .66    .000
      [I%=35.0:S%= 2.00]
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .09  7.17  78.13  .40    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
   *  CALIB STANDHYD     0009  1  5.0   76.82    2.42  7.00  50.42  .26    .000
      [I%=26.4:S%= 1.34]
*
   *  CALIB STANDHYD     2000  1  5.0   44.27    1.29  7.00  63.73  .33    .000
      [I%=23.1:S%= 5.00]
*
   *  CALIB STANDHYD     1700  1  5.0   18.84     .78  7.00  76.01  .39    .000
      [I%=33.5:S%= 2.02]
*
   *  CALIB STANDHYD     0014  1  5.0   21.40    1.03  7.00  84.27  .44    .000
      [I%=40.1:S%= 1.16]
*
   *  CALIB STANDHYD     1900  1  5.0   64.29    2.00  7.00  56.39  .29    .000
      [I%=26.0:S%= 2.02]
*
   *  CALIB STANDHYD     0008  1  5.0   33.64    1.66  7.00  83.46  .43    .000
      [I%=41.3:S%= 1.34]
*
   *  CALIB STANDHYD     0007  1  5.0   56.32    2.51  7.00  71.24  .37    .000
      [I%=37.3:S%= 1.34]
*
   *  CALIB NASHYD       0006  1 10.0   13.24     .78  7.00  79.87  .41    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
```

```
*
  *   CALIB NASHYD       0005  1 10.0   76.24    3.78  7.17  80.50  .42    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    2.06  7.00  81.17  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29    1.78  7.33  77.98  .40    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    3.12  7.17  90.95  .47    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    2.87  7.17 101.95  .53    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09   12.70  7.50  82.04  .43    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    3.22  7.17  91.85  .48    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01   10.66  7.50 105.34  .55    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.19  7.00  56.59  .29    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.01  7.00 114.62  .59    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.54  7.00  32.47  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.95  7.00 124.83  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .52  7.08  75.92  n/a    .000
      {ST=   .41 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .39 12.17  56.36  n/a    .000
      {ST=  2.60 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.89  7.00  65.67  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.50  7.00  71.24  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .37 12.00  81.15  n/a    .000
      {ST=  2.46 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    2.04  7.33  79.57  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    3.07  7.25  90.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    2.87  7.25 101.95  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09   12.68  7.50  82.03  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    2.94  7.42  91.84  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17    1.24  7.42  56.47  n/a    .000
      {ST=  1.13 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .59  9.08 114.60  n/a    .000
      {ST=   .56 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .86  7.50  32.46  n/a    .000
      {ST=   .89 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    5.04  7.00 122.53  n/a    .000
*
      ADD [2000 + 0017]  1231  3  5.0   63.11    1.80  7.00  67.37  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.87  7.00  65.67  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    2.01  7.42  79.57  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23   15.47  7.42  84.83  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67    1.79  9.08  65.96  n/a    .000
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .85  7.67  32.45  n/a    .000
*
```

```
     ADD [0204 + 1202]  1203  3  5.0   74.69    5.47  7.00 116.97  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .45 12.33  67.33  n/a    .000
     {ST=  2.98 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    2.61  9.08  49.86  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69    3.38  9.08 116.91  n/a    .000
     {ST=  3.68 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51    1.22  7.00  71.62  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15   13.18  7.50  80.27  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.20  7.00  71.61  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15   13.09  7.58  80.27  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    3.61  7.00  61.52  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92   15.97  7.58  81.87  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    5.48  7.00  63.09  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    7.98  7.00  64.54  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    8.76  7.00  65.16  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    8.73  7.00  65.16  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    9.67  7.08  74.74  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    9.45  7.08  74.74  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   13.21  7.17  75.65  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   15.13  7.17  76.22  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   14.31  7.33  76.22  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   17.34  7.33  77.54  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   2 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                 10.0
     [ Ptot=105.16 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .25 13.07  29.31  .28    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .67 12.33  50.22  .48    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    2.65 12.25  58.23  .55    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .05 12.75  27.52  .26    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    2.26 12.08  27.23  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27    1.20 12.00  23.83  .23    .000
     [I%=23.1:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .75 12.00  34.56  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .99 12.08  41.37  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.83 12.08  26.82  .26    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.59 12.08  42.60  .41    .000
     [I%=41.3:S%= 1.34]
*
  *  CALIB STANDHYD     0007  1  5.0   56.32    2.37 12.08  38.48  .37    .000
     [I%=37.3:S%= 1.34]
*
```

```
  *   CALIB NASHYD       0006  1 10.0   13.24     .41 12.33  28.03  .27    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.95 12.67  28.01  .27    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.93 12.08  43.84  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .91 12.83  26.86  .26    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.67 12.67  32.78  .31    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.61 12.83  38.25  .36    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    6.50 13.00  28.58  .27    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74 12.67  33.35  .32    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.92 13.00  39.98  .38    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.01 12.08  27.44  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .65 12.00  43.58  .41    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.41 12.17  17.54  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.68 12.25  57.06  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .36 12.75  34.47  n/a    .000
      {ST=   .32 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .18 14.83  26.79  n/a    .000
      {ST=  1.20 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.68 12.08  32.22  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.31 12.17  38.48  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .18 14.83  43.81  n/a    .000
      {ST=  1.22 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94    1.07 12.83  35.37  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.64 12.83  32.77  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.60 12.92  38.25  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    6.47 13.08  28.58  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.53 13.00  33.34  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .91 13.00  27.31  n/a    .000
      {ST=   .93 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .18 13.17  43.55  n/a    .000
      {ST=   .27 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .59 13.08  17.52  n/a    .000
      {ST=   .67 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    3.34 12.25  55.50  n/a    .000
*
      ADD [2000 + 0017]  1231  3  5.0   63.11    1.39 12.00  27.00  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.60 12.25  32.22  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94    1.05 13.00  35.37  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23    8.02 13.08  29.94  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67    1.08 13.00  29.96  n/a    .000
```

```
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .59 13.25  17.52  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.48 12.25  51.69  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .15 16.50  26.97  n/a    .000
     {ST=  1.03 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.66 13.08  23.98  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .70 14.50  51.62  n/a    .000
     {ST=  2.28 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51    1.09 12.08  30.62  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    7.57 13.00  32.75  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.03 12.25  30.62  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    7.50 13.17  32.75  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    3.26 12.17  29.01  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    9.01 13.17  32.83  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    4.86 12.17  30.22  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    7.17 12.17  31.69  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    7.56 12.17  31.55  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    7.53 12.25  31.55  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    7.77 12.25  35.26  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    7.34 12.42  35.26  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    9.14 12.50  34.11  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    9.93 12.50  34.29  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    9.48 12.75  34.29  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   11.11 12.75  34.15  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   3 **
 ****************************

 W/E COMMAND              HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                   10.0
     [ Ptot= 86.04 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .17 13.07  19.95  .23    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .50 12.17  38.06  .44    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41    1.98 12.25  44.94  .52    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .03 12.75  19.01  .22    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    1.83 12.08  22.19  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .96 12.08  19.41  .23    .000
     [I%=23.1:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .61 12.00  28.15  .33    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .80 12.08  33.70  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.48 12.17  21.85  .25    .000
     [I%=26.0:S%= 2.02]
*
  *  CALIB STANDHYD     0008  1  5.0   33.64    1.29 12.08  34.71  .40    .000
     [I%=41.3:S%= 1.34]
*
```

```
  *   CALIB STANDHYD     0007  1  5.0   56.32    1.92 12.08  31.35  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .28 12.33  19.25  .22    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.32 12.67  19.17  .22    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.56 12.08  35.72  .42    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .61 12.83  18.31  .21    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.14 12.67  22.67  .26    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.12 12.83  26.81  .31    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    4.39 13.00  19.54  .23    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.19 12.67  23.15  .27    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    4.11 13.00  28.13  .33    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.62 12.17  22.35  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .53 12.00  33.62  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.14 12.17  14.29  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.01 12.25  43.96  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .26 12.83  28.06  n/a    .000
      {ST=   .28 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .15 14.92  21.82  n/a    .000
      {ST=   .98 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.36 12.08  26.25  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.87 12.17  31.34  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .15 14.83  35.69  n/a    .000
      {ST=  1.00 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .71 12.83  27.04  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.12 12.83  22.66  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.11 12.92  26.81  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    4.37 13.17  19.54  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.03 13.08  23.14  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .73 13.08  22.23  n/a    .000
      {ST=   .78 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .14 13.08  33.59  n/a    .000
      {ST=   .22 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .46 13.17  14.27  n/a    .000
      {ST=   .58 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.50 12.17  42.61  n/a    .000
*
      ADD [2000 + 0017]  1231  3  5.0   63.11    1.09 12.17  21.99  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.29 12.25  26.25  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .70 13.08  27.04  n/a    .000
*
```

```
     ADD [1214 + 1204]  0200  3  5.0  343.23    5.45 13.08  20.56  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .87 13.08  24.08  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .44 13.33  14.27  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    2.59 12.25  39.33  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .13 16.33  21.96  n/a    .000
     {ST=   .80 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.30 13.25  19.37  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .53 14.58  39.27  n/a    .000
     {ST=  1.77 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51     .85 12.08  24.93  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    5.41 13.17  24.17  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .82 12.33  24.93  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    5.34 13.25  24.17  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    2.62 12.17  23.63  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    6.35 13.25  24.03  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    3.89 12.17  24.62  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    5.76 12.17  25.82  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    6.03 12.17  25.55  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    6.02 12.25  25.55  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    6.16 12.25  28.09  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    5.80 12.42  28.09  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    7.02 12.50  26.70  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    7.55 12.50  26.74  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    7.11 12.75  26.74  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    8.22 12.75  26.38  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   4 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                  10.0
     [ Ptot= 64.53 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .09 13.07  11.08  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .33 12.17  25.57  .40    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41    1.35 12.17  31.02  .48    .000
     [I%=35.0:S%= 2.00]
*
  ** CALIB NASHYD       0202  1  5.0    1.87     .02 12.75  10.94  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    1.34 12.17  16.51  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .72 12.08  14.44  .22    .000
     [I%=23.1:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .45 12.00  20.95  .32    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .60 12.08  25.07  .39    .000
     [I%=40.1:S%= 1.16]
*
  *  CALIB STANDHYD     1900  1  5.0   64.29    1.09 12.17  16.26  .25    .000
     [I%=26.0:S%= 2.02]
*
```

```
  *   CALIB STANDHYD     0008  1  5.0   33.64     .96 12.08  25.82  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    1.42 12.08  23.32  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .15 12.33  10.92  .17    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .73 12.83  10.80  .17    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.15 12.17  26.58  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .34 12.83  10.25  .16    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .64 12.83  12.95  .20    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .64 12.83  15.62  .24    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    2.41 13.17  10.98  .17    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .68 12.83  13.32  .21    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    2.37 13.17  16.47  .26    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.19 12.17  16.63  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .39 12.00  25.01  .39    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47     .84 12.17  10.63  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    1.36 12.17  30.26  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .15 13.00  20.85  n/a    .000
      {ST=   .23 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .11 15.00  16.23  n/a    .000
      {ST=   .73 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.00 12.08  19.52  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.38 12.25  23.32  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .09 16.33  26.55  n/a    .000
      {ST=   .75 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .42 13.00  18.44  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .63 12.92  12.95  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .63 12.92  15.62  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    2.41 13.17  10.98  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .56 13.17  13.31  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .53 13.08  16.51  n/a    .000
      {ST=   .62 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11 13.08  24.98  n/a    .000
      {ST=   .16 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .21 13.67  10.62  n/a    .000
      {ST=   .49 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.69 12.17  29.19  n/a    .000
*
      ADD [2000 + 0017]  1231  3  5.0   63.11     .73 12.08  16.36  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93     .95 12.25  19.52  n/a    .000
```

```
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .41 13.08  18.44  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    3.02 13.08  11.63  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .63 13.08  17.89  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .20 13.92  10.61  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    1.73 12.17  26.55  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .11 15.83  16.33  n/a    .000
     {ST=   .55 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .80 13.58  14.39  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .25 15.25  26.49  n/a    .000
     {ST=  1.28 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51     .63 12.08  18.54  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    3.14 13.17  15.53  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .59 12.25  18.54  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    3.08 13.33  15.53  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    1.93 12.17  17.57  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    3.63 13.33  15.22  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    2.87 12.25  18.31  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    4.25 12.25  19.20  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    4.41 12.25  18.87  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    4.38 12.25  18.87  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    4.44 12.25  20.28  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    4.16 12.50  20.28  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    4.84 12.50  18.77  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    5.14 12.58  18.72  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    4.78 12.75  18.72  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    5.40 12.83  18.20  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   5 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     MASS STORM                  10.0
     [ Ptot= 50.19 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .05 13.20   6.36  .13    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
 **  CALIB STANDHYD     0203  1  5.0   14.52     .23 12.08  18.10  .36    .000
     [I%=25.0:S%= 2.00]
*
 **  CALIB STANDHYD     0201  1  5.0   47.41     .98 12.17  22.48  .45    .000
     [I%=35.0:S%= 2.00]
*
 **  CALIB NASHYD       0202  1  5.0    1.87     .01 12.75   6.60  .13    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    1.03 12.17  12.72  .25    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27     .55 12.08  11.13  .22    .000
     [I%=23.1:S%= 5.00]
*
  *  CALIB STANDHYD     1700  1  5.0   18.84     .34 12.08  16.14  .32    .000
     [I%=33.5:S%= 2.02]
*
  *  CALIB STANDHYD     0014  1  5.0   21.40     .46 12.08  19.32  .39    .000
     [I%=40.1:S%= 1.16]
*
```

```
  *   CALIB STANDHYD     1900  1  5.0   64.29     .83 12.25  12.53  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64     .73 12.08  19.90  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    1.08 12.17  17.97  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .09 12.33   6.45  .13    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .42 12.83   6.33  .13    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65     .88 12.17  20.48  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .19 13.00   5.98  .12    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .37 12.83   7.67  .15    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .38 12.83   9.42  .19    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    1.38 13.17   6.41  .13    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .40 12.83   7.96  .16    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    1.41 13.17   9.97  .20    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17     .91 12.25  12.82  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .30 12.00  19.28  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47     .64 12.25   8.19  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28     .99 12.17  21.88  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .07 13.58  16.05  n/a    .000
      {ST=   .20 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .08 15.17  12.50  n/a    .000
      {ST=   .57 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93     .77 12.08  15.04  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.05 12.33  17.97  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .08 15.33  20.45  n/a    .000
      {ST=   .57 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .26 13.00  13.25  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .36 12.92   7.67  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .37 13.00   9.41  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    1.37 13.25   6.41  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .31 13.25   7.95  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .32 13.33  12.69  n/a    .000
      {ST=   .53 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08 13.17  19.25  n/a    .000
      {ST=   .13 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .09 14.50   8.18  n/a    .000
      {ST=   .40 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    1.22 12.17  21.02  n/a    .000
*
```

```
      ADD [2000 + 0017]  1231  3  5.0   63.11     .56 12.08  12.60  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93     .73 12.25  15.04  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .26 13.17  13.24  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23    1.73 13.17   6.83  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .40 13.33  13.76  n/a    .000
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .09 14.67   8.18  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    1.23 12.17  18.88  n/a    .000
*
      RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .07 16.42  12.57  n/a    .000
      {ST=   .42 ha.m }
*
      ADD [1238 + 1211]  1236  3  5.0  159.14     .48 13.42  11.08  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .15 16.42  18.83  n/a    .000
      {ST=   .96 ha.m }
*
      ADD [0020 + 0014]  1230  3  5.0   84.51     .48 12.08  14.28  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15    1.87 13.17  10.47  n/a    .000
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .46 12.25  14.28  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.83 13.42  10.47  n/a    .000
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    1.48 12.25  13.54  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92    2.13 13.42  10.12  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  259.26    2.21 12.25  14.10  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  315.58    3.26 12.25  14.80  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  328.82    3.35 12.25  14.46  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    3.33 12.33  14.46  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  403.52    3.39 12.33  15.27  n/a    .000
*
      CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    3.12 12.50  15.27  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  479.76    3.52 12.58  13.85  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  560.70    3.71 12.58  13.76  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    3.41 12.83  13.76  n/a    .000
*
      ADD [1212 + 1213]  0100  3  5.0  616.00    3.76 12.83  13.21  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   6 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha     cms   hrs     mm           cms

      START @   .00 hrs
      --------------------
      CHIC STORM                 10.0
      [ Ptot= 77.31 mm ]
*
  **  CALIB NASHYD       0204  1  8.0   10.89     .22  2.27  16.12  .21    .000
      [CN=54.3         ]
      [ N = 3.0:Tp  .73]
*
   *  CALIB STANDHYD     0203  1  5.0   14.52    1.76  1.33  32.83  .42    .000
      [I%=25.0:S%= 2.00]
*
   *  CALIB STANDHYD     0201  1  5.0   47.41    7.35  1.33  39.15  .51    .000
      [I%=35.0:S%= 2.00]
*
   *  CALIB NASHYD       0202  1  5.0    1.87     .05  1.92  15.53  .20    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
   *  CALIB STANDHYD     0009  1  5.0   76.82    7.78  1.33  19.88  .26    .000
      [I%=26.4:S%= 1.34]
*
   *  CALIB STANDHYD     2000  1  5.0   44.27    4.34  1.33  19.96  .26    .000
      [I%=23.1:S%= 5.00]
*
   *  CALIB STANDHYD     1700  1  5.0   18.84    2.74  1.33  28.09  .36    .000
      [I%=33.5:S%= 2.02]
*
```

```
  *   CALIB STANDHYD     0014  1  5.0   21.40    3.59  1.33  31.63  .41    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    6.17  1.33  20.96  .27    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    5.70  1.33  31.52  .41    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    8.29  1.33  28.09  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .57  1.50  15.36  .20    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.92  1.83  15.26  .20    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    6.67  1.33  32.01  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .84  2.00  14.54  .19    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.65  1.83  18.15  .24    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.56  2.00  21.64  .28    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    5.73  2.33  15.55  .20    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.74  1.83  18.58  .24    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    5.41  2.33  22.75  .30    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    6.73  1.33  21.13  .27    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    2.39  1.33  37.62  .49    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    4.71  1.33  12.80  .17    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    7.36  1.33  38.25  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .34  1.83  28.00  n/a    .000
      {ST=   .31 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .17  4.08  20.93  n/a    .000
      {ST=  1.12 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    5.75  1.33  24.57  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    6.68  1.42  28.09  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .17  4.00  31.98  n/a    .000
      {ST=  1.14 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .99  2.17  23.30  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.61  2.00  18.15  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.55  2.08  21.64  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    5.72  2.33  15.55  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77    1.39  2.33  18.57  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .88  2.00  21.04  n/a    .000
      {ST=   .91 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .21  2.83  37.59  n/a    .000
      {ST=   .32 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .58  2.08  12.79  n/a    .000
      {ST=   .66 ha.m }
```

```
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    9.11  1.33  37.01  n/a    .000
*
     ADD [2000 + 0017]  1231  3  5.0   63.11    4.40  1.33  22.36  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    4.23  1.42  24.57  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .96  2.25  23.30  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    7.18  2.25  16.40  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67    1.08  2.08  23.74  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .56  2.33  12.79  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    9.13  1.33  33.97  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .15  5.08  22.33  n/a    .000
     {ST=   .95 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.63  2.17  18.48  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .61  4.00  33.93  n/a    .000
     {ST=  1.99 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51    3.63  1.33  24.68  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    7.03  2.33  20.82  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    2.62  1.42  24.68  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    6.93  2.42  20.82  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33   10.12  1.33  22.40  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    8.30  2.42  20.51  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   13.87  1.33  23.22  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   20.50  1.33  24.09  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   20.95  1.33  23.73  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   19.27  1.50  23.73  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   19.42  1.50  25.62  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   15.05  1.67  25.62  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   16.76  1.67  23.97  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   17.23  1.67  23.88  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   13.19  2.08  23.88  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   14.79  2.08  23.36  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   7 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                 10.0
     [ Ptot= 63.96 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .15  2.27  10.87  .17    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52    1.38  1.33  25.26  .39    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    5.79  1.33  30.67  .48    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .03  1.92  10.75  .17    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    6.20  1.33  16.36  .26    .000
     [I%=26.4:S%= 1.34]
*
  *  CALIB STANDHYD     2000  1  5.0   44.27    3.49  1.33  14.31  .22    .000
     [I%=23.1:S%= 5.00]
*
```

```
  *   CALIB STANDHYD     1700  1  5.0   18.84    2.21  1.33  20.76  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    2.88  1.33  24.84  .39    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    4.39  1.42  16.11  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    4.57  1.33  25.59  .40    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    6.62  1.33  23.11  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .39  1.50  10.53  .17    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24    1.32  2.00  10.41  .16    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    5.31  1.33  26.33  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .58  2.17   9.89  .16    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30    1.15  2.00  12.50  .20    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14    1.10  2.00  15.09  .24    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    3.96  2.33  10.59  .17    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77    1.21  2.00  12.86  .20    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    3.82  2.33  15.92  .25    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    4.80  1.42  16.48  .26    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.92  1.33  28.84  .45    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    3.36  1.42  10.53  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    5.80  1.33  29.91  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .24  1.92  20.66  n/a    .000
      {ST=   .27 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .14  4.08  16.08  n/a    .000
      {ST=   .91 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    4.60  1.33  19.34  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    5.42  1.42  23.11  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .13  4.00  26.30  n/a    .000
      {ST=   .96 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .67  2.17  18.13  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30    1.11  2.08  12.49  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14    1.09  2.08  15.09  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    3.93  2.33  10.59  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .94  2.33  12.85  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .71  2.08  16.40  n/a    .000
      {ST=   .77 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .16  2.67  28.81  n/a    .000
      {ST=   .24 ha.m }
```

```
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .43  2.17  10.52  n/a    .000
     {ST=   .57 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    7.18  1.33  28.85  n/a    .000
*
     ADD [2000 + 0017]  1231  3  5.0   63.11    3.50  1.33  16.21  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    3.39  1.42  19.34  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .65  2.25  18.13  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    4.96  2.33  11.22  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .87  2.08  18.43  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .41  2.42  10.52  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    7.19  1.33  26.23  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .12  4.17  16.18  n/a    .000
     {ST=   .70 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14    1.27  2.33  14.63  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .43  4.00  26.20  n/a    .000
     {ST=  1.59 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51    2.91  1.33  18.37  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    5.09  2.33  15.33  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    2.11  1.42  18.37  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    4.98  2.50  15.33  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    8.03  1.33  17.41  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    5.90  2.50  14.99  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26   10.95  1.33  18.14  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   16.14  1.33  19.03  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   16.43  1.33  18.69  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   16.20  1.42  18.69  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   16.26  1.42  20.08  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52   12.64  1.67  20.08  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76   13.78  1.67  18.54  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70   14.09  1.67  18.48  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70   11.07  1.92  18.48  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00   12.14  1.92  17.94  n/a    .000
*
 ****************************
 ** SIMULATION NUMBER:   8 **
 ****************************

 W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha     cms   hrs     mm          cms

     START @   .00 hrs
     --------------------
     CHIC STORM                 10.0
     [ Ptot= 45.64 mm ]
*
 **  CALIB NASHYD       0204  1  8.0   10.89     .07  2.40   5.09  .11    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
  *  CALIB STANDHYD     0203  1  5.0   14.52     .95  1.33  15.89  .35    .000
     [I%=25.0:S%= 2.00]
*
  *  CALIB STANDHYD     0201  1  5.0   47.41    3.98  1.33  19.92  .44    .000
     [I%=35.0:S%= 2.00]
*
  *  CALIB NASHYD       0202  1  5.0    1.87     .02  1.92   5.41  .12    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
  *  CALIB STANDHYD     0009  1  5.0   76.82    3.88  1.42  11.52  .25    .000
     [I%=26.4:S%= 1.34]
*
```

```
  *   CALIB STANDHYD     2000  1  5.0   44.27    2.49  1.33  10.08  .22    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    1.58  1.33  14.62  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    2.05  1.33  17.50  .38    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    3.09  1.42  11.35  .25    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    3.24  1.33  18.02  .39    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    4.66  1.33  16.28  .36    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .18  1.50   5.14  .11    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .62  2.00   5.02  .11    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    3.32  1.42  18.55  .41    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .27  2.17   4.73  .10    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .55  2.00   6.12  .14    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .53  2.00   7.56  .17    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09    1.86  2.33   5.07  .11    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .59  2.00   6.37  .14    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01    1.89  2.33   8.02  .18    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    3.38  1.42  11.61  .25    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.38  1.33  17.45  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    2.36  1.42   7.42  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    3.98  1.33  19.37  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .11  2.33  14.52  n/a    .000
      {ST=   .21 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .09  4.08  11.31  n/a    .000
      {ST=   .65 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    3.26  1.33  13.62  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    3.79  1.42  16.27  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .08  4.08  18.52  n/a    .000
      {ST=   .67 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .35  2.17  11.65  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .52  2.08   6.11  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .53  2.17   7.56  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09    1.84  2.42   5.07  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .42  2.42   6.36  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .44  2.17  11.53  n/a    .000
      {ST=   .58 ha.m }
```

```
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .11  2.17  17.43  n/a    .000
     {ST=   .16 ha.m }
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .13  3.08   7.40  n/a    .000
     {ST=   .46 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    4.94  1.33  18.58  n/a    .000
*
     ADD [2000 + 0017]  1231  3  5.0   63.11    2.50  1.33  11.41  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    2.34  1.42  13.62  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .33  2.42  11.65  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    2.34  2.33   5.42  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .55  2.17  12.49  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .13  3.33   7.40  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    4.94  1.33  16.61  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .10  4.08  11.37  n/a    .000
     {ST=   .46 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .63  2.33  10.05  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .18  4.08  16.58  n/a    .000
     {ST=  1.08 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51    2.07  1.33  12.93  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    2.51  2.33   8.93  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.45  1.42  12.92  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    2.44  2.58   8.93  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    5.34  1.42  12.26  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    2.85  2.58   8.58  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    7.67  1.42  12.77  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58   11.46  1.42  13.40  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82   11.61  1.42  13.06  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82   11.03  1.42  13.06  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52   11.08  1.42  13.71  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    8.23  1.58  13.71  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    8.66  1.58  12.35  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    8.74  1.58  12.25  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    6.55  1.83  12.25  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    6.99  1.83  11.70  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:   9 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha     cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     CHIC STORM                  10.0
     [ Ptot= 33.77 mm ]
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .03  2.40   2.38  .07    .000
     [CN=54.3         ]
     [ N = 3.0:Tp  .73]
*
   * CALIB STANDHYD     0203  1  5.0   14.52     .70  1.33  10.57  .31    .000
     [I%=25.0:S%= 2.00]
*
   * CALIB STANDHYD     0201  1  5.0   47.41    2.89  1.33  13.61  .40    .000
     [I%=35.0:S%= 2.00]
*
   * CALIB NASHYD       0202  1  5.0    1.87     .01  1.92   2.82  .08    .000
     [CN=49.0         ]
     [ N = 3.0:Tp  .48]
*
```

```
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.85  1.42   8.39  .25    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.84  1.33   7.34  .22    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84    1.18  1.33  10.64  .32    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.52  1.33  12.74  .38    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    2.26  1.42   8.26  .24    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    2.38  1.33  13.12  .39    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    3.03  1.42  11.85  .35    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .09  1.50   2.56  .08    .000
      [CN=51.9        ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .30  2.00   2.46  .07    .000
      [CN=51.4        ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    2.44  1.42  13.50  .40    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .13  2.17   2.30  .07    .000
      [CN=50.1        ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .26  2.00   3.03  .09    .000
      [CN=57.0        ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .26  2.17   3.84  .11    .000
      [CN=62.5        ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09     .88  2.33   2.46  .07    .000
      [CN=52.4        ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .29  2.00   3.21  .10    .000
      [CN=57.2        ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .94  2.33   4.09  .12    .000
      [CN=64.2        ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    2.46  1.42   8.45  .25    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50    1.03  1.33  12.71  .38    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.72  1.42   5.40  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.89  1.33  13.20  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .03  3.83  10.55  n/a    .000
      {ST=   .18 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .06  4.08   8.23  n/a    .000
      {ST=   .47 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    2.40  1.33   9.91  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    2.58  1.50  11.85  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .07  4.08  13.47  n/a    .000
      {ST=   .48 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .19  2.17   7.91  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .24  2.17   3.03  n/a    .000
*
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .26  2.25   3.84  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09     .87  2.50   2.46  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .19  2.58   3.20  n/a    .000
```

```
*
     RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .17  2.75   8.37  n/a    .000
     {ST=   .48 ha.m }
*
     RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .08  2.17  12.68  n/a    .000
     {ST=   .12 ha.m }
*
     RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .08  3.58   5.39  n/a    .000
     {ST=   .34 ha.m }
*
     ADD [0203 + 1201]  1202  3  5.0   63.80    3.59  1.33  12.60  n/a    .000
*
     ADD [2000 + 0017]  1231  3  5.0   63.11    1.85  1.33   8.30  n/a    .000
*
     CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.66  1.42   9.91  n/a    .000
*
     CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .18  2.50   7.91  n/a    .000
*
     ADD [1214 + 1204]  0200  3  5.0  343.23    1.12  2.42   2.65  n/a    .000
*
     ADD [0010 + 0015]  1238  3  5.0   82.67     .25  2.75   9.08  n/a    .000
*
     CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .08  4.00   5.39  n/a    .000
*
     ADD [0204 + 1202]  1203  3  5.0   74.69    3.59  1.33  11.11  n/a    .000
*
     RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .04  4.17   8.27  n/a    .000
     {ST=   .31 ha.m }
*
     ADD [1238 + 1211]  1236  3  5.0  159.14     .32  2.83   7.30  n/a    .000
*
     RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .07  4.25  11.08  n/a    .000
     {ST=   .75 ha.m }
*
     ADD [0020 + 0014]  1230  3  5.0   84.51    1.53  1.33   9.40  n/a    .000
*
     ADD [0013 + 1236]  1239  3  5.0  352.15    1.24  2.50   5.54  n/a    .000
*
     CHANNEL[ 2 : 1230] 1208  1  5.0   84.51    1.03  1.42   9.40  n/a    .000
*
     CHANNEL[ 2 : 1239] 1209  1  5.0  352.15    1.19  2.75   5.54  n/a    .000
*
     ADD [0009 + 1208]  1229  3  5.0  161.33    3.88  1.42   8.92  n/a    .000
*
     ADD [1210 + 1209]  0300  3  5.0  408.92    1.38  2.75   5.22  n/a    .000
*
     ADD [1229 + 1207]  1232  3  5.0  259.26    5.54  1.42   9.29  n/a    .000
*
     ADD [1232 + 1206]  1228  3  5.0  315.58    8.10  1.42   9.75  n/a    .000
*
     ADD [1228 + 0006]  1227  3  5.0  328.82    8.17  1.42   9.46  n/a    .000
*
     CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    7.84  1.50   9.46  n/a    .000
*
     ADD [0016 + 1216]  1226  3  5.0  403.52    7.88  1.50   9.76  n/a    .000
*
     CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    5.59  1.67   9.76  n/a    .000
*
     ADD [1205 + 0005]  1237  3  5.0  479.76    5.83  1.67   8.60  n/a    .000
*
     ADD [1237 + 1215]  1234  3  5.0  560.70    5.88  1.67   8.50  n/a    .000
*
     CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    4.30  1.92   8.50  n/a    .000
*
     ADD [1212 + 1213]  0100  3  5.0  616.00    4.51  1.92   8.01  n/a    .000
*
  ****************************
  ** SIMULATION NUMBER:  10 **
  ****************************

  W/E COMMAND             HYD ID   DT    AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                  min     ha     cms   hrs     mm           cms

     START @   .00 hrs
     --------------------
     READ STORM                 10.0
     [ Ptot= 24.99 mm ]
     fname : T:\2804_Everett MSP\SWM Assessment\Everett_VO2_Model\Storms\Owen-4hrC25mm.stm
     remark: 25mm - 4hr CHICAGO STORM - OWEN SOUND RAINFALL
*
  ** CALIB NASHYD       0204  1  8.0   10.89     .01  2.53    .98  .04    .000
     [CN=54.3          ]
     [ N = 3.0:Tp  .73]
*
  ** CALIB STANDHYD     0203  1  5.0   14.52     .50  1.33   7.06  .28    .000
     [I%=25.0:S%= 2.00]
*
  ** CALIB STANDHYD     0201  1  5.0   47.41    2.06  1.33   9.33  .37    .000
     [I%=35.0:S%= 2.00]
```

```
*
  **  CALIB NASHYD       0202  1  5.0    1.87     .00  2.00   1.41  .06    .000
      [CN=49.0         ]
      [ N = 3.0:Tp  .48]
*
  *   CALIB STANDHYD     0009  1  5.0   76.82    2.04  1.42   6.07  .24    .000
      [I%=26.4:S%= 1.34]
*
  *   CALIB STANDHYD     2000  1  5.0   44.27    1.33  1.33   5.31  .21    .000
      [I%=23.1:S%= 5.00]
*
  *   CALIB STANDHYD     1700  1  5.0   18.84     .85  1.33   7.70  .31    .000
      [I%=33.5:S%= 2.02]
*
  *   CALIB STANDHYD     0014  1  5.0   21.40    1.09  1.33   9.22  .37    .000
      [I%=40.1:S%= 1.16]
*
  *   CALIB STANDHYD     1900  1  5.0   64.29    1.61  1.42   5.98  .24    .000
      [I%=26.0:S%= 2.02]
*
  *   CALIB STANDHYD     0008  1  5.0   33.64    1.51  1.42   9.50  .38    .000
      [I%=41.3:S%= 1.34]
*
  *   CALIB STANDHYD     0007  1  5.0   56.32    2.18  1.42   8.58  .34    .000
      [I%=37.3:S%= 1.34]
*
  *   CALIB NASHYD       0006  1 10.0   13.24     .04  1.50   1.18  .05    .000
      [CN=51.9         ]
      [ N = 3.0:Tp  .20]
*
  *   CALIB NASHYD       0005  1 10.0   76.24     .13  2.00   1.11  .04    .000
      [CN=51.4         ]
      [ N = 3.0:Tp  .49]
*
  *   CALIB STANDHYD     1800  1  5.0   40.65    1.75  1.42   9.77  .39    .000
      [I%=42.5:S%= 2.02]
*
  *   CALIB NASHYD       0004  1 10.0   40.29     .05  2.17   1.02  .04    .000
      [CN=50.1         ]
      [ N = 3.0:Tp  .61]
*
  *   CALIB NASHYD       0003  1 10.0   55.30     .12  2.00   1.38  .06    .000
      [CN=57.0         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0001  1 10.0   48.14     .12  2.17   1.80  .07    .000
      [CN=62.5         ]
      [ N = 3.0:Tp  .60]
*
  *   CALIB NASHYD       0002  1 10.0  295.09     .38  2.50   1.09  .04    .000
      [CN=52.4         ]
      [ N = 3.0:Tp  .76]
*
  *   CALIB NASHYD       0012  1 10.0   56.77     .13  2.00   1.51  .06    .000
      [CN=57.2         ]
      [ N = 3.0:Tp  .50]
*
  *   CALIB NASHYD       0013  1 10.0  193.01     .43  2.50   1.92  .08    .000
      [CN=64.2         ]
      [ N = 3.0:Tp  .80]
*
  *   CALIB STANDHYD     1000  1  5.0   69.17    1.75  1.42   6.12  .24    .000
      [I%=26.6:S%= 2.02]
*
  *   CALIB STANDHYD     1500  1  5.0   13.50     .75  1.33   9.20  .37    .000
      [I%=40.0:S%= 2.02]
*
  *   CALIB STANDHYD     1100  1  5.0   76.47    1.11  1.50   3.91  .16    .000
      [I%=17.0:S%= 2.02]
*
      ADD [0201 + 0202]  1201  3  5.0   49.28    2.06  1.33   9.03  n/a    .000
*
      RESRVR [ 2 : 1700] 0017  1  5.0   18.84     .02  4.00   7.61  n/a    .000
      {ST=   .13 ha.m }
*
      RESRVR [ 2 : 1900] 0019  1  5.0   64.29     .04  4.08   5.95  n/a    .000
      {ST=   .34 ha.m }
*
      ADD [0019 + 0008]  1233  3  5.0   97.93    1.53  1.42   7.17  n/a    .000
*
      CHANNEL[ 2 : 0007] 1206  1  5.0   56.32    1.85  1.50   8.57  n/a    .000
*
      RESRVR [ 2 : 1800] 0018  1  5.0   40.65     .06  4.00   9.74  n/a    .000
      {ST=   .34 ha.m }
*
      ADD [0018 + 0004]  1240  3  5.0   80.94     .11  2.33   5.40  n/a    .000
*
      CHANNEL[ 2 : 0003] 1213  1  5.0   55.30     .10  2.33   1.38  n/a    .000
*
```

```
      CHANNEL[ 2 : 0001] 1214  1  5.0   48.14     .12  2.33   1.80  n/a    .000
*
      CHANNEL[ 2 : 0002] 1204  1  5.0  295.09     .37  2.58   1.09  n/a    .000
*
      CHANNEL[ 2 : 0012] 1210  1  5.0   56.77     .06  2.92   1.49  n/a    .000
*
      RESRVR [ 2 : 1000] 0010  1  5.0   69.17     .03  4.17   6.05  n/a    .000
      {ST=   .39 ha.m }
*
      RESRVR [ 2 : 1500] 0015  1  5.0   13.50     .06  2.17   9.17  n/a    .000
      {ST=   .09 ha.m }
*
      RESRVR [ 2 : 1100] 0011  1  5.0   76.47     .06  3.58   3.89  n/a    .000
      {ST=   .25 ha.m }
*
      ADD [0203 + 1201]  1202  3  5.0   63.80    2.56  1.33   8.58  n/a    .000
*
      ADD [2000 + 0017]  1231  3  5.0   63.11    1.33  1.33   6.00  n/a    .000
*
      CHANNEL[ 2 : 1233] 1207  1  5.0   97.93    1.13  1.50   7.17  n/a    .000
*
      CHANNEL[ 2 : 1240] 1215  1  5.0   80.94     .10  2.58   5.40  n/a    .000
*
      ADD [1214 + 1204]  0200  3  5.0  343.23     .48  2.50   1.19  n/a    .000
*
      ADD [0010 + 0015]  1238  3  5.0   82.67     .08  2.50   6.56  n/a    .000
*
      CHANNEL[ 2 : 0011] 1211  1  5.0   76.47     .06  4.25   3.89  n/a    .000
*
      ADD [0204 + 1202]  1203  3  5.0   74.69    2.56  1.33   7.47  n/a    .000
*
      RESRVR [ 2 : 1231] 0020  1  5.0   63.11     .03  4.08   5.97  n/a    .000
      {ST=   .22 ha.m }
*
      ADD [1238 + 1211]  1236  3  5.0  159.14     .13  3.42   5.28  n/a    .000
*
      RESRVR [ 2 : 1203] 0016  1  5.0   74.69     .05  4.25   7.44  n/a    .000
      {ST=   .50 ha.m }
*
      ADD [0020 + 0014]  1230  3  5.0   84.51    1.10  1.33   6.79  n/a    .000
*
      ADD [0013 + 1236]  1239  3  5.0  352.15     .56  2.50   3.44  n/a    .000
*
      CHANNEL[ 2 : 1230] 1208  1  5.0   84.51     .69  1.42   6.79  n/a    .000
*
      CHANNEL[ 2 : 1239] 1209  1  5.0  352.15     .53  2.83   3.44  n/a    .000
*
      ADD [0009 + 1208]  1229  3  5.0  161.33    2.73  1.42   6.45  n/a    .000
*
      ADD [1210 + 1209]  0300  3  5.0  408.92     .59  2.83   3.17  n/a    .000
*
      ADD [1229 + 1207]  1232  3  5.0  259.26    3.69  1.42   6.72  n/a    .000
*
      ADD [1232 + 1206]  1228  3  5.0  315.58    5.44  1.42   7.05  n/a    .000
*
      ADD [1228 + 0006]  1227  3  5.0  328.82    5.47  1.42   6.81  n/a    .000
*
      CHANNEL[ 2 : 1227] 1216  1  5.0  328.82    5.34  1.50   6.81  n/a    .000
*
      ADD [0016 + 1216]  1226  3  5.0  403.52    5.37  1.50   6.93  n/a    .000
*
      CHANNEL[ 2 : 1226] 1205  1  5.0  403.52    3.73  1.67   6.93  n/a    .000
*
      ADD [1205 + 0005]  1237  3  5.0  479.76    3.83  1.67   6.00  n/a    .000
*
      ADD [1237 + 1215]  1234  3  5.0  560.70    3.85  1.67   5.92  n/a    .000
*
      CHANNEL[ 2 : 1234] 1212  1  5.0  560.70    2.76  2.00   5.92  n/a    .000
*
      ADD [1212 + 1213]  0100  3  5.0  616.00    2.83  2.00   5.51  n/a    .000
*
 FINISH

===============================================================================================================
```

APPENDIX MDP-E

Greenland International Consulting Ltd. - Pine River Assimilative Capacity Study (August 2012)

20 August 2012

REVISED December 2012

Pine River Assimilative Capacity Study

FINAL REPORT

Prepared for: The Township of Adjala Tosorontio

Submitted by:

Greenland International Consulting Ltd.

Project No. 12-G-2703

Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

The Township of Adjala Tosorontio has an interest in promoting growth in the community of Everett. In order to do so, provision of sanitary servicing is needed to meet the needs of a growing population. One (1) option is to provide a wastewater treatment plant (WWTP) to service the new and existing population in Everett, with a surface water outfall to the nearest major watercourse (i.e. Pine River). In order to add a new wastewater treatment facility with surface water outfall directed to the Pine River, among other requirements, it must first be established that the river has the capacity to receive treated effluent without adversely impacting downstream water quality. The intent of this assimilative capacity study (ACS) is to establish existing conditions in the Pine River with respect to flow and water quality; determine the expected effluent characteristics and estimate the resulting change to in-stream flow and concentration associated with the additional outfall under design flow conditions. The proposed outfall location is on the Pine River north-west of Everett, to the west of County Road 13.

2. Background

2.1 Study Location

Everett is located northwest of Alliston and southwest of Base Borden on Regional Road 5 at the intersection of County Road 13 as shown on Figure 2-1. Everett is close in proximity to the Pine River and Boyne River which are tributaries to the Nottawasaga River. The Pine River is the subject of this study and generally flows east from Highway 124 to Angus.

2.2 Watershed Characteristics

The Pine River watershed is primarily a rural watershed with the majority of land being under forest cover and agriculture. For this study the watershed was divided into 14 catchment areas ranging in size from 220 ha to 6,100 ha with a total drainage area of 33,533 ha

The Nottawasaga Valley Conservation Authority has indicated that the watercourse is a high quality fish habitat with sand and gravel substrate and limited nutrient uptake capacity except in the river banks.

The Pine River currently receives effluent from an existing WWTP at CFB Borden. The WWTP at Angus discharges directly to the Nottawasaga River and will not impact the results of this analysis on the Pine River.

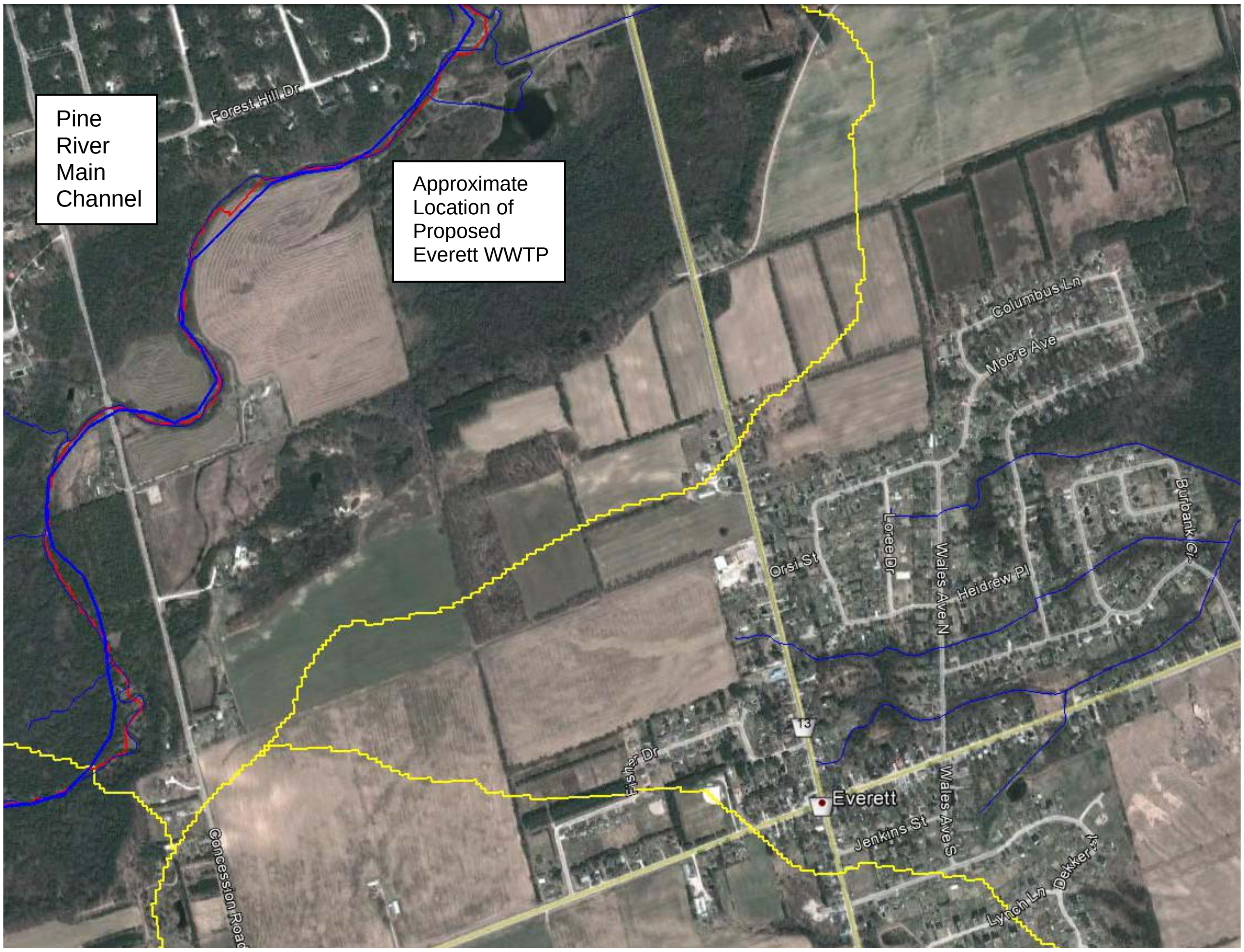


Figure 2-1 Everett location map

3. Study Method

The study was comprised of four (4) main components including: (i) Scenario Development and Applicable Guidelines; (ii) Collection and Analysis of Monitoring Data; (iii) Watershed Water Quality Modeling; and, (iv) Dispersion Modeling

3.1 Scenarios Development and Applicable Guidelines

Four (4) scenarios were considered in the study in order to assess water quality under future conditions of population growth.

Base Scenario: An existing conditions model was calibrated for the 25 year period from 1985 through to 2010. This period represents recent historical conditions with an adequate duration to include wet and dry years and climatic cycles needed to be considered within the lifetime of a new wastewater treatment plant.

Scenario 2: The base model was modified by adding a phased point source at Everett that would service an interim total population of 4,500.

Scenario 3: Includes a final Everett population of 10,000, inclusive of the existing population.

Scenario 4: Represents conditions with the final Everett population and the CFB Borden WWTP operating at full capacity under its current discharge criteria.

Change in concentration and loading under the proposed conditions were compared against existing conditions in order to quantify the level of impact and the level of offsetting that might need to be found from other sources in the watershed.

With respect to existing effluent criteria, the MOE uses the surface water management goals and policies described in MOEE (1994) summarized as follows where the goal is to ensure that the surface waters of the Province are of a quality which is satisfactory for aquatic life and recreation.

***Policy 1*: In areas which have water quality better than the Provincial Water Quality Objective (PWQO), water quality shall be maintained at or above the objective (better than the objective).**

***Policy 2*: Water quality which presently does not meet the PWQOs shall not be further degraded and all practical measures shall be undertaken to upgrade the water quality to the PWQO.**

3.2 Collection and Analysis of Monitoring Data

Review of available monitoring data from the Provincial Water Quality Monitoring Network (PWQMN) and Water Survey of Canada (WSC) found four (4) water quality stations with on-going or historical records and one (1) flow gauge. The flow gauge station (02ED014) located on the Pine River upstream of Everett provides real-time flow data with 43 years of historical data. The Nottawasaga Valley Conservation Authority (NVCA) collects data for the PWQMN and WSC and was able to provide records of available historical monitoring data.

On the recommendation of the NVCA and the Ministry of Environment (MOE) a water quality sampling program collected four (4) sets of grab samples during low to medium flow conditions from May through June 2012. Samples were taken at the Water Survey of Canada station located just upstream of Everett. The monitoring program was needed to confirm that current water quality conditions upstream of Everett remain consistent with historical data.

Monitoring data was processed for use in calibrating the water quality model; for determination of statistical low flow (design constraint) conditions; and to characterize flow and water quality at available positions in the watercourse.

3.3 Watershed In-Stream Water Quality Modeling

CANWET™ 4.2 was used to simulate point and non-point sources and to route flow and concentrations through the Pine River stream network upstream of Angus. The simulation considered sediment, total phosphorus, nitrogen species, dissolved oxygen (DO), biological oxygen demand (BOD), and temperature.

The model simulates one-dimensional continuous daily water balance and non-point source loads from a network of catchments in the watershed. It routes catchment and point source flows and loads at a daily time step and computes in-stream concentrations and flows at nodes within the stream network corresponding with catchment outlets.

The catchment delineation was set up with consideration for the locations of monitoring stations and WWTP locations. In-stream chemical reactions and decay are accounted for in the routed water quality computations.

The simulation used interpolated weather data for the period 1985 through 2003. Weather data from this period is available from Agriculture and Agri-Foods Canada from an application of the ANUSPLIN software to produce continuous historical meteorological data at a 10km resolution grid across Canada. Weather station data was appended for the period of 2004 through to 2010 from the nearest available weather stations in Shanty Bay and Egbert CS. The extended record was needed to simulate up to 2010 in order to take advantage of the most recent flow and water quality monitoring data available.

Constituents of critical importance in the water quality modeling were total phosphorus, dissolved oxygen, and un-ionized ammonia. Total ammonia nitrogen, biologic and sediment oxygen demand, temperature, pH, flow rate, re-aeration rate and a host of decay rate coefficients are part of the determination of critical constituent concentrations.

The base model was calibrated to agree with available monitoring data on a long term annual basis. Scenario results were reported for long term annual and for 7Q20 flow conditions under more restrictive summer temperatures.

3.4 Water Quality Dispersion Modeling

CORMIX version 8 is a 3-dimensional hydrodynamic mixing zone model. It was used in determining the length of the mixing zone downstream of the proposed treatment plant outfall. The physical mixing model provides an estimate of the location where the concentration of the subject constituent becomes fully mixed or below a set threshold both vertically and laterally in the watercourse. The constituent concentration in the plume is modelled at each sub-section of the reach. Results can be compared against PWQO, acute toxicity and background concentrations. This Report presents an analysis of the mixing zone downstream of the proposed WWTP with consideration of un-ionized ammonia which is the only effluent constituent that poses a potential risk in terms of acute toxicity. Other constituents in the effluent are considered in the water quality model but the extent and dimensions of the plume are less critical since toxicity to aquatic life is not the primary concern for these. The following data was used in this mixing zone analysis:

- 7Q20 flow in the Pine River upstream of Everett;
- Estimated average flows from the proposed WWTP; and,
- Ambient upstream and effluent concentrations of un-ionized ammonia

A series of assumptions were made regarding the specific design features of the outfall which will have a direct impact on the shape, length and concentration of the downstream plume. If the actual design is different from those assumptions, the model will need to be updated. However, the interim outfall design used in the model is not particularly aggressive in terms of expediting complete mixing. Diffusers were not used, but rather a single discharge point on the side of the stream channel that discharges below the surface of the channel flow. The final design of the outfall should aim to expedite and achieve complete mixing at a minimum distance downstream of the outfall.

The dispersion model was not calibrated as there is currently no existing outfall with characteristic plume data to compare against.

4. Scenario Development and Applicable Guidelines

Expected effluent concentrations from the proposed WWTP were characterized as shown in **Table 4-1** for the purposes of assessing down-stream water quality resulting from the additional point source. Without better information, the C of A effluent limits from the Angus WWTP were used as a reference.

Table 4-1 WWTP Effluent Expected Concentrations of Governing Constituents

WQ Parameter	Expected Characteristics
Total P	0.1 mg/L considered typical of convention WWTPs
Total Ammonia	Optimized to 1.8 mg/L maximum (summer conditions to achieve 0.02 mg/L un-ionized ammonia in-stream concentration at outfall)
NO3 - N	Assumed NH4 was governing nitrogen constituent as information on WWTP technology and typical concentrations from nearby facilities was not available
TSS	10 mg/L from Angus C of A
BOD	10 mg/L from Angus C of A
DO	Assumed 4.0 mg/L but ultimately dependant on time of year temperature, outfall characteristics and use of aeration prior to release
Temperature	Assumed effluent temperature is equal to ambient in-stream temperature
Total Fecal Coliforms	200 CFU/100 mL allowable limit from Angus C of A

Effluent from the proposed wastewater treatment facility for the Everett Secondary Planning Study was considered using two (2) possible flow scenarios from Everett and a third with CFB Borden WWTP operating at capacity. With a per capita flow rate of 350 L/cap/day, **Table 4-2** shows the resulting flow rates from the proposed treatment facility with phased population growth.

Table 4-2 Annual Average Flow from Proposed Everett WWTP

	4,500 population	10,000 population
Avg. Flow (L/s) @ 350 L/cap/day	18	41

5. Collection and Analysis of Monitoring Data

5.1 Available Monitoring Data

Review of available monitoring data from the Provincial Water Quality Monitoring Network (PWQMN) and Water Survey of Canada (WSC) found four (4) water quality stations with on-going or historical records and one (1) flow gauge (shown in **Figure 5-1** and **Table 5-1**). The proposed discharge location for treated WWTP effluent is north-west of Everett, to the west of County Road 13.

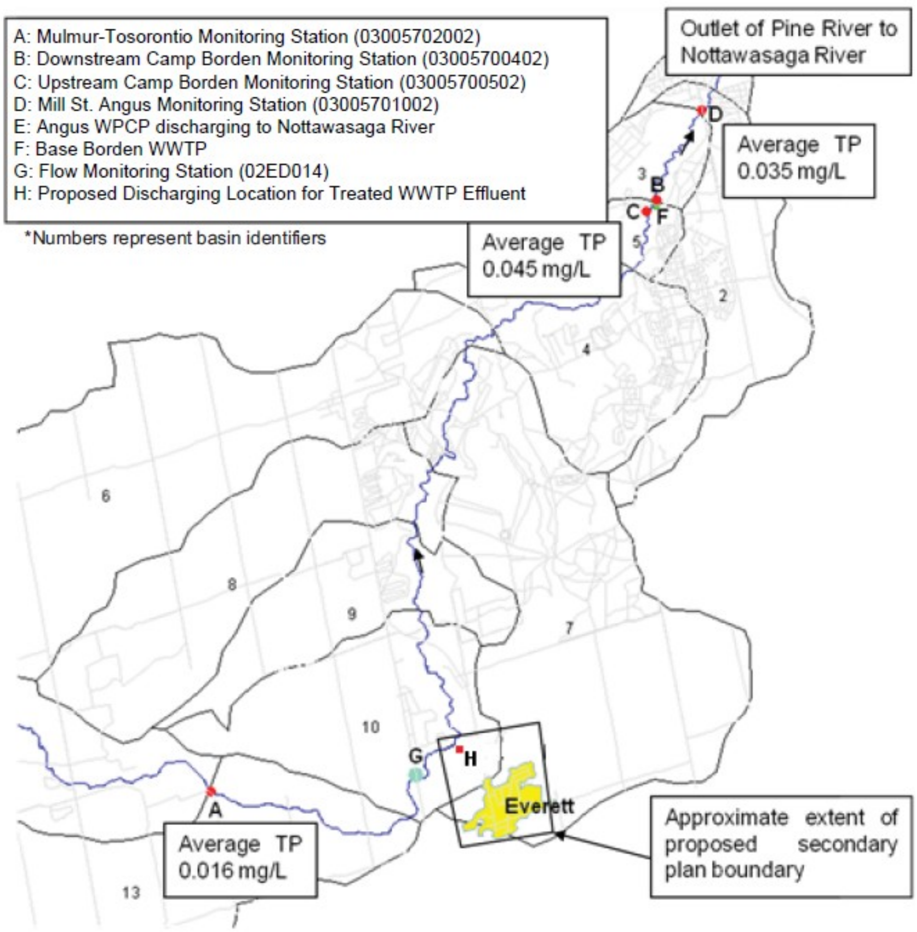


Figure 5-1 Pine River Watershed with Monitoring Stations and Proposed Surface Water Discharge Location

Table 5-1 Water Quality Monitoring Stations on the Pine River

Station	Map Name	Location	Status	First Year	Last Year	Total Years	Missing Years
03005702002 (water quality)	A	Mulmur Tosoronto Townline	Inactive	1975	1996	7	15
03005700402 (water quality)	B	Downstream CFB Borden WWTP	Inactive	1966	1971	6	0
03005700502 (water quality)	C	Upstream CFB Borden WWTP	Inactive	1966	1990	25	0
03005701002 (water quality)	D	Mill Street, Angus	Active	1972	2010	39	0
02ED014 (flow monitoring)	G	Everett	Active	1967	2009	Study used data from 1990-2009	

Note: Data older than 1980 was considered in the study, but was ultimately not used. Location A was found to pre-date current effluent conditions from CFB Borden WWTP.

5.2 Statistical Low Flow Conditions

Statistical low flow conditions were determined from historical flow data at Everett. Standard practice is to use the lowest 7-day consecutive average flow over a 20-year period (7Q20) to establish a “worst case scenario” for dilution of treated effluent. For this analysis the 20-year stream flow record from 1990 through 2009, inclusive, was analyzed. The statistical 7Q20 low flow for the data analyzed was found to occur during the period from 15 to 21 February 2000 with a value of 471 L/sec.

Under historical 7Q20 flow conditions of 471 L/sec for the Pine River at Everett, the effluent from the proposed WWTP facility would account for approximately 8% of the total combined flow for the 10,000 population scenario. Under average annual flow conditions of 1,897 L/sec, between 1990 and 2009, the proportion of stream flow from the Everett facility would be approximately 2% for the same population. The contribution of effluent flow to environmental impact from the proposed facility cannot be considered in isolation without looking at ambient in-stream and effluent constituent concentrations.

5.3 Characterization of Pine River Water Quality

Tables 5-2 and **5-3** provide a statistical summary of water quality data from two (2) locations with relatively recent historical data. There are a comparatively small number of water quality sample points upstream of Everett and a fairly wide range of results from the data downstream at Station D (Mill Street in Angus).

Analysis of available historical water quality data upstream of Everett (Station A, **Figure 5-1**) is based on 13 water quality samples that were taken during periods of low to average flow from 1992 through 1996. Historical water quality data at Station D extends from 1972 to 2010 and provides a much larger sample set to draw conclusions from.

Because the data available from stations B and C, upstream and downstream of CFB Borden, was limited, and the majority more than 20 years old, this data was not included in the analysis.

Further, it is expected that changes have been made to the CFB Borden WWTP that would make these data non-representative of current conditions.

The sampling program undertaken at Station G at the WSC flow gauge upstream of Everett from May and June 2012 provided the results shown in **Table 5-4**. In general, the recently completed monitoring program shows results consistent with historical data.

Trends from upstream to downstream, based on median results, suggest that phosphorus, TKN, fecal coliforms and BOD concentrations increase moving downstream. Ammonia and DO tend to decrease.

Table 5-2 Summary of Historical In-stream Water Quality Data at Everett (Station A)

Parameter	Mean	Median	No. of Samples
TP (mg/L)	0.02	0.01	13
Total Ammonia (mg/L)	0.03	0.03	2
Nitrates (mg/L)	N/A	N/A	N/A
TKN (mg/L)	0.32	0.30	13
BOD (mg/L)	0.85	0.56	13
DO (mg/L)	10.0	10.5	6
Total Fecal Coliforms (CFU/100mL)	N/A	N/A	N/A
Temperature (degrees C)	variable	variable	variable

Table 5-3 Summary of Historical In-stream Water Quality Data at Mill Street (Station D)

Parameter	Average	Median	No. of Samples
TP (mg/L)	0.03	0.02	98
Total Ammonia (mg/L)	0.01	0.01	99
Nitrates (mg/L)	1.4	1.5	22
TKN (mg/L)	0.36	0.33	100
BOD (mg/L)	0.92	0.70	73
DO (mg/L)	10	10	104
Total Fecal Coliforms (CFU/100mL)	125	40	87
Temperature (degrees C)	10	10	105

Table 5-4 Summary of 2012 In-stream Water Quality Data at Station G (WSC Station)

Parameters / Sampling Date and Time	Units	2012-05-07 10:50	2012-05-24 10:07	2012-06-15 12:00	2012-06-20 10:40
Total Ammonia-N	mg/L	ND	ND	0.04	ND
Total Carbonaceous BOD	mg/L	ND	ND	ND	ND
Total Kjeldahl Nitrogen (TKN)	mg/L	0.29	0.42	0.49	0.32
Orthophosphate (P)	mg/L	0.004	0.002	0.003	0.002
Total Phosphorus	mg/L	0.018	0.006	0.003	ND
Total Suspended Solids	mg/L	8	3	3	5
Nitrite (N)	mg/L	ND	ND	NA	NA
Nitrate (N)	mg/L	2.6	2.9	2.6	2.5
Nitrate + Nitrite	mg/L	2.6	2.9	NA	NA
Fecal coliform	CFU/100mL	30	<10	20	250
ND = Not detected					
NA = Not analyzed					

6. Catchment and In-stream Modeling

6.1 Model Calibration Summary

The CANWET™ model was first calibrated for flow at Everett and then for water quality parameters and Station A (upstream of Everett) and at Station D (Mill Street, Angus).

As shown in **Figure 6-1**, the simulated long-term monthly flow agreed well with the stream gauge data with an overall percent difference of 0.5% and Nash—Sutcliff coefficient of 0.96 between 1990 and 2009.

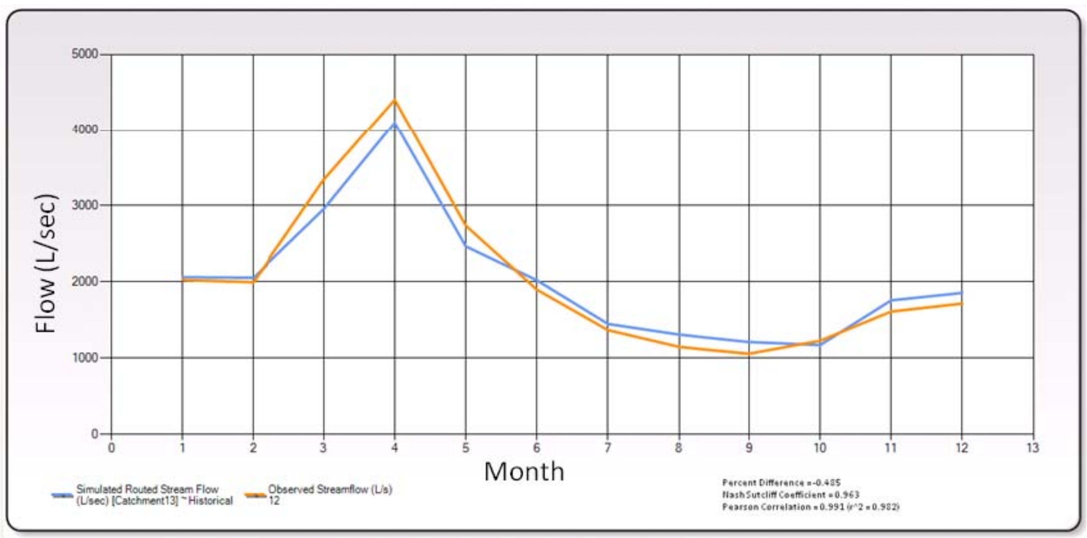


Figure 6-1 Long-term monthly flow simulation and flow gauge data (1990-2009)

For individual days, however, there is some variance between the simulation and the observed data. **Figure 6-2** shows an example of this. For the 7-day period identified for the 7Q20 conditions, the model tended to over predict the flow. Therefore this design flow condition was simulated in isolation using the catchment loading rates simulated for the 7Q20 period, but with a reduced flow equal to that determined from the gauge data from 2000 February 15-21.

The water quality simulation results from the base scenario under average annual flow conditions were all within the 10th and 90th percentiles of the observed concentration data upstream of Everett and downstream at Mill Street with the exception of dissolved oxygen at Mill Street (See summary in **Tables 6-1** and **6-2**). At Mill Street the simulated dissolved oxygen was marginally below the 10th percentile of observed data because the maximum observed stream temperature of 22 degrees was used in this isolated simulation run. This higher temperature was used for consistency with the 7Q20 scenario simulations that were to follow. It was selected in order to add further conservativeness to the approach as it was deemed equally probable that the 7Q20 condition could occur during the summer periods as opposed to the winter when the actual condition was recorded.

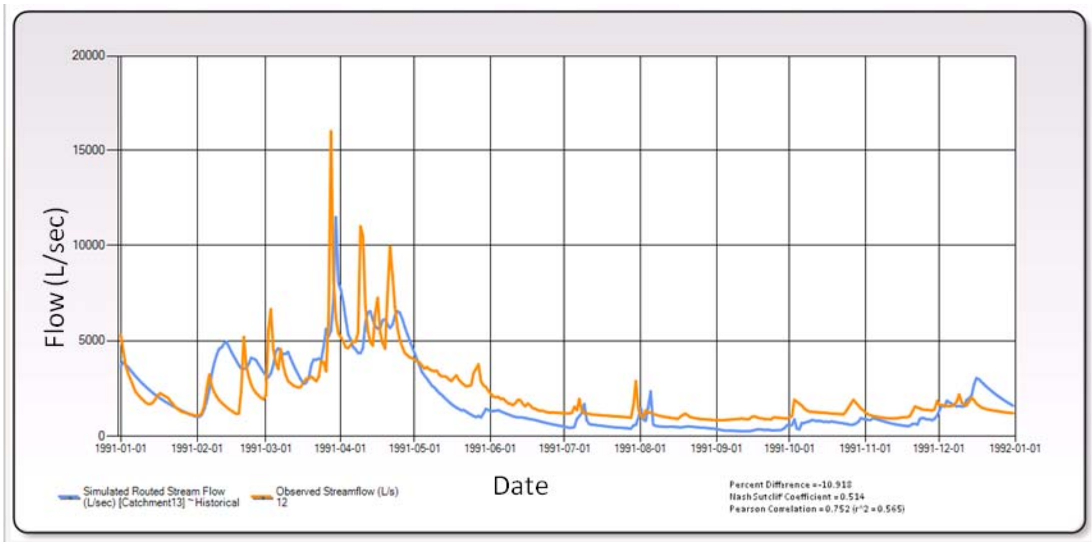


Figure 6-2 Example of daily simulated and measured stream flows (1991)

If the median measured stream temperature of 10 degrees is applied, the dissolved oxygen concentration increases to 10 mg/L at Mill Street. This is consistent with the median dissolved oxygen concentration measured at this location.

Table 6-1 Summary of Historical In-stream Water Quality Data at Everett (Station A)

Parameter	10th Percentile	90th Percentile	No. of Samples	CANWET base scenario
TP (mg/L)	0.00	0.02	13	0.02
Total Ammonia (mg/L)	0.01	0.04	2	0.01
Nitrates (mg/L) (1)	2.5	2.9	4	1.7
TKN (mg/L)	0.20	0.42	13	0.34
BOD (mg/L)	0.22	1.28	13	1.01
DO (mg/L)	8.4	11.0	6	8.1
Total Fecal Coliforms (CFU/100mL) (1)	<10	250	4	118
Temperature (degrees C)	variable	variable	variable	22

Notes:

(1) Historical data was not available; data shown are maximum and minimum values from 2012 monitoring program

Table 6-2 Summary of Historical In-stream Water Quality Data at Mill Street (Station D)

Parameter	10th Percentile	90th Percentile	No. of Samples	CANWET base scenario
TP (mg/L)	0.01	0.06	98	0.02
Total Ammonia (mg/L)	0.00	0.03	99	0.01
Nitrates (mg/L)	1.0	1.7	22	1.3
TKN (mg/L)	0.23	0.52	100	0.24
BOD (mg/L)	0.30	1.78	73	0.66
DO (mg/L)	8	13	104	7
Total Fecal Coliforms (CFU/100mL)	10	253	87	38
Temperature (degrees C)	1	19	105	22

6.2 Scenario Simulations

Plots (**Figure 6-3** to **Figure 6-5**) of critical water quality parameters for which there are Provincial Water Quality Objectives (PWQOs) were generated to investigate the downstream impact of introducing a phased WWTP at Everett and future increase of flow from the CFB Borden facility. Plots show how in-stream concentration is expected to change as flow travels downstream toward Angus due to increased flow, contaminant load, in-stream decay, chemical interactions and re-aeration.

Phosphorus concentrations increase immediately downstream of the two (2) treatment facility outfalls and then begin to decline further downstream due to deposition, plant uptake and dilution from incoming tributaries. The greatest increase in phosphorus concentration occurs immediately downstream of the proposed Everett WWTP with an estimated in-stream concentration increase of 0.006 mg/L under 7Q20 conditions. Immediately downstream of the CFB Borden facility under Scenario 4 the concentration increases by 0.004 mg/L compared with existing conditions. The maximum estimated total phosphorus concentration is just under 0.03 mg/L immediately downstream of the Everett facility under 7Q20 conditions. Therefore all scenarios tested are in compliance with the 0.03 mg/L in-stream PWQO concentration for total phosphorus.

Un-ionized ammonia concentrations increase immediately downstream of the two (2) treatment facility outfalls and then begin a steep decline further downstream due to deposition, plant uptake and dilution from incoming tributaries. The greatest increase in un-ionized ammonia concentration occurs immediately downstream of the proposed Everett WWTP with an estimated maximum in-stream concentration increase to 0.018 mg/L under 7Q20 conditions. For Scenario 4 with 7Q20 flow rates, immediately downstream of the CFB Borden facility, the concentration increases by 0.004 mg/L compared with existing conditions. The maximum estimated un-ionized ammonia concentration is 0.02 mg/L immediately downstream of the Everett facility under 7Q20 conditions, assuming instantaneous complete mixing. The lesser response at the CFB Borden WWTP is due to the higher flow volume in the Pine River at this location which provides a higher level of dilution.

The PWQO for nitrate is 10 mg/L. Although the model accounts for ambient nitrate concentration in-stream, the effluent concentration was unknown and was therefore not evaluated since the un-ionized ammonia was deemed to be the limiting nitrogen species because of its acute toxicity. Ambient water quality samples taken as part of the study were consistent with historical findings showing nitrate concentrations less than 3.0 mg/L suggesting there is adequate capacity within the PWQO and that nitrate is not a limiting consideration.

The simulation predicts that dissolved oxygen concentrations will decline by just over 1 mg/L from the headwaters to the confluence with the Nottawasaga in the base 7Q20 scenario. For Scenario 4 with a 10,000 serviced population at Everett and CFB Borden at capacity, the simulation predicts a further reduction of 0.7 mg/L just above the confluence with the Nottawasaga River. Total in-stream fecal coliform count is estimated to increase by a maximum of 14 CFU/100 mL.under Scenario 4.

A sample of the catchment loading function input parameters for catchment 10 and summary tables for each of the 4 scenarios under average flow conditions and 7Q20 flow conditions are provided in **Appendix A**.

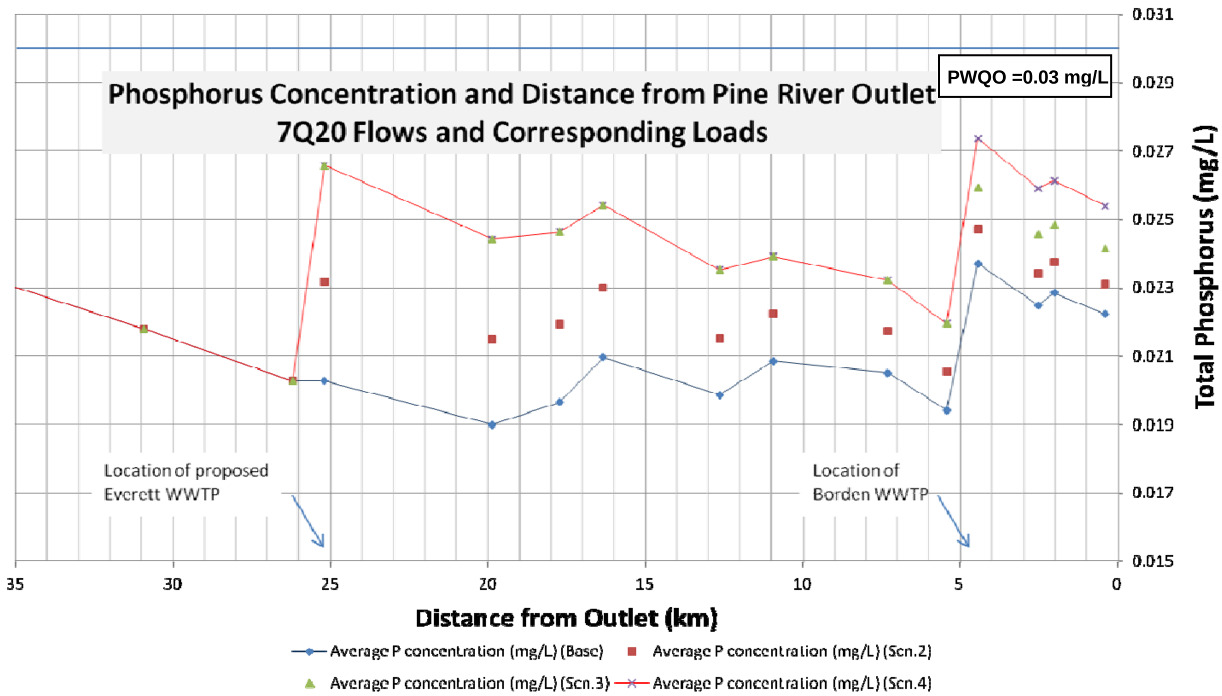


Figure 6-3 Phosphorus concentration and distantance from outlet

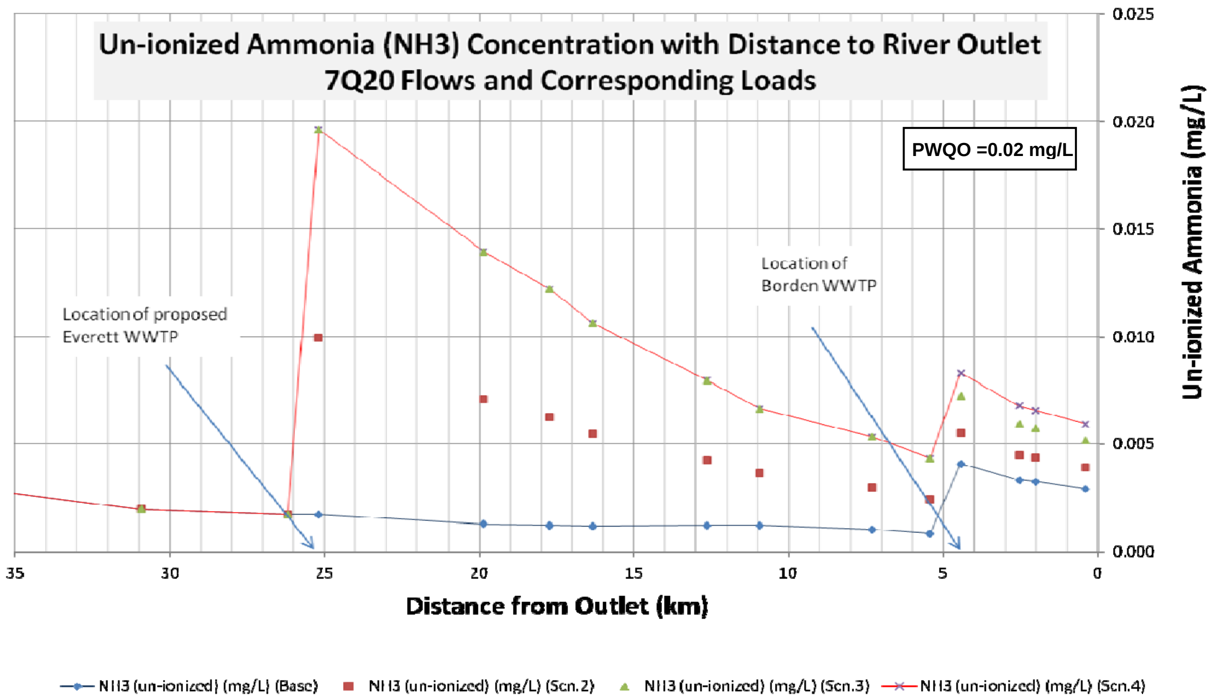


Figure 6-4 Un-ionized ammonia concentration and distantance from outlet

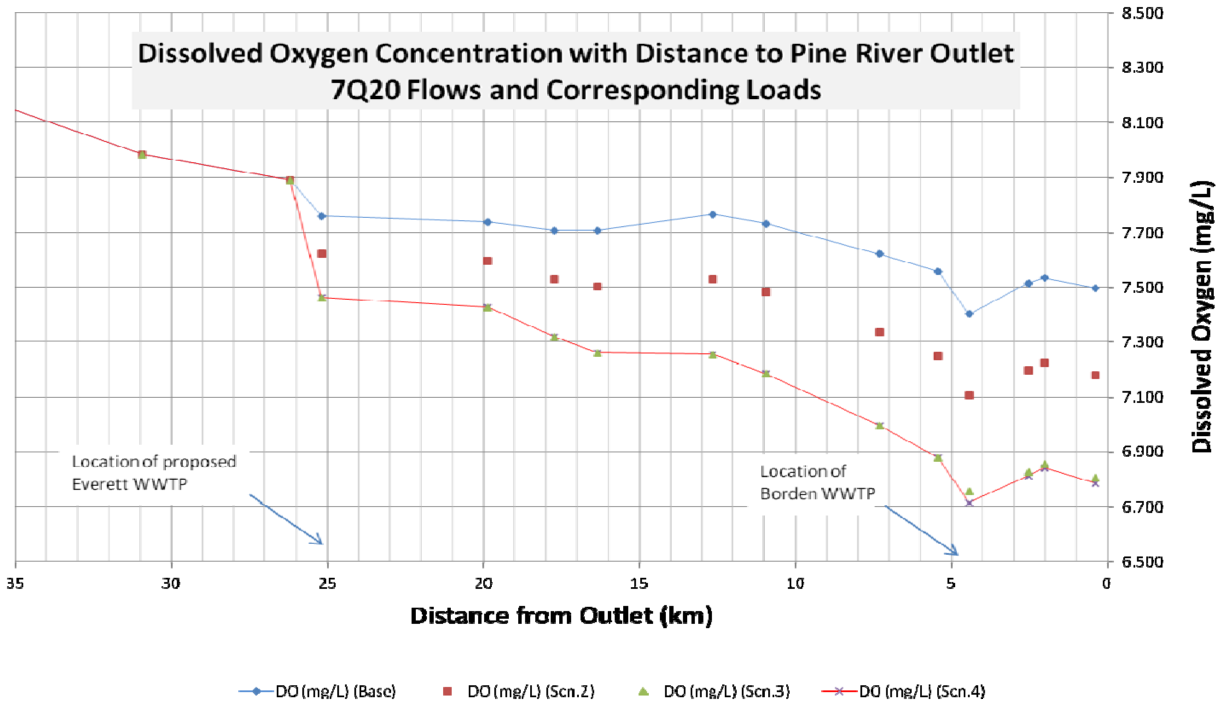


Figure 6-5 Dissolved oxygen concentration and distantance from outlet

7. Dispersion Modeling

The near field mixing zone is most critical for consideration of acute toxicity immediately downstream of the outfall. Un-ionized ammonia was considered a limiting constituent in terms of adherence to PWQO and concerns regarding lethality to aquatic life (acute toxicity).

As the shape and concentration of the downstream plume is highly dependent on the outfall characteristics (i.e. discharge above or below surface, with or without diffusers, velocity, pipe diameter, angle of discharge, temperature, etc.) the results provided herein are a rough estimate, until these design specifications are better known.

A somewhat conservative approach was adopted by assuming a below surface discharge from a single 10 cm diameter pipe 9 cm above the bottom of the stream and 4 m from the nearest bank. The effluent discharges at a rate of 41 L/sec under the 10,000 population condition at an angle parallel to the ambient stream flow. This configuration will take longer and greater downstream distance to achieve complete mixing than multiple pipes with diffusers.

An effluent concentration of un-ionized ammonia of 0.226 mg/L greater than the upstream ambient simulated concentration of 0.002 mg/L was used. At a pH of 8.5 and temperature of 22 degrees, 13% of total ammonia is un-ionized ammonia. Total ammonia in the effluent was determined to have a maximum allowable concentration of 1.8 mg/L using the CANWET model. This value was determined to be the maximum concentration of total ammonia that could be released and achieve a concentration equal to the PWQO for un-ionized ammonia immediately downstream assuming instantaneous complete mixing. The proportion of un-ionized ammonia increases with increased temperature and pH.

Modeling a conservative constituent means that there is no decay or fall out of that constituent as it moves downstream. Given the short travel time and distance during which the plume is expected to exceed the PWQO, this is a reasonable assumption.

The model reports that downstream of the outfall, lateral mixing to a concentration less than the PWQO for un-ionized ammonia of 0.02 mg/L (MOEE, 1994) is achieved at a distance of less than 9 meters downstream after a travel time of less than 9 seconds as shown in **Figure 7-1** and **7-2**. The shape and extent of the plume is sensitive to the angle of discharge. Discharging perpendicular to the ambient flow reduces the distance needed to achieve a similar level of dilution but causes the plume to interact with the left bank of the channel.

The model results note that the effluent velocity is higher than recommended relative to the ambient flow and might be reduced by the addition of multiple pipes or a larger diameter pipe. It is also noted that under 7Q20 flow conditions there is insufficient flow to return the concentration to the ambient upstream concentration in the near field mixing zone.

The model session report is provided in **Appendix B**

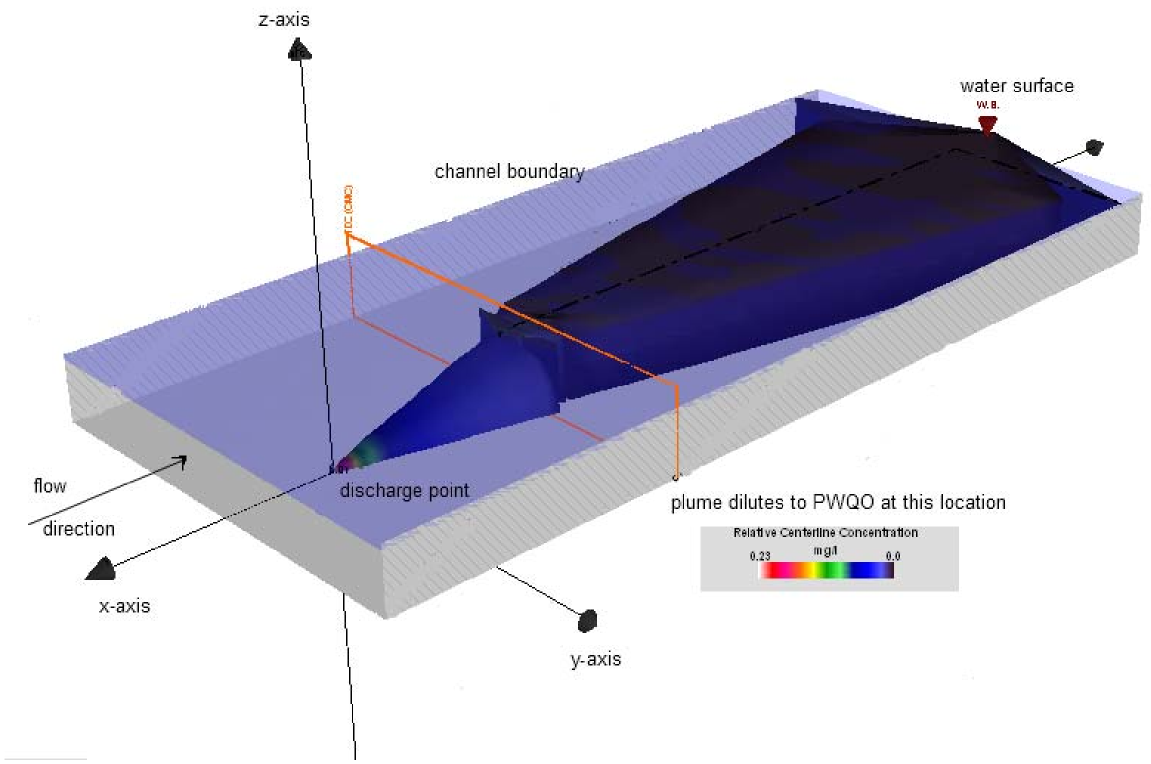


Figure 7-1 Shape of downstream plume

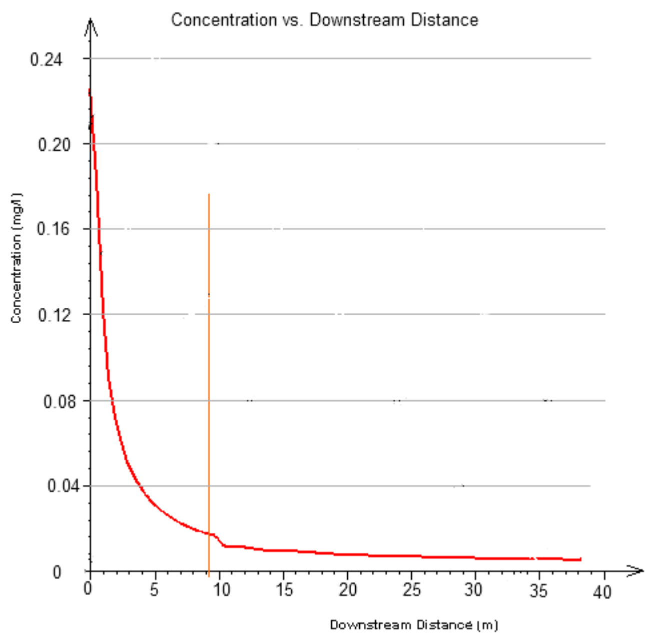


Figure 7-2 Dilution of unionized ammonia in the near field mixing zone

The maximum concentration of un-ionized ammonia in the plume is estimated to be 0.226 mg/L immediately at the outfall.

Unionized ammonia (NH_3) and ammonium (NH_4) exist together in equilibrium in an aqueous solution. MOEE (1994) indicates that the fraction of un-ionized ammonia in an aqueous solution is dependent on temperature and pH according to equation (1) and (2). These equations were applied with an expected summer maximum water temperature of 22 degrees and a pH of 8.5 (consistent with in-stream monitoring results).

$$f = \frac{1}{10^{pKa-pH} + 1} \qquad (1)$$

Where f is the fraction of NH_3 in solution and

$$pKa = 0.09018 + \frac{2729.92}{T + 273.16} \qquad (2)$$

Where T is temperature in degrees Celsius

8. Comparison with In-Stream Water Quality Objectives

In-stream modeling results found the concentrations of total phosphorus, un-ionized ammonia and dissolved oxygen to be within PWQO criteria, as shown in **Table 8-1**. Nitrate loading from WWTPs was not specifically considered due to lack of data, but given that the highest ambient concentrations (simulated and monitored) were less than 3 mg/L, nitrate concentration is not a critical consideration unless the effluent concentration of nitrate is to be greater than 10 mg/L.

Table 8-1 Governing PWQOs and simulated 7Q20 conditions (most limiting reach)

Parameter	Governing PWQO (mg/L)	Critical simulated 7Q20 condition compliant with PWQO?
Dissolved Oxygen (DO)	5 to 8 degrees C (warm water) 4 to 7 degrees C (cold water)	6.7 mg/L; Compliant
Total Phosphorus	0.03	0.03 mg/L; Compliant
Un-ionized Ammonia	0.02	0.02 mg/L; Compliant
Total fecal coliform	200 CFU/100mL	52 CFU/100mL; Compliant

Although there are data points in the historical monitoring record that exceed the PWQO for total phosphorus and total fecal coliforms from the data reviewed, the Pine River is a Policy 1 receiver at Everett based on median concentration data. **The simulation analysis suggests that under average and 7Q20 flow conditions, the PWQO criterion is not exceeded at Everett and the addition of the proposed WWTP with population up to 10,000 will not cause conditions downstream to exceed PWQO under the conditions evaluated.**

9. Conclusions and Recommendations

A Township of Adjala Tosorontio operated treatment facility at Everett with a serviced population of 10,000 will result in increased contaminant loading to the Pine River. Urban growth in Everett will also likely increase the amount of non-point source loading. As a Policy 1 receiver, downstream of Everett, in-stream constituent concentrations must be maintained below PWQOs or better and dissolved oxygen concentrations need to be above specified levels.

The water quality simulations show that under 7Q20 flow conditions that PWQOs for governing water quality constituents are met when effluent is maintained as per the concentrations specified in **Section 4.** However, maximum concentrations of total phosphorus and un-ionized ammonia approach the criteria in reaches immediately downstream of the proposed WWTP. Given that monitoring data suggests concentrations can periodically exceed PWQO criteria, independent of low flow conditions, the Township should consider adding a safety factor to the maximum effluent concentrations identified and/or possibly seek offsetting opportunities downstream or within the Community of Everett. Replacement of older, failing septic systems and better control of nutrient loss from urban and agricultural lands would be possible examples for further investigation.

Offsetting opportunities include any management activities, land use changes, structures or other technologies that would reduce contaminant loading by an amount equivalent to or greater than the anticipated load increase from the proposed Everett WWTP.

The watershed modeling work could be used to assist in identifying the most beneficial locations where offsetting practices might be considered. From our assessment it appears that the rise in phosphorus concentration in the lower reaches of the Pine are at least in part attributable to point and non-point sources within CFB Borden. It is also likely that urban runoff from Angus further increases concentration and loading downstream of the Mill Street monitoring station.

10. References Cited

Ontario Ministry of Environment and Energy (1994) Policies, Guidelines, Provincial Water Quality Objectives, Queen's Printer for Ontario ISBN 0-7778-8473-9 rev

Appendix A

Water Quality Model Input Parameters and Results Summary

Weather Data

Gaps in the weather data used in the water quality model post 2003 were filled in based on a regression equation from matching values between the Shanty Bay and Egbert CS Environment Canada weather stations.

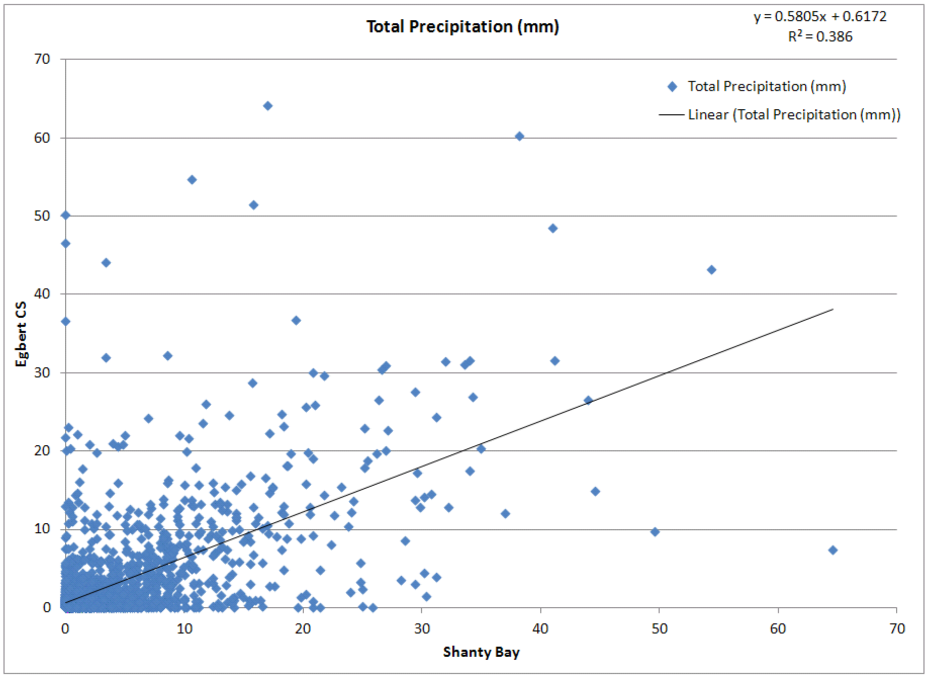


Figure 1: Precipitation Regression: Shanty Bay and Egbert CS Stations

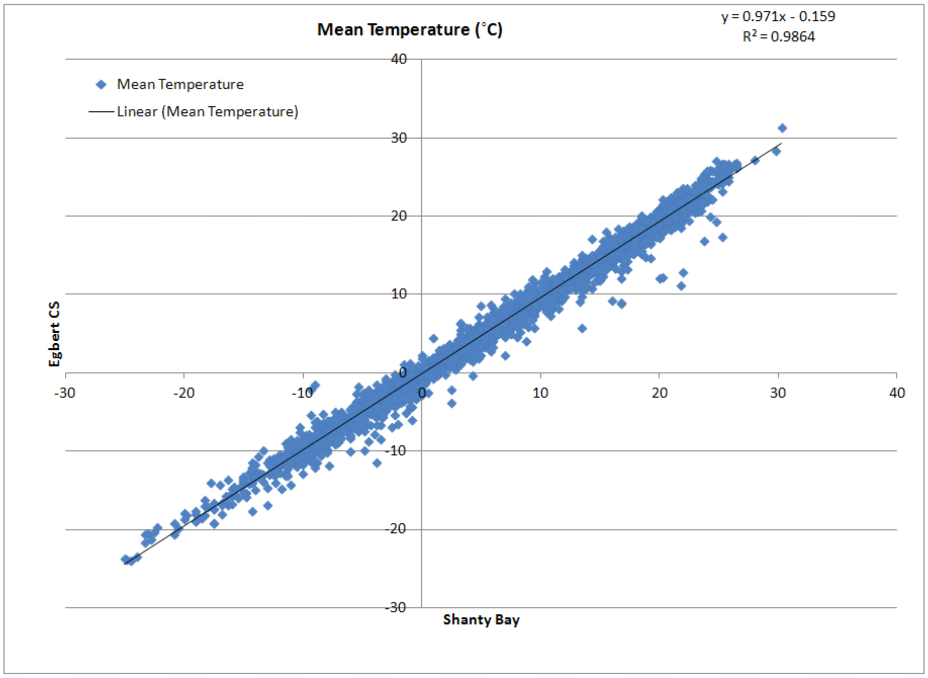


Figure 2: Mean Temperature Regression: Shanty Bay and Egbert CS Stations

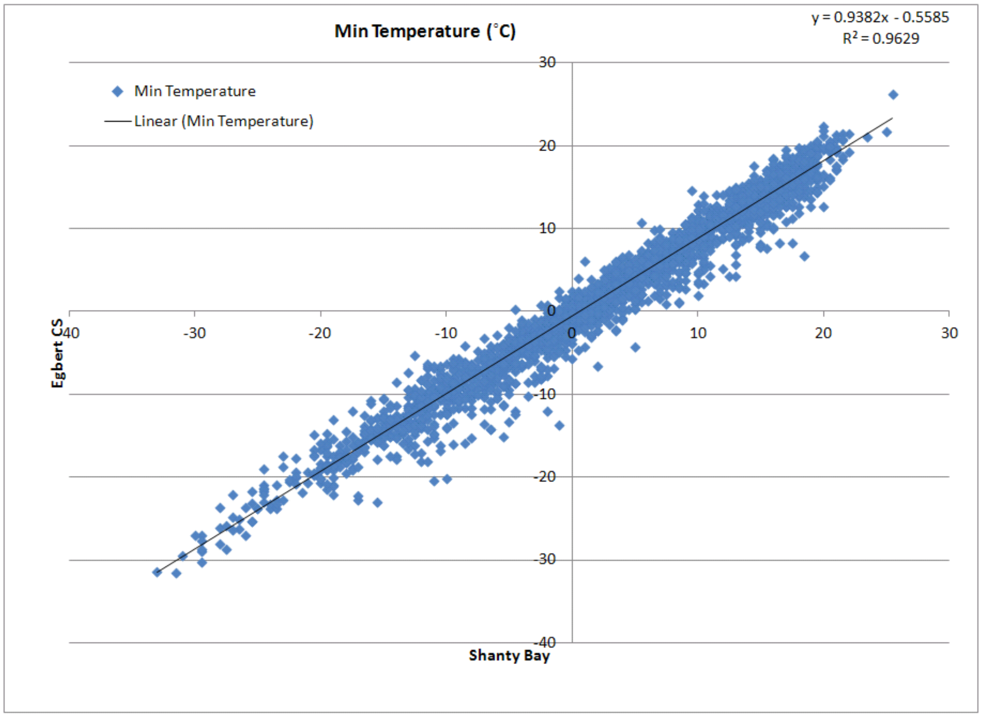


Figure 3: Min Temperature Regression: Shanty Bay and Egbert CS Stations

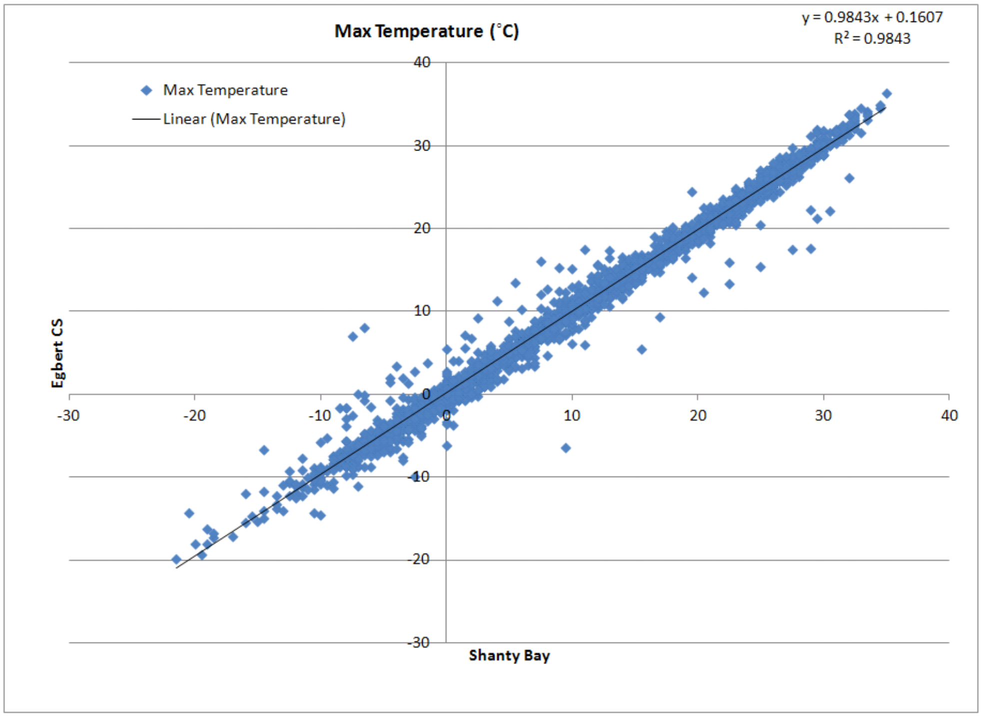
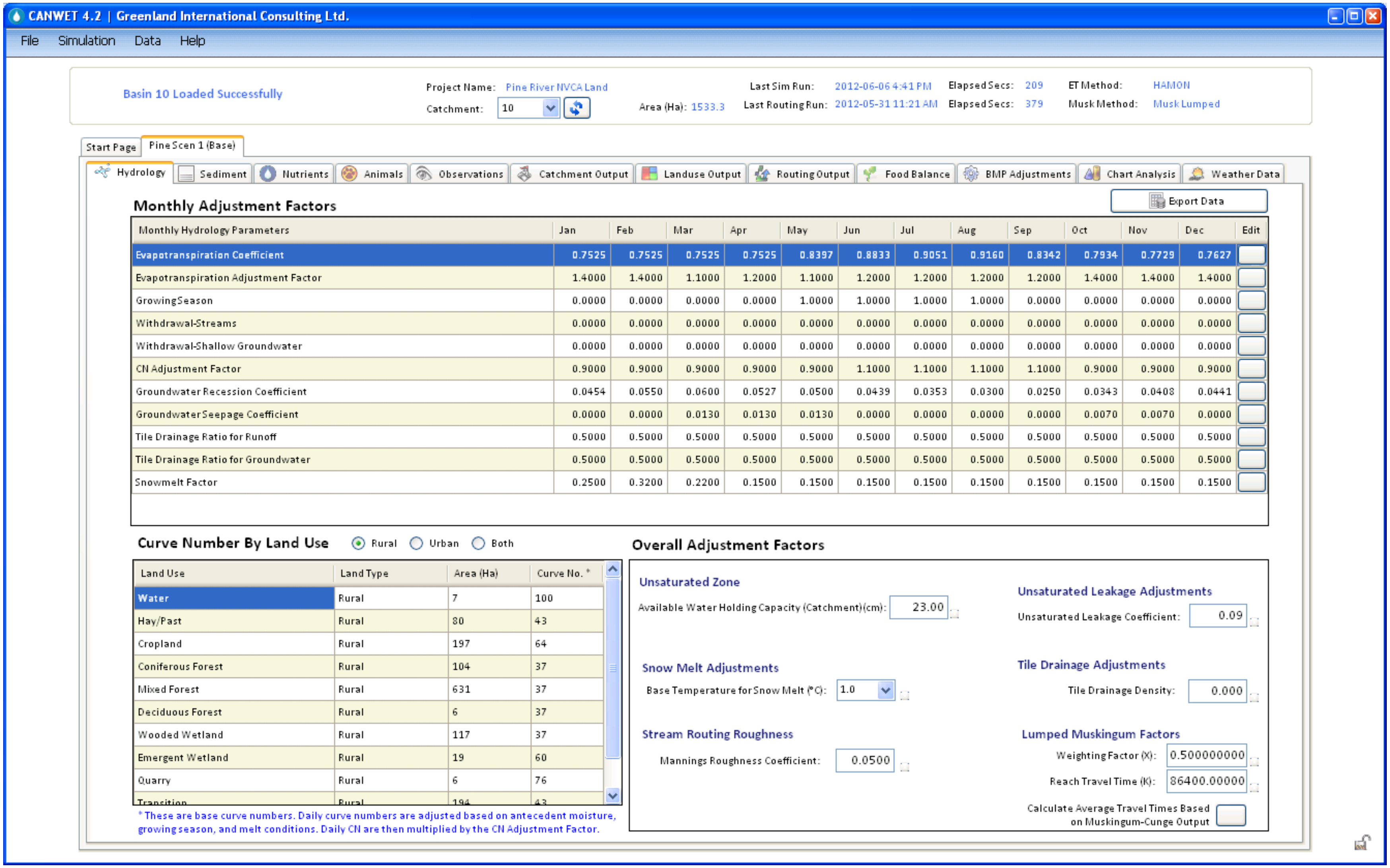


Figure 4: Max Temperature Regression: Shanty Bay and Egbert CS Stations

Sample CANWET Input Screens for Catchment 10 Containing Proposed WWTP Everett



Monthly Hydrology Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Edit
Evapotranspiration Coefficient	0.7525	0.7525	0.7525	0.7525	0.8397	0.8833	0.9051	0.9160	0.8342	0.7934	0.7729	0.7627	
Evapotranspiration Adjustment Factor	1.4000	1.4000	1.1000	1.2000	1.1000	1.2000	1.2000	1.2000	1.2000	1.4000	1.4000	1.4000	
GrowingSeason	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	
Withdrawal-Streams	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Withdrawal-Shallow Groundwater	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
CN Adjustment Factor	0.9000	0.9000	0.9000	0.9000	0.9000	1.1000	1.1000	1.1000	1.1000	0.9000	0.9000	0.9000	
Groundwater Recession Coefficient	0.0454	0.0550	0.0600	0.0527	0.0500	0.0439	0.0353	0.0300	0.0250	0.0343	0.0408	0.0441	
Groundwater Seepage Coefficient	0.0000	0.0000	0.0130	0.0130	0.0130	0.0000	0.0000	0.0000	0.0000	0.0070	0.0070	0.0000	
Tile Drainage Ratio for Runoff	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	
Tile Drainage Ratio for Groundwater	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	
Snowmelt Factor	0.2500	0.3200	0.2200	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	

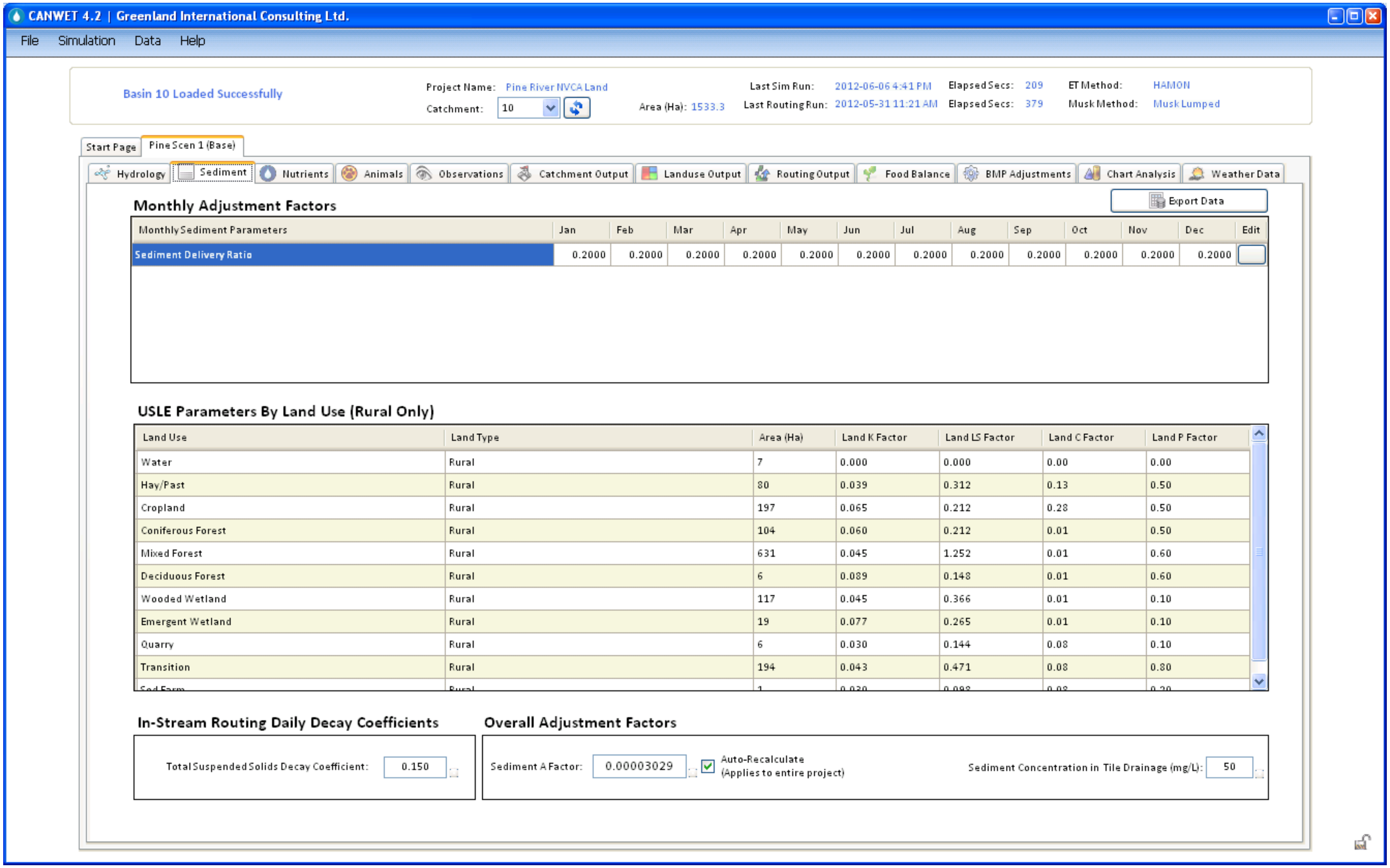
Curve Number By Land Use — Rural / Urban / Both

Land Use	Land Type	Area (Ha)	Curve No. *
Water	Rural	7	100
Hay/Past	Rural	80	43
Cropland	Rural	197	64
Coniferous Forest	Rural	104	37
Mixed Forest	Rural	631	37
Deciduous Forest	Rural	6	37
Wooded Wetland	Rural	117	37
Emergent Wetland	Rural	19	60
Quarry	Rural	6	76
Transition	Rural	194	43

* These are base curve numbers. Daily curve numbers are adjusted based on antecedent moisture, growing season, and melt conditions. Daily CN are then multiplied by the CN Adjustment Factor.

Overall Adjustment Factors

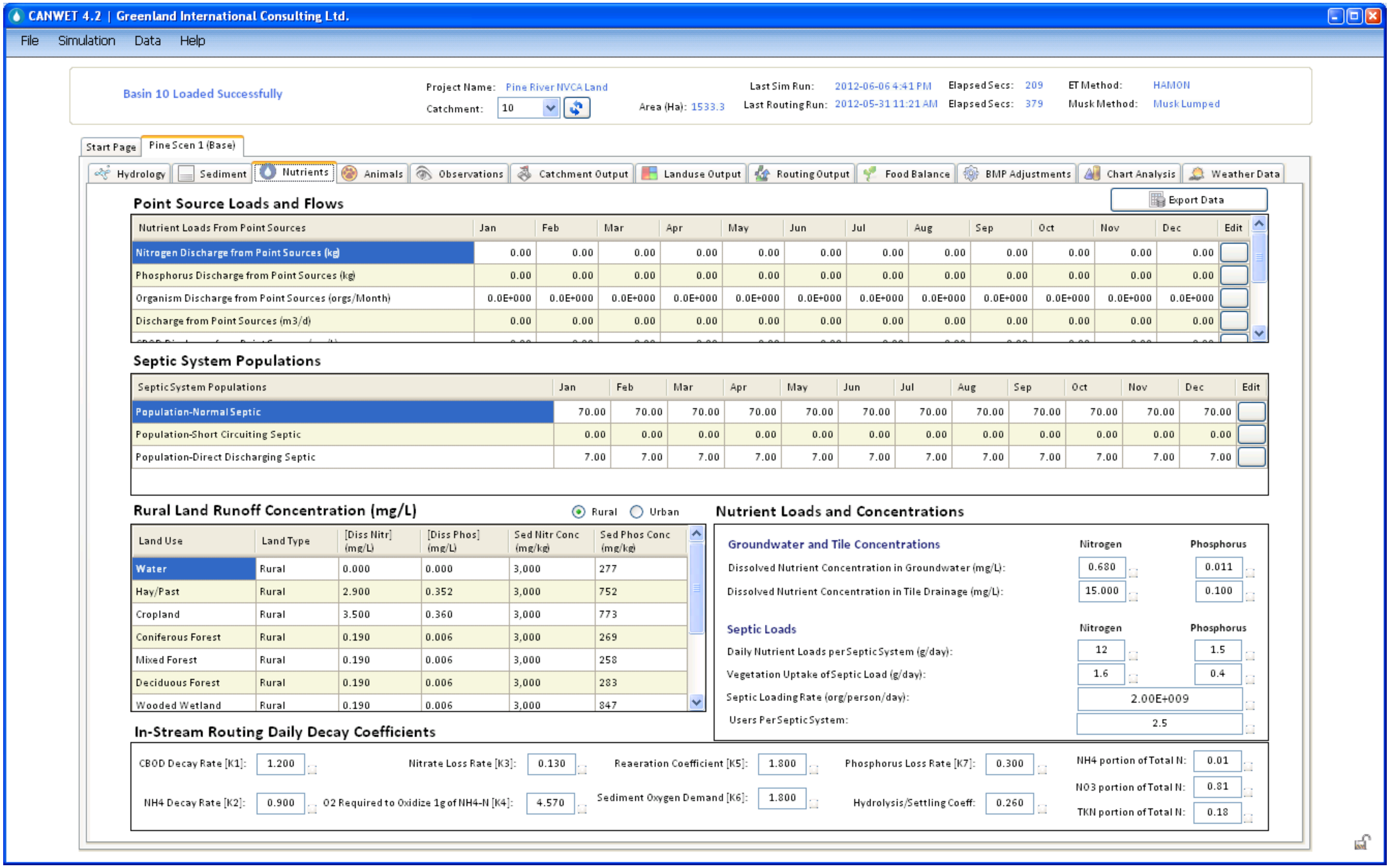
Catchment 10 CANWET hydrology inputs



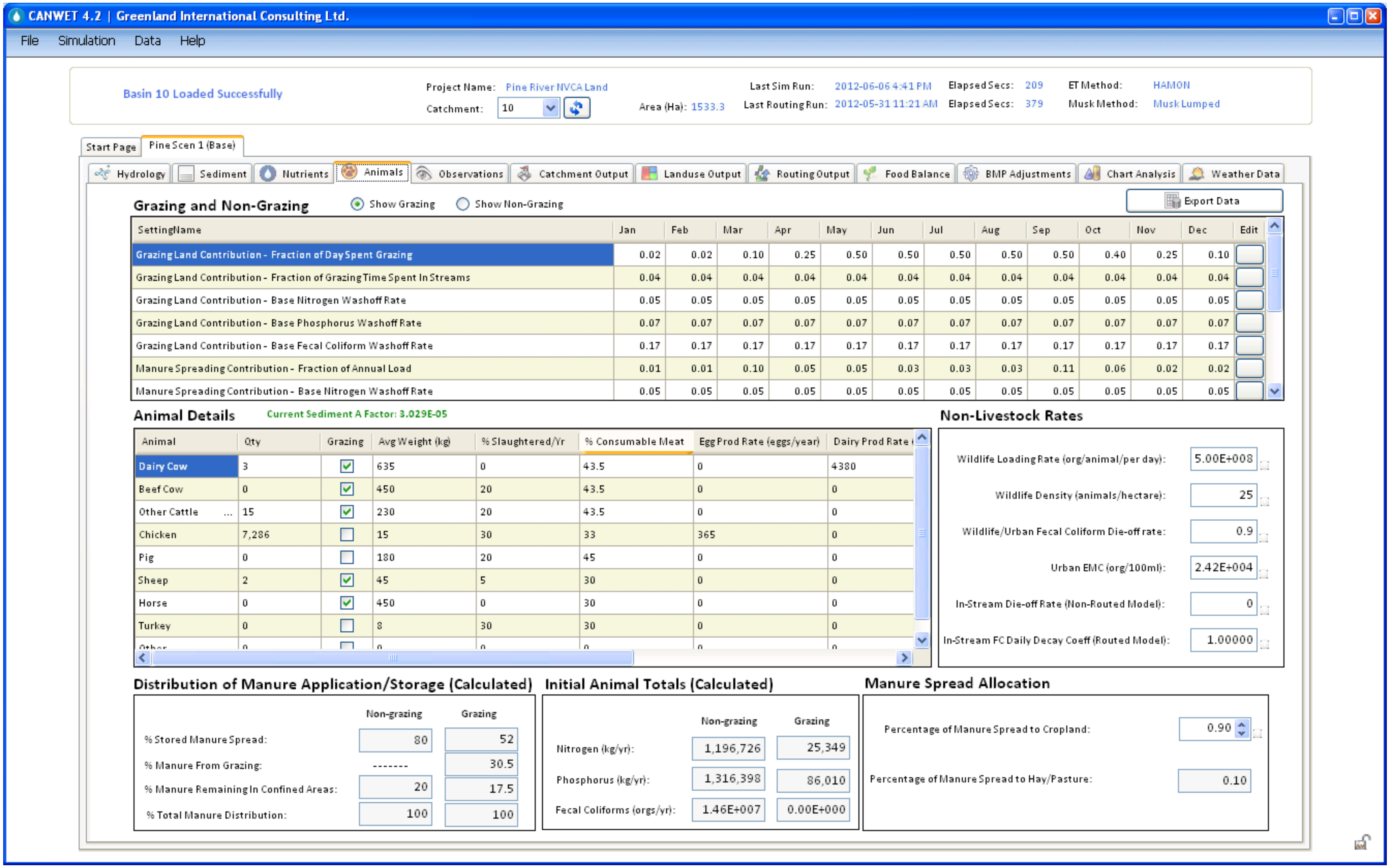
Monthly Sediment Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Edit
Sediment Delivery Ratio	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	

Land Use	Land Type	Area (Ha)	Land K Factor	Land LS Factor	Land C Factor	Land P Factor
Water	Rural	7	0.000	0.000	0.00	0.00
Hay/Past	Rural	80	0.039	0.312	0.13	0.50
Cropland	Rural	197	0.065	0.212	0.28	0.50
Coniferous Forest	Rural	104	0.060	0.212	0.01	0.50
Mixed Forest	Rural	631	0.045	1.252	0.01	0.60
Deciduous Forest	Rural	6	0.089	0.148	0.01	0.60
Wooded Wetland	Rural	117	0.045	0.366	0.01	0.10
Emergent Wetland	Rural	19	0.077	0.265	0.01	0.10
Quarry	Rural	6	0.030	0.144	0.08	0.10
Transition	Rural	194	0.043	0.471	0.08	0.80
Sod Farm	Rural	1				

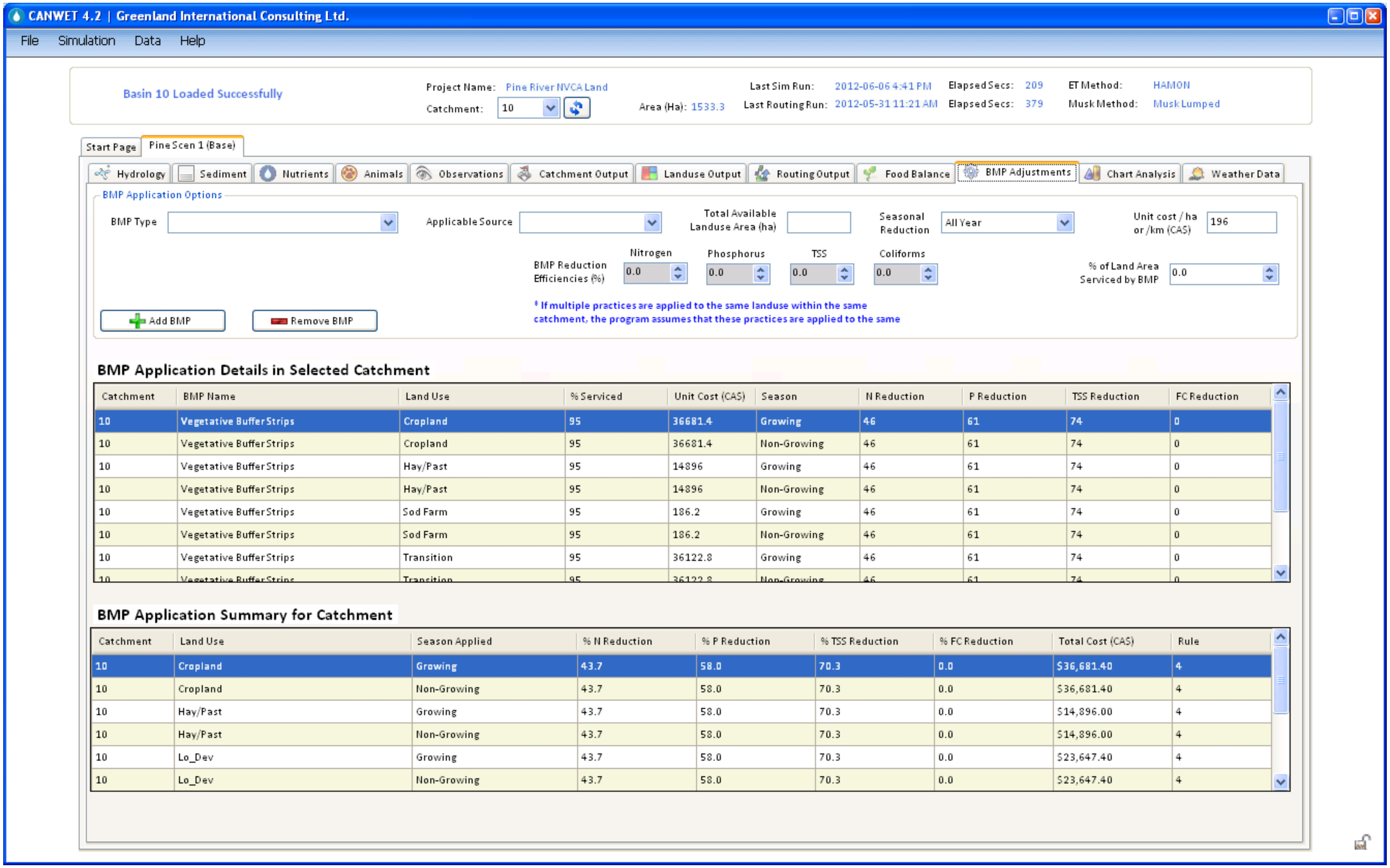
Catchment 10 CANWET sediment inputs



Catchment 10 CANWET nutrient inputs



Catchment 10 CANWET livestock / animal inputs



Catchment 10 CANWET best management practices inputs

Summary of CANWET Results for Average Flow Conditions Isolated

		Base Scenario using Mean Annual Flow									
	Dist. From Outlet (km)	Routed Flow at Node (L/sec) (Base)	Average P concentration (mg/L) (Base)	Average NH3+NH4 concentration (mg/L) (Base)	Average NO2/NO3 concentration (mg/L) (Base)	Average TKN concentration (mg/L) (Base)	NH3 (un-ionized) (mg/L) (Base)	BOD (mg/L) (Base)	DO (mg/L) (Base)	CFU/100 mL (Base)	TSS at reach outlet node (mg/L) (Base)
	52	828	0.027	0.037	3.019	0.671	0.005	1.500	8.626	0.000	0.543
	42	1453	0.022	0.020	2.010	0.427	0.003	1.302	8.432	188.112	0.301
	31	1745	0.020	0.013	1.725	0.344	0.002	1.015	8.069	118.130	0.257
	26	2057	0.020	0.012	1.663	0.328	0.002	0.950	7.952	87.770	0.206
Everett WWTP	25	2057	0.020	0.012	1.663	0.328	0.002	0.950	7.832	87.770	0.000
	20	2179	0.020	0.010	1.576	0.302	0.001	0.836	7.772	72.306	0.039
	18	2272	0.019	0.009	1.537	0.291	0.001	0.796	7.713	65.638	0.028
	16	2411	0.019	0.009	1.498	0.281	0.001	0.774	7.689	60.468	0.046
	13	2787	0.019	0.010	1.509	0.287	0.001	0.815	7.731	51.559	0.160
	11	3159	0.019	0.009	1.442	0.275	0.001	0.836	7.675	46.595	0.094
	7	3306	0.019	0.008	1.386	0.257	0.001	0.737	7.517	39.326	0.133
	5	3319	0.019	0.007	1.368	0.249	0.001	0.678	7.436	36.415	0.026
Borden WWTP	4	3353	0.020	0.013	1.354	0.247	0.002	0.713	7.396	38.089	0.047
	3	3381	0.019	0.012	1.336	0.240	0.002	0.660	7.407	35.274	0.010
	2	3479	0.020	0.012	1.327	0.240	0.002	0.684	7.431	35.825	0.075
	0	3511	0.020	0.011	1.307	0.232	0.001	0.634	7.377	32.932	0.083

		Scenario 2 using Mean Annual Flow									
	Dist. From Outlet (km)	Routed Flow at Node Outlet (L/sec) (Scn.2)	Average P concentration (mg/L) (Scn.2)	Average NH3+NH4 concentration (mg/L) (Scn.2)	Average NO2/NO3 concentration (mg/L) (Scn.2)	Average TKN concentration (mg/L) (Scn.2)	NH3 (un-ionized) (mg/L) (Scn.2)	BOD (mg/L) (Scn.2)	DO (mg/L) (Scn.2)	CFU/100 mL (Scn.2)	TSS at reach outlet node (mg/L) (Scn.2)
	52	828	0.027	0.037	3.019	0.671	0.005	1.500	8.626	0.000	0.543
	42	1453	0.022	0.020	2.010	0.427	0.003	1.302	8.432	188.112	0.301
	31	1745	0.020	0.013	1.725	0.344	0.002	1.015	8.069	118.130	0.257
	26	2057	0.020	0.012	1.663	0.328	0.002	0.950	7.952	87.770	0.206
Everett WWTP	25	2075	0.021	0.027	1.649	0.325	0.003	1.028	7.798	88.744	0.087
	20	2197	0.020	0.022	1.566	0.299	0.003	0.898	7.748	73.110	0.055
	18	2290	0.020	0.019	1.529	0.289	0.002	0.850	7.679	66.359	0.029
	16	2429	0.020	0.017	1.491	0.279	0.002	0.820	7.647	61.096	0.046
	13	2805	0.020	0.017	1.504	0.286	0.002	0.852	7.686	52.088	0.159
	11	3177	0.020	0.015	1.438	0.273	0.002	0.864	7.625	47.032	0.093
	7	3324	0.019	0.012	1.384	0.255	0.002	0.760	7.456	39.684	0.133
	5	3337	0.019	0.011	1.366	0.248	0.001	0.699	7.370	36.744	0.026
Borden WWTP	4	3371	0.020	0.017	1.352	0.246	0.002	0.734	7.331	38.406	0.047
	3	3399	0.020	0.015	1.335	0.239	0.002	0.679	7.339	35.563	0.010
	2	3497	0.020	0.015	1.326	0.238	0.002	0.702	7.364	36.103	0.075
	0	3529	0.020	0.014	1.306	0.231	0.002	0.651	7.307	33.187	0.083

	Dist. From Outlet (km)	Scenario 3 using Mean Annual Flow Routed Flow at Node Outlet (L/sec) (Scn.3)	Average P concentration (mg/L) (Scn.3)	Average NH3+NH4 concentration (mg/L) (Scn.3)	Average NO2/NO3 concentration (mg/L) (Scn.3)	Average TKN concentration (mg/L) (Scn.3)	NH3 (un-ionized) (mg/L) (Scn.3)	BOD (mg/L) (Scn.3)	DO (mg/L) (Scn.3)	CFU/100 mL (Scn.3)	TSS at reach outlet node (mg/L) (Scn.3)
	52	828	0.027	0.037	3.019	0.671	0.005	1.500	8.626	0.000	0.543
	42	1453	0.022	0.020	2.010	0.427	0.003	1.302	8.432	188.112	0.301
	31	1745	0.020	0.013	1.725	0.344	0.002	1.015	8.069	118.130	0.257
	26	2057	0.020	0.012	1.663	0.328	0.002	0.950	7.952	87.770	0.206
Everett WWTP	25	2098	0.022	0.047	1.631	0.321	0.006	1.126	7.757	89.964	0.195
	20	2220	0.021	0.037	1.553	0.296	0.005	0.976	7.718	74.119	0.075
	18	2313	0.021	0.033	1.518	0.286	0.004	0.918	7.637	67.263	0.031
	16	2452	0.020	0.029	1.482	0.277	0.004	0.878	7.595	61.885	0.046
	13	2828	0.020	0.025	1.497	0.283	0.003	0.897	7.630	52.755	0.158
	11	3200	0.020	0.022	1.434	0.271	0.003	0.901	7.562	47.584	0.093
	7	3347	0.020	0.018	1.381	0.254	0.002	0.788	7.380	40.136	0.132
	5	3360	0.019	0.016	1.364	0.246	0.002	0.725	7.287	37.159	0.026
Borden WWTP	4	3394	0.020	0.022	1.350	0.244	0.003	0.759	7.248	38.805	0.047
	3	3422	0.020	0.020	1.333	0.237	0.003	0.702	7.253	35.928	0.010
	2	3520	0.021	0.020	1.324	0.237	0.002	0.724	7.280	36.455	0.074
	0	3552	0.020	0.018	1.305	0.230	0.002	0.671	7.219	33.509	0.082

	Dist. From Outlet (km)	Scenario 4 using Mean Annual Flow Routed Flow at Node Outlet (L/sec) (Scn.4)	Average P concentration (mg/L) (Scn.4)	Average NH3+NH4 concentration (mg/L) (Scn.4)	Average NO2/NO3 concentration (mg/L) (Scn.4)	Average TKN concentration (mg/L) (Scn.4)	NH3 (un-ionized) (mg/L) (Scn.4)	BOD (mg/L) (Scn.4)	DO (mg/L) (Scn.4)	CFU/100 mL (Scn.4)	TSS at reach outlet node (mg/L) (Scn.4)
	52	828	0.027	0.037	3.019	0.671	0.005	1.500	8.626	0.000	0.543
	42	1453	0.022	0.020	2.010	0.427	0.003	1.302	8.432	188.112	0.301
	31	1745	0.020	0.013	1.725	0.344	0.002	1.015	8.069	118.130	0.257
	26	2057	0.020	0.012	1.663	0.328	0.002	0.950	7.952	87.770	0.206
Everett WWTP	25	2098	0.022	0.047	1.631	0.321	0.006	1.126	7.757	89.964	0.195
	20	2220	0.021	0.037	1.553	0.296	0.005	0.976	7.718	74.119	0.075
	18	2313	0.021	0.033	1.518	0.286	0.004	0.918	7.637	67.263	0.031
	16	2452	0.020	0.029	1.482	0.277	0.004	0.878	7.595	61.885	0.046
	13	2828	0.020	0.025	1.497	0.283	0.003	0.897	7.630	52.755	0.158
	11	3200	0.020	0.022	1.434	0.271	0.003	0.901	7.562	47.584	0.093
	7	3347	0.020	0.018	1.381	0.254	0.002	0.788	7.380	40.136	0.132
	5	3360	0.019	0.016	1.364	0.246	0.002	0.725	7.287	37.159	0.026
Borden WWTP	4	3407	0.021	0.024	1.345	0.243	0.003	0.772	7.236	39.423	0.064
	3	3435	0.020	0.022	1.328	0.236	0.003	0.714	7.251	36.493	0.012
	2	3533	0.021	0.022	1.319	0.236	0.003	0.736	7.278	37.002	0.074
	0	3565	0.021	0.019	1.301	0.229	0.002	0.681	7.216	34.011	0.082

Summary of CANWET Results for 7Q20 Flow Conditions Isolated

		Base Scenario using 7Q20 Flow Condition									
	Dist. From Outlet (km)	Routed Flow at Node (L/sec) (Base)	Average P concentration (mg/L) (Base)	Average NH3+NH4 concentration (mg/L) (Base)	Average NO2/NO3 concentration (mg/L) (Base)	Average TKN concentration (mg/L) (Base)	NH3 (un-ionized) (mg/L) (Base)	BOD (mg/L) (Base)	DO (mg/L) (Base)	CFU/100 mL (Base)	TSS at reach outlet node (mg/L) (Base)
	52	192	0.030	0.057	4.650	1.033	0.007	1.500	8.626	0.000	0.151
	42	337	0.025	0.031	3.119	0.663	0.004	1.302	8.433	51.666	0.049
	31	405	0.022	0.015	2.580	0.486	0.002	0.838	7.984	25.457	0.151
	26	477	0.020	0.013	2.405	0.443	0.002	0.774	7.890	17.412	0.089
Everett WWTP	25	477	0.020	0.013	2.405	0.443	0.002	0.774	7.759	17.412	0.000
	20	505	0.019	0.010	2.244	0.395	0.001	0.645	7.738	13.332	0.030
	18	527	0.020	0.010	2.189	0.382	0.001	0.629	7.708	12.186	0.018
	16	559	0.021	0.009	2.133	0.371	0.001	0.629	7.709	11.453	0.045
	13	647	0.020	0.010	2.036	0.355	0.001	0.659	7.763	9.063	0.120
	11	733	0.021	0.010	1.944	0.342	0.001	0.709	7.731	8.294	0.067
	7	767	0.020	0.008	1.864	0.320	0.001	0.635	7.622	6.754	0.081
	5	770	0.019	0.007	1.813	0.301	0.001	0.537	7.558	5.732	0.019
Borden WWTP	4	804	0.024	0.032	1.735	0.288	0.004	0.689	7.402	5.488	0.196
	3	811	0.022	0.026	1.688	0.271	0.003	0.586	7.514	4.639	0.038
	2	833	0.023	0.026	1.669	0.269	0.003	0.605	7.534	4.477	0.005
	0	841	0.022	0.023	1.643	0.261	0.003	0.563	7.497	4.096	0.029

		Scenario 2 using 7Q20 Flow Condition									
	Dist. From Outlet (km)	Routed Flow at Node (L/sec) (Scn.2)	Average P concentration (mg/L) (Scn.2)	Average NH3+NH4 concentration (mg/L) (Scn.2)	Average NO2/NO3 concentration (mg/L) (Scn.2)	Average TKN concentration (mg/L) (Scn.2)	NH3 (un-ionized) (mg/L) (Scn.2)	BOD (mg/L) (Scn.2)	DO (mg/L) (Scn.2)	CFU/100 mL (Scn.2)	TSS at reach outlet node (mg/L) (Scn.2)
	52	192	0.030	0.057	4.650	1.033	0.007	1.500	8.626	0.000	0.151
	42	337	0.025	0.031	3.119	0.663	0.004	1.302	8.433	51.666	0.049
	31	405	0.022	0.015	2.580	0.486	0.002	0.838	7.984	25.457	0.151
	26	477	0.020	0.013	2.405	0.443	0.002	0.774	7.890	17.412	0.089
Everett WWTP	25	495	0.023	0.078	2.318	0.427	0.010	1.109	7.623	24.049	0.364
	20	523	0.021	0.056	2.183	0.382	0.007	0.888	7.596	18.283	0.130
	18	545	0.022	0.049	2.136	0.370	0.006	0.840	7.529	16.579	0.027
	16	577	0.023	0.043	2.088	0.360	0.005	0.811	7.504	15.276	0.045
	13	665	0.022	0.034	2.004	0.346	0.004	0.788	7.531	11.912	0.117
	11	751	0.022	0.029	1.919	0.334	0.004	0.811	7.482	10.623	0.066
	7	785	0.022	0.024	1.845	0.313	0.003	0.716	7.335	8.660	0.079
	5	788	0.021	0.019	1.797	0.294	0.002	0.604	7.248	7.350	0.018
Borden WWTP	4	822	0.025	0.043	1.722	0.282	0.006	0.750	7.107	15.389	0.192
	3	829	0.023	0.035	1.677	0.265	0.004	0.636	7.200	13.011	0.038
	2	851	0.024	0.035	1.659	0.264	0.004	0.654	7.225	12.564	0.004
	0	859	0.023	0.031	1.635	0.256	0.004	0.607	7.181	11.497	0.029

		Scenario 3 using 7Q20 Flow Condition									
	Dist. From Outlet (km)	Routed Flow at Node Outlet (L/sec) (Scn.3)	Average P concentration (mg/L) (Scn.3)	Average NH3+NH4 concentration (mg/L) (Scn.3)	Average NO2/NO3 concentration (mg/L) (Scn.3)	Average TKN concentration (mg/L) (Scn.3)	NH3 (un-ionized) (mg/L) (Scn.3)	BOD (mg/L) (Scn.3)	DO (mg/L) (Scn.3)	CFU/100 mL (Scn.3)	TSS at reach outlet node (mg/L) (Scn.3)
	52	192	0.030	0.057	4.650	1.033	0.007	1.500	8.626	0.000	0.151
	42	337	0.025	0.031	3.119	0.663	0.004	1.302	8.433	51.666	0.049
	31	405	0.022	0.015	2.580	0.486	0.002	0.838	7.984	25.457	0.151
	26	477	0.020	0.013	2.405	0.443	0.002	0.774	7.890	17.412	0.089
Everett WWTP	25	518	0.027	0.155	2.215	0.408	0.020	1.504	7.462	31.858	0.791
	20	546	0.024	0.110	2.110	0.366	0.014	1.174	7.428	24.135	0.249
	18	568	0.025	0.096	2.073	0.355	0.012	1.091	7.317	21.787	0.038
	16	600	0.025	0.084	2.034	0.346	0.011	1.027	7.260	19.826	0.044
	13	688	0.024	0.063	1.965	0.334	0.008	0.942	7.254	15.335	0.114
	11	774	0.024	0.053	1.890	0.324	0.007	0.934	7.185	13.442	0.064
	7	808	0.023	0.042	1.823	0.304	0.005	0.814	6.995	10.972	0.077
	5	811	0.022	0.034	1.779	0.286	0.004	0.686	6.880	9.314	0.018
Borden WWTP	4	845	0.026	0.057	1.707	0.274	0.007	0.825	6.757	17.054	0.187
	3	852	0.025	0.047	1.664	0.258	0.006	0.698	6.825	14.422	0.037
	2	874	0.025	0.045	1.648	0.257	0.006	0.713	6.856	13.937	0.004
	0	882	0.024	0.041	1.624	0.249	0.005	0.660	6.805	12.756	0.028

		Scenario 4 using 7Q20 Flow Condition									
	Dist. From Outlet (km)	Routed Flow at Node Outlet (L/sec) (Scn.4)	Average P concentration (mg/L) (Scn.4)	Average NH3+NH4 concentration (mg/L) (Scn.4)	Average NO2/NO3 concentration (mg/L) (Scn.4)	Average TKN concentration (mg/L) (Scn.4)	NH3 (un-ionized) (mg/L) (Scn.4)	BOD (mg/L) (Scn.4)	DO (mg/L) (Scn.4)	CFU/100 mL (Scn.4)	TSS at reach outlet node (mg/L) (Scn.4)
	52	192	0.030	0.057	4.650	1.033	0.007	1.500	8.626	0.000	0.151
	42	337	0.025	0.031	3.119	0.663	0.004	1.302	8.433	51.666	0.049
	31	405	0.022	0.015	2.580	0.486	0.002	0.838	7.984	25.457	0.151
	26	477	0.020	0.013	2.405	0.443	0.002	0.774	7.890	17.412	0.089
Everett WWTP	25	518	0.027	0.155	2.215	0.408	0.020	1.504	7.462	31.858	0.791
	20	546	0.024	0.110	2.110	0.366	0.014	1.174	7.428	24.135	0.249
	18	568	0.025	0.096	2.073	0.355	0.012	1.091	7.317	21.787	0.038
	16	600	0.025	0.084	2.034	0.346	0.011	1.027	7.260	19.826	0.044
	13	688	0.024	0.063	1.965	0.334	0.008	0.942	7.254	15.335	0.114
	11	774	0.024	0.053	1.890	0.324	0.007	0.934	7.185	13.442	0.064
	7	808	0.023	0.042	1.823	0.304	0.005	0.814	6.995	10.972	0.077
	5	811	0.022	0.034	1.779	0.286	0.004	0.686	6.880	9.314	0.018
Borden WWTP	4	858	0.027	0.066	1.681	0.270	0.008	0.875	6.715	19.837	0.254
	3	865	0.026	0.053	1.641	0.254	0.007	0.740	6.811	16.777	0.050
	2	888	0.026	0.052	1.625	0.253	0.007	0.753	6.841	16.219	0.004
	0	895	0.025	0.047	1.603	0.245	0.006	0.696	6.784	14.846	0.028

Appendix B

Dispersion Model Details: Session Report

CORMIX Session Report

Session Report

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 8.0E
                       HYDRO1:Version-8.0.0.0  April,2012
SITE NAME/LABEL:                Everett Proposed WWTP
  DESIGN CASE:                  Summer 7Q20 Flow
  FILE NAME:                    C:\Program Files\CORMIX8\Sample Files\Sample1.prd
  Using subsystem CORMIX1:     Single Port Discharges
  Start of session:             07/25/2012--15:46:00
*****************************************************************************
SUMMARY OF INPUT DATA:
-----------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                              = bounded
  Width                             BS       = 8.4 m
  Channel regularity                ICHREG   = 2
  Ambient flowrate                  QA       = 0.47 m^3/s
  Average depth                     HA       = 1 m
  Depth at discharge                HD       = 1 m
  Ambient velocity                  UA       = 0.0560 m/s
  Darcy-Weisbach friction factor    F        = 0.1961
    Calculated from Manning's n              = 0.05
  Wind velocity                     UW       = 2 m/s
  Stratification Type               STRCND   = U
  Surface temperature                        = 22 degC
  Bottom temperature                         = 22 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density                   RHOAS    = 997.7714 kg/m^3
  Bottom density                    RHOAB    = 997.7714 kg/m^3
-----------------------------------------------------------------------------
DISCHARGE PARAMETERS:               Single Port Discharge
  Nearest bank                               = right
  Distance to bank                  DISTB    = 4 m
  Port diameter                     D0       = 0.1 m
  Port cross-sectional area         A0       = 0.0079 m^2
  Discharge velocity                U0       = 5.22 m/s
  Discharge flowrate                Q0       = 0.041 m^3/s
  Discharge port height             H0       = 0.09 m
  Vertical discharge angle          THETA    = 0 deg
  Horizontal discharge angle        SIGMA    = 0 deg
  Discharge temperature (freshwater)         = 22 degC
  Corresponding density             RHO0     = 997.7714 kg/m^3
  Density difference                DRHO     = 0 kg/m^3
  Buoyant acceleration              GP0      = 0 m/s^2
  Discharge concentration           C0       = 0.226 mg/l
  Surface heat exchange coeff.      KS       = 0 m/s
  Coefficient of decay              KD       = 0 /s
-----------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ   = 0.09 m          Lm  = 8.27 m          Lb  = 0 m
  LM   = 99999 m         Lm' = 99999 m         Lb' = 99999 m
-----------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
  Port densimetric Froude number    FR0      = 99999
  Velocity ratio                    R        = 93.30
-----------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                            = yes
  CMC concentration                 CMC      = 0.018 mg/l
  CCC concentration                 CCC      = 0.002 mg/l
  Water quality standard specified           = given by CCC value
  Regulatory mixing zone                     = no
  Region of interest                         = 500 m downstream
*****************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS    = H5-0 |
  *------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 1 m
*****************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-----------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the bottom below the port center:
    4 m from the right bank/shore.
  Number of display steps NSTEP = 20 per module.
-----------------------------------------------------------------------------
```

```
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.0057 mg/l
  Dilution at edge of NFR              s = 39.3
  NFR Location:                        x = 38.18 m
    (centerline coordinates)           y = 0 m
                                       z = 1 m
  NFR plume dimensions:  half-width (bh) = 3.16 m
                          thickness (bv) = 1 m
Cumulative travel time:       511.2476 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 12.46
 This value is below the computed dilution of 39.34 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-----------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is equal or about about equal to the surrounding
  ambient water density at the discharge level.
  Therefore, the effluent behaves essentially as NEUTRALLY BUOYANT.
-----------------------------------------------------------------------------
Near-field instability behavior:
  The discharge flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-----------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-----------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
************************ TOXIC DILUTION ZONE SUMMARY ************************
Recall: The TDZ corresponds to the three (3) criteria issued in the USEPA
  Technical Support Document (TSD) for Water Quality-based Toxics Control,
  1991 (EPA/505/2-90-001).
  Criterion maximum concentration (CMC)  = 0.018  mg/l
Corresponding dilution                   = 12.555556
The CMC was encountered at the following plume position:
  Plume location:                      x = 8.90 m
    (centerline coordinates)           y = 0 m
                                       z = 0 m
  Plume dimension:       half-width (bh) = 0.06 m
                          thickness (bv) = 0.06 m

 Computed distance from port opening to CMC location = 8.90 m.
 CRITERION 1: This location is beyond 50 times the discharge length scale of
             Lq = 0.09 m.
 +++++ The discharge length scale TEST for the TDZ has FAILED. ++++++

 Computed horizontal distance from port opening to CMC location = 8.90 m.
 CRITERION 2: This location is beyond 5 times the ambient water depth of
             HD = 1 m.
 ++++++++++ The ambient depth TEST for the TDZ has FAILED. ++++++++++

 CRITERION 3: No RMZ has been defined. Therefore, the Regulatory Mixing zone
             test for the TDZ cannot be applied.

 The diffuser discharge velocity is equal to 5.22 m/s.
 This exceeds the value of 3.0 m/s recommended in the TSD.

 *** This discharge DOES NOT SATISFY all three CMC criteria for the TDZ. ****
********************** REGULATORY MIXING ZONE SUMMARY **********************
No RMZ has been specified.
The CCC for the toxic pollutant was not encountered within the predicted
  plume region.
********************* FINAL DESIGN ADVICE AND COMMENTS **********************
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Save Print Clear Close

APPENDIX MDP-F

MDP Option Water Quality and SWMF Sizing Calculations

OPTION 1

STORM STORAGE VOLUMES (ha*m)						
SWMF ID	Catchment	100 YR Max Storage Used	Catchment Area (ha)	TIMP (Impervious)	Perm. Pool Vol. (m3/ha)	Perm. Pool Vol. (m3)
1	15	0.27	13.50	65.00%	173.5	2342
2	17	0.32	18.84	49.00%	134.6	2536
A (3)	16	2.03	74.70	35.00%	100.6	7515
B	10	0.58	69.17	24.90%	76.1	5261
C	20	0.35	44.27	16.00%	54.4	2410
F	18	1.27	40.65	47.00%	129.8	5275

OPTION 1

ACTIVE STORAGE CALCULATIONS											
SWMF ID	Catchments	Catchment Volume (m3)	AS Area (m2)	AS Width (m)	AS Side (m)	AS Area (m2)	Width Plus Buffer (m)	Entire Area (m2)	Entire Area (ha)	% Drainage Area	1.1 Factor (ha)
1	15	2676	1338	21.1	12.0	3941	61	6317	0.63	5.15%	0.69
2	17	3197	1599	23.1	12.0	4390	63	6892	0.69	4.02%	0.76
A (3)	16	20318	10159	58.2	12.0	16321	98	21070	2.11	3.10%	2.32
B	10	5756	2878	31.0	12.0	6427	71	9434	0.94	1.50%	1.04
C	20	3497	1749	24.1	12.0	4642	64	7211	0.72	1.79%	0.79
F	18	12724	6362	46.1	12.0	11359	86	15330	1.53	4.15%	1.69

OPTION 3

STORM STORAGE VOLUMES (ha*m)						
SWMF ID	Catchment	100 YR Max Storage Used	Catchment Area (ha)	TIMP (Impervious)	Perm. Pool Vol. (m3/ha)	Perm. Pool Vol. (m3)
1	15	0.27	13.50	65.00%	173.5	2342
2	17	0.29	18.84	49.00%	134.6	2536
A (3)	16	2.03	74.70	35.00%	100.6	7515
B	10	0.98	69.17	46.80%	129.3	8942
C	20	1.00	44.27	42.00%	117.6	5207
D	11	0.68	76.47	29.20%	86.5	6615
E	19	1.22	64.29	46.90%	129.5	8327
F	18	1.35	40.65	47.00%	129.8	5275

OPTION 3

ACTIVE STORAGE CALCULATIONS											
SWMF ID	Catchments	Catchment Volume (m3)	AS Area (m2)	AS Width (m)	AS Side (m)	AS Area (m2)	Width Plus Buffer (m)	Entire Area (m2)	Entire Area (ha)	% Drainage Area	1.1 Factor (ha)
1	15	2677	1339	21.1	12.0	3942	61	6318	0.63	5.15%	0.69
2	17	2860	1430	21.8	12.0	4102	62	6523	0.65	3.81%	0.72
A (3)	16	20318	10159	58.2	12.0	16321	98	21070	2.11	3.10%	2.32
B	10	9772	4886	40.4	12.0	9336	80	12943	1.29	2.06%	1.42
C	20	9970	4985	40.8	12.0	9474	81	13107	1.31	3.26%	1.44
D	11	6771	3386	33.6	12.0	7186	74	10360	1.04	1.49%	1.14
E	19	12177	6089	45.0	12.0	10989	85	14896	1.49	2.55%	1.64
F	18	13500	6750	47.4	12.0	11880	87	15939	1.59	4.31%	1.75

OPTION 4

STORM STORAGE VOLUMES (ha*m)						
SWMF ID	Catchment	100 YR Max Storage Used	Catchment Area (ha)	TIMP (Impervious)	Perm. Pool Vol. (m3/ha)	Perm. Pool Vol. (m3)
1	15	0.27	13.50	65.00%	173.5	2342
2	17	0.32	18.84	49.00%	134.6	2536
A (3)	16	2.28	74.70	35.00%	100.6	7515
B	10	0.93	69.17	46.80%	129.3	8942
C	20	1.03	44.27	42.00%	117.6	5207
D	11	0.67	76.47	29.20%	86.5	6615
E	19	1.20	64.29	46.90%	129.5	8327
F	18	1.22	40.65	47.00%	129.8	5275

OPTION 4

ACTIVE STORAGE CALCULATIONS											
SWMF ID	Catchments	Catchment Volume (m3)	AS Area (m2)	AS Width (m)	AS Side (m)	AS Area (m2)	Width Plus Buffer (m)	Entire Area (m2)	Entire Area (ha)	% Drainage Area	1.1Factor (ha)
1	15	2676	1338	21.1	12.0	3941	61	6317	0.63	5.15%	0.69
2	17	3197	1599	23.1	12.0	4390	63	6892	0.69	4.02%	0.76
A (3)	16	22791	11396	61.6	12.0	17888	102	22857	2.29	3.37%	2.51
B	10	9299	4650	39.4	12.0	9005	79	12548	1.25	2.00%	1.38
C	20	10291	5146	41.4	12.0	9697	81	13372	1.34	3.32%	1.47
D	11	6748	3374	33.5	12.0	7169	74	10340	1.03	1.49%	1.14
E	19	11979	5990	44.7	12.0	10855	85	14739	1.47	2.52%	1.62
F	18	12200	6100	45.1	12.0	11005	85	14915	1.49	4.04%	1.64

100-Year Pond Sizing	
XD Length:Width	3
XD Depth	2
XD Side Slope	6
8 m Buffer	8

APPENDIX MDP-G

Stage 1 Archaeological Assessment of
The Everett Secondary Plan and Master Services Class EA

GREENLAND®

Stage 1 Archaeological Assessment of
The Everett Secondary Plan and Master Services Class EA
Township of Adjala-Tosorontio
Simcoe County

ORGINAL REPORT

Prepared for:

Township of Adjala-Tosorontio
7855 Sideroad 30, R.R. #1
Alliston, Ontario L9R 1V1
T: 705-434-5055
F: 705-434-5051

Archaeological Licence #P047 (Bruce Welsh)
Ministry of Tourism, Culture and Sport PIF# P047-374-2012
ASI File 12TS-125

25 September, 2012

Archaeological Services Inc.
528 Bathurst St.
Toronto, Ontario
Canada, M5S 2P9
T 416-966-1069
F 416-966-9723
info@iASI.to/www.iASI.to

Stage 1 Archaeological Assessment of
The Everett Secondary Plan and Master Services Class EA
Township of Adjala-Tosorontio
Simcoe County

EXECUTIVE SUMMARY

Archaeological Services Inc. was contracted by the Township of Adjala-Tosorontio, Ontario to undertake a Stage 1 Archaeological Assessment of the Everett Secondary Plan and Master Services Class EA, located in the Township of Adjala-Tosorontio, Simcoe County. The study area is approximately 660 hectares. The study area is generally bordered by Forest Hill Drive to the north, Dekker Street to the south, Concession Road 4 to the west and Concession Road 6 to the east. The study area encompasses an area that includes both urban and rural residential areas, active farm land, wetlands, watercourses, forested lands, municipal parks and active commercial lands.

The background research determined that one archaeological site has been registered within the study area and that no other archaeological sites have been registered within a one kilometre radius. Nineteenth century mapping of the study area illustrated the historical settlement centre of Everett, the Hamilton and North Western Railway and a single dwelling. A review of the general physiographic setting of the study area determined that it is located in both the Simcoe Lowlands and the Peterborough Drumlin Field physiographic regions. The lands of the study area are well drained with multiple watercourses, including the Pine River, as well as multiple tributaries of the Nottawasaga River and the Boyne River. This research has led to the conclusion that there is archaeological potential for the recovery of both pre-contact and Euro-Canadian archaeological resources within the study area.

The detailed Stage 1 field review carried out for this assessment resulted in the following determinations for archaeological potential within the study area:

- All lands that have been fully developed are considered to have no archaeological potential. Likewise, all paved roadways, rail lines, and any parcels of land associated with buried utilities lack any archaeological potential, given the level and severity of land alteration which has occurred in these portions of the study area. This determination is consistent with section 1.3.2 of MTCS's Standards and Guidelines for Consultant Archaeologists.
- The areas of residential development within the Developed Area of Everett are considered to have no remaining archaeological potential. These areas have been subject to severe land alterations which were observed during the field review. This determination is consistent with Section 1.3.2 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*.
- All permanently low and wet areas such as watercourses or wetlands have no archaeological potential. This determination is consistent with standard 2, section 2.1 of MTCS's *2011 Standards and Guidelines for Consultant Archaeologists*.
- A corduroy road was encountered within the unpaved portion of Concession Road 6. Any development within the roadway must be monitored by a licensed archaeologist. This determination is consistent with Standard 4, Section 2.1.7 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*.

- A pond and berm dominated area within the Pine River Block fronting County Road 13 must be subject to a Stage 2 archaeological assessment using a judgmental testpitting strategy. This determination is consistent with Standard 2, Section 2.1.8 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*.
- The balance of the study area, which consists of all active farm lands, woodlots and forested lands, as well as open, unaltered lands and all single residential lot lands as well as all infill lands are considered to have archaeological potential. These lands will require Stage 2 archaeological assessment carried out in accordance with section 2 of the MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists* prior to any development occurring within these lands.

TABLE OF CONTENTS

List of Tables

List of Plates / Images

List of Figures / Maps

ARCHAEOLOGICAL SERVICES INC.
PLANNING DIVISION

PROJECT PERSONNEL

Project Manager:	Beverly Garner, Hons. BA, Assistant Manager, Planning
Project Director:	Bruce Welsh, PhD, (P047) Senior Archaeologist
Project Archaeologist:	John Dunlop, Hons. BA, (R261) Staff Archaeologist
Report Preparation:	John Dunlop Jennifer Rose, Hons. BA, (R376) Staff Archaeologist
Report Reviewers:	Beverly Garner Lisa Merritt, MA, (P094) Senior Archaeologist, EA Division

1.0 PROJECT CONTEXT

1.1 Development Context

Archaeological Services Inc. was contracted by the Township of Adjala-Tosorontio, Ontario to undertake a Stage 1 Archaeological Assessment of the Everett Secondary Plan and Master Servicing Municipal Class EA lands, located within the former Geographic Township of Tosorontio, Simcoe County, now in the Township of Adjala-Tosorontio, Simcoe County (Figure 1). The study area is approximately 660 hectares.

This assessment was conducted under the project management of Ms. Bev Garner and project direction of Dr. Bruce Welsh (MTCS PIF P047-374-2012) in accordance with the *Ontario Heritage Act* (R.S.O. 1990) and the Ministry of Tourism, Culture, and Sport's 2011 *Standards and Guidelines for Consultant Archaeologists*. This assessment was carried out prior to the Official Plan amendment for Simcoe County for the acceptance of the Secondary Plan and under the Municipal Class Environmental Assessment process as required by the *Ontario Planning Act* (R.S.O. 1990) and the *Environmental Assessment Act* (R.S.O. 1990) and regulations made under these Acts, and are therefore subject to all associated legislation. This project is being conducted under Schedule B of the Municipal Class Environmental Assessment process. Permission to access the study area and to carry out all activities necessary for the completion of the assessment was granted by the proponent on August 15, 2012.

1.2 Historical Context

The MTCS's *Standards and Guidelines for Consultant Archaeologists* (MTC 2011:18) stipulates that areas of early Euro-Canadian settlement, including places of early military pioneer settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and early cemeteries, are considered to have archaeological potential. There may be commemorative markers of their history, such as local, provincial, or federal monuments or heritage parks. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the *Ontario Heritage Act* or a federal, provincial, or municipal historic landmark or site, and properties that local histories or informants have identified with possible archaeological sites, historical events, activities, or occupations are also considered to have archaeological potential.

The study area extends across part of Lots 10, 11, 12 and 13, Concession 4 and Lots 10, 11, 12, 13 and 14, Concession 5, in the Geographic Township of Adjala-Tosorontio, Simcoe County.

1.2.1 Brief History of Adjala-Tosorontio Township, Simcoe County

The Township of Adjala was named after the wife or daughter of Chief Tecumseh, while the Township of Tosorontio was named after the Huron word for "beautiful mountain" (Township of Adjala-Tosorontio website).

Beginning in the 1820s, settlement of the Township began in the south. The Irish Catholics who came to Adjala began naming their communities after their hometowns in Ireland, or after prominent pioneer families who first settled in the area. The sandy soils of Tosorontio's provided habitat for the vast stands of pine trees, which supported as many as seven large sawmills and provided further incentive to come to the area (Township of Adjala-Tosorontio website).

In 1994, the former Township of Adjala and the former Township of Tosorontio were amalgamated into the Township of Adjala-Tosorontio (Township of Adjala-Tosorontio website).

The Hamilton and North Western Railway

Simcoe County was desperate for an alternative to Toronto's Northern Railway of Canada, as the local residents believed that they did not have proper service to the western portion of the County. The North Railway, recognized this as an issue and decided to form a line from King City through Beeton, Angus and on to Penetanguishene (Cooper 2001). Simcoe County was able to provide municipal aid in the amount of $300,000 in order to ensure the construction of a branch line from Beeton to Collingwood (Cooper 2001). The Hamilton and North Western Railway officially reached Barrie in 1877, and Collingwood in December of 1878, thus passing through such hamlets as Everett, Lisle and Glencairn in Tosorontio Township (Cooper 2001, Township of Adjala-Tosorontio website).

1.2.2 History of the Settlement Area of Everett

The first use of the name Everett is a debated question. There are two competing ideas as to how the community was named. The first of which is that the name was taken after an early settler by the name of Mr. Fisher, who named his farm "Everett," while the other is after another early settler by the name of Mr. Henry Baycroft, who named the community after his hometown in England (New Tecumseth Public Library).

Everett was originally located one concession east at the intersection of present-day County Road 5 and Concession Road 7. A plaque is now found at this location commemorating the original location of the community (Plate 1). Everett was moved to its current location after the Hamilton and North Western Railway was established in 1878, so that the town could reap the benefits of a local railway station (New Tecumseth Public Library). Soon after its relocation, Everett began to see growth in population and commerce through the late-nineteenth and into the twentieth century.

The first business in Everett was William Lockhart's general store (JDG 2006). Other early businesses consisted of Pat Hanlan's blacksmith shop, Edward Anderson's shoemaker shop, Simpson Jenkin's carriage shop and John Gallaugher's hotel (JDG 2006). The local timber industry also proved to be a prosperous commodity for the community (JDG 2006). However, by the mid-twentieth century the general decline of railways in favour of roads led to the demise of the Hamilton and North Western railway and the rail line was dismantled. Everett likewise declined in population and commercial presence.

1.2.3 Review of Nineteenth Century Mapping

A review of the 1881 *Simcoe Supplement in the Illustrated Atlas of the Dominion of Canada* was completed in order to determine if this source depicts any nineteenth-century Euro-Canadian settlement features that may represent potential historical archaeological sites within the study area (Figure 2).

The 1881 *Illustrated Atlas* depicts the historical settlement centre of Everett at the intersection of present-day County Road 5 and County Road 13. Within this intersection, the Everett Post Office is depicted. Immediately adjacent to this settlement centre is the Hamilton and North Western Railway. Lot 11, Concession 4, depicts one additional historical feature of interest; a dwelling owned by A. Wanless. The Pine River is illustrated within Lot 13, Concession 4.

It should be noted that the schematic illustrations of settled areas such as Everett in the *Illustrated Atlas*, do not accurately depict the nature or frequency of any historical features potentially located therein Depicting these smaller settled areas in a schematic manner was a common mapping practice of the nineteenth century.

Jim Hosick, Director of Growth and Development, Township of Adjala-Tosorontio was contacted in order to determine if any properties within the study area had been designated under Part IV of the *Ontario Heritage Act* (R.S.O. 1990) or otherwise listed as having heritage interest by the Township of Adjala-Tosorontio. It was confirmed that there are no designated properties within the study area (Joe Hosick pers. comm. 2012).

Therefore, given the presence of the schematically illustrated settlement area of Everett, the Hamilton and North Western Railway and the dwelling located in Lot 11, Concession 4, there is the potential for the recovery of historical archaeological resources, depending on degree of more recent land alterations.

1.3 Archaeological Context

Understanding the archaeological context of a study area involves research to describe the known and potential archaeological resources within the vicinity of a study area. The background research for such an assessment incorporates a review of previous archaeological research, physiography, and nineteenth-century development for the study area. Background research was completed to identify any archaeological sites within the subject property and to assess its archaeological potential.

1.3.1 Registered Archaeological Sites

In order that an inventory of archaeological resources could be compiled for the study area, three sources of information were consulted: the site record forms for registered sites housed at the Ministry of Tourism, Culture and Sport, published and unpublished documentary sources, and the files of Archaeological Services Inc.

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (OASD) which is maintained by the Ministry of Tourism, Culture and Sport. This database contains archaeological sites registered within the Borden system. The Borden system was first proposed by Dr. Charles E. Borden and is based on a block of latitude and longitude. Each Borden block measures approximately 13 km east-west by 18.5 km north-south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The subject property under review is located within the BbGx Borden block.

One archaeological site has been registered within the study area; however, no other sites have been registered within a one kilometre radius of the study limits. The site consists of an isolated corner-notched projectile point fragment resembling a Middle Woodland Jack's Reef point (BP 1500-1000) (Spence, Pihl and Murphy 1990). The isolated point fragment was encountered by ASI in 2011 (ASI 2011). This type of point is not attributable to any specific cultural complex of the Middle Woodland, having being encountered in association with Point Peninsula, Saugeen and independent complexes (Spence, Pihl and Murphy 1990).

1.3.2 Previously Assessed Lands

Archaeological Services Inc. has previously assessed two large areas within the southwest corner of current study area limits.

The Stage 1 and 2 archaeological assessment of the Everett Community Phase 1 Proposed Residential Subdivision, located within part of Lot 10, Concession 4, took place in October of 2010, under MTCS PIF P049-577-2010. Approximately 28 hectares south of County Road 5 were assessed by means of a pedestrian survey and test pit survey employed at five metre intervals (ASI 2011). No cultural material was encountered during the course of the assessment.

The Stage 1 and 2 archaeological assessment of the Everett Community Phase 2 Proposed Residential Subdivision, located within part of Lot 10, Concession 4, took place in August of 2011, under MTCS PIF P049-578-2010 and P347-079-2011. Approximately 40 hectares south of County Road 5 and east of Concession Road 4 were assessed by means of a pedestrian survey employed at five metre intervals (ASI 2011). During the course of the assessment, pre-contact site BdGx-5 was encountered within a relatively flat portion of the southern half of the property. A single corner-notched projectile point fragment resembling a Middle Woodland Jack's Reef point (BP 1500-1000) manufactured from Onondaga chert was collected (ASI 2011). Due to the isolated nature of the find, no further archaeological assessment was recommended.

Further to the assessments completed by ASI, one additional assessment has been completed within the study area. A Stage 1 and 2 archaeological assessment of the R&M Homes Subdivision Development, located within part of Lot 12, Concession 4, was completed by Archaeological Assessments Ltd. in July of 2011, under MTCS PIF P013-595-2011 (AAL 2011). Approximately 6.96 hectares east of County Road 13 and north of Moore Avenue were assessed by means of a pedestrian survey employed at five metre intervals (AAL 2011). No cultural material was encountered during the course of the assessment.

1.3.3 Review of Physiographic Setting

The majority of the study area is situated within the Simcoe Lowlands physiographic region of southern Ontario; however the southeast corner of the study area is found within the Peterborough Drumlin Field physiographic region of southern Ontario.

The Simcoe Lowlands region occupies approximately 2,849 square km, lying predominately to the east and west of the City of Barrie (Chapman and Putman 1966:299). The lowland surrounding Lake Simcoe, also referred to as the Lake Simcoe basin is situated to the east. While the plains which drain into Nottawasaga Bay, by way of the Nottawasaga River, also referred to as the Nottawasaga basin, is situated to the west. The Nottawasaga basin at one time made up a portion of the glacial Lake Algonquin floor. However, the southern portion of the basin, primarily located in the area of Tecumseh Township represents an area separated from the main bay by moraine uplands. The upper Nottawasaga River and its tributaries have therefore transported large amounts of sand and silt into the area. Shallow streams are present in this area; however drainage is generally poor which in turn has created large bogs (Chapman and Putman 1966:300).

The Peterborough Drumlin Field region occupies an area of approximately 4,523 square km and extends from Hastings County to Simcoe County (Chapman and Putman 1966:280). This belt contains approximately 3,000 drumlins in addition to many drumlinoidal hills and eskers. The drumlins throughout this region are generally composed of highly calcareous till, however this does change locally. While, the eskers in this region are comprised of gravel ridges featuring poor soils. The orientation of the drumlin axes in this field is from northeast to southwest, however within the Lake Simcoe area, the direction of the ice movement seems to have been as much as 60 degrees west of south (Chapman and Putman 1966:282).

The study area is underlain by shales of the Utica formation, which contain layers of calcareous sandstone and sandy shale (Hoffman, Wicklund and Richards 1962:10-11). According to the Soil Survey of Simcoe County Ontario, the surface deposits within the study area are largely comprised of sandy and gravelly glacio-fluvial outwash, however areas within the southwest are found to be comprised of lacustrine clays, silts and sand laid down in glacial lakes. The topography in the southeast is found to feature gentle to moderately steeped slopes (Hoffman, Wicklund and Richards 1962:12-14).

Multiple watercourses are found within the limits of the study area. The largest of which is the Pine River, which flows through the northwest quadrant of the study area. Other watercourses located within the study area include multiple tributaries of the Nottawasaga River. These tributaries are found primarily throughout the east-central portion of the study area, surrounding much of the extant residential area. These tributaries also flow through the northeast corner of the study area. Within the eastern limits of the study area, these watercourses have created wet lands adjacent to Concession Road 6. Finally, the southern portion of the study area features several tributaries of the Boyne River.

The terrain of the study area consists of relatively level lands featuring a gentle northerly slope and is broken only by the Pine River Valley which extends through the northwest corner of the study area. However, the southeastern corner of the property, adjacent to Concession Road 6 and south of County Road 5 is situated approximately 40 metres higher in elevation than the majority of the study area.

A review of the surficial geology mapping of Simcoe County determined that the paleo-shoreline of glacial Lake Algonquin extended through the western extent of the study area (Figure 3). The balance of the study area features inland near shore deposits formed during the initial formation and flooding of glacial Lake Algonquin. The southeast corner of the study area, the highest point of lands, falls within lands classified as the edge of a glacially formed drumlin, which would have acted as a an archipelago during the formation phase of glacial Lake Algonquin. Finally the present-day Pine River valley is classified as a glacial river delta, emptying into the glacial lake.

1.3.4 Pre-and-Post-Contact Period Aboriginal Occupation in Simcoe County

Human occupation of the northwest Simcoe County area extends over the entire breadth of the pre-and-post-contact period of southern Ontario, which is outlined generally in Table 1. There are two specific periods which are particularly significant to northwest Simcoe County; the Paleo-Indian period of occupation and the early-post contact period of the Huron-Wendat.

The paucity of documented sites in the study area may be attributable to the fact that much of the area has not been subject to development or has not been subject to detailed archaeological survey being conducted under the terms of the Planning and Environmental Assessment Acts. It is not a reflection of First Nation settlement or land use prior to Euro-Canadian colonization. Indeed it is known that the environment of the area was rich in resources of particular use to both the Paleo-Indian period and later early-post contact period of the Huron-Wendat. This does not preclude the occupation of the study area throughout the pre-contact period of Southern Ontario.

Table 1: Outline of Southern Ontario Pre-contact and Post-contact Cultures

Period	Archaeological Culture	Date Range	Lifeways/Attributes
PALEO-INDIAN			
Early	Gainey, Barnes, Crowfield	11000 - 10500 BP	Big game hunters
Late	Holcombe, Hi-Lo, Lanceolate	10500 - 9500 BP	Small nomadic groups
ARCHAIC			
Early	Nettling, Bifurcate-base	9800 - 8000 BP	Nomadic hunters and gatherers
Middle	Kirk, Stanly, Brewerton, Laurentian	8000 - 4000 BP	Transition to territorial settlements
Late	Lamoka, Genesee, Crawford Knoll, Innes	4500 - 2500 BP	Polished/ground stone tools (small stemmed)
WOODLAND			
Early	Meadowood	2800 - 2400 BP	Introduction of pottery
Middle	Point Peninsula, Saugeen, Jack's Reef Corner-Notched	2400 -1200 BP	Incipient horticulture
Late	Algonkian, Iroquoian	1200-700 BP	Transition to village life and agriculture
	Algonkian, Iroquoian	700-600 BP	Establishment of large palisaded villages
	Algonkian, Iroquoian	600-400 BP	Tribal differentiation and warfare

Table 1: Outline of Southern Ontario Pre-contact and Post-contact Cultures

Period	Archaeological Culture	Date Range	Lifeways/Attributes
CONTACT/POST-CONTACT			
Early	Huron, Neutral, Petun, Odawa, Ojibwa	400-350 BP	Tribal displacements
Late	Six Nations Iroquois, Ojibwa, Mississauga	350-200 BP	
	Euro/Canadian	220 BP-Present	Present European settlement

Paleo-Indian Occupation of Simcoe County

The term Paleo-Indian refers to the earliest well documented groups within the Americas dating from approximately 11,500 BP, at the time of the final ice sheets retreat (Ellis and Deller 1990 and Storck 1984). These populations were the first human occupation of the post-glacial landscape of southern Ontario. Archaeological sites dating to this period are rare and are considered to be highly significant archaeological resources. Paleo-Indian groups are defined by their artifact assemblages, site characteristics and the ways in which they subside and exploit their environment (Ellis and Deller 1990). Living in small mobile bands or groups, Paleo-Indians relied on hunting large game rather than hunting and gathering or agriculture, like their later descendants (Ellis and Deller 1990).

Paleo-Indian populations inhabited an environment that may have been similar to present-day Arctic tundra (Ellis and Deller 1990). As such, many sites have been encountered within proximity of the glacial Lake Algonquin Strand, which represents the initial shoreline formed by the glacial lake during the retreat of the ice sheets (Karrow and Warner 1990). The glacial Lake Algonquin Strand extends within general proximity west of the study area (Jackson, Ellis, Morgan, McAndrews 2000). The terrain located within proximity of the strand, both inland and out towards the gradually diminishing glacial Lake Algonquin, provided a habitable environment for Paleo-Indian peoples (Jackson, Ellis, Morgan, McAndrews 2000). As previously noted in section 1.3.3, the paleo-shoreline of glacial Lake Algonquin extends through a portion of the study area. The present-day Pine River valley was also a glacial river delta. Finally, the southeast corner of the study area would have projected into the lake as a high point of land. All of these areas represent potential areas of habitation and activity for Paleo-Indian populations.

It should also be noted that given the path of the paleo-shoreline of glacial Lake Algonquin, the northern and western portions of Simcoe County may have been some of the more densely populated areas by Paleo-Indian people, as reflected by the relative density of known Paleo-Indian sites within this region (Jackson, Ellis, Morgan, McAndrews 2000).

The earliest Paleo-Indians produced distinctive spear or dart points featuring channels or “flutes” located in the centre of the point originating at the base (Ellis and Deller 1990), thus often referred to as fluted projectile points. Within Ontario, Onondaga and Collingwood (Fossil Hill formation) cherts were widely preferred as the raw material of choice. Other Ontario sources such as Haldimand, Selkirk, Ancaster and Kettle Point cherts were available, yet rarely utilized (Ellis and Deller 1990). Therefore, an important indicator in the Paleo-Indian occupation of Simcoe Region is also the known in situ exposure of Fossil Hill chert in the Collingwood area (Storck 1984).

Early Contact/Post-Contact Occupation of Simcoe County

The late sixteenth century witnessed a northward migration of Wendat communities from the north shore of Lake Ontario that resulted in the historical coalescence in Huronia and abandonment of the southern and eastern homelands (Popham and Emerson 1952; Emerson 1959, 1961). Recognizing the existing limitations in archaeological data, researchers considered three main lines of explanation for the migration: ecological factors, socio-economic factors, and socio-political factors (Heidenreich 1963; 1971, Trigger 1962, 1963, 1969, 1979, 1985).

Push and pull factors surrounding northern migration may have stemmed from the attractiveness of Huronia as a settlement area and the looming warfare that may have rendered southern haunts less appealing. However, Trigger (1962; 1963; 1969:24; 1985:157-158) argued that socio-economic incentives were most responsible for the late pre-contact and contact period coalescence of Huron tribes in Huronia. He suggested that trade relations with northern Algonquian peoples, who plied the canoe routes of the upper Great Lakes, were important and longstanding, having been established at least as early as the first Iroquoian settlement of Simcoe County in Middle Iroquoian times.

Indeed, towards the latter part of the fourteenth century, the Barrie region was a primary area of Iroquoian settlement in Simcoe County, but a more diffuse distribution of numerous other apparently late fourteenth century sites throughout southern Simcoe County also attests to an expansion of Middle Iroquoian settlement. Settlements in the Flos Lowlands, together with the sites on the Penetang Peninsula, suggest a western movement into this portion of Simcoe County (Warrick 1990:360-361). Similarly, expansion northwards from the Barrie core area is suggested by relatively isolated middle to late fourteenth century villages located along the rivers flowing north into Severn Sound and along the Sturgeon River watershed. The spread of villages further northward must, in large part, be attributable to the continued migration of new communities into the area, creating a “leapfrog” pattern of village distribution in which less favourable areas were avoided (Sutton 1995:74).

By the end of the sixteenth century, the northward migration that had begun in the thirteenth century approached its final stage, as groups coalesced to form the Huron tribal confederacy in the northern uplands of Simcoe County. The South Slopes Till Plain and the Trent Valley were virtually abandoned at this time, while settlement in southern Simcoe County was considerably reduced.

At the time of contact, the largest nation, the Attignawantan, were historically ensconced on the Penetang Peninsula. The Ataronchonnon were located to their east between Hog Bay and Matchdash Bay. Further east still were the Attingneenongnac and the Arendaronnon, the latter of whom were on the west side of Lake Couchiching. Finally, the Tahontaenrat were located to the south of the Ataronchonnon. They were the smallest nation of the confederacy and were the last group to migrate into Huronia, arriving circa A.D. 1610-1620 (Heidenreich 1971; Trigger 1976).

Overall Pre-and-Post-Contact Period Archaeological Potential

The MTCS’s Standards and Guidelines for Consultant Archaeologists (MTC 2011:17) stipulates that primary water sources (lakes, rivers, streams, creeks), secondary water sources (intermittent streams and creeks, springs, marshes, swamps), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh) are characteristics that indicate archaeological potential.

Other geographic characteristics that can indicate archaeological potential include: elevated topography (eskers, drumlins, large knolls, plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas, prairie), and scarce raw materials (quartz, copper, ochre, or outcrops of chert) are also considered characteristics that indicate archaeological potential (MTC 2011:18).

An added factor of this pre-contact potential model is the presence of the elevated, well drained lands found within the southeastern corner of the study area. These lands pose as an important indicator in the possibility of encountering potential for the presence of pre-contact archaeological sites.

Therefore, given the presence of the recorded pre-contact archaeological site, the presence of various physiographic determinants such as the Pine River and tributaries of the Boyne and Nottawasaga Rivers, as well as the proximity of the glacial Lake Algonquin Strand and the noted occupation of the Huronia Region, the study area has the potential for the recovery of pre-contact archaeological resources, depending on the degree of more recent land alterations.

1.3.5 Study Area Description

The Stage 1 field review was completed on August 21, 2012 in order to assess the archaeological potential of the property. All field work was conducted under the direction of Mr. John Dunlop (R261). The weather conditions were appropriate for the completion of field work.

The study area consists of the Everett Secondary Plan lands, which is generally bordered by the development boundary approximately extending along Forest Hill Drive to the north, the development boundary approximately extending along Dekker Street to the south, Concession Road 4 to the west and Concession Road 6 to the east. The study area encompasses an area that includes both urban and rural residential areas, active farm land, wetlands, watercourses, municipal parks and active commercial lands. Given the large size, the variety of land uses and physiographic characteristics, the study area was subdivided into eight distinct sections; The Developed Area of Everett, the Southwest Block, the Southeast Block, the Western Block, the Eastern Block, the Pine River Block, the Northern Block, and all Roadways and Right of Ways. The boundaries of these sections are illustrated on Figure 4. The location of the field photos are also depicted on Figure 3.

The Developed Area of Everett

The central portion of the overall study area is dominated by mixed residential and commercial lands comprising the current settlement area of Everett. These lands extend outward from the major intersection of County Road 5/Main Street and County Road 13, in the location of the centre of the historic settlement and the current downtown. County Road 5/Main Street and County Road 13 are dominated by late-nineteenth and early twentieth century structures including houses, store fronts and former churches (Plates 2 and 3). These structures were not depicted on the nineteenth century mapping, but were incorporated into the schematically illustrated Everett as noted on Figure 2. St. David's Anglican Church and cemetery are located on County Road 13, south of Main Street (Plates 4 and 5). The church and cemetery were founded 1880, and neither is noted on the historical mapping.

The northeast, northwest and southeast quadrants of the downtown are the locations of the more recently developed subdivisions. These areas consist of single residential lots, full servicing and utilities, and several municipal parks and were most likely developed within the past thirty years (Plates 6-10). The tributaries of the Nottawasaga River, flow through this portion of the study area (Plate 11). Portions of these tributaries have been modified and incorporated into the municipal water management system.

The Hamilton and Northwestern rail line is noted on the historical mapping as extending north-south on the eastern side of the historic downtown section of Everett. There is currently no evidence of a rail line within this portion of the study area, however, a detailed examination of aerial photography for the study area indicates a treeline and "shadow" outline of the rail line course, extending along the present-day path of Wales Avenue, and further north into agricultural fields in the northern block of the study area (Figure 5).

The Southeast Block

The Southeast Block comprises the portion of the study area which is located within the Peterborough Drumlin Field, and is bordered by the residential development to the west, the study area boundary to the south, Concession Road 6 to the east and the residential lots fronting County Road 5/Main Street. Overall, it lies upon lands which slope up to the north and west, and are generally found to be approximately 40 m above the balance of the study area (Plate 12). This elevated area is a distinct feature when looking across the landscape. The Southeast Block currently consists of agricultural land with a farm complex as well as a separate, single residential lot, both of which front Concession Road 6 (Plates 13 and 14).

The Southwest Block

The Southwest Block is bordered by County Road 5/Main Street to the north, developed lands to the east, Concession Road 4 to the west and the study area boundary to the south. This portion of the study area consists of agricultural lands featuring level terrain, as well as one farm complex, fronting County Road 5/Main Street (Plates 15 and 16). The majority of the lands within the Southwest Block have previously been subjected to archaeological assessments by ASI, as noted in section 1.3.2 (ASI 2011, 2012).

The Western Block

The Western Block is bordered by County Road 5/Main Street to the south, the developed area of Everett to the southeast, County Road 13 to the east, the forested and undeveloped Pine River to the north, and Concession Road 4 to the west. These lands consist of open agricultural lands featuring level terrain

(Plate 17). There are two farm complexes within the Western Block; one fronting County Road 5/Main Street and the other fronting Concession Road 4, as well as a residence at the intersection of the two roads (Plates 18 and 19). The farm complex fronting County Road 5/Main Street is located in the same location as the homestead belonging to A. Wanless, as depicted on the nineteenth century mapping (Figure 2).

The Pine River Block

The Pine River Block consists of lands dominated by the Pine River. These lands consist of forest and open agricultural lands (Plates 20-22). The block is bordered by County Road 13 to the east, the study area boundary to the north, the Western Block to the south and Concession Road 4 to the west. There are several large, single residential lots fronting Concession Road 4 (Plate 23). The eastern portion of the block features an area dominated by ponds and berms indicative of land altering activities in the past (Plates 24 and 25).

The Northern Block

The Northern Block is bordered by County Road 13 to the west, the developed area of Everett to the south, Concession Road 6 to the east, and the study area boundary to the north. These lands consist of open agricultural lands and a woodlot which slopes slightly down to the south (Plates 26-28). There are several single residential lots and one farm complex which front County Road 13 within the lot (Plate 29). Several tributaries of the Nottawasaga River flow through the block, and the Hamilton and North Western rail line shadow extends through several agricultural fields and woodlot (Figure 5). The southernmost fields within the Northern Block have previously been assessed by Archaeological Assessments Limited in 2011 (AAL 2011).

The Eastern Block

The Eastern Block fronts Concession Road 6 and is bordered by the Northern Block and the developed area of Everett. These lands consist primarily of low lying cedar swamp lands, although the low lying wet area ceases as the lands slope upward in the northern portion of the block (Plates 30 and 31). Several tributaries of the Nottawasaga River flow through the block, draining the developed areas to the west (Plate 32).

Roadways and Right of Ways

There are two different types of road which extend through the study area; County and Concession Roads which follow the historical transportation corridors as noted on the nineteenth century mapping and the smaller residential roads which extend through the residential developments in Everett. Typically, rights-of-way (ROW) can be divided into two areas: the disturbed ROW, and ROW lands beyond the disturbed ROW. The typically disturbed ROW extends outwards from either side of the centerline of the traveled lanes, and it includes the traveled lanes and shoulders and extends to the toe of the fill slope, the top of the cut slope, or the outside edge of the drainage ditch, whichever is furthest from the centerline. Subsurface disturbance within these lands may be considered extreme and pervasive, thereby negating any archaeological potential for such lands.

ROW construction disturbance may be found to extend beyond the typical disturbed ROW area, and this generally includes additional grading, cutting and filling, additional drainage ditching, watercourse alteration or channelization, servicing, removals, intensive landscaping, and heavy construction traffic. Areas beyond the typically disturbed ROW generally require archaeological assessment in order to determine archaeological potential relative to the type or scale of disturbances that may have occurred in these zones

The County Roads (County Road 5/Main Street and County Road 13) feature two-lane paved roadways with right of ways which featured buried utilities and services as well as drainage ditches (Plates 33-36). Concession Road 4 consists of a two-lane paved road which features drainage ditches in both right of ways (Plate 37). Concession Road 6 consists of a paved two-lane road south of County Road 5; however, it is an unassumed packed dirt road north of County Road 5 (Plates 38 and 39). Concession Road 6 features a section of a corduroy road within the Eastern Block of the study area (Plates 40 and 41). This corduroy road consists of logs which have been laid lengthwise across the roadway in order to maintain its form through the low lying swampy lands. The logs were noted just below the surface of the packed dirt roadway along a section approximately 200 m in length. The corduroy road is not intact and there are several portions of the roadway which have flooded (Plate 42).

The residential roads which extend through the residential developments within Everett were all found to be two-lane paved roads which feature drainage ditches and buried utilities within the right of ways (Plates 43-45).

2.0 FIELD METHODS

The Stage 1 archaeological assessment was conducted by means of a visual review of the study area that involved spot checking every 40 metres (131 feet) across the study area. Special emphasis was given to locations with high pre-contact archaeological potential and features of historical significance during the field assessment. This strategy is consistent with Section 1.2, Standard 1 of the *Standards and Guidelines for Consultant Archaeologists* (MTC 2011:5).

3.0 ANALYSIS AND CONCLUSION

Archaeological Services Inc. was contracted by the Township of Adjala-Tosorontio, Ontario to undertake a Stage 1 Archaeological Assessment of the Everett Secondary Plan and Master Servicing Municipal Class EA lands, located within the former Geographic Township of Tosorontio, Simcoe County, now in the Township of Adjala-Tosorontio, Simcoe County.

The study area is approximately 660 hectares. The detailed background assessment determined that one archaeological site had been registered within the study area and no other sites have been registered within a one kilometre radius of the study area. A review of the history of the study area determined the settlement area of Everett was originally established one concession road east of its present-day location and that the settlement was moved to accommodate the Hamilton and North Western Railway in the late nineteenth century. A review of the general physiographic setting of the study area determined that it is located in both the Simcoe Lowlands and Peterborough Drumlin Field physiographic regions. The lands of the study area were well drained with multiple watercourses, including Pine River in the northwest quadrant and tributaries of the Nottawasaga and Boyne River in the south and eastern portions of the study area. A review of pre-and-post contact archaeological potential determined that the study area is located within proximity of the glacial Lake Algonquin Strand and is located within a larger area which features a number of Paleo-Indian sites. Furthermore, the study area is located within the traditional lands of what is known as Huronia, the historically occupied lands associated with the Huron/Wendat people.

The study area consists of the Everett Secondary Plan lands, which is generally bordered by Forest Hill Drive to the north, Dekker Street to the south, Concession Road 4 to the west and Concession Road 6 to the east. The study area encompasses an area that includes both urban and rural residential areas, active farm land, wetlands, watercourses, municipal parks and commercial lands (Figures 4 and 6).

Three parcels of land within the study area have been previously subject to archaeological assessments. The recommendations from these assessments have stated that these lands are free of any further archaeological concern (Figure 6).

In order to determine the archaeological potential for the study area, a detailed Stage 1 field review was undertaken, in order to determine the integrity of archaeological potential across the study area.

All lands that have been developed for commercial use are considered to not require further archaeological assessment. Likewise, all paved roadways, rail lines, and any parcels of land associated with buried utilities are considered to lack any archaeological potential. These lands have been altered by the significant disturbance and removal of soils to such a degree that any extant archaeological resources would have been removed. This determination is consistent with section 1.3.2 of MTCS's *Standards and Guidelines for Consultant Archaeologists*. These areas are noted on Figure 6.

All recently built residential developments located inside the Developed Area of Everett are considered to not have remaining archaeological potential. These areas include any parkland which has been notably graded or otherwise impacted during the development process. These areas have been subject to including severe land alterations consistent with current construction techniques which were observed during the field review. This determination is consistent with Section 1.3.2 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*. These areas are noted on Figure 6.

All permanently low and wet areas such as watercourses or wetlands do not have archaeological potential. This determination is consistent with Standard 2, Section 2.1 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*. These areas are noted on Figure 6.

The pond and berm dominated area within the Pine River Block fronting County Road 13 must be subject to a Stage 2 archaeological assessment using a judgmental testpitting strategy. This determination is consistent with Standard 2, Section 2.1.8 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*. This area is noted on Figure 6.

The corduroy road located within Concession Road 6 is potentially representative of a unique historic transportation corridor. Although the visible corduroy road may have been constructed in more recent times, it should be subject to further investigation. Therefore, any development or alteration taking place along the roadway should be monitored by a licensed archaeologist. This determination is consistent with Standard 4, Section 2.1.7 of MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists*.

The balance of the study area, including all active farm lands, woodlots, open, unaltered lands, including and all residential lands excluding the above mentioned current developments and all infill lands within the residential developments where land alterations may not have taken place, are considered to have archaeological potential (Figure 7). There are several factors which were considered in this determination. The extensive forested areas within the Pine River Block and the Northern Block may represent undisturbed forest lands which have the potential for the recovery of insitu archaeological deposits. All active farm lands are considered to have been subject to minimal land alteration (i.e. ploughing). Likewise, any large, single lot residential lands, municipal parks, schoolyards or large scale, mid twentieth century residential lands have likely only been altered in the areas of building footprints or buried utilities. Finally, the majority of these non-agricultural lands are located within the historic settlement area of Everett as noted by the schematically illustrated settlement area on the historical mapping. Given these factors, these lands will require Stage 2 archaeological assessments carried out in accordance with section 2 of the MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists* prior to any development. These lands are identified on Figures 6 and 7.

4.0 RECOMMENDATIONS

In light of these results, the following recommendations are made:

1. Prior to any land-disturbing activities within the subject property, a Stage 2 archaeological assessment must be conducted on the lands as identified in Figures 6 and 7. The Stage 2 assessment must be carried out in accordance with the Ministry of Tourism and Culture's 2011 *Standards and Guidelines for Consultant Archaeologists*.

2. Any development within the Concession Road 6 roadway must be carried out under monitoring of a licensed archaeologist. The archaeologist shall make a thorough inspection of the roadway for any evidence of a historic corduroy road. Any remnant of a historic corduroy road should be fully documented in accordance with the MTCS's 2011 *Standards and Guidelines for Consultant Archaeologists.*

5.0 ADVICE ON COMPLIANCE WITH LEGISLATION

- This report is submitted to the Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, RSO 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation and protection 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 archaeological field work 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 sec. 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 immediately notify the police or coroner and the Registrar of Cemeteries, Ministry of Consumer Services.

- Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.

The documentation related to this archaeological assessment will be curated by Archaeological Services Inc. until such a time that arrangements for their ultimate transfer to Her Majesty the Queen in right of Ontario, or other public institution, can be made to the satisfaction of the project owner(s), the Ontario Ministry of Tourism, Culture and Sport, and any other legitimate interest groups.

6.0 BIBLIOGRAPHY AND WORKS CITED

(AAL) Archaeological Assessments Ltd.

2011 The Stage 1-2 Archaeological Assessment of the R&M Homes Subdivision Development, File No. AT-T-0103, Part of Lot 12, Concession 5, Township of Adjala-Tosorontio, County of Simcoe. Oakville. PIF P013-595-2011.

(ASI) Archaeological Services Inc.

2012 Stage 1 and 2 Archaeological Assessment of Everett Community Phase 1 Proposed Residential Subdivision, Part of Lot 10, Concession 4, Geographic Township of Adjala-Tosorontio, Simcoe County. Toronto. PIF P049-577-2012. Report on file with the Ministry of Tourism, Culture and Sport.

2011 Stage 1 and 2 Archaeological Assessment of Everett Community Phase 2 Proposed Residential Subdivision, Part of Lot 10, Concession 4, Geographic Township of Adjala-Tosorontio, Simcoe County. Toronto. PIF P049-578-2012 and P047-079-2011. Report on file with the Ministry of Tourism, Culture and Sport.

Belden, H.

1881 *Simcoe Supplement in the Illustrated Atlas of the Dominion of Canada*. Toronto.

Cooper, Charles

2001 *Hamilton's Other Railway.* Ottawa: Bytown Railway Society.

Chapman, L.J. and D.F. Putman

1966 *The Physiography of Southern Ontario*. Second Edition. Toronto: University of Toronto Press.

Ellis, Chris J. and Deller, Brian D.

1990 Paleo-Indians. In *The Archaeology of Southern Ontario to A.D. 1650,* edited by Chris J. Ellis and Neal Ferris, pp. 37-63. Occasional Publication of the London Chapter, OAS Number 5.

Emerson, J. N.

1959 A Rejoinder Upon the MacNeish-Emerson Theory. *Pennsylvania Archaeologist* 29: 98-107.

Heidenreich, C.E.

1963 The Huron Occupance of Simcoe County, Ontario. *The Canadian Geographer* 7(3): 131-144.

Hoffman, D.W., Wicklund, R.E. and Richards, N.R.

1962 Soil Survey of Simcoe County Ontario. *Report No. 29 of the Ontario Soil Survey.* Research Branch, Canada Department of Agriculture and the Ontario Agricultural College: Guelph, Ontario.

Jackson, Lawrence, Chris Ellis, Alan Morgan and John McAndrews
2000 Glacial Lake Levels and Eastern Great Lakes Paleo-Indians. *Geoarchaeology*. Vol. 15, No. 5, 415-440.

(JCG) Jones Consulting Group LTD.
2006 Everett Community Plan. Barrie.

Karrow, P. F., and B.G. Warner.
1990 The Geological Environment for Human Occupation in Southern Ontario. In *The Archaeology of Southern Ontario to A.D. 1650*, edited by Chris J. Ellis and Neal Ferris, pp. 5-36. Occasional Publication of the London Chapter, OAS Number 5.

(MTC/MTCS) Ministry of Tourism and Culture, now the Ministry of Tourism, Culture and Sport
2011 *Standards and Guidelines for Consultant Archaeologists*. Cultural Programs Branch, Archaeology and Planning Unit, Toronto. http://www.culture.gov.on.ca/english/heritage/archaeology/S%20&%20G%202009%20-%20FINAL.pdf

Popham, R.E. and J.N. Emerson
1952 Comments upon the Huron and Lalonde Occupations of Ontario. *American Antiquity* 18(2): 197-210.

Revised Statutes of Ontario (R.S.O.)
1990- Planning Act: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90p13_e.htm
1990 Heritage Act: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o18_e.htm
1990 Environmental Assessment Act http://www.ene.gov.on.ca/environment/en/legislation/environment_assessment_act/index.htm

Spence, Michael, Robert Pihl and Carl Murphy.
1990 Cultural Complexes of the Early and Middle Woodland Transition. In *The Archaeology of Southern Ontario to A.D. 1650*, edited by Chris J. Ellis and Neal Ferris, pp. 125-170. Occasional Publication of the London Chapter, OAS Number 5.

Storck, Peter L.
1984 Research Into the Paleo-Indian Occupations of Ontario: A Review. *Ontario Archaeology* 14:3-28.

Sutton, R. E.
1995 Identifying Prehistoric Iroquoian Migrations: Some New Approaches. In *Origins of the People of the Longhouse: Proceedings of the 21st Annual Symposium of the Ontario Archaeological Society*, edited by A. Bekerman and G. Warrick, pp. 71–85. Ontario Archaeological Society, North York, Ontario.

Township of Adjala-Tosorontio Website, Accessed August 2012.
http://www.townshipadjtos.on.ca/Community/History/

Tremaine, George C.
1861 *Tremaine Map of the County of York.* Tremaine Map Establishment. Toronto.

Trigger, B.G.
1962 The Historic Location of the Hurons. *Ontario History* 54(2): 137-148.
1963 Settlement as an Aspect of Iroquoian Adaptation at the Time of Contact. *American Anthropologist* 65(1): 86-101.
1969 *The Huron: Farmers of the North*. Holt, Rinehart and Winston, Toronto.
1976 *The Children of Aataentsic: A History of the Huron People to 1660*. McGill-Queen’s University Press, Montreal and Kingston.
1979 Sixteenth Century Ontario: History, Ethnohistory, and Archaeology. *Ontario History* 71: 205-223.
1985 *Natives and Newcomers: Canada's "Heroic Age" Reconsidered.* McGill-Queen's University Press, Montreal.

Warrick, G.A.
1990 A Population History of the Huron-Petun, A.D. 900-1650. Unpublished PhD Thesis, Department of Anthropology, McGill University, Montreal, Québec.

7.0 PLATES/IMAGES


Plate 1: A Plaque commemorating the original location of Everett.


Plate 2: The late-nineteenth and early twentieth century structures within the settlement area of Everett.


Plate 3: The late-nineteenth and early twentieth century structures within the settlement area of Everett.


Plate 4: St. David's Anglican Church, County Road 13.


Plate 5: St. David's Church and Cemetery, founded in 1880.


Plate 6: A recently built residential area.


Plate 7: A recently built residential area.


Plate 8: A graded municipal park.


Plate 9: A recently built residential area.


Plate 10: Buried utilities located within the residential areas.


Plate 11: A tributary of Nottawasaga River within the residential area.


Plate 12: The rise in land within the southeast corner of the study area.

Plate 13: A recently built residence in the Southeast Block.

Plate 14: The farm complex in the Southeast Block.

Plate 15: Agricultural lands within the Southwest Block.

Plate 16: The farm complex in the Southwest Block.

Plate 17: Active farm land within the Western Block.

Plate 18: The historic farmstead in the Western Block, as noted on Figure 2.

Plate 19: The residence at the intersection of Concession Road 4 and County Road 5.

Plate 20: Forest land within the Pine River Block.

Plate 21: Open agricultural land within the Pine River Block.

Plate 22: The Pine River.

Plate 23: A single lot residence along Concession Road 4.

Plate 24: Berms located within the Pine River Block, fronting County Road 13.

Plate 25: A pond located within the Pine River Block, fronting County Road 13.

Plate 26: Agricultural lands within the Northern Block.

Plate 27: Agricultural lands within the Northern Block.

Plate 28: Forested area within the Northern Block.

Plate 29: Residence fronting County Road 13, Northern Block.

Plate 30: Low lying area in the Eastern Block.

Plate 31: Higher, drier wooded area within the Eastern Block.

Plate 32: Tributary of the Nottawasaga River flowing through the Eastern Block.

Plate 33: Roadway and right of way of County Road 5.

Plate 34: Roadway and right of way of County Road 5.

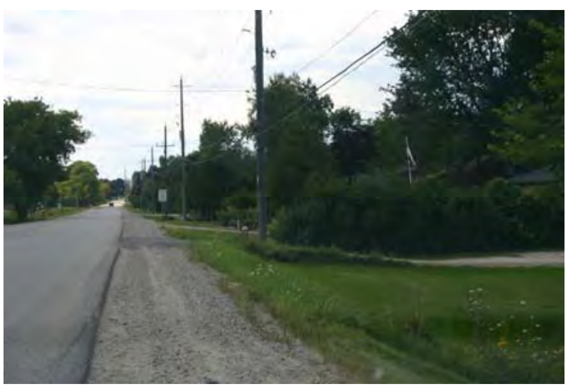


Plate 35: Roadway and right of way of County Road 13.

Plate 36: Roadway and right of way of County Road 13.

Plate 37: Concession Road 4 and right of way.

Plate 38: Concession Road 6, south of County Road 5.

Plate 39: Concession Road 6, north of County Road 5.

Plate 40: Corduroy Road within Concession Road 6.

Plate 41: Corduroy Road within Concession Road 6.

Plate 42: Flooded roadway with Corduroy Road eroded from the roadway..

Plate 43: Typical roadway and right of way within the residential areas.

Plate 44: Roadway and right of way within the residential areas.

Plate 45: Typical utilities encountered in the right of way along the residential roads.

8.0 MAPS

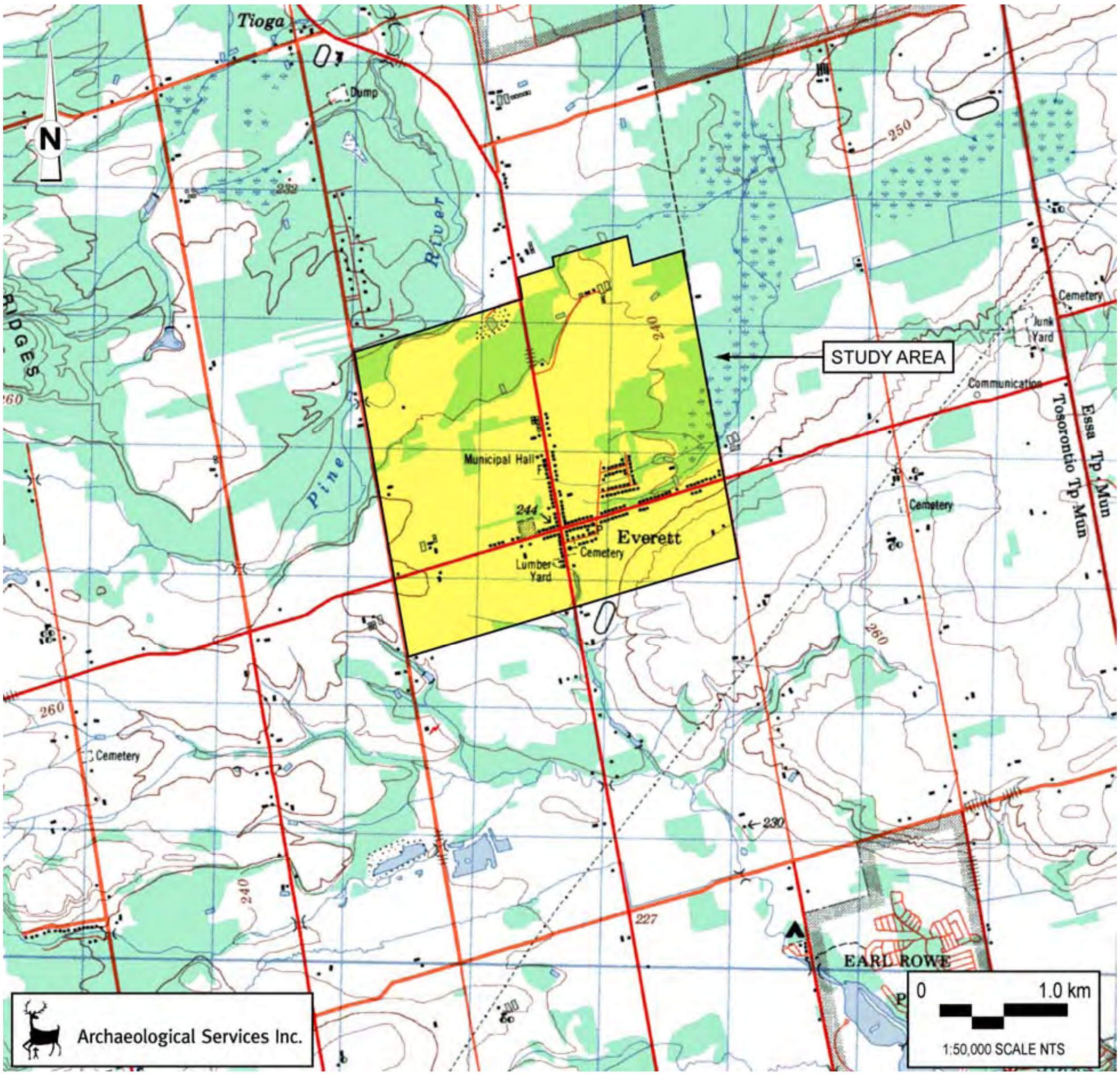


Figure 1: The study area illustrated on the NTS Sheet Alliston 31 D/4, 7th Edition, 1986.

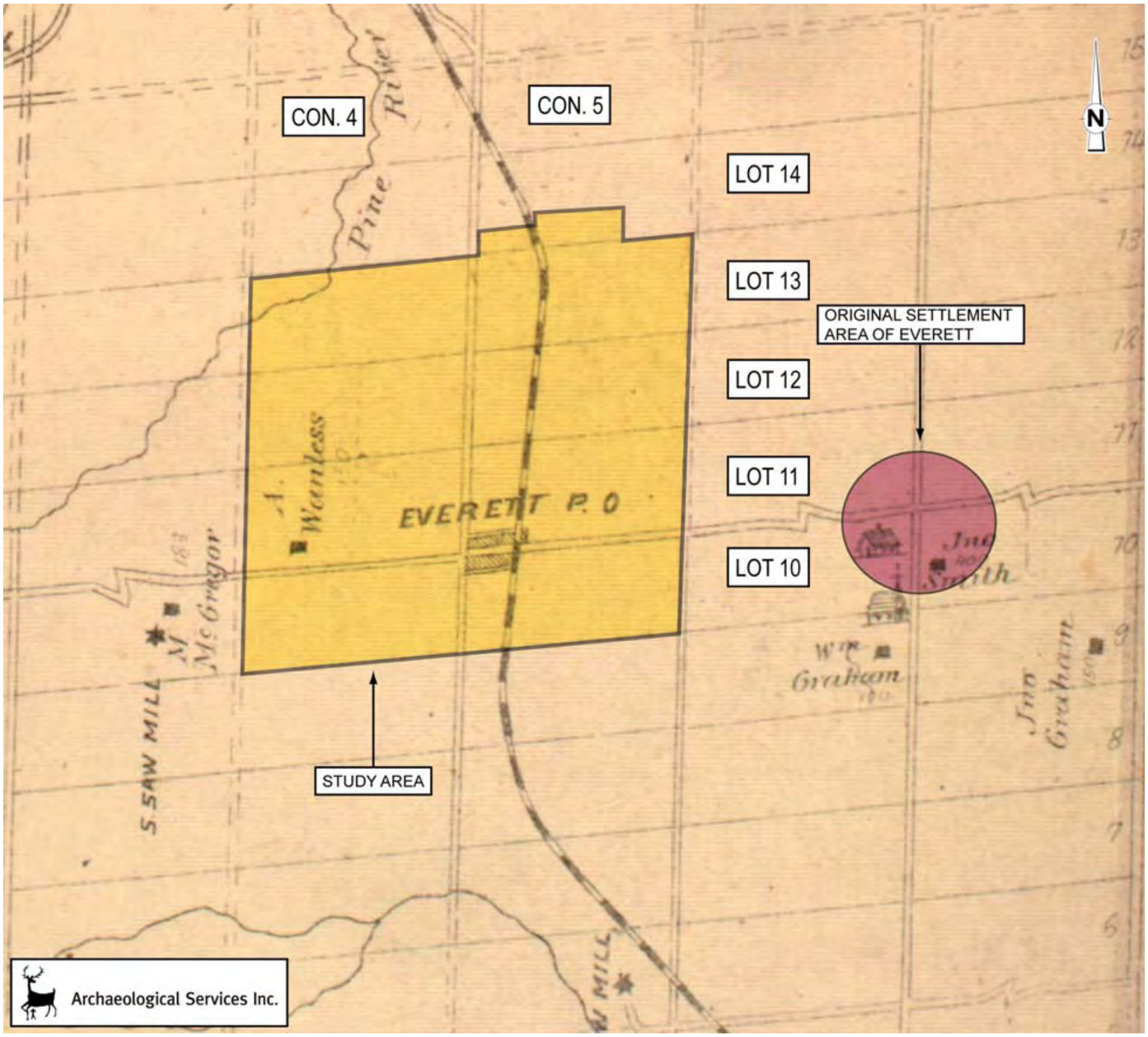


Figure 2: The study area located on the 1881 *Simcoe Supplement in the Illustrated Atlas of the Dominion of Canada.*

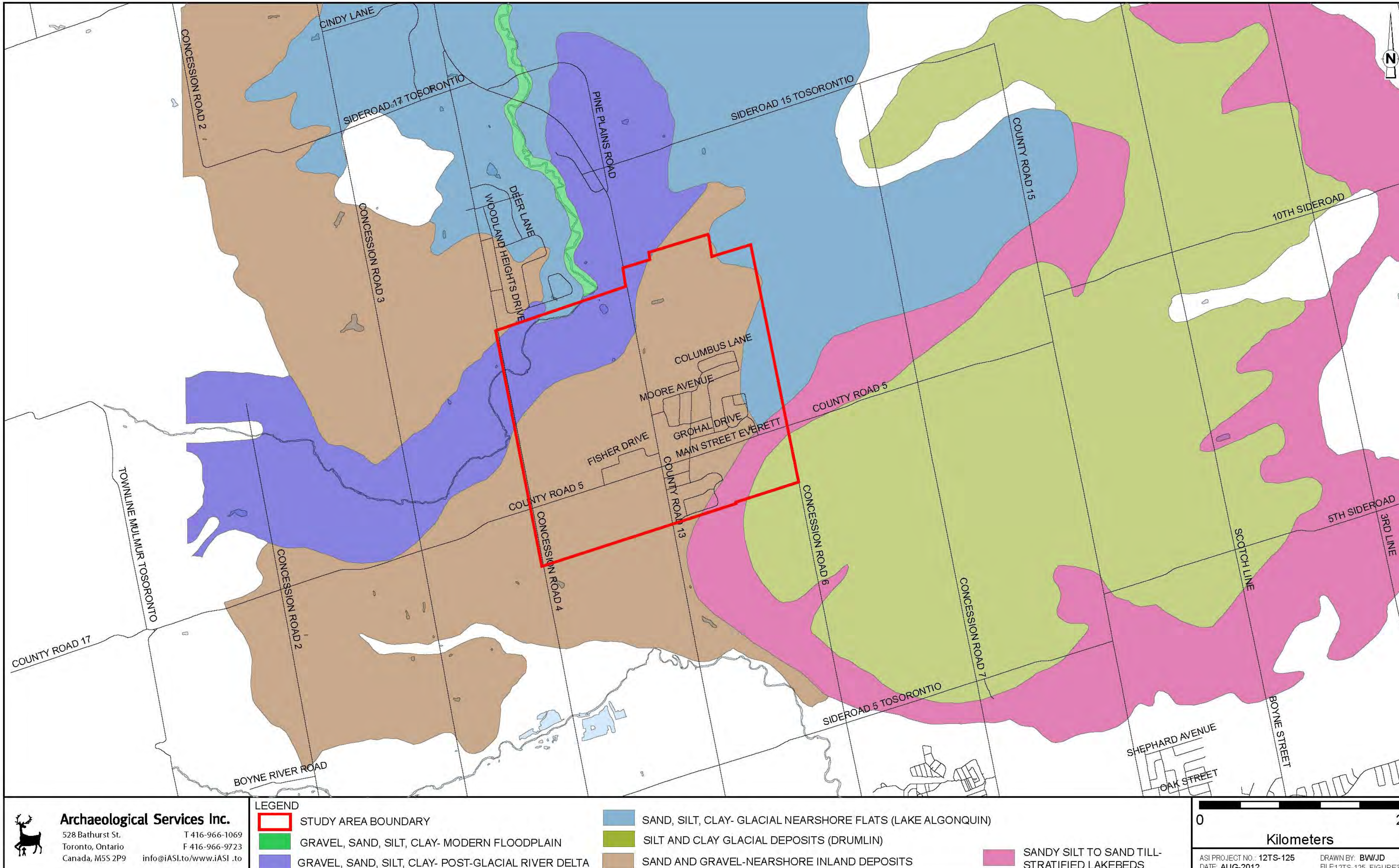


Figure 3: The Surficial Geology of the Everett Secondary Plan, Township of Adjala-Tosorontio, Simcoe County

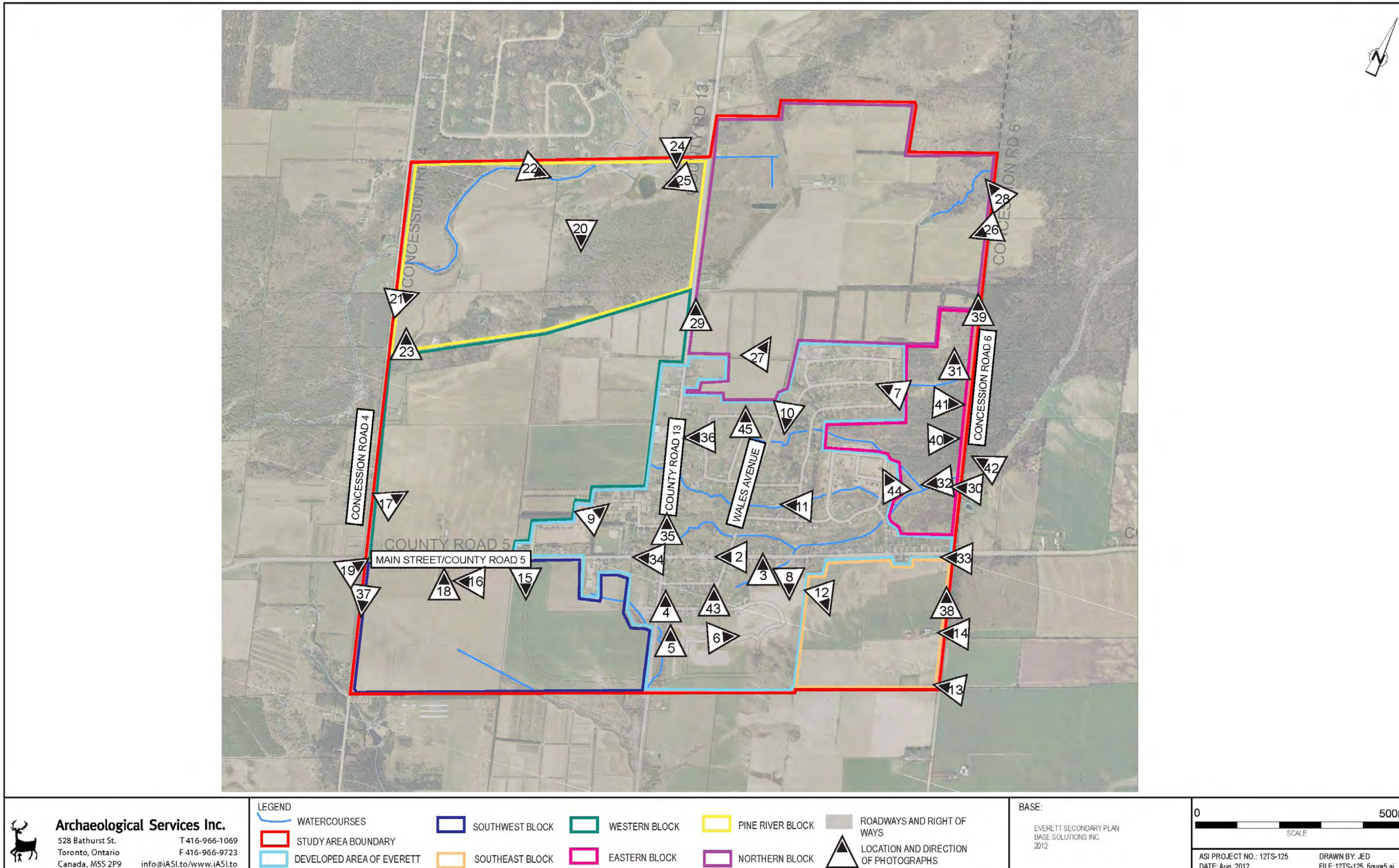


Figure 4: Stage 1 field review outline of the Everett Secondary Plan Lands, Simcoe County.

Figure 5: Aerial image showing the Hamilton and North Western Rail line “shadow” extending through the study area. The shadow line of the rail line is indicated with red arrows.

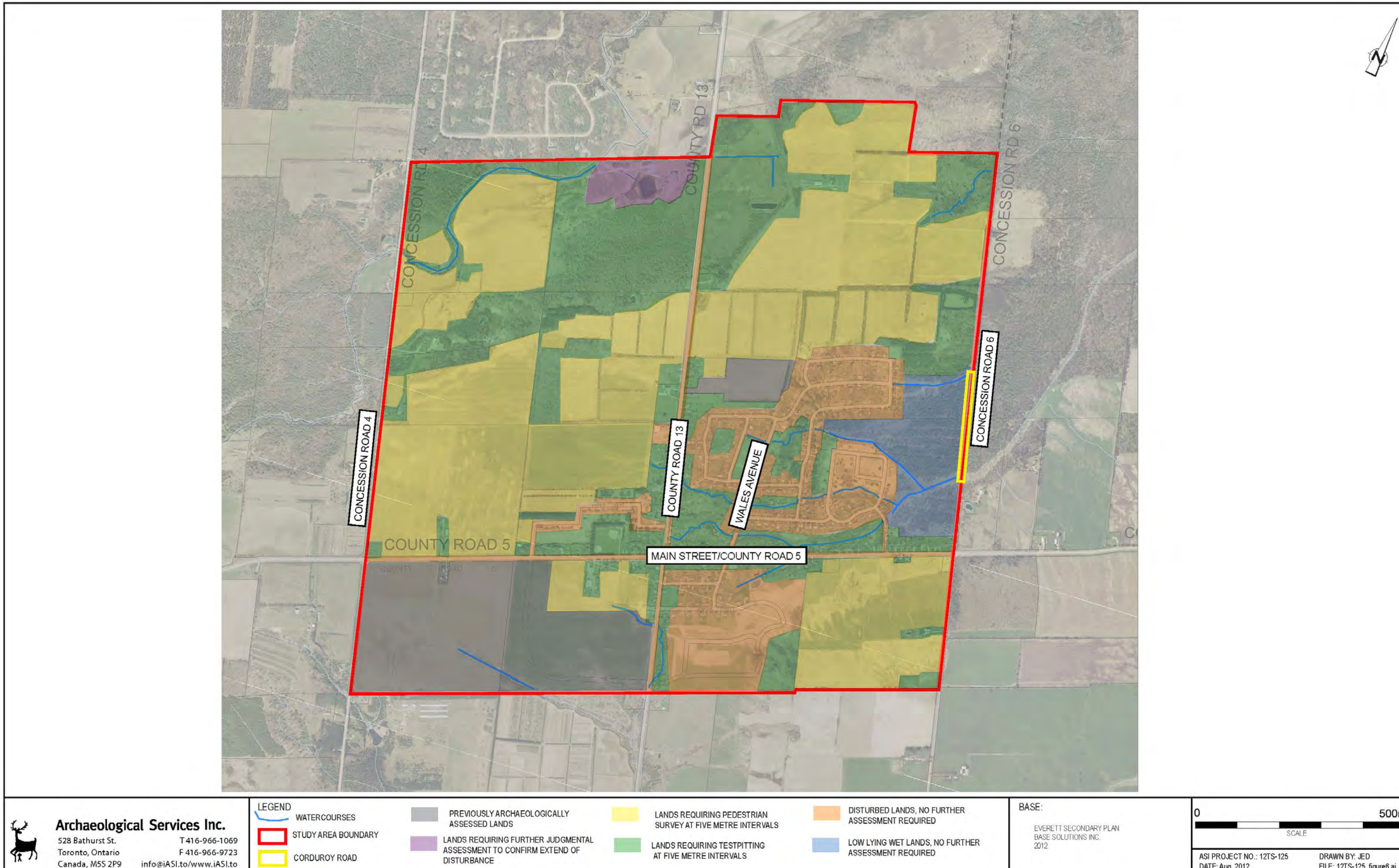


Figure 6: Detailed Stage 1 Field Review of the Everett Secondary Plan Lands, Simcoe County.

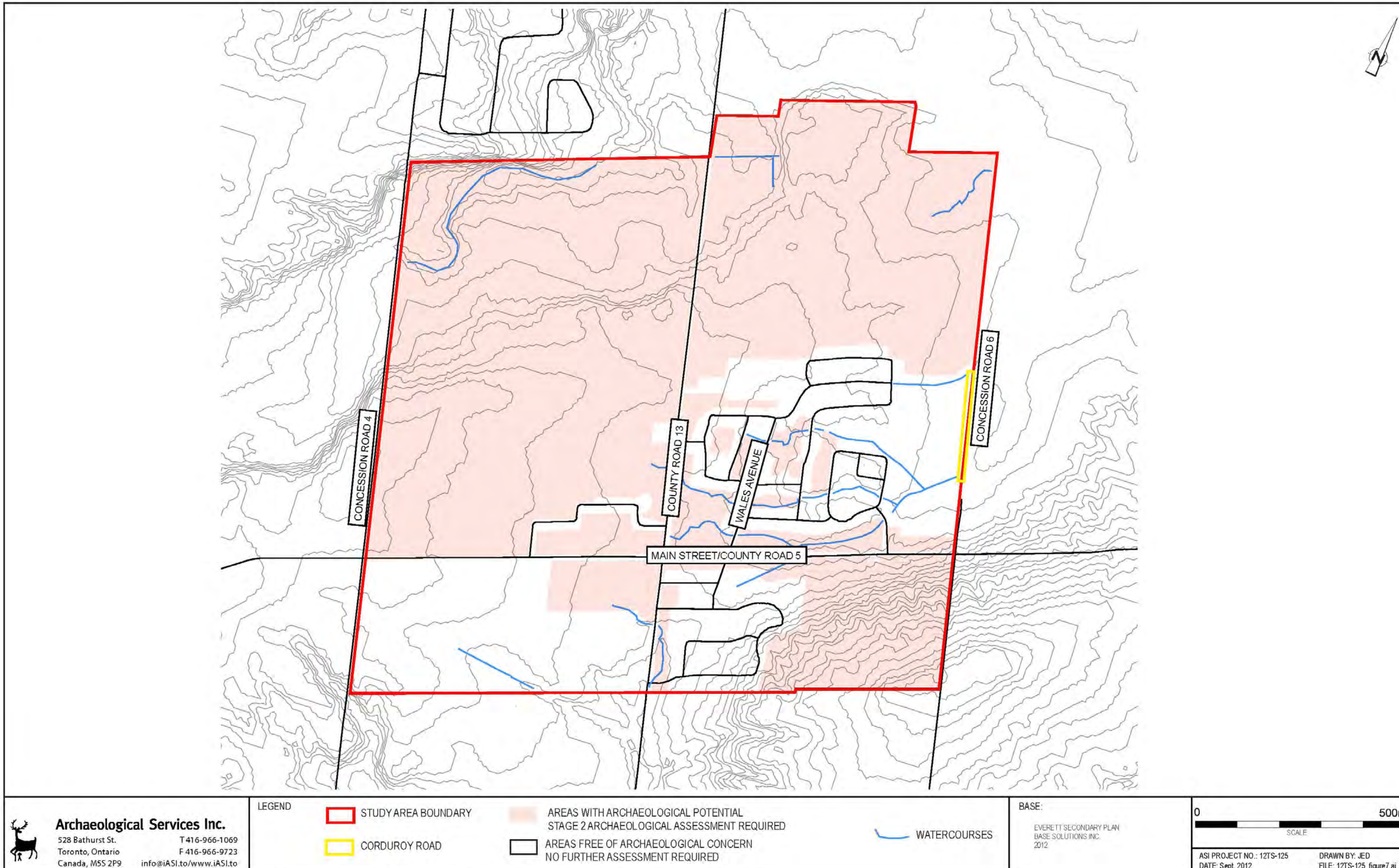


Figure 7: Areas of Archaeological Potential Requiring Further Assessment, Everett Secondary Plan lands, Simcoe County.

VOLUME 3: MASTER SERVICING STUDIES

Part 2 – Sanitary Servicing Master Plan Study Report

Everett Secondary Plan
Township of Adjala-Tosorontio
Sanitary Servicing Master Plan Study Report
November 2012
Greenland Project No. 12-G-2804

FINAL REPORT

GREENLAND® **International Consulting Ltd.**
A Member of the Greenland Group of Companies

120 Hume Street, Collingwood, Ontario, Canada, L9Y 1V5
TEL: 705 444-8805 FAX: 705 444-5482
E-MAIL: greenland@grnland.com WEBSITE: www.grnland.com

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

1.1 GENERAL

Greenland Consulting Engineers (GRN) has been retained by the Township of Adjala-Tosorontio (Township) to prepare a Master Servicing Plan which includes a Sanitary Servicing Master Plan Study Report for the Community of Everett.

1.2 SITE LOCATIONS AND CHARACTERTISTICS

The Community of Everett is located in the Township of Adjala-Tosorontio, northwest of the Town of Alliston. A location map is included as **Figure 1.1**.

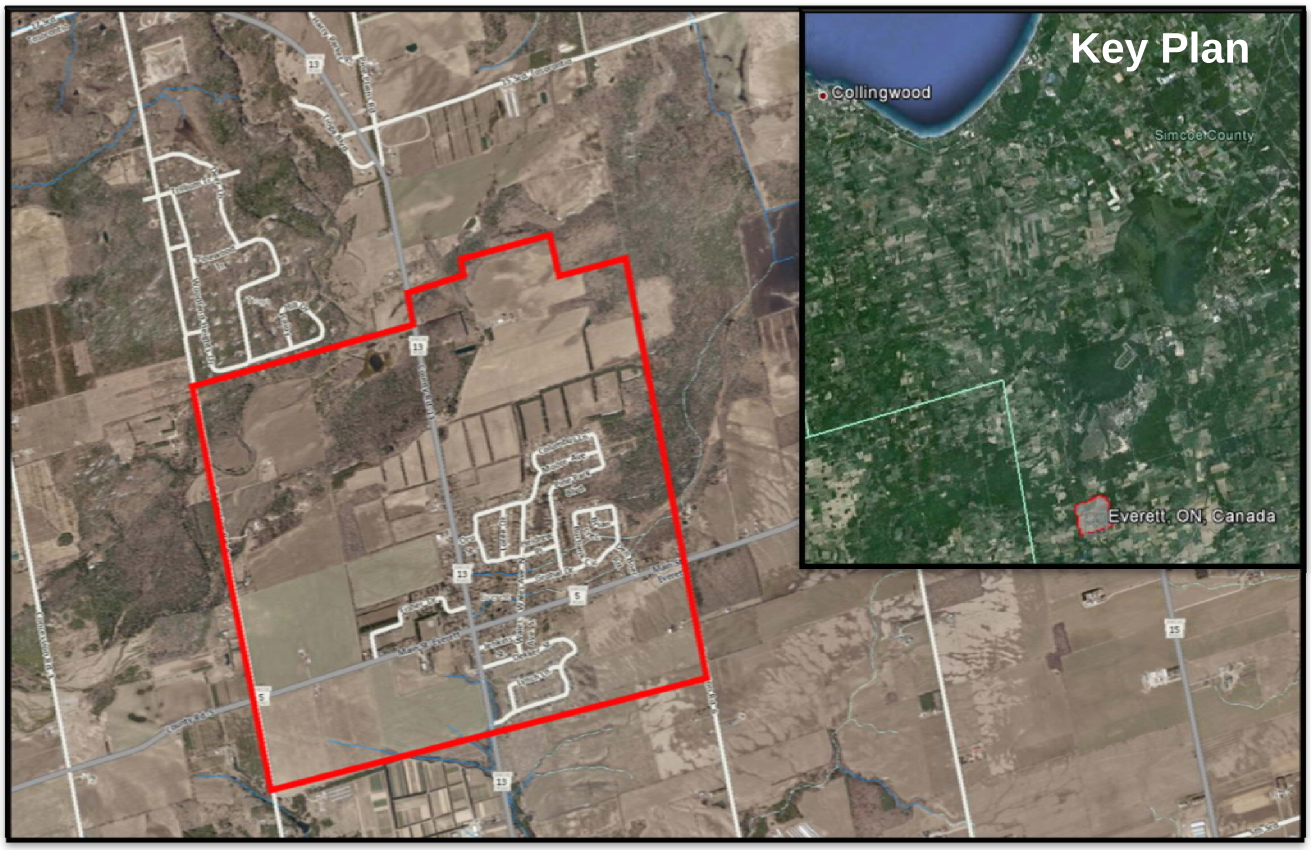


Figure 1.1 – Location Map: Community of Everett Secondary Plan

The existing land use in the Study Area includes a combination of agricultural land, floodplain; natural areas; existing residential development; and vacant or fallow agricultural land.

The Community of Everett (Study Area) is serviced by a municipal well system, and by individual septic systems except for the New Horizons subdivision, which is serviced by a municipal Wastewater Treatment Plant (WWTP).

The proposed R&M Homes development (R&M) located in the northern portion of the Everett Secondary Plan development area has received municipal Draft Plan Approval as of the date of this report. As such, the proposed infrastructure for the subdivision has been considered as existing development for the purposes of this study. R&M Homes is proposed to be serviced by an internal watermain network connected to the existing municipal water system. R&M will utilize a gravity sanitary sewer collection system which will discharge to a new sanitary pumping station and new WWTP and will be constructed specifically to service the proposed development.

1.3 SECONDARY PLAN POPULATION AND LAND USE

Concept Level land-use plans were developed at the outset of this study by The Planning Partnership, with technical input from Greenland and a preferred concept was generated which was used to develop population projections and servicing requirements for this Master Servicing Study. As part of this concept plan development, the undeveloped portions of the Secondary Plan Area were categorized into three (3) in process and four (4) future development parcels.

Land use for future development areas was determined by designating 5% of the parcel area each for storm water management (SWM) and parkland, and then assigning parcel specific "concept level" commercial and institutional uses. All remaining lands were designated as residential, with a density of 12 units per ha. The concept land use plan is provided in **Figure A-1 (Appendix SS-A)**.

With respect to the in process parcels, unit density and land use for the R&M Homes and Walton Developments were determined using "as submitted" values (i.e. for park and storm water management areas, total number of residential units, designated commercial blocks) based on the submitted draft plan applications for these properties. Land use for the Barzo Development was calculated using the same methodology as the future development areas.

Equivalent populations for each area were derived on a parcel specific basis using the projected land uses within each parcel to calculate sewage flows and water demands, at a unit population of 2.67 persons per unit, and a flow/demand rate of 250 L/c/d, based on the average sanitary flow as measured in the existing community of Everett sanitary system at the New Horizon WWTP (rounded up from 246 L/c/d). The sanitary flow is greater than the current municipal water demand rate of approximately 200 L/c/d. Commercial and institutional flow/demand rates were derived from MOE guidelines, and total average sewage flow rates were calculated for each parcel for all contributing land use areas. This net flow value for commercial and institutional (CI) land uses was then divided by 250 L/c/d to arrive at an equivalent population for each CI land use. A summary of the equivalent population calculations for each of the three (3) in process and four (4) future development parcels (and a lumped value for existing areas) is provided in **Table 1.1**. Detailed population and flow calculations are included in **Appendix SS-B**.

Table 1.1 - Secondary Plan Area Population by Parcel								
In Process Population			**Future Development Population**				**Existing**	**Total**
R&M Homes	Walton	Barzo	1	2	3	4		
1,466	684	1,357	2,681	1,127	341	1,084	1,929	**10,669**

1.4 STUDY PURPOSE AND REPORT STRUCTURE

The objective of this Study is to present a summary of existing sanitary infrastructure within the Study Area in order to provide a framework for development decisions within the municipality, and to then identify a detailed list of servicing options for additional development within the Community of Everett, i.e. within the Everett Community Secondary Plan Area. Summary analysis of all servicing options will be provided, and feasible options will be selected, analyzed in detail, and ranked in order of their adherence to criteria determined as part of this Study, to ultimately arrive at a preferred master sanitary servicing plan option for the Community of Everett.

The Secondary Plan Boundaries are presented in **Figure 1.1**, and a concept level future land use plan for the Study Area can be found in **Appendix SS-A (Figure A-1)**.

This Sanitary Servicing Master Plan Study Report is structured in the following manner:

- **Chapter 1.0:** Introduction
- **Chapter 2.0**: Discussion of existing (and In Process) sanitary collection & treatment infrastructure, including demands and residual capacity of current systems;
- **Chapter 3.0**: Presentation and analysis of Master Servicing Alternatives for both sanitary treatment and collection systems;
- **Chapter 4.0**: Comparison of preferred Master Servicing Alternatives;
- **Chapter 5.0:** Conclusions and recommendations drawn from the aforementioned analyses.

2.0 EXISTING SANITARY SERVICING

2.1 EXISTING WASTEWATER FLOW REQUIREMENTS

As with most communities within the Township of Adjala Tosorontio (Township), and with the exception of the New Horizon Subdivision, homes in Everett are predominantly serviced with Private Septic Systems, 70% of which are over twenty (20) years old and some of which are over fifty (50) years old. Sandy soil conditions coupled with metered water usage in the municipality have created a relatively low rate of failure for septic systems in the Study Area to date. Homes located within the New Horizon Subdivision are serviced via gravity sewers. Effluent from the sewer system is collected at two (2) sanitary pumping stations and pumped to a communal wastewater treatment plant (WWTP) located in the north east part of the subdivision. The R&M Homes Development is proposed to be serviced with a network of gravity sewers, a sanitary pumping station and a Sequencing Batch Reactor (SBR) WWTP for wastewater treatment. As the R&M Homes Development has received Draft Plan Approval from the Township, the development has been considered “Existing” for the purposes of this Study.

Sanitary system flows used for this existing conditions assessment were calculated using the best available existing information as provided by the Township, and in accordance with municipal and Ministry of the Environment (MOE) design standards.

The Total Equivalent Population used to determine both the existing water demand and sanitary flow servicing assessments was 1,929 persons (Simcoe County Water and Wastewater Visioning Strategy, 2012).

A summary of existing condition flows used to assess the municipal sanitary system and wastewater treatment infrastructure can be found in **Table 2.1 and Table 2.2**. Sanitary peaking factors (PF) are based on the Harmon Formula.

The average daily flow rate of 340 L/c/d, which is used throughout this study for determining wastewater treatment average daily design flows and residual capacities, was developed based on the (rounded) sum of the measured 250 L/c/d average flow rate (2009) from the New Horizons Subdivision WWTP flows and a 90 L/c/d extraneous flow allowance. It should be noted that the average flow rate at the New Horizons WWTP from 2009 to 2011 is less, at approximately 240 L/c/d.

Table 2.1 – Existing Sanitary Average Daily Flow Requirements

Flow Description/Area	Units Serviced	Equivalent Population	Avg. Flow (L/c/d)	Daily Average (L/s)	Daily Average (m^3/d)
New Horizon Subdivision	112	300	246	0.85	73.8
Proposed in Process (R&M)	492	1,466	340	5.77	498.3
Existing Unserviced Areas	610	1,629	340	6.41	553.9

Table 2.2 – Existing Sanitary Peak Flow Requirements						
Flow Description/Area	Equivalent Population	Avg. Flow (L/c/d)	I/I Allowance (L/c/d)	Peaking Factor	Peak Flow (L/s)	Peak Flow (m^3/d)
New Horizon Subdivision	300	450	90	4	6.56	567
R&M Homes Subdivision	1,466	450	90	3.66	29.67	2,563
Existing Unserviced Areas	1,629	450	90	3.65	32.69	2,825

A detailed breakdown of water and sanitary flows used in this Study to develop future flow projections is provided in **Appendix SS-B.**

2.2 EXISTING SANITARY TREATMENT AND COLLECTION – NEW HORIZONS SUBDIVISION

The New Horizon Subdivision is a development located south of Regional Road 5 (Main Street Everett) and east of County Road 13 in the Community of Everett, with a population of approximately 300 people (approximately 112 lots). The subdivision is serviced by a municipal sanitary sewage collection system and a small municipal WWTP. Sanitary pumping station (SPS) and WWTP locations are shown in **Figure 2.1**.

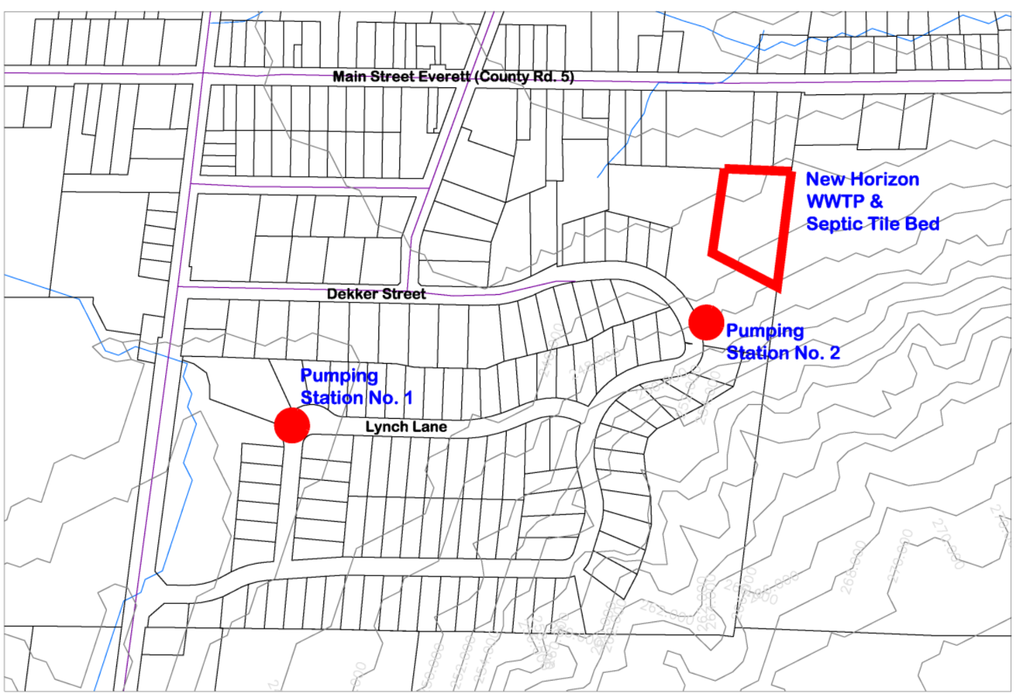


Figure 2.1 – Existing Sanitary Infrastructure

As of 2009, the average daily flows (ADF) for the development were approximately 75 m^3/day (0.87 L/s). The WWTP has a design capacity of 175 m^3/d (2.03 L/s). The residual capacity of the facility based on current average flows is approximately 100 m^3/d (1.16 L/s), which equates to an equivalent residual population of 295 people, based on a per-capita flow rate of 340 L/c/d.

2.2.1 EXISTING WASTEWATER TREATMENT

The facility serving the New Horizons Development is a package treatment plant (approximate dimensions are 22 meters x 10.2 meters x 3.8 meters) located approximately 90 meters east of existing Sewage Pumping Station Number 2 (PS2) and east of Dekker Street. Based on the facility's Certificate of Approval (C of A, #2145-6TEJDM), this facility has a rated capacity of 175 m^3/day. The main facility outlets to a final effluent pumping station, which in turn discharges to a subsurface tile bed disposal system. Each of these components are described below:

<u>Sewage Treatment Facility</u>

- One (1) concrete primary settling tank with a volume of 48.5 m^3 (after allowance for sludge), providing 195 days of sludge storage;
- Four-stage Rotating Biological Contactor (RBC) with a first stage surface area of approximately 873.3 m^2;
- A denitrification zone RBC with a surface area of approximately 1,717.3 m^2 equipped with a carbon source dosing system at a maximum dosing rate of 7.6 liters/hour;
- One(1) alum/pass dosing system to be used as an aid in flocculation, if necessary;
- One(1) submerged pump in the 4^{th} stage of the RBC returning nitrified water to the primary settling tank at a flowrate of approximately 6.3 L/s along with a bucket recycling system returning nitrified water to the primary settling tank at a flowrate of approximately 0.8L/s;
- One (1) final settling tank inlet weir;
- One concrete final settling tank with a capacity of 47.2 m^3providing an area of 19.79 $m^2$with a minimum of 3 hour retention time;
- One (1) 90 V-Notch weir and ultrasonic level transmitter to flow pace all chemical feeds and record flows; and
- One (1) 50kW diesel generator is also located on-site as an auxiliary power supply in the event of power outages.

<u>Final Effluent Dosing Pump Station</u>

One (1) effluent dosing pumping station located by the package treatment plant, equipped with two (2) submersible pumps (one duty, one standby) each pump rated at approximately 10.0 liters/second at 2.0 TDH with a float control system, valves and piping.

Subsurface Final Effluent Disposal System

The subsurface effluent disposal system is located approximately 50 meters west of the Treatment Building and consists of three (3) tile beds with a combined area of 2,430 m^2 with the following provisions:

- A 100 mm diameter forcemain discharging to the primary distribution box that splits the flow evenly to six (6) splitter distribution boxes feeding the three(3) tile beds;
- Each of the three (3) tile beds consist of two(2) tile grids; each consisting of 8 runs of 25 meters of 100 millimeter diameter distribution pipe on 1.8 meters centre to centre;
- Backfill consisting of native fill material with a "T" time of 10 minutes from 150 meters below each distribution pipe to 100mm above the pipe with a layer of filter fabric covering all pipe to a width of 500 mm;
- Sides of the bed backfilled with soil and sloped at a maximum of 1 vertical to 4 horizontal;
- Diversion swales beyond the side slopes directing drainage away from the bed; and,
- Theoretically maximum daily treatment capacity (based on MOE recommended maximum daily loading of 40 $L/m^2/d$) of 97.2 m^3/d (1.13 L/s)

Other

- All other controls, electrical equipment, instrumentation, piping, pumps, valves and appurtenances essential for the proper operation of the aforementioned sewage works.
- In 2008 and 2009, breakout of effluent was discovered from separate cells in the facility's tile bed. Temporary fixes consisting of reducers to the two affected beds were installed and remain in place today.

2.2.2 EXISTING SANITARY SEWAGE COLLECTION SYSTEM

The New Horizons development utilizes a network of 200-250mm diameter gravity sewers with slopes from 0.4 to 4.0%. Branches of the gravity system drain into two (2) existing raw sewage pumping stations.

Raw Sewage Pumping Station Number 1 (PS1)

PS1 is a prefabricated raw sewage duplex pumping station (approximately 7.4m deep x 1.2m diameter) located on the west side of Lynch Lane with a capacity of approximately 5.0 L/s at 30.0 meters total dynamic head (TDH). PS1 Services "Phase 2" of the New Horizon subdivision including all of Lynch Lane, and Dekker Street between County Road 13, and the New Horizon WWTP.

PS1 has a float control system, valves and piping, lockable access hatchways, benching, one(1) goose necked vent, with bird screen and an above ground enclosed 20 kW propane generator set with control panel, ventilation, etc. The pump discharges to a 75mm diameter sanitary sewer force main on Lynch lane directing sewage to the treatment plant.

Raw Sewage Pumping Station Number 2 (PS2)

PS2 is a prefabricated raw sewage duplex pumping station (approximately 9.6 metres deep x 1.2 meters diameter) located on the north side of Decker Street approximately 300 meters east of Wales Avenue. PS2 currently services twelve (12) properties located on Dekker Street west of the New Horizon WWTP.

It is equipped with two (2) submersible grinder pumps (one duty, one standby), which are each rated at approximately 1 L/S at 20 meters TDH, with a float control system, valves and pumping, benching, one (1) goose necked vent with bird screen, lockable access hatch and control panel with duty and backup power supplied from the treatment plant. PS2 discharges to a 50 mm diameter sanitary sewer force main directing sewage to the treatment plant.

2.3 EXISTING SANITARY TREATMENT AND COLLECTION – UNSERVICED DEVELOPMENTS

The total population in the Study Area as of 2009 was 1,929 persons, which roughly translates to 722 developed lots. Of these properties, approximately 112 lots with an equivalent population of 300 persons are connected to municipal sanitary sewers, all of which are currently located within the New Horizons Subdivision, which is described in **Section 2.3**.

2.3.1 EXISTING WASTEWATER TREATMENT

Approximately 1,629 persons (or 610 units) within the Study Area are serviced by private wastewater treatment systems (i.e. septic tanks) and are not connected to any existing municipal sewage collection or treatment system. A per-capita flow rate of 340 L/c/d was used to determine an average daily sanitary sewage generation rate of **554 m^3/d** (6.41 L/s) for the unserviced population within the Study Area.

2.3.2 EXISTING SANITARY SEWAGE COLLECTION SYSTEM

No sanitary sewage collection system currently exists for any properties outside of the New Horizon Subdivision.

2.4 SANITARY TREATMENT AND COLLECTION - R&M HOMES SUBDIVSION (PROPOSED – IN PROCESS)

The R&M Homes Development, which has received Draft Plan Approval at the time of this Study is proposed to be serviced with a network of gravity sewers in accordance with MOE guidelines, and will require a new WWTP to treat collected effluent.

The proposed development consists of approximately 492 units (Equivalent Population of 1,314 persons including commercial space), which using a per capita flow rate of 340 L/c/d would generate an average daily flow of approximately 480 m^3/d (5.56 L/s), and a 1.52 ha commercial block with a an average daily flow of 42.6 m^3/d (0.49 L/s), using the MOE recommended design flow rate of 25 m^3/ha/d for commercial developments. Adding the equivalent population for this block (152 persons – see **Appendix SS-B**) to the residential population gives a total equivalent population for the development of **1,466** persons, and total design flow of **498 m^3/d** (5.77 L/s).

2.4.1 PROPOSED WASTEWATER TREATMENT

A Sequencing Batch Reactor (SBR) system by Napier-Reid of Markham has been proposed to meet the wastewater treatment needs for the development. The facility is designed to provide a treatment capacity of **748 m^3/d** (8.66 L/s).

This average daily design flow (ADDF) value was derived by the Development's design engineer, Pearson-McQuaig Engineering Ltd, using a per capita flow rate of 350 L/c/d, 90 L/c/d of extraneous flows, plus commercial contributions at 65 m^3/ha/d as per the following equation:

ADDF = 350L/c/d x1476 Persons + 65 m^3/ha/d x 1.52ha x 1000L +1,476 Persons x 90 L/c/d

ADDF = 748,240 L/day (8.66 L/s)

(Source: *R&M Homes Residential Development Sanitary Servicing Report, Rev. Jan. 2012*)

Based upon projected flows presented herein, the R&M Homes flow design is conservative given observed water use trends in the area, and our experience with similar development projects. Using the per capita flow rate of 340 L/c/d (which includes infiltration) presented herein, the facility would be able to service an equivalent population of approximately 2,200 people. Based on the full build-out equivalent population of 1,466 persons proposed for the development, and using the current capacity as designed the R&M Homes WWTP would have a residual capacity of approximately 734 equivalent persons (2.89 L/s).

As designed, the R&M Homes WWTP raw sewage will enter a pump station and be pumped to a mechanical fine screen before entering two (2) SBR tanks. The proposed system will continue to accept raw sewage inflow throughout an entire SBR cycle. Treated secondary effluent from the SBR process is then further treated with continuous backwash tertiary filters. Finally, the treated effluent will be discharged to a pump chamber located west of the WWTP, consisting of eight effluent pumps which discharge to the Large Subsurface Disposal Field (LSDF).

The effluent pumping chamber will be located approximately 3m west of the SBR and consists of a modified 36,000L sanitary holding tank with eight pumps. Treated effluent from the WWTP will enter the pumping chamber via one 250mm dia. PVC sanitary pipe. This chamber will be a rectangular waterproof concrete tank with an overall capacity of 36,000 L. Effluent will be pumped via 75mm HDPE sanitary pressure pipes to the LSDF. The septic pumping chamber will contain eight Flygt 6.5hp pumps designed to pump at 10.0L/s each against a total dynamic head(TDH) of 20m.

The 27,750 m^2 tile bed proposed for the facility will provide a hydraulic loading rate of approximately 27 $L/m^2/d$ using 8 cells, or 36 $L/m^2/d$ with 6 cells, based on the proposed ADDF of 748 m^3/d. The design proposed to alternate use between 6 and 8 cell treatment to cycle the use of cells and allow each cell one full day of “rest” in a given four (4) day cycle. This loading rate is below the MOE recommended maximum hydraulic loading rate of 40 $L/m^2/d$, and additional land has been purchased for the purpose of expansion in the event that groundwater monitoring suggests additional cells would be warranted.

Effluent Criteria for the proposed facility are presented in **Table 2.3**. These criteria were developed on the assumption that attenuation rights will be obtained over property immediately to the north and effluent entering the watercourse to the east within this property limit.

Table 2.3 – Effluent Limits & Objectives

	BOD5 (mg/L)	Suspended Solids (TSS) - (mg/L)	Phosphorous (mg/L)	Total Nitrate + Ammonia (mg/L)
Effluent Limits	10	10	1.0	10
Effluent Objectives	5	5	0.5	7

2.4.2 PROPOSED SANITARY SEWAGE COLLECTION SYSTEM

The sanitary sewer system for the development consists of approximately 4.9 km of 200mm – 250mm PVC sanitary sewer which varies in slope from 0.3% to 2.5%. Sewage is currently proposed to flow to a 250mm diameter trunk sewer to the raw sewage pumping station, located as shown in **Figure 2.2**. The pumping station is designed to discharge to a forcemain at a maximum rate of **27.4 L/s** (2,367 m^3/d), which will transport effluent North to the proposed WWTP along Concession Road 6.

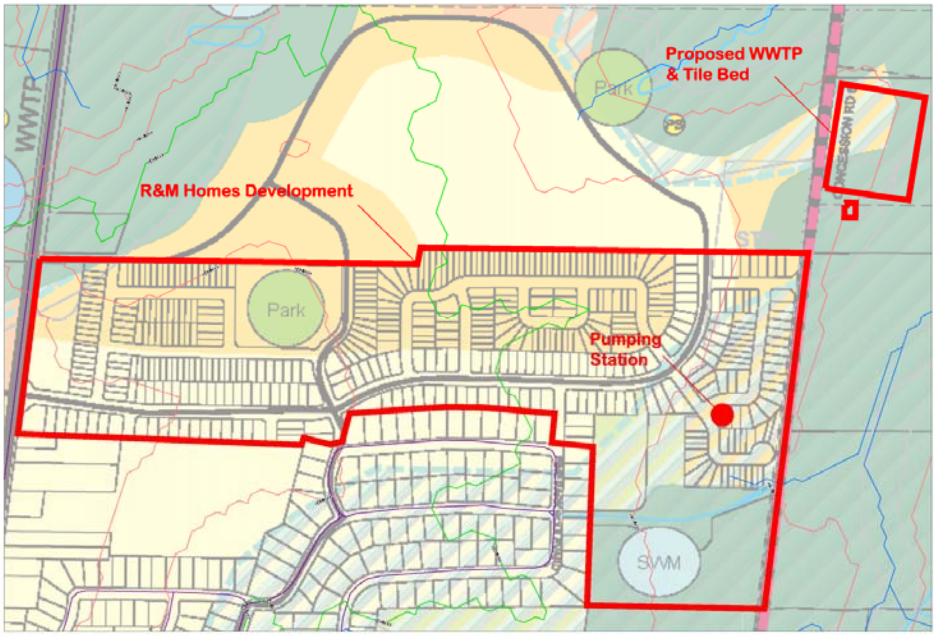


Figure 2.2 – R&M Homes Sanitary Infrastructure

Based on the calculations presented in **Table 2.2**, the proposed pump system is slightly undersized to convey the projected peak flow of **29.67 L/s** (2,564 m^3/d) from the development, as designed and assuming a conveyance average daily flow generation rate of 450 L/c/d.

2.5 Sanitary Servicing Gaps

Based on the calculations presented in **Section 2.0** of this study, the existing New Horizons WWTP and the proposed R&M Homes WWTP (as designed) have a combined residual capacity which could service the equivalent of 1,029 additional people. **Table 2.4** summarizes the overall treatment capacity of existing and "in process" (R&M Homes) municipal treatment systems:

Table 2.4 – Existing and Proposed Wastewater Treatment Capacity

Area/WWTP	Equivalent Population (Persons)	Treatment Capacity (Persons)	Residual Capacity (Persons)
New Horizon Subdivision	300	595	295
R&M Homes Subdivision[2]	1,466	2,200	734
Existing Unserviced Areas	1,629	0	-1,629
Totals	**3,395**	**2,795**	**-600**

[1] Existing Serviced Population of 300 + Residual Capacity of 100 m^3/d @ 340 L/c/d

[2] Based on Study Flows of 340 L/c/d (Including Infiltration) and MOE rate of 25m^3/ha/d Commercial Flows. Current WWTP Design is based on 350 L/c/d + 90 L/c/d + 65m^3/ha/d Commercial.

Assuming all residual servicing capacity of both WWTP's is to be used up by connecting a portion of the existing unserviced population, the system would have a servicing gap of approximately 600 people.

In practical terms however, the New Horizons subsurface wastewater treatment plant has limited residual capacity and experiences regular maintenance issues. This system has limited ability to service any additional development, and the Township has expressed an interest in decommissioning the facility.

Based on the foregoing the existing wastewater treatment and sanitary conveyance systems do not have the capacity to service the ultimate development of the proposed Secondary Plan as designed or proposed to date. The following Chapters of this Report, will propose alternative master sanitary servicing options to address above referenced servicing gap, and the projected future population of approximately **10,669** equivalent persons for the ultimate buildout of the Everett Secondary Plan. Detailed calculations for existing, in process and future development populations for the Secondary Plan are provided in **Appendix SS-B**.

3.0 ALTERNATIVE SANTIARY SERVICING SOLUTIONS

3.1 BACKGROUND

Draft plan submissions received by the Township in recent years currently propose that individual wastewater treatment facilities will be installed for each of the various developments within the Community of Everett and existing residents will be continue to be serviced by individual private septic systems. Although some of the draft plan applications have been approved to date, the objective of this study is to review alternative solutions in order to determine a preferred master servicing option for the Everett Secondary Plan which provides the greatest net benefits to all stakeholders, including, but not necessarily limited to the municipality, existing residents, the local community and the natural environment. To be considered feasible, servicing options need to be capable of providing treatment for the Study Area's ultimate total projected average daily flow rate of **3.63 ML/d** (41.98 L/s) based on an equivalent population of **10,669** persons (see **Appendix SS-B** for detailed calculations).

Servicing options can be categorized as either "treatment" or "collection" alternatives, as each treatment option will have specific collection constraints. As such, wastewater treatment and disposal alternative solutions were assessed first, and collection alternative solutions were developed and reviewed based on the analysis of the treatment system options. Identification and evaluation of treatment and disposal alternative solutions reviewed as part of this Study are presented in **Section 3.2**, while the identification and evaluation of associated collection alternative solutions is provided in **Section 3.3** of this Report.

Previous studies reviewed as part of this investigation, namely the *November 2012 Preliminary Hydrogeological Investigation by Golder Assoicates* (**Appendix SS-C**) and the *Pine River Assimilative Capacity Study by Greenland* (**Appendix SS-D**), suggest respectively, that the soils within the Study Area are suitable for subsurface discharge, and that the Pine River has sufficient capacity as a receiving watercourse from a nutrient management perspective for surface water effluent discharge. As such, both subsurface and surface water disposal options were investigated.

3.2 WASTEWATER TREATMENT ALTERNATIVE EVALUATION CRITERIA

At the outset of this Study, a long-list of wastewater treatment and effluent disposal alternative solutions were developed to address the servicing gap in the community of Everett and ultimately service the future Everett Secondary Plan development areas. This list is presented in **Table 3.1.**

Table 3.1 – Community of Everett Wastewater Treatment Alternatives

Alternative	Description
Option WWT-1 – Do Nothing	• Maintain the status quo.
Option WWT-2 – Septic Systems for New Growth	• Provide lot level treatment using individual septic systems for all new development areas
Option WWT-3 – Water Conservation	• Reduce existing conditions water use to create additional system capacity for new development
Option WWT-4 – Development Specific WWTP's	• This option would involve construction of individual WWTP's for each new development.
Option WWT-5 – Expand New Horizons WWTP	• Expand the existing WWTP to provide additional capacity for future developments.
Option WWT-6 – Expand R&M Homes WWTP (Subsurface Discharge)	• Provide additional treatment capacity at the proposed R&M Homes Subsurface Discharge WWTP to service both existing and future developments.
Option WWT-7 – Expand R&M Homes WWTP (Surface Water Discharge)	• Same as Option WWT-5 but with discharge of treated effluent to a surface water outlet (main branch of the Pine River).
Option WWT-8 – Construct New WWTP (Surface Water Discharge)	• Construct a new WWTP which discharges treated effluent to the Pine River (main branch).
Option WWT-9 – Combine Alternatives 6 & 7	• Convert the R&M WWTP from subsurface to surface water discharge once a certain capacity is exceeded.
Option WWT-10 – Combine Alternatives 6 & 8	• Construct a new surface water discharge WWTP once capacity at the proposed R&M WWTP is exceeded.
Option WWT-11 – Transport Effluent to a Neighbouring Municipality for Treatment and Disposal	• Construct a forcemain system between Everett and another municipality and treat effluent using existing facilities located within that municipality.
Option WWT-12 – Spray Irrigation	• Dispose of treated effluent using spray irrigation over a large area

In order to evaluate the proposed alternative solutions, each of the options presented in **Table 3.1** were assessed with respect to their strengths and weaknesses in terms of the following general criteria:

- Natural Environment Impacts:
  - Impacts of the option to vegetation, wildlife and surface/groundwater quality.

- Social / Cultural Environment Impacts:
  - Existing/future land use impacts of the option;
  - Traffic impacts of the option;
  - Archaeological considerations associated with the option; and,
  - Visual landscape/aesthetic impacts of the option.

- Economic Impacts:
  - Capital/construction costs associated with the option;
  - Long term/operational costs for the option; and,
  - Payment structure and responsibility for the costs associated with the option.

- Technical/Operational Considerations:
  - Impacts of the option to existing wastewater treatment activities;
  - Efficiency of the Option from an operations and maintenance perspective; and
  - Difficulty to construct or implement the Option relative to other alternatives.

Any options which did not satisfy one or more of these criteria (i.e. options which could clearly not be implemented due to prohibitive costs, detrimental environmental effects, or technical infeasibility) were eliminated without further detailed analysis. Options which appeared to be feasible within the context of these criteria were selected as potential "short-listed" alternative solutions and evaluated further in terms of their relative advantages and disadvantages within each evaluation criteria category.

3.3 WASTEWATER TREATMENT & EFFLUENT DISPOSAL ALTERNATIVES

A summary evaluation of the long-list of alternative wastewater treatment and disposal alternative solutions presented in **Table 3.1** is provided in the following subsections.

3.3.1 Option WWT-1 - Do Nothing

This option represents the status quo with respect to wastewater treatment and disposal and if the alternative solutions were not implemented. As existing servicing capacity is limited, this option would not allow for any future development and its selection would not satisfy the goals of the Everett Secondary Plan. As such, this option would not be a viable alternative and was not considered further in the evaluation of alternatives solutions.

3.3.2 Option WWT-2 - Septic Systems for New Growth

The majority of homes in the Community of Everett are currently serviced by individual septic systems. This option would suggest that this treatment process could be used for all future developments. Although soil conditions in the community are appropriate for subsurface (septic system) disposal methods, large scale implementation of lot level septic systems is contrary to environmental policy objectives associated with wastewater disposal in the province of Ontario. In addition, the subsurface disposal would only be recommended outside of the 2-year source water capture zone for existing and proposed potable water wells and on lots that could support sufficient subsurface disposal areas, thereby limiting growth with the Secondary Plan Area. It should also be noted that the upper groundwater aquifer has been found to have elevated levels of nitrate (per **Appendix SS-C**) which is often attributed to agricultural and septic system contamination. Limited Secondary Plan growth and numerous environmental concerns for this alternative solution eliminated it from further consideration in this Study.

3.3.3 Option WWT-3 – Water Conservation

In some cases, water conservation measures can reduce loading on existing treatment facilities and increase available capacity. Given the scope of proposed development within the Secondary Plan Area and the already low existing water usage rates, this would not be a viable alternative solution for the ultimate development of the Everett Secondary Plan

However, it could be considered a complementary solution to the recommended preferred sanitary servicing alternative in the Community of Everett.

3.3.4 Option WWT-4 – Development Specific WWTP's

The majority of development applications currently being reviewed by the Township within the Study Area include provisions for construction of small scale WWTP's to service each development parcel. This option represents practice, constructing a number of facilities similar to the existing New Horizon's WWTP, as opposed to developing a more centralized wastewater treatment strategy.

Given the issues the Township has experienced to date with the New Horizon's facility, and the fact that maintenance responsibilities for development specific WWTP's would result in a significant operational burden on the Township, once multiple facilities were up and running (both from the perspective of on-going costs and personnel requirements), this option is not a sustainable long term alternative wastewater treatment alternative.

3.3.5 Option WWT-5 – Expand New Horizons WWTP

This option would include upgrades and expansion to the existing New Horizons subdivision WWTP to accept flows from future development areas. The facility is currently near capacity, and no acceptable surface water discharge point is located in the vicinity, which suggests that additional subsurface discharge cells would be required to provide the treatment capacity needed to accommodate future development. Given that the existing facility has a total available treatment area of 1.8 ha, and the MOE's recommended maximum daily loading of a treatment area is 40 L/m^2/d, the theoretical maximum daily treatment capacity of the facility would be approximately **720 m^3/d** (8.33 L/s).

In order to provide the projected **3.63 ML/d** (41.98 L/s) of ultimate build-out treatment capacity, a minimum total land area of 9.1 ha would be required for subsurface treatment beds alone (using the maximum allowable loading rate of 40L/m^2/d) or 13.4 ha using a reduced the reduced rate of 27L/m^2/d (the rate used to design the R&M Homes WWTP). This would require the purchase of 7.3 - 11.6 ha of otherwise developable land in an area which is currently partially developed.

Given the potential impacts to existing residents, that large land area requirement to facilitate treatment/subsurface disposal and the Township's stated desire to decommission the New Horizon's WWTP, it has been concluded that this is not a desirable alternative wastewater treatment and disposal alternative and will not be considered further in this assessment.

3.3.6 Option WWT-6 – Expand R&M Homes WWTP (Subsurface Discharge)

A Sequencing Batch Reactor (SBR) system is currently proposed to meet the wastewater treatment needs for the R&M Homes development. The facility is designed to provide a treatment capacity of **748 m^3/d** (8.66 L/s). The WWTP is proposed to be constructed on lands owned by the developer which are located to the North East of the development along Concession Road 6, directly east of the proposed Barzo Development Lands. The property is approximately 20 ha in size, with a watercourse bisecting the property approximately 410m east of Concession Road 6.

The currently proposed WWTP includes 2.77 ha area for treatment cells associated with the R&M homes development, which provides 27 L/m^2/d of treatment capacity using eight (8) treatment cells. To maintain this loading rate, an addition 8.83 ha of area would be required, for a total of 11.6 ha. Although there is theoretically enough space on this property, and the adjacent property (also owned by the developer), the proximity of the proposed facility to the Pine River tributary may present environmental concerns and further investigations would be required to verify the environmental impacts of such a large number of treatment cells in close proximity to the watercourse or potentially new water wells required to service the future growth in the Everett Secondary Plan area.

In addition, the efficiency of subsurface treatment for such a large volume of flow is questionable, and could present significant maintenance issues for Township Staff in the future. Based on the foregoing, this option, although technically feasible, presents concerns with potential future maintenance and environmental concerns and ultimately may limit growth in the Secondary Plan Area. As such, this alternative solution has been eliminated from further consideration in this assessment.

3.3.7 Option WWT-7 – Expand R&M Homes WWTP (Surface Water Discharge)

Similar to Option WWT-6, this option would also involve expanding the proposed SBR system for the R&M Homes Development to include additional capacity for all existing and future development within the Secondary Plan Area. However, this alternative solution would include discharge to a surface water source as opposed to having subsurface discharge.

Based on the results of an Assimilative Capacity Study completed by Greenland for the Pine River at Everett (provided for reference in **Appendix SS-C**), there is sufficient capacity in the Pine River to accept the additional total phosphorous (TP - limiting parameter of concern) which would be generated as a result of WWTP discharge at 0.1 mg/L TP at an average daily rate or 3.5 ML/d, or for an equivalent population of approximately 10,500 persons.

From a social and technical standpoint, there are no major concerns associated with the implementation of this option. The R&M WWTP would have to be upgraded to provide the required phosphorus treatment limit of 0.1 mg/L TP in the plant effluent. Economically, the viability of this option will be impacted by the associated wastewater collection and conveyance options, for example, treated effluent must be pumped to the main branch of the Pine River (located roughly 2.0 km to the west of the proposed WWTP). Significant infrastructure investments may be required to facilitate conveyance of the treated flows, however this is true for all viable options and given the lack of limiting technical, social and environmental issues, this option was “short listed” and considered in further detail.

Finally, it would be proposed that given the high quality stream capacity of the Pine River, that 0.1 mg/L be the maximum effluent limit, with the objective being 0.05 mg/L which is consistent with “state of the art” phosphorous treatment systems in Ontario.

3.3.8 Option WWT-8 – Construct New WWTP (Surface Water Discharge – Walton Lands)

As with Option WWT-7, this option would involve constructing a new wastewater treatment facility which discharges to the Pine River. The key difference for this option is that the proposed facility would be located to the west of County Road 13, in close proximity to the Pine River (in the north end of the Study Area).

The economic viability of this option is beholden to servicing and phasing constraints. Specifically, although the proposed location for this WWTP is within several hundred metres of the proposed discharge location, the facility is located nearly 1.5 km from the proposed pumping station for the R&M Homes development.

As with Option WWT-7, the natural environmental impacts of this Option WWC-Are not significant enough to exclude the option. Similarly, the social and financial implications are reasonable and as such, this option was "short listed" and considered in further detail.

3.3.9 Option WWT-9 – Combine Alternatives 6 & 7

Option WWT-9 is a "hybrid" option of alternative solutions 6 and 7 presented herein. This Option WWC-Combines aspects of each option, as well as phasing opportunities. A combined approach has the distinct advantage of allowing some of the currently proposed development (i.e. R&M Homes) to proceed, with perhaps some additional consideration being given to capacity for additional expansion at the proposed WWTP, and provisions to switch the discharge from subsurface to surface water discharge once the design capacity of the WWTP is exceeded.

While other development occurs in the Secondary Plan Area, the Township can collect development charges as new developments come on line, which can be used to fund additional infrastructure investments once the threshold population is reached. At this time, conveyance infrastructure (i.e. pumps and forcemain) for treated effluent could be constructed to facilitate discharge to the Pine River.

Under this option the Township also has the option of requiring developers to construct some of the required infrastructure (i.e. partial forcemains, pump upgrades) as a condition of their subdivision agreements.

3.3.10 Option WWT-10 – Combine Alternatives 6 & 8

This option represents another "phased" approach, similar to Option WWT-9, however this option would result in the construction of a New WWTP on the lands west of County Road 13 (near the Pine River in the north end of the Study Area) once the threshold population for the Study Area is reached. As with Option WWT-9, the viability of this option will depend upon the collection strategies developed for both incoming sewage flows and outgoing treated effluent.

Phasing of development areas within the Secondary Plan Area will also impact the feasibility of this option, as development charges, availability of "external" infrastructure installed under subdivision agreements and the staging of municipal capital works projects to bring existing residents on line (and the associated local improvement charges collected by the municipality) will all impact the financial viability of this Option.

3.3.11 Option WWT-11 – Transport Effluent to a Neighboring Municipality

Option WWT-11 would involve transporting all raw sanitary effluent to another municipality for treatment at their facility. Given the volume of flow to be treated, trucking is not a feasible option logistically or financially, therefore transport of effluent would need to be accomplished by installing a forcemain between Everett and another municipality with treatment systems already in place (i.e. Alliston, Borden or Angus).

It is unlikely that this option will be viable, given that any excess treatment capacity in neighboring municipal systems is likely earmarked for development within those municipalities, and given the significant costs associated with installing and maintaining a forcemain system capable of transporting the effluent to any nearby treatment facility. On this basis, this option is not a ”short-listed option for further consideration as part of this Study.

3.3.12 Option WWT-12 – Spray Irrigation

This Option would utilize similar treatment systems to the other proposed options but with discharge via spray irrigation. This disposal method can be appropriate for small scale use in agricultural areas. This Option was not investigated in further detail as given the scale of the project, land area required for disposal would be similar to Option WWT-5.

3.3.13 Summary of Short Listed Wastewater Treatment/Disposal Alternative Solutions

Based on the foregoing, the “short listed” alternatives for Wastewater Treatment in the Everett Secondary Plan Area are; **Option WWT-7, Option WWT-8, Option WWT-9, and Option WWT-10.**

Figure A-2 in **Appendix SS-A**, shows the locations of the “short listed” wastewater treatment and disposal options.

These options as described will be used in the next section of this report to develop the wastewater collection alternatives, in order to develop a broader assessment of the evaluation criteria as they relate to an overall wastewater servicing strategy.

3.4 WASTEWATER COLLECTIONALTERNATIVES

In general, given the relatively flat topography of the majority of the Study Area, it was determined at the outset of this assessment that the ideal combination of pumping stations and gravity flow trunk sewers, which attempt to maximize the use of gravity while minimizing the number of required pumping systems for any given WWTP location, would represent the ideal wastewater collection strategy for any given wastewater treatment alternative.

With this strategy in mind, a number of collection strategies were developed based on the “short listed” treatment and disposal alternative solutions **7, 8, 9 & 10** as outlined in **Section 3.3** of this report.

Detailed Sanitary Sewer Design Spreadsheets for each of these options are provided in **Appendix SS-E**.

3.4.1 Option WWC-A – Mixed Gravity and Forcemain to R&M Homes Pumping Station

This sewage conveyance option, depicted in **Figure A-3 (Appendix SS-A),** would involve using Wales Ave., Moore Ave. and Pine Park Blvd. as the main trunk sewer alignment (TS-1 & TS-2), through the Everett Glen Subdivision (EG) and into the R&M Homes Subdivision (RM) with a final outlet at the proposed R&M sanitary Sewage Pumping Station (SPS). This SPS is currently designed to discharge to a forcemain at a maximum rate of **27.4 L/s** (2,367 m^3/d), and will need to be upsized to provide the required **173.75 L/s** (14,860 m^3/d) of peak flow conveyance. This option has the advantage of utilizing the existing topography to concentrate sanitary flows at a downstream location, while using pumping to minimize depth of proposed sewers.

Gravity Sewers

Under this option, the proposed SPS wet well invert elevation of 233.20 was held constant in order to design the upstream Trunk Sewer to drain by gravity from Main Street to the R&M Homes Subdivision. The northern portion of County Road 13 (CR13-N) drains to the northern half of the Moore Avenue Subdivision (MA-N) and ultimately to TS-2. The northern half of the Grohal Subdivision (GH-N) also drains to TS-2, with the southern half of MA (MA-S) draining to TS-1 and the southern half of GH (GH-S) draining to the Cumac Subdivision (CM).

Flows from the existing Vanderzaag Subdivision (VZ) would enter this trunk sewer from the South, with flows from Future Development Area No. 3 (F3) entering the VZ sewer by gravity. The Blanchard Subdivision (BL) and existing properties along County Road 13 (CR13-S) south of the Everett Drain and County Road 5 (CR5-W) West of Wales Ave. would also enter this trunk sewer via an extension of the piping along Main Street to the intersection of Main Street (MS) and CR-13S. A portion of County Road 5 located to the East of this intersection (CR5-E) is also proposed to drain by gravity to MS.

Future Development Area No. 1 (F1) drains by gravity to MH1072 at the western end of RM, and ultimately meets up with the proposed trunk sewer at MH1025 at the north end of Pine Park Blvd. Future Development Area No. 4 (F4) will drain to CR5-E and ultimately to CM. It is also proposed that the Barzo Development (BZ) drains by gravity to RM with a connection at MH1001.

Forcemains

Flows from the New Horizon Subdivision (NH) would be pumped to VZ and would enter the gravity system at the intersection of Dekker St. and Wales Ave. South. The existing Sanitary Pumping Station (SPS) which is currently used to convey effluent to the existing New

Horizon's WWTP would be used instead to pump effluent to the new gravity system and the existing WWTP could be decommissioned. Approximately 350m of forcemain would be needed to accommodate this change. Minor upsizing of the existing pump total dynamic head (TDH) may also be required.

A second new SPS would be required under this Option at the south end of the proposed Walton Development (WN). Future Development Area No. 2 (F2) would drain to WN under this option, with the downstream effluent of both areas being pumped to the north via a forcemain to VZ. This SPS would require a pump capable of delivering 37.1 L/s peak flow conveyance, with an inlet pipe invert depth of 238.00.

Although the bulk of CM collects gravity flows under this option from upstream areas, a third SPS will be required at the north east corner of CM in to convey the upstream flows to EG. This SPS would require a pump capable of delivering 29.3 L/s peak flow conveyance, with an inlet pipe invert depth of 235.00.

Infrastructure Summary

Infrastructure requirements for this Option are summarized in **Table 3.2**, with infrastructure requirements within the proposed R&M Homes Subdivision shown separately.

Table 3.2 – Option WWC-A Infrastructure Requirements			
Existing and Future Development Areas		R&M Homes Development	
200mm Pipe	4359.00	200mm Pipe	3327.10
250mm Pipe	4173.00	250mm Pipe	301.33
300mm Pipe	3654.00	300mm Pipe	488.81
375mm Pipe	660.00	375mm Pipe	399.87
450mm Pipe	325.00	450mm Pipe	284.48
525mm Pipe	0.00	525mm Pipe	127.50
Forcemain	945.00	Forcemain	607.00
New SPS's	2.00	New SPS's	1.00

In addition, the average, minimum, and maximum depths of all required sanitary infrastructure for this option were calculated in order to ensure that the minimum depth requirement for servicing of residential lots could be met at all locations, and to provide a comparison of the relative "constructive" effort for the option at the preferred option assessment stage (i.e. options with greater average depth of sewers will be more difficult and costly to construct and maintain). These results are summarized in **Table 3.3**.

Table 3.3 – Option WWC-A Sanitary Depth Summary	
Max Depth	7.00
Min Depth	3.06
Avg. Depth	4.68

3.4.2 Option WWC-B – Gravity Flow to R&M Homes Pumping Station

This sewage conveyance option, depicted in **Figure A-4 (Appendix SS-A)** follows the same general collection strategy (i.e. direction of flow between catchments) as **Option WWC-A**, however this option increases the depth of the R&M Homes SPS by 1.0 m to 232.20, to eliminate the need for additional pumping stations in upstream areas. This elevation was determined to be the maximum elevation which would allow for all downstream areas to drain by gravity, including WN, CM, and the other development parcels which under **Option WWC-A** would drain to these locations and then be pumped to a downstream gravity sewer. Infrastructure requirements and sanitary sewer depths for **Option WWC-B** are summarized in **Tables 3.4 and 3.5** respectively. It should be noted that for all options, the peak flow at the overall system outlet (R&M SPS) was 173.75 L/s (14.86 ML/d).

Table 3.4 – Option WWC-B Infrastructure Requirements

Existing and Future Development Areas		R&M Homes Development	
200mm Pipe	4784.00	200mm Pipe	3327.10
250mm Pipe	2608.00	250mm Pipe	301.33
300mm Pipe	5624.00	300mm Pipe	488.81
375mm Pipe	660.00	375mm Pipe	399.87
450mm Pipe	325.00	450mm Pipe	284.48
525mm Pipe	0.00	525mm Pipe	127.50
Forcemain	350.00	Forcemain	607.00
New SPS's	0.00	New SPS's	1.00

Table 3.5 – Option WWC-B Sanitary Depth Summary

Max Depth	8.00
Min Depth	3.06
Avg. Depth	5.37

As presented in the comparison of the above tables to those presented in **Option WWC-A**, this option requires an additional 0.69 m average depth of sewers in order to eliminate two (2) pumping stations and 595 m of forcemain. Numerous runs of pipe which were determined to be 250mm in diameter under the previous option needed to be upsized to 300mm diameter pipe under **Option WWC-B** due to a reduction in pipe slope to achieve the required upstream inverts while maintaining a minimum servicing depth of 3.06 to pipe obvert from road centerline.

3.4.3 Option WWC-C – Gravity Flow to R&M Homes via County Road 13

This sewage conveyance option, depicted in **Figure A-5 (Appendix SS-A)** addresses the Social Environment disadvantages of the previous options, namely that both **Options A & B** require significant “up-front” infrastructure implementation in existing residential areas. This option was developed with the goal of creating an option which would allow for new development to proceed in the Secondary Plan Area, with a minimum initial impact to existing residential properties and natural environment areas by shifting the Trunk Sewer (TS-1 & 2) location to County Road 13.

Under this option, the areas east of County Road 13 drain in much the same fashion as under Option WWC-B, albeit with reduced flows and some decreased pipe size requirements. Depths were generally the same at stream crossings within CS and gravity connections between CS & EG still needed to be maintained.

The main difference with this option is that the sewer along Wales Ave. (WA-S & WA-N) is no longer the Trunk Sewer. The new trunk sewer alignment (TS1 & TS2) begins at the intersection of Main Street (MS) and County Road 13 (formerly CR13-N & CR13-S). The main line drains by gravity to the north and eventually intersects with the F1 sewer and RM MH1072. The trunk line then continues to the east through the R&M Homes development to its final discharge location at the R&M Homes pumping station. Under this option, the R&M SPS also needed to be lowered to a depth of 232.20. Area's F1, F2, F3, WN, NH & VZ drain as they did under previous options, with the exception of the trunk sewer following a different alignment. Area's F4, CR5-E & MS now drain to the new TS-1 & TS-2 alignment under **Option WWC-C**. Infrastructure requirements and sanitary sewer depths for **Option WWC-C** are summarized in **Tables 3.6 and 3.7** respectively.

Table 3.6 – Option WWC-C Infrastructure Requirements			
Existing and Future Development Areas		R&M Homes Development	
200mm Pipe	4305.00	200mm Pipe	3327.10
250mm Pipe	2997.00	250mm Pipe	301.33
300mm Pipe	4847.00	300mm Pipe	92.58
375mm Pipe	0.00	375mm Pipe	0.00
450mm Pipe	2011.00	450mm Pipe	888.68
525mm Pipe	0.00	525mm Pipe	319.40
Forcemain	350.00	Forcemain	607.00
New SPS's	0.00	New SPS's	1.00

Table 3.7 – Option WWC-C Sanitary Depth Summary	
Max Depth	10.07
Min Depth	3.01
Avg. Depth	5.72

As shown from a comparison of the above tables to those presented in previous options, this option requires another 0.35 m of additional average depth of sewers from Option WWC-B, with the deepest sewer in the system being 10.07 m deep. Drop structures ranging in depth from 2.5m to 4.5m have been included at F3, VZ, BL & CR5-W to minimize some of the upstream depths without impacting the required trunk elevation, and to improve the average depth.

From the technical analysis of this option, servicing areas CR5-E and F4 is the limiting technical criteria of this option which resulted in the noticeably increased sewer depth. Also, in order to minimize the downstream depths to slightly more manageable levels, and maintain minimum depths upstream, many increases to pipe size were required over the previous options (to maintain required minimum scour velocities).

Although this option has arguable social advantages in the short term, it will require significant oversizing of infrastructure which would need to be constructed eventually in residential areas in order to bring these residents online. Maintenance of a system with such deep pipes will be more difficult, and the structures in the system will be costly to construct due to the need for safety platforms in manholes and larger structures to support the additional depths. In addition, although interruption to residents might be minimized, construction of deep sewers along County Road 13 could have significant traffic impacts and disruption of business activity in Everett.

4.0 SELECTION OF RECOMMENDED SOLUTION (FINAL EVALUATION OF ALTERNATIVES)

4.1 EVALUATION CRITERIA FOR RECOMMENDED SOLUTION

As part of the final solution selection process, the four (4) wastewater treatment and disposal “short listed” alternative solutions and the three (3) conveyance alternative solutions were assessed in terms of the evaluation criteria presented in **Section 3.2.**

Criteria highlighted in “green” represent the most preferred alternative, while “yellow” criteria represent less preferred alternatives and criteria in “red” represent the least preferred alternative.

For review purposes and for the convenience of the reader, the evaluation criteria used to select the recommended solution are as follows:

- Natural Environment Impacts:
  - Impacts of the option to vegetation, wildlife & the Natural Environment; and
  - Surface/groundwater quality and quantity implications;
- Social/Cultural Environment Impacts:
  - Land Use & Archaeological Considerations (Including First Nations);
  - Traffic impacts & interruption to residents; and
  - Visual landscape/Aesthetic impacts;
- Technical/Operational Considerations
  - Difficulty to construct or implement the Option relative to other alternatives; and
  - Operation & Maintenance Efficiency;
- Economic Impacts
  - Capital/construction costs;
  - Long term/operation & maintenance cost burden; and
  - Payment structure, cost recovery options for Municipality, Phasing Flexibility.

4.2 EVALUATION OF TREATMENT ALTERNATIVES

The assessment of "short listed" Wastewater Treatment & Disposal Options Is presented in **Table 4.1** below.

Table 4.1- Wastewater Treatment and Disposal Options Assessment

Evaluation Criteria	Option WWT-7 Expand R&M – Surface Water Discharge(SWD)	Option WWT-8 New WWTP – Surface Discharge	Option WWT-9 R&M Subsurface with Phasing to Surface Discharge	Option WWT-10 R&M Subsurface Discharge with Phasing to New WWTP
Natural Environment Impacts				
Impacts of the option to vegetation, wildlife & the Natural Environment	Potential for impacts to wetland vegetation/wildlife habitat and groundwater regime from construction of force main along County Road (CR) 13, however mitigation measures could be investigated as part of the SWD/WWTP Class EA.	As the Proposed WWTP and discharge pipe located in previously disturbed area (former sand and gravel pit) Opportunities for restoration/enhancement of larger NHS.	Potential for impacts to wetland vegetation/wildlife habitat and groundwater regime from construction of force main along CR13, however mitigation measures could be investigated as part of the SWD/WWTP Class EA.	Same impacts & opportunities as Options 7 & 8, but with the increased environmental footprint associated with building two facilities - this Option would require the most clearing of vegetation of all options.
Surface/groundwater quality implications	The Pine River Assimilative Capacity Study (ACS) shows capacity in the Pine River for discharge of treated effluent. Advantage of this option is no discharge to groundwater at any time.	This Option has similar advantages to Option 7	This option includes discharge to both groundwater and surface water sources under different phases.	This option includes discharge to both groundwater and surface water sources under different phases.
Natural Environment Overall Rating				
Social / Cultural Environment Impacts				
Land Use & Archaeological Considerations (Including First Nations)	As per Archaeological Report (see **Appendix SS-F**) No significant impacts or Archaeological impacts	As per Archaeological Report (see **Appendix SS-F**) No significant impacts or Archaeological impacts	No significant impacts or Archaeological impacts.	Given this option would include Construction of two facilities, it would consequently use the most land of the four options.

Table 4.1- Wastewater Treatment and Disposal Options Assessment				
Evaluation Criteria	**Option WWT-7** Expand R&M – Surface Water Discharge(SWD)	**Option WWT-8** New WWTP – Surface Discharge	**Option WWT-9** R&M Subsurface with Phasing to Surface Discharge	**Option WWT-10** R&M Subsurface Discharge with Phasing to New WWTP
Traffic impacts & interruption to residents	Minimal impact due to location of proposed facility	Slightly more impact than Option 7 due to facility being located on County Road.	Minimal impact due to location of proposed facility, some interruptions to service possible due to phasing.	Similar impacts to Options 8 and 9
Visual landscape/Aesthetic impacts	Minimal impact as proposed facility is located away from existing residential areas.	Proposed facility would be visible from CR13 but is located outside of existing residential areas.	Minimal impact as proposed facility is located away from existing residential areas.	Future Phase facility would be visible from CR13. Both facilities would be located outside of existing residential areas, however with two (2) facilities in total, this Option has the greatest visual impact.
Social / Cultural Environment Overall Rating				
Technical/Operational Considerations				
Difficulty to construct or implement the Option relative to other alternatives	Proposed facility will need to be redesigned and constructed to accomodate treatment for all future development.	New facility will need to be designed and constructed to accomodate treatment for all future development. Facility will also be located in a different location than proposed.	Currently designed facility can move forward (pending required approvals) with slight modifications to account for phasing of future development and treatment requirements.	Current facility may proceed similar to Option 9, however an additional new facility would need to be designed and constructed to handle future treatment requirements.
Operation & Maintenance Efficiency	Use of a single modern treatment facility will minimize maintenance burdens.	Use of a single modern treatment facility will minimize maintenance burdens.	Use of a single modern treatment facility will minimize maintenance burdens. Changeover from subsurface to surface discharge will present more operational challenges than Option's 7 & 8	Switching from one facility to a second facility will present more siginificat operational challenges than Option 9.
Technical/Operational Considerations Rating				

Table 4.1- Wastewater Treatment and Disposal Options Assessment

Evaluation Criteria	**Option WWT-7** Expand R&M – Surface Water Discharge(SWD)	**Option WWT-8** New WWTP – Surface Discharge	**Option WWT-9** R&M Subsurface with Phasing to Surface Discharge	**Option WWT-10** R&M Subsurface Discharge with Phasing to New WWTP
Economic Impacts				
Capital/construction costs	Similar costs to Option WWT-9, but with additional costs to modify the existing design. All costs front-loaded under this option. Capital Costs are estimated to be approximately $15.1 Million.	Similar costs to Option WWT-7, with additional expense for completion of a new WWTP design. Capital Costs are estimated to be approximately $15.4 Million.	Least expensive option as single facility will need to be built and expanded upon in future. Initial facility is already designed. Capital Costs are not front loaded. Capital Costs are estimated to be approximately $14.6 Million.	Most expensive option as two facilities will need to be designed and built during separate phases of development. Capital Costs are estimated to be approximately $21.1 Million.
Long term/operation & maintenance cost burden	Use of a single modern treatment facility will allow for predictable maintenance costs.	Use of a single modern treatment facility will allow for predictable maintenance costs.	Single, modern facility will have predictable maintenance costs. Some changeover costs between phases to be expected.	Switching from one facility to a second facility will require more significant changeover costs than Option 9, with similar long term costs.
Payment structure, cost recovery options for Municipality, Phasing Flexibility	Limited phasing and cost recovery options - all future flows to be accounted for in the initial design and facility construction.	Limited phasing and cost recovery options - all future flows to be accounted for in the initial design and facility construction.	Allows maximum flexibility to the municipality long term, both for recovery of costs and through staging of development.	Flexible from a phasing perspective but cost recovery will be less efficient due to larger relative capital costs for each phase.
Economic Ranking				
Overall Ranking:				

4.3 EVALUATION OF CONVEYANCE ALTERNATIVES

The assessment of "short listed" Wastewater Conveyance Options Is presented in **Table 4.2** below.

Table 4.2 - Wastewater Conveyance Options Assessment

Evaluation Criteria	**Option WWC-A** Mixed Gravity and Forcemain to R&M Homes Pumping Station via Wales Ave.	**Option WWC-B** Gravity Flow to R&M Homes Pumping Station via Wales Ave	**Option WWC-C** Gravity Flow to R&M Homes via County Road 13
Natural Environment Impacts			
Impacts of the option to vegetation, wildlife & the Natural Environment	Discharge pipe would need to be constructed in existing Environmental Setback, however mitigation measures could be investigated in facility Class EA.	New WWTP location (and discharge piping) would be close to the Pine River and on the edge of existing Environmental Setbacks. Same discharge pipe impacts as Option 7.	Same discharge pipe impacts as Option 7.
Surface/groundwater quality implications	Less dewatering due to minimized depth of excavations. Approx. 6 Watercourse Crossings.	Potential for more dewatering than Option WWC-A due to sewer depth. Approx. 6 Watercourse Crossings.	Potential for more dewatering than Option WWC-B. Approx. 7 Watercourse Crossings.
Natural Environment Overall Rating			
Social / Cultural Environment Impacts			
Land Use & Archaeological Considerations (Including First Nations)	Higher land area required for three (3) SPS's. No known Archaeological issues with proposed trunk alignment.	No known Archaeological issues with proposed trunk alignment. Land required for 1 SPS.	No known Archaeological issues with proposed trunk alignment. Land required for 1 SPS.
Traffic impacts & interruption to residents	Shallower sewers will result in shorter construction phase for Trunk installation - trunk alignment minimizes disruption at major intersections.	Deeper sewers and installation along CR-13 (south of Main Street) will create more construction phase traffic impacts than Option WWC-A.	Deepest sewers of all options and trunk alignment along CR-13 will have the most traffic impact of all Options.

Table 4.2 - Wastewater Conveyance Options Assessment			
Evaluation Criteria	**Option WWC-A** Mixed Gravity and Forcemain to R&M Homes Pumping Station via Wales Ave.	**Option WWC-B** Gravity Flow to R&M Homes Pumping Station via Wales Ave	**Option WWC-C** Gravity Flow to R&M Homes via County Road 13
Visual landscape/Aesthetic impacts	Slightly higher visibility than other Options due to additional structures in residential areas to house proposed SPS's.	Minimal visual impact.	Minimal visual impact.
Social / Cultural Environment Overall Rating			
Technical/Operational Considerations			
Difficulty to construct or implement the Option relative to other alternatives	Shallowest Sewers of all options, however the installation of three (3) SPS's increases the relative degree of construction difficulty.	Sewer depth moderate, single SPS.	Deepest sewers of all options, single SPS. Increased restoration difficulty due to County Road alignment.
Operation & Maintenance Efficiency	Operation and regular maintenance of three (3) SPS's will be less efficient than a gravity based system with a single SPS.	Single SPS will require regular maintenance.	Single SPS will require regular maintenance - deeper sewers will be slightly more difficult to maintain than shallower sewers.
Technical/Operational Considerations Rating			
Economic Impacts			
Capital/construction costs	Capital Costs of Trunk Infrastructure (Including SPS's and Forcemain) is estimated to be $7.2 Million.	Capital Costs of Trunk Infrastructure (Including SPS's and Forcemain) is estimated to be $7.0 Million.	Capital Costs of Trunk Infrastructure (Including SPS's and Forcemain) is estimated to be $7.5 Million.
Long term/operation & maintenance cost burden	Highest maintenance cost due to three (3) SPS.	Lowest maintenance cost due to single SPS and shallower sewers than Option WWC-C.	Moderate maintenance cost due to single SPS and deepest sewers.

Table 4.2 - Wastewater Conveyance Options Assessment			
Evaluation Criteria	**Option WWC-A** Mixed Gravity and Forcemain to R&M Homes Pumping Station via Wales Ave.	**Option WWC-B** Gravity Flow to R&M Homes Pumping Station via Wales Ave	**Option WWC-C** Gravity Flow to R&M Homes via County Road 13
Payment structure, cost recovery options for Municipality, Phasing Flexibility	Wales Ave. alignment will provide trunk service to the greatest number of existing residents, however phasing & cost sharing could be complicated by pumping requirements in certain areas.	Wales Ave. alignment will provide trunk service to the greatest number of existing residents, phasing and cost sharing will be predominantly based on trunk sewer installations.	County Road 13 Alignment will provide service to the least number of existing residents - Cost sharing options will be very limited.
Economic Ranking			
Overall Ranking:			

5.0 CONCLUSIONS

5.1 SELECTION OF RECOMMENDED SOLUTION

Based on the evaluation of Sanitary Servicing Options presented in **Chapter 4**, the preferred alternative was determined to be **Option WWT-9-WWC-B**, which is a combination of treatment Option WWT-9, and Conveyance Option WWC-B. This combined Option provides the most cost effective long term servicing solution, while also offering phasing options for development within the Secondary Plan Area.

The recommended preferred Sanitary Servicing Master Plan for the Everett South Secondary Plan Area includes the following general characteristics:

- Approximately 1,400m of gravity trunk sewer as shown in **Figure A-4**, ranging in diameter from 375mm to 525mm, located along Wales Ave. and discharging at a new SPS in the R&M Homes Subdivision. Under ultimate buildout conditions, this pump should be capable of delivering a peak flow conveyance capacity of 14.86 ML/d with a depth of 5.5 m (232.2 m).

- A gravity based sanitary sewer collection network upstream of the trunk sewer which includes approximately 17,500 m of pipe, ranging in diameter from 200mm – 375mm.

- One (1) subsurface discharge WWTP, with room for future expansion to a surface water discharge facility. Conversion to surface water discharge should occur prior to the serviced equivalent residential population reaching 2,200 persons, and the ultimate design should include treatment capacity for an ADDF of 3.63 ML/d.

- Future expansion of the treatment facility should also include an effluent pump and forcemain which discharges treated effluent to the Pine River, as shown **in Figure A-2, Option WWT-9**.

- This option will allow currently approved developments to proceed with the least financial impacts to future developments or existing residents who wish to connect of all options evaluated. The Township can plan for the expansion of the subsurface facility in conjunction with developers to optimize growth while ensuring effective recovery of capital costs.

- This option will allow for the New Horizon's WWTP to be decommissioned after the new WWTP and trunk sewer are constructed, without needing to wait for other developments to proceed first. By converting the current SPS at the WWTP to pump flows to an extension of the new trunk sewer on Wales Ave. South, the Township can maximize their existing infrastructure to meet future servicing goals.

5.2 MITIGATION AND MONITORING MEASURES

The impacts of the Recommended Preferred Solution can be minimized through implementation of a mitigation and monitoring strategy. **Option WWT-9-WWC-B** is the recommended preferred solution from an Economic, Technical, and Social and Natural Environment perspective as discussed in **Chapter 4.0**, as the WWTP will be constructed in an area which is currently undeveloped, and expanded as required to service future developments. Routine inspections during Construction phases of all projects associated with the preferred option will need to be carried out to ensure adherence to design specifications. **Table 5.1** summarizes the potential impacts and methods of mitigation.

Table 5.1 – Recommended Solution Implementation Impacts and Mitigation

Potential Impact	Mitigation Strategy
Water Quality & Monitoring of Effluent From WWTP	• Prior to Construction of the Recommended Solution components, detailed design and project specific Class EA's will be completed – as part of this process effluent "polishing" measures will be investigated, i.e. discharge to constructed wetlands, and downstream monitoring of nutrient loading. • The Certificate of Approval for the WWTP will require, by law, that effluent quality is monitored and effluent limits and objectives are achieved.
Sediment & Erosion Control	• Sedimentation and erosion control strategies will be developed for each individual site prior to construction.
Traffic	• Affected Property Owners will be notified in advance of construction schedule and duration. • Consultation with Ministry of Transportation, County of Simcoe, local utilities and school boards may be required prior to or during construction
Removal of Vegetation and Temporary Impacts (e.g. noise & vibration)	• Recommended Solution minimizes impacts to existing vegetation • Construction activities will be limited to day-light hours to minimize impacts to residents • Dust and storm water controls to be implemented during construction

5.3 CLOSING REMARKS

We trust that the foregoing Sanitary Servicing Master Plan Study report meets with the requirements and the goals for the Township's Everett Secondary Plan Area.

We look forward to working with the Township to implement the strategies outlined herein.

Sincerely,

GREENLAND INTERNATIONAL CONSULTING LTD.

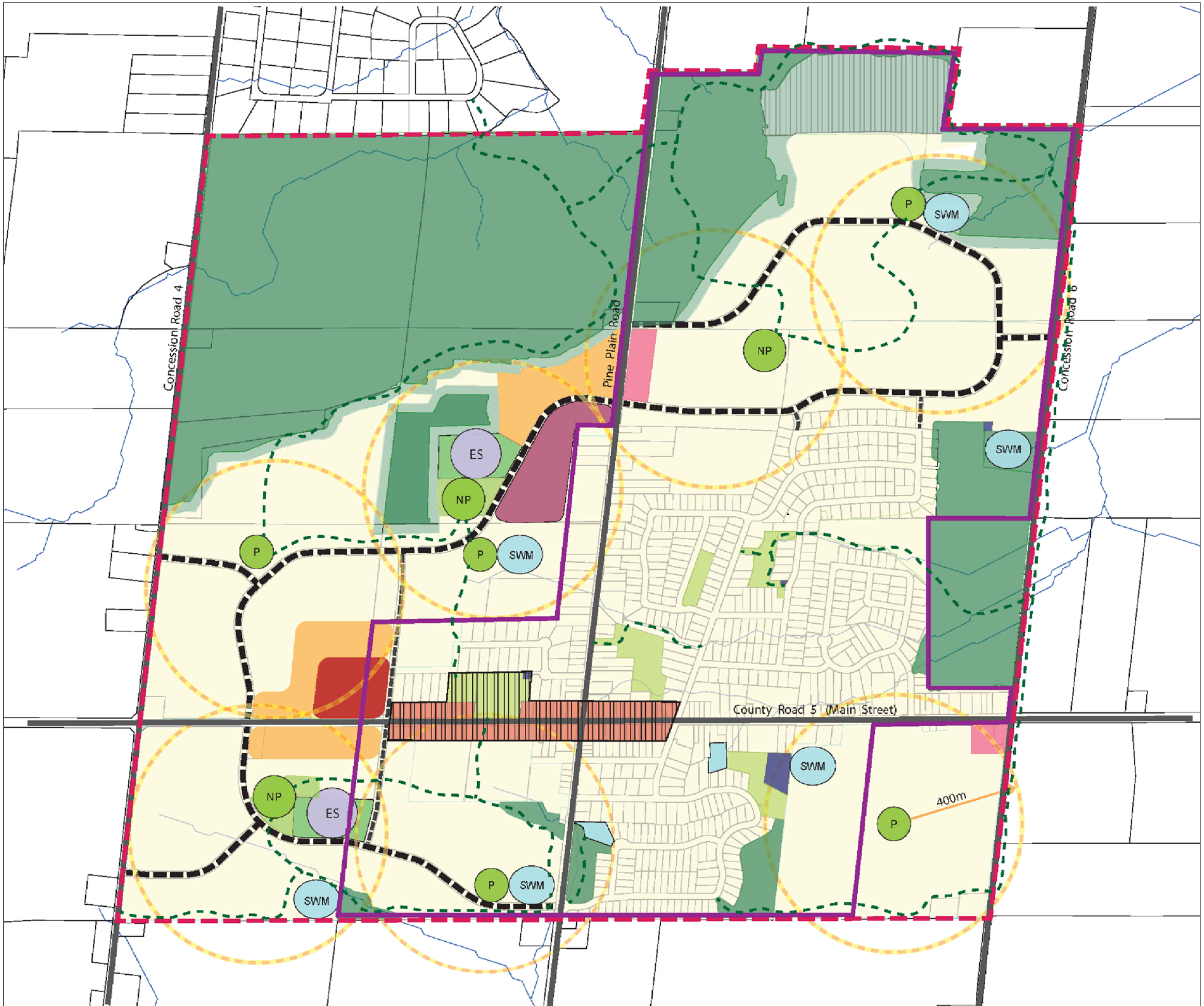
Jim Hartman, P.Eng.
Senior Associate

Josh Maitland
Project Coordinator

APPENDIX SS-A

Figures

FIGURE A-1
Everett Secondary Plan
Township of Adjala-Tosrontio



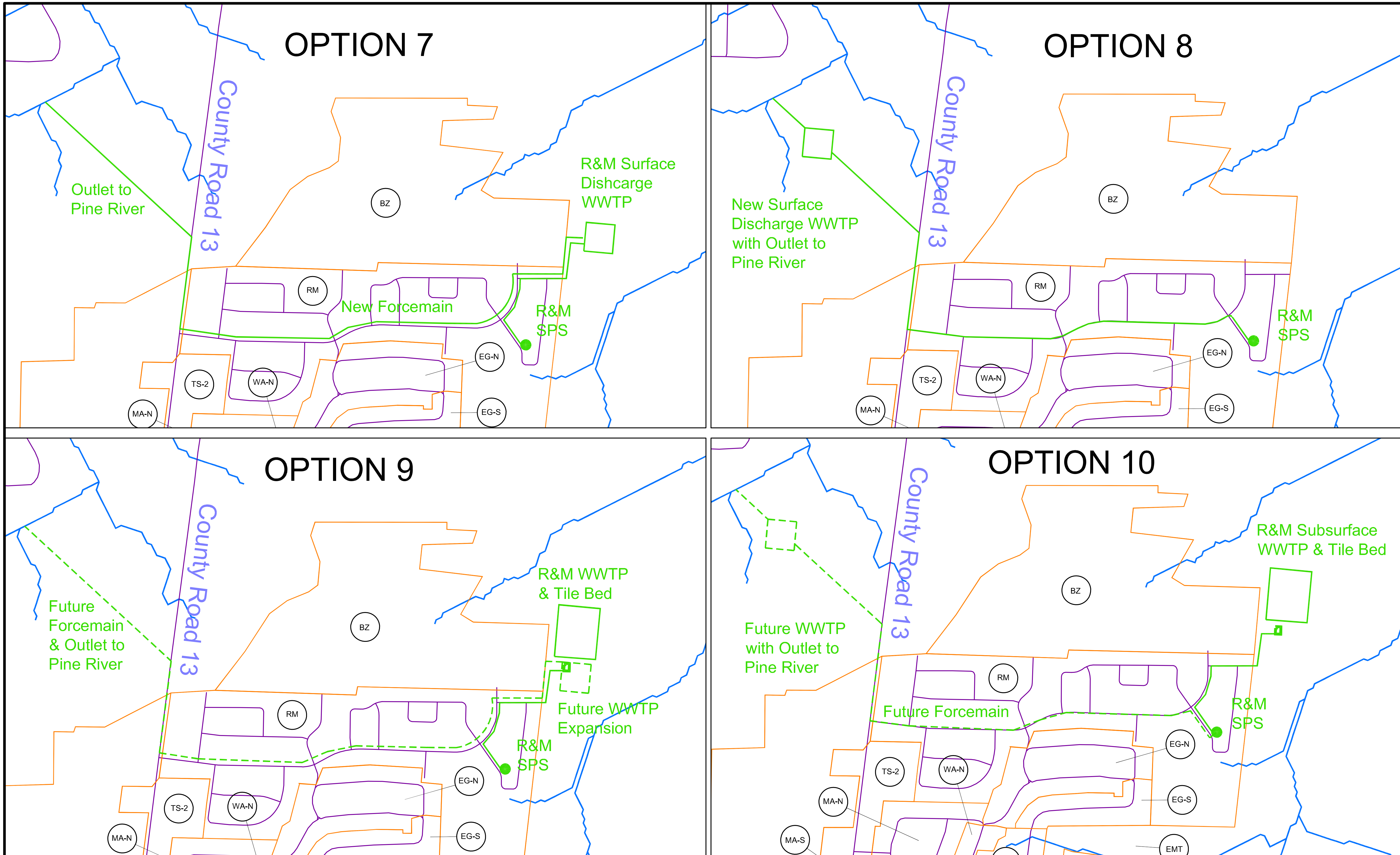
Conceptual Land Use Legend

- Proposed Secondary Plan Boundary
- Low Density Residential
- Medium Density Residential
- Convenience Commercial
- Main Street
- Neighbourhood Commercial
- Community Centre
- Existing Parks / Open Space
- Proposed Neighbourhood Park
- Proposed Parkette
- Proposed Elementary School
- Existing SWM
- Proposed SWM
- Natural Heritage System
- 30.0m buffer
- Lands for further Study
- Proposed Local Road (20.0m)
- Proposed Collector Road (23.0m)
- Utilities
- Community Improvement Areas
- 400m Radius (5 minute walking distance)
- Proposed Trail Network

GREENLAND® consulting engineers

SCALE 1:5000

N



LEGEND

Development Parcel	Proposed Treatment Infrastructure
Stream	Direction of Flow
Development Parcel Label	Existing Infrastructure

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

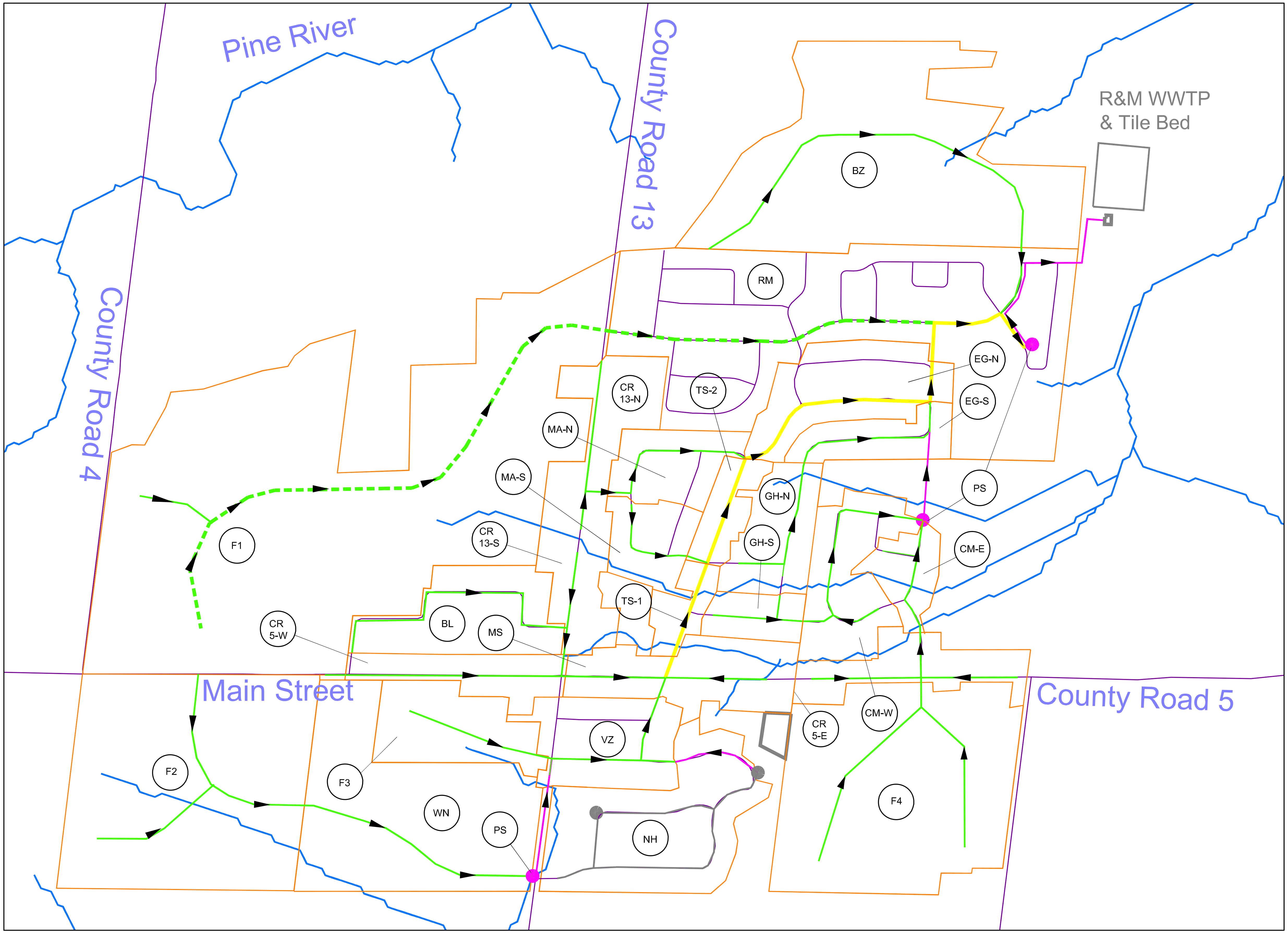
PROJECT TITLE
EVERETT SECONDARY PLAN

DRAWING TITLE
WASTEWATER
TREATMENT OPTIONS

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@grnland.com
Website: www.grnland.com

SCALE: NTS
DESIGN: J.M.
DRAWN: J.M.
CHECKED: J. HARTMAN
DATE: OCT. 2012
PROJECT No.: 12-G-2804
DWG No. FIGURE A-2

T:\2804_Everett MSP\MSP in Progress\CAD Files\Everett MSP_2012-10-24-SANITARY FIGURES.dwg
Date Plotted: Oct 24, 2012 – 2:08pm



LEGEND

Development Parcel	
Stream	
Gravity Sewer	
Main Trunk Sewer (Wales Ave.)	
Western Trunk Sewer	
Forcemain	
Direction of Flow	
Existing Infrastructure	
Development Parcel Label	

NOTES:

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN

DRAWING TITLE

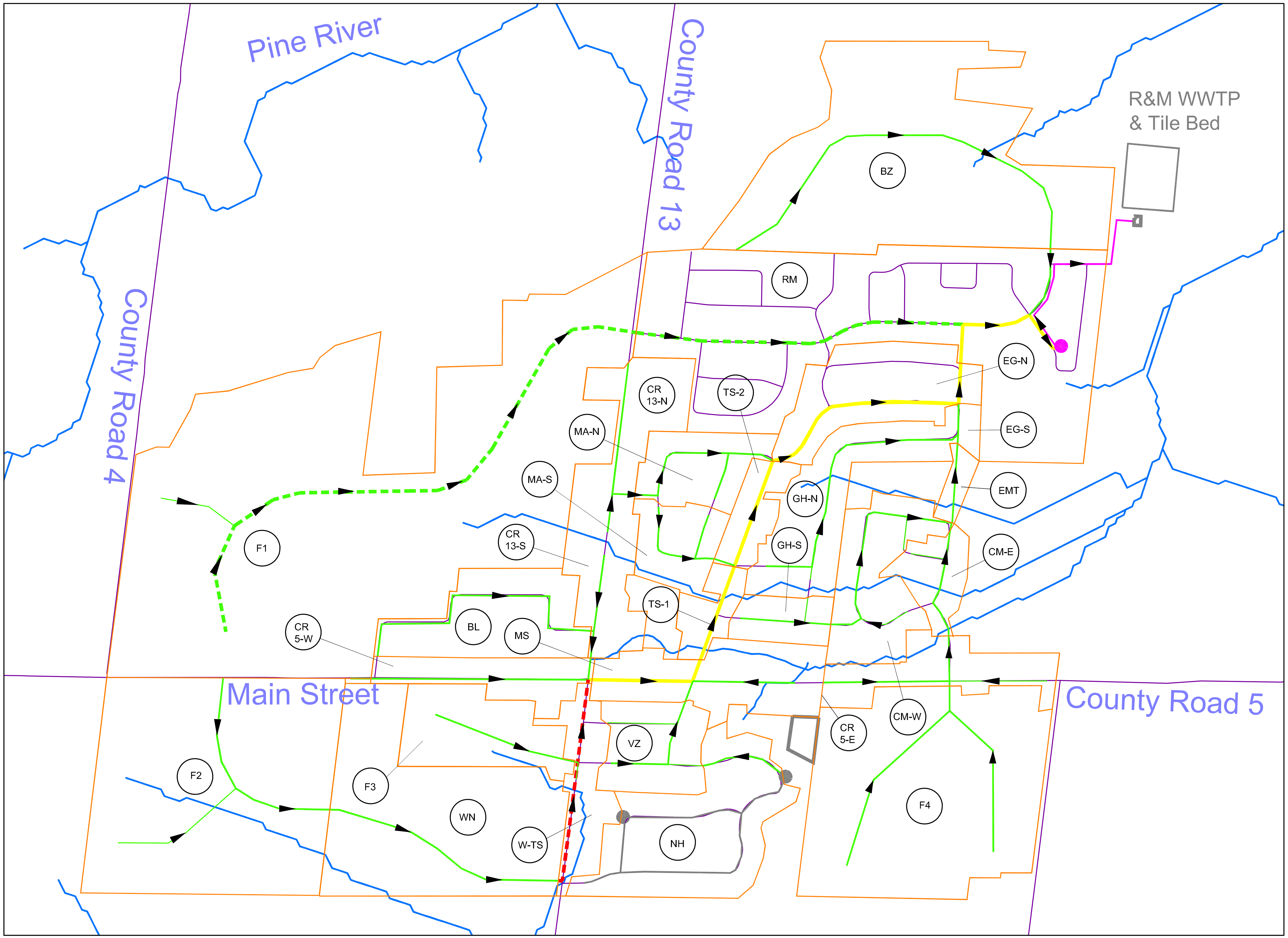
Sewage Collection Option A

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@gmland.com
Website: www.gmland.com

SCALE: NTS | PROJECT No.: 12-G-2804
DESIGN: J.M. | CHECKED: J. HARTMAN
DRAWN: J.M. | DATE: OCT. 2012
DWG No. FIGURE A-3

T:\2804_Everett MSP\MSP in Progress\CAD Files\Everett MSP_2012-10-24-SANITARY FIGURES.dwg

Date Plotted: Oct 24, 2012 – 2:21pm



LEGEND

- Development Parcel
- Stream
- Gravity Sewer
- Main Trunk Sewer (Wales Ave.)
- Western Trunk Sewer
- Southern Trunk Sewer
- Forcemain
- Direction of Flow
- Existing Infrastructure
- Development Parcel Label

NOTES:

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE
EVERETT SECONDARY PLAN

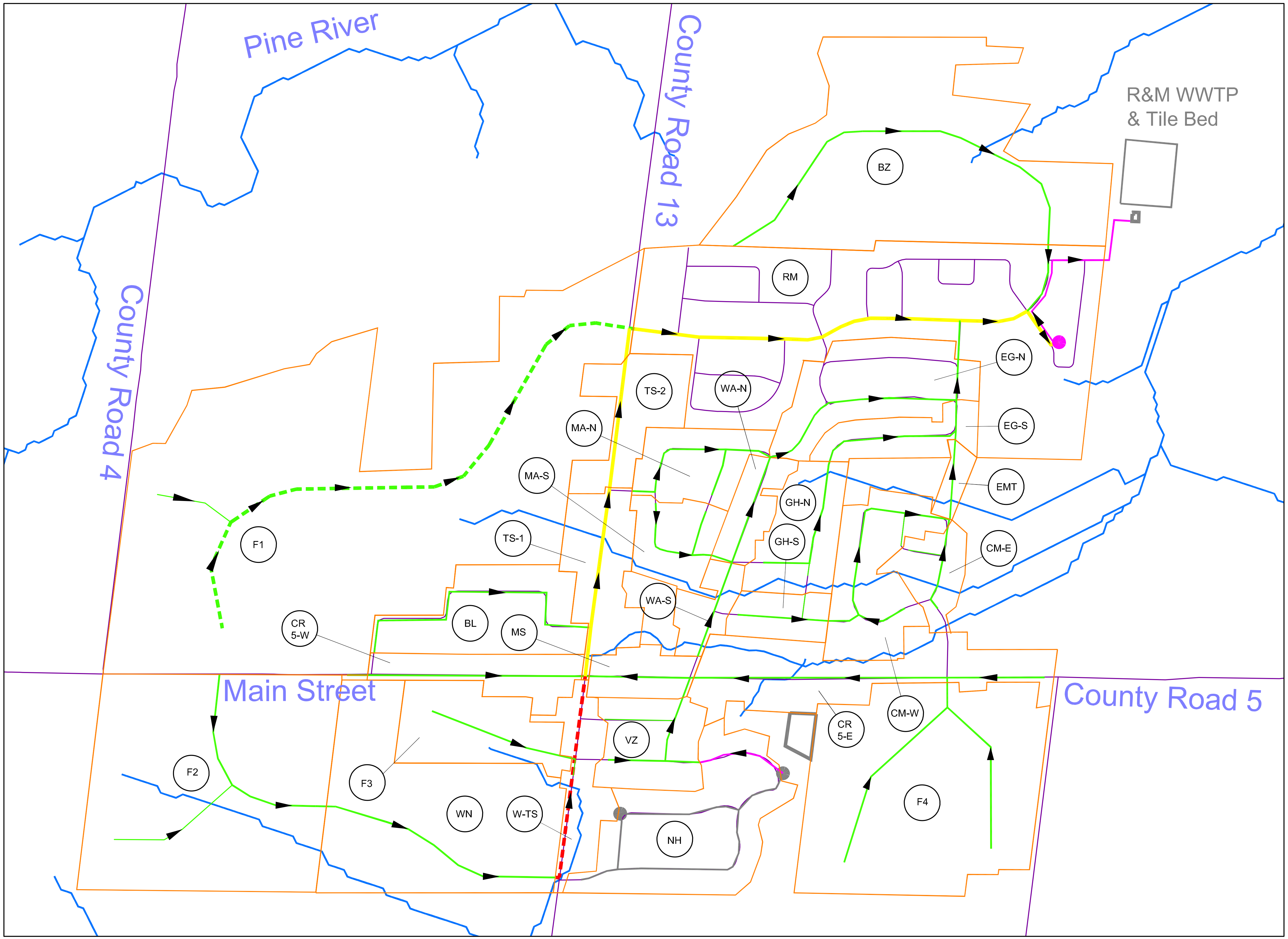
DRAWING TITLE
Sewage Collection Option B

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@grnland.com
Website: www.grnland.com

SCALE: NTS
PROJECT No.: 12-G-2804
DESIGN: J.M.
CHECKED: J. HARTMAN
DRAWN: J.M.
DATE: OCT. 2012
DWG No. FIGURE A-4

T:\2804_Everett MSP\MSP in Progress\CAD Files\Everett MSP_2012-10-24-SANITARY FIGURES.dwg

Date Plotted: Nov 29, 2012 – 1:27pm



LEGEND

- Development Parcel
- Stream
- Gravity Sewer
- Main Trunk Sewer (CR-13)
- Western Trunk Sewer
- Southern Trunk Sewer
- Forcemain
- Direction of Flow
- Existing Infrastructure
- Development Parcel Label

NOTES:

N

No.	REVISION	DATE	INIT.
3.			
2.			
1.			

APPROVED

PROJECT TITLE

EVERETT SECONDARY PLAN

DRAWING TITLE

Sewage Collection Option C

GREENLAND® Consulting Engineers
120 Hume Street
Collingwood, Ontario, L9Y 1V5
Tel: (705) 444-8805
Fax: (705) 444-5482
E-mail: greenland@gmland.com
Website: www.gmland.com

SCALE: NTS

PROJECT No.: 12-G-2804

DESIGN: J.M.

CHECKED: J. HARTMAN

DRAWN: J.M.

DATE: OCT. 2012

DWG No. FIGURE A-5

T:\2804_Everett MSP\MSP in Progress\CAD Files\Everett MSP_2012-10-24-SANITARY FIGURES.dwg

Date Plotted: Nov 29, 2012 - 1:26pm

APPENDIX SS-B

Detailed Population and Flow Calculations

Land Use + Population Projections		Centralized Services and Public Amenities			2.67	Equivalent Pop.	250	Lpcd		
		Option1 (Option 3 in PP original spreadsheet)								
Parcel 1		**Area** (in hectares)	**Units**	**Population** (2.67 ppl/unit)	**Sewage Flow Factor**	**Units**	**Source**	**Avg. Sewage Flow (L) per day**	**Equivalent Population**	**Total E. Pop.**
Parcel Area		88.92								
Retail										
Convenience Commercial		4.40			2225	L per 1000	sq .m - MOE Guidelines	97900	392	
Main Street		——								
Neighbourhood Commercial		——								
School + Services										
Community Centres		8.00			18000	L per d	cum/yr for 8 mths per 2 ice pad - IIHF	18000	72	
Elementary Schools		2.80		500	70	L/std/d	std per school - MOE Guidelines	35000	140	
Environmental										
Parkland (5%)		4.45								
SWM (5%)		4.45								
Net Residential		64.83								
Future Units			778							
Future Population				**2,077**				**519315**	**2077**	**2681**
Parcel 2										
Parcel Area		39.75								
Retail										
Convenience Commercial		——								
Main Street		——								
Neighbourhood Commercial		——								
School + Services										
Community Centres		——								
Elementary Schools (Optional)		2.80		250	70	L/std/d	std per school - MOE Guidelines	17500	70	
Environmental										
Parkland (5%)		1.99								
SWM (5%)		1.99								
Net Residential		32.98								
Future Units			396							
Future Population				**1,057**				**264330**	**1057**	**1127**
Parcel 3										
Parcel Area		9.31								
Retail										
Main Street		1.09			25	cum /ha	MOE Guidelines (commercial)	27250	109	
School + Services										
Community Centres		——								
Elementary Schools		——								
Environmental										
Parkland (5%)		0.47								
SWM (5%)		0.47								
Net Residential		7.29								
Future Units			87							
Future Population				**232**				**58073**	**232**	**341**
Parcel 4										
Parcel Area		36.39								
Retail										
Convenience Commercial		0.60			2225	L per 1000	sq .m - MOE Guidelines (shop centre)	13350	53	
School + Services										
Community Centres		——								
Elementary Schools		——								
Environmental										
Parkland (5%)		1.82								
SWM (5%)		1.82								
Net Residential		32.15								
Future Units			386							
Future Population				**1,031**				**257655**	**1031**	**1084**
In Process - R&M Homes										
Parcel Area		54.20	*Area/Unit Breakdown From Pearson McQuaig Report - R&M Homes Sanitary Servicing Report							
Retail										
All Commercial		1.52			25	cum /ha	MOE Guidelines (commercial)	38000	152	
School + Services										
Community Centres		——								
Elementary Schools		——								
Environmental (Estimated)										
Parkland (5%)		2.71								
SWM (5%)		2.71								
Net Residential		47.26	492.00	10.41049513						
Future Units			492							
Future Population				**1,314**				**328410**	**1314**	**1466**
In Process - Barzo Development										
Parcel Area		43.12	*Net Residential and Open Space Areas Measured from Most Recent Proposed Land Use Plan by the Planning Partnership							
Retail										
All Commercial		2.00			2225	L per 1000	sq .m - MOE Guidelines (shop centre)	44500	178	
School + Services										
Community Centres		——								
Elementary Schools		——								
Environmental										
Parkland/Open Space (5%)		2.16								
SWM (5%)		2.16								
Net Residential		36.81								
Future Units			442							
Future Population				**1,179**				**294832**	**1179**	**1357**

Parcel 1		Area (in hectares)	Units	Population (2.67 ppl/unit)	Sewage Flow Factor	Units	Source	Avg. Sewage Flow (L) per day	Equivalent Population	Total E. Pop.
In Process - Walton										
Parcel Area		27.34	*Area/Unit Breakdown From Stantec Report - Beausart Subdivision Functional Servicing Report							
Retail										
Convenience Commercial		0.66			2225	L per 1000	sq .m - MOE Guidelines (shop centre)	14685	59	
School + Services										
Community Centres		—								
Elementary Schools		—								
Environmental										
Parkland/Open Space		4.31								
SWM		1.78								
Net Residential		14.75	234.00	15.86440678						
Future Units			234							
Future Population				**625**				**156195**	**625**	**684**
Units & Populatsion (Excluding Commercial/Service Population Equivalents)							**Units & Population (Including Commercial/Service Population Equivalents)**			
Existing Units			722							
Existing Population				1,929			Existing Population			1,929
In Process Units			1,168							
In Process Population				3,118			In Process Eq Pop. (Incl. comm./services)			3,506
Future Units			1,647							
Future Population				4,397			Future Dev. Eq Pop. (Incl. comm./services)			5,233
Total			3,537	**9,444**			**Total Equivalent Population**			**10,669**

***Projected Residential Sewage Flows are based on 250 L/d/capita*

***2.67 people per unit has been applied to the average of 10 units/hectare and 15 units/hectare that includes single detached houses to townhouses. Please note that the person per unit calculation will vary per unit type. They will have to be adjusted to anticipate the range of units that are being suggested.*

***Net Residential calculations includes all residential land, local roads, and minor collector roads.*

APPENDIX SS-C

Everett Preliminary Hydrogeological Investigation
(DRAFT November 2012)

November 2012

COMMUNITY OF EVERETT CLASS EA: WATER SUPPLY

Preliminary Hydrogeological Investigation

Submitted to:
Township of Adjala - Tosorontio
C/O Greenland Consulting Engineers
120 Hume Street,
Collingwood, ON L9Y 1V5

REPORT

Report Number: 12-1170-0033

Distribution:

2 copies - Greenland Consulting Engineers

1 copy - Golder Associates Ltd.

Golder Associates

Table of Contents

1.0 INTRODUCTION

The purpose of this letter report is to provide a hydrogeological basis for the selection of the preferred alternative for an expansion of the existing groundwater supply in the Community of Everett (Everett). Everett currently obtains potable water supplies from two deep wells located within the Community boundaries. Wastewater servicing is currently via private on-site sewage waste disposal systems. Everett is located approximately four kilometers north west of the Community of Alliston and approximately 20 km south west of the City of Barrie.

Golder Associates Ltd (Golder) has been retained by Greenland Consulting Engineers (Greenland) to provide an assessment of the existing water supply, the potential for additional water supplies, the location of additional water supply wells, and to comment on the Source Water Protection issues.

1.1 Water Supply Requirements

Greenland has prepared an assessment of water supply demand for Everett (Attached in Appendix A). The population of Everett is currently 1,929. Their Maximum Day Demand (MDD) for the past three years was 939 m^3/day and the MDD peaking factor is 2.43 times the Average Day Demand (ADD).

The future water demand is divided into three phases with population thresholds of 3,500, 7,000 and 10,000 people. The future ADD and MDD are as follows:

Phase	Population	ADD (m^3/day)	MDD (m^3/day)
Phase 1	3,500	819	1,829
Phase 2	7,000	1,782	3,755
Phase 3	10,000	2,607	5,214

The MDD is typically required from the water supply source, while the Peak Hour Demand is provided from storage.

2.0 EXISTING WATER SUPPLIES

Everett is currently supplied by three wells constructed in a confined artesian aquifer and are located within the developed area of Everett (Figure 1). Two of the wells are located on Pine Park Blvd (Well 1 and Well 3) and one well is located on Main Street (Well 2). The well records are attached as Figures 2, 3 and 4. The former production wells (PWs 1-78 and 2-78) were constructed in the upper aquifer and have been abandoned due to elevated nitrate concentrations. The shallow aquifer is found in Everett at an elevation range of approximately 220 to 240 masl, which is at a maximum depth of approximately 20 metres below the ground surface.

Well 1 was constructed by Northern Well Drilling (License # 3903) in 1989. The well has a diameter of 254 mm and an overall depth of 62.2 m. The well is equipped with nominal 254 mm diameter telescoping well screen with 16 slot screen installed between 56 and 62.5 mbgl (metres below ground level). The 6.1 m long well screen has a theoretical transmitting capacity of approximately 25 L/sec. Well 1 was originally tested at a rate of 27.3 L/sec for a period of 24 hours, during which time water levels declined from 7.74 mbgl to 35.1 mbgl. A specific capacity of 1.0 L/sec per metre of drawdown is calculated from the original testing.

Testing done in 2011 by Stantec (2011) resulted in a specific capacity of 1.4 L/sec per metre of drawdown. The 2011 testing was done at a rate of 21.1 L/sec which accounts for the slightly higher specific capacity. The recent testing indicates that the performance of the well is similar to that noted during the original testing.

The primary limitations for higher well yields from all of the wells in Everett are the limited aquifer thickness and the relatively fine textured nature of the aquifer. The transmitting capacity of the well screen in Well 1 is relatively low at 25 L/sec. The transmitting capacity of a well screen is the pumping rate at which water passes through the well screen at a velocity of 3 cm/sec under ideal conditions. In naturally developed water wells a significant portion of the well screen is blocked by the aquifer materials; therefore the velocity of water across the well screen is greater than 3 cm/sec. For this reason, many well designers consider the safe yield for a well to be half of the theoretical transmitting capacity of the well screen.

Pumping wells at rates that result in water passing through the screen at velocities higher than 3 cm/sec can cause an increase in the rate of encrustation of the screen by carbonate minerals and an increased rate of corrosion of the well screen. Encrustation of the well screen will result in increased maintenance costs and corrosion of the well screen will reduce the well's useful life. Well 1 is currently operating at 21 L/sec and the well losses are similar to those recorded during the original construction of the well. The current yield of Well 1 is 84% of the maximum theoretical yield for the well screen. The well yield should not be increased over the permitted amount.

Well 2 was constructed by Lunny Well Drilling (License # 3406) in 1990. The well has a diameter of 254 mm and an overall depth of 61.0 m, including a 0.91 m sump at the base of the screen. The well is equipped with nominal 254 mm diameter telescoping well screen with 16, 30 and 50 slot well screen installed between 54.3 and 60.0 mbgl (Figure 3). The 5.5 m long screen has a theoretical transmitting capacity of approximately 30.5 L/sec. The well was originally tested at a rate of 22.7 L/sec for a period of 24 hours, during which time water levels declined from 12.94 m to 39.51 m. A specific capacity of 0.86 L/sec per metre of drawdown was calculated from the original test data.

Well 2 has similar limitations to Well 1, in that the limited aquifer thickness and fine texture of the aquifer limited results in small unit well yields. The transmitting capacity of the screen is approximately 30.5 L/sec and the current yield of Well 2 is 75% of the theoretical transmitting capacity of the well screen. Pumping wells close to or above their theoretical capacities can result in encrustation of the well resulting in increased maintenance and corrosion of the screen results in a shortened well life. Currently Well 2 is operating at approximately 22.7 L/sec, which appears to be acceptable; however the well yield should not be increased over the permitted amount.

Well 3 was constructed as a test well by Snider Well Drilling of Craighurst (License # 4816) in 1978. The well has a diameter of 152 mm and an overall depth of 57.9 m. The well is equipped with nominal 152 mm diameter telescoping well screen with 16 slot screen installed between 56 and 62.5 mbgl. The 4.6 m long well screen has a theoretical transmitting capacity of approximately 11.7 L/sec. The well was originally tested at a rate of 11.2 L/sec for a period of 24 hours, during which time water levels declined from 7.44 mbgl to 18.1 mbgl. A specific capacity of 1.1 L/sec per metre of drawdown is calculated from the original testing.

Well 3 has similar limitations to Wells 1 and 2 with respect to the limited aquifer thickness and fine texture of the aquifer plus the added limitation of a smaller casing diameter than the other two wells. The transmitting capacity of the screen is approximately 12.9 L/sec. Well 3 is currently permitted to take 11 L/sec, which is 85% of the theoretical transmitting capacity of the well screen. Operation of the well at this rate would result in screen entrance velocities in excess of 3 cm/sec, which as described above, could result in an increased rate of encrustation of the screen by carbonate minerals and an increased rate of corrosion of the well screen resulting in a shortened useful life for the well.

2.1 Existing and Future Aquifer Yield

The wells operate under PTTW 93-P-3011 and conditions included in the PTTW include the measuring of non-pumping water levels in production wells on a monthly basis. Golder has reviewed these data for the past three years and compared them to the as-built static water levels. The current non-pumping water levels in the production wells are within 0.5 m of the original water levels during low demand periods and within 2 m of the original static water levels during high water demand periods. It should be recognized that the water level monitoring is done manually and pumps are turned off for a relatively short period of time prior to measuring the static water level. These water levels may represent partially recovered water levels. It is therefore reasonable to conclude that there has been no significant reduction in the static water level in the aquifer at the Everett municipal water supply wells since their construction. The water use at Everett has been 368 to 400 m^3/day over the past three years with maximum day demands of 797 to 1045 m^3/day.

Golder and Waterloo Hydrogeologic conducted well head protection mapping in 2004 (Golder, 2004). This work involved the preparation of a ModFlow 3-D groundwater flow model. This modelling work indicated that an average day water demand of 2,500 m^3/day is available from groundwater resources in the area. The future average day water demand for the area is 2,607 m^3/day, which is expected to be available from the lower aquifer system.

Further work to develop water supplies that will increase the water supply above the current permit to take water maximums will be required. It is expected that this work will include the construction of an additional water supply that will be capable of providing a minimum of 16 L/sec.

3.0 FUTURE WATER SUPPLIES

3.1 Options for water:

There are limited options for additional water supplies in or near Everett. As noted earlier the upper aquifer in the Everett area currently has elevated nitrate concentrations and is unsuitable as a water supply source for municipal purposes. The source of the nitrate is not completely certain, however a combination of the application of agricultural fertilizer and private on-site sewage disposal systems are the likely sources.

The confined artesian aquifer that is being used to supply water to the Everett municipal water distribution system is currently unaffected by the elevated nitrate concentrations in the upper aquifer. This source of water supply continues to be the only viable groundwater source in the area of Everett.

3.2 Groundwater Supply Options

Golder has prepared a series of draft cross sections in the Everett area and two of these have been presented here as Figures 4 and 5. They were prepared using the Ontario Water Well Record database that is compiled and maintained by the Ontario Ministry of the Environment. The database that was used to prepare the maps and cross sections appearing herein was updated at the initiation of this study.

Figure 4 is oriented in an east – west orientation with the line of section along County Road 5 through Everett. The cross section shows the presence of a thick unconfined aquifer in the Everett area. This aquifer was intersected at Everett Wells 1 and 3, where it is approximately 20 m thick. In most areas there is a confined artesian aquifer with a limited thickness that is found at an elevation of approximately 200 metres above sea level (masl) in the Everett area. This aquifer is used by individuals as a source of water supply. The middle aquifer is relatively thin and as a result not useful as a municipal water supply aquifer. The confining layer between the middle and lower aquifer is 5 to 10 m thick in the Everett area.

The Municipal water supply in Everett is likely a lateral equivalent to Regional Aquifer A3 as identified in the Barrie Borden area. This aquifer is generally protected from contamination of surface activities. The area of Everett is similar to other areas in Simcoe County where the Regional A3 Aquifer has little evidence of the impact from surface activities, such as low nitrate concentrations.

The extent of Aquifer A3 is shown on Figures 4 and 5 as the shaded yellow pattern between the elevations of 175 and 190 masl. Aquifer A3 is found throughout the area and to the west of Everett in the Mansfield area Aquifer A3 may be hydraulically connected to Aquifer A2. Aquifer A3 appears to be thicker toward the north and east of Everett.

Figure 6 is a compilation of the well yields of wells within a 10 km radius of Everett. The pumping rates are represented as circles around the water well and are proportional to the yield of the well. High capacity municipal wells are present in Everett, Lisle and Alliston, while high capacity irrigation wells are found between Alliston and Everett, to the east of Everett and to the west of Lisle.

3.3 Future Water Well Drilling

The detailed data from the original testing for Well 1 (Grohal #2) and Well 2 (Ballpark) are not available; however it is clear from the water well records that the wells have similar drawdown and yield characteristics. The interference resulting from the pumping of these wells is not documented in the reports; therefore the Theis equation has been used to estimate the mutual interference among the wells.

The aquifer at Well 1 was intersected between 53.6 and 62.4 mbgl, resulting in 8.9 m of aquifer. The aquifer was relatively uniform and a 16 slot screen was installed in the well. The aquifer at Well 2 was intersected between 55.2 and 61.6 mbgl, resulting in 6.37 m of aquifer, which is 2.5 m thinner than at Well 1. On the basis of a slightly higher specific yield from Well 1 and a greater aquifer thickness, the site of Well 1 has been assessed for a new water supply well with a yield of 15.8 L/sec. Assuming Well 1 and Well 2 each yield 1,964 m^3/day, a well yield of approximately 15.8 L/sec would be required from a third well.

The zone of influenced may be governed by the lateral groundwater flow through the granular soils, based on the reported transmissivity from aquifer testing (Trow, 1990) of 205 m^2/day.

Applying the Theis analytical solution, the lateral extent of groundwater level drawdown can be estimated as follows:

$$s(r,t) = \frac{Q}{4\pi T} W\left(\frac{r^2 S}{4Tt}\right)$$

where $s(r,t)$ = drawdown at distance (r) and time (t) after the start of pumping,

Q = pumping rate required to supply the ADD potable water supply (2,600 m^3/day),

T = aquifer transmissivity (205 m^2/day – based on field study results),

S = aquifer storativity (1 x 10^{-4} – assumed for confined aquifer conditions), and,

W = Theis well function.

It is assumed that a new well would be constructed 100 m from Well 1 and would yield 15.8 L/sec (approximately 1,300 m^3/day). In combination with Well 1 and Well 3, the MDD well yield would be 5,214 m^3/day and the pumping levels following 90 days of pumping at the wells is calculated to be between 15 and 23 m above the well screens. Under ADD water demand of 2,606 m^3/day for 20 years, the pumping levels in the wells are calculated to be between 19 and 26 m above the well screens. The calculations are shown in Table 2 for both MDD conditions and ADD conditions. These calculations would have to be confirmed with the construction and testing of a 203 mm diameter well.

If an alternative location for a new water supply well is contemplated, sites to the north of Everett would be preferred. The aquifer appears to thicken toward the north and the location of a well offset from the existing wells toward the north would widen the zone of capture for the wells and increase the recharge area for the Everett water supply system. Locating a new well to the south is possible; however the potential for competing for water with the Alliston groundwater supply system increases.

4.0 SOURCE WATER PROTECTION

There are three Storm Water Management (SWM) ponds proposed in Everett (Figure 3). None of the SWM ponds is proposed for lands that fall within an area of high vulnerability or within WHPA-A or WHPA-B, as defined by Burnside (2010). One of the proposed SWM ponds is at the 25 year Time of Travel (ToT), a second pond is on the 10-year ToT, and a third SWM pond is located near between the 2-year and 10-year ToT (Figure 3).

Since the SWM ponds are located outside vulnerable areas in the WHPA for Everett, the potential vulnerability scores for pathogens, or chemical parameters do not represent a significant threat to the water supply system for Everett. If the SWM ponds are expected to hold water they will likely have to be lined, since the surficial soils are sandy and the water table is two to six metres below the ground surface.

5.0 SUMMARY AND CONCLUSION

The existing wells are currently being operated at or near their maximum well yields based on their construction.

A new source of water supply to augment the existing Everett municipal water supply could be obtained from a groundwater source in Everett. The Regional A3 aquifer provides the adequate unit well yields; good quality water, and a source water that is protection from direct contamination from surface activities.

Additional water supplies could be obtained either from twinning one of the existing wells or drilling a new well on a different property. Well construction and testing would be required to confirm the well yield and interference among wells.

The aquifer at Well 1 appears to be a slightly coarser and has a greater thickness than at Well 2. The Well 1 site would be the preferred site for water supply development, barring other site or pump house restrictions.

The construction of SWM ponds at the locations shown on Figure 3 should not pose a significant threat to the on-going operation of municipal water supply wells in Everett.

Report Signature Page

GOLDER ASSOCIATES LTD.

John Easton, M.Sc., P.Geo.
Senior Hydrogeologist, Associate

JAE/plc

6.0 REFERENCES

Burnside Associates, 2010.

Nottawasaga Valley Source Protection Area Approved Assessment Report. Chapter 8: The Township of Adjala -Tosorontio.

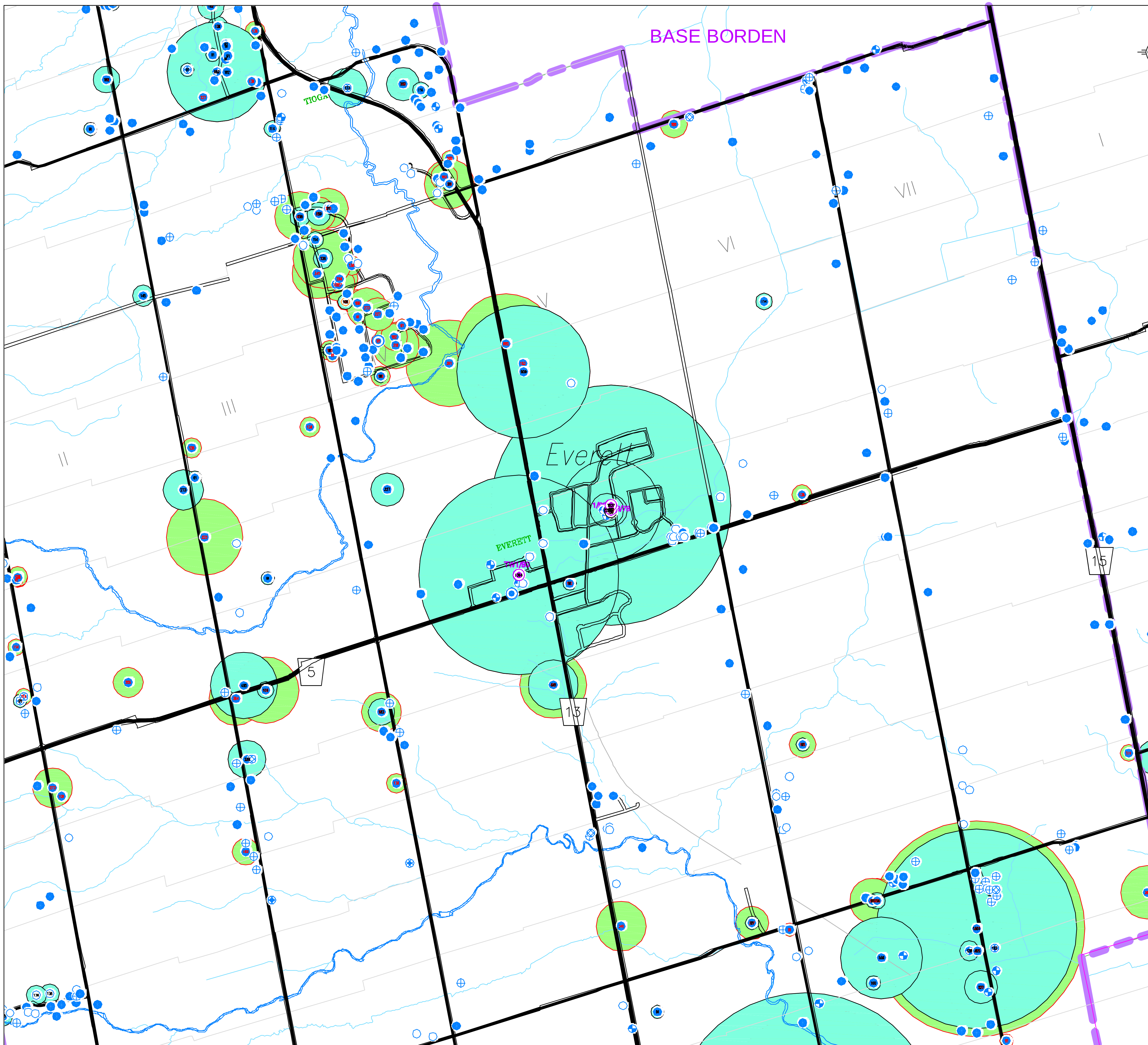
Golder Associates, 2004.

South Simcoe Municipal Groundwater Study. Golder Associates Ltd., Barrie.

Stantec, 2011.

Walton- Everett Phase 1 Lands- PW1/90 Municipal Well Pumping Test. Draft Plan of Subdivision Application – 254 Units, Township of Adjala-Tosorontio, County of Simcoe. Letter to Louise Foster, September 27, 2011, Stantec File: 1606-21773/02.

FIGURES



LEGEND:

Tested Rate (L/min) - Proportional to Recharge

Recommend Rate (L/min)

REFERENCES:

MAPPING BASED ON MOE WATER WELL RECORDS, QUEEN'S PRINTER

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

PUMPING RATES MAP

EVERETT CLASS EA: WATER SUPPLY

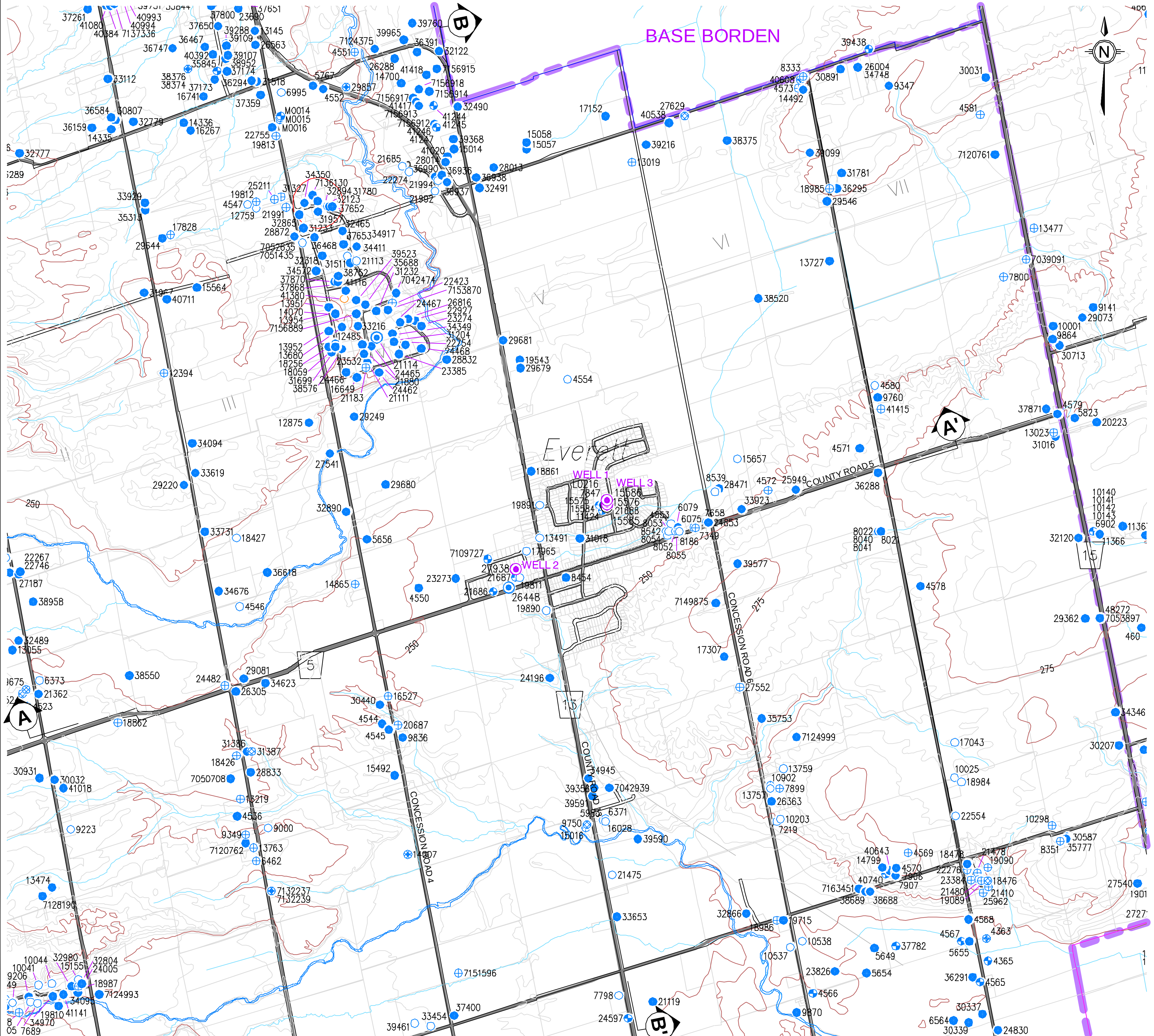
Golder Associates

Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FILE No.	1211700033ABRATE.dwg
PROJECT No.	12-1170-0033
REV.	
FIGURE	6

PLOT DATE: October 30, 2012

FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABRATE.dwg1211700033ABRATE.dwg: [Figure 6]



LEGEND:

- Shallow Dug or Bored <10 m
- Deep Bored Well >10 m
- Drilled Overburden Well
- Test or Observation Well
- Drilled Bedrock Well
- Sandpoint
- Municipal / Public Supply

REFERENCES:

MAPPING BASED ON MOE WATER WELL RECORDS, QUEEN'S PRINTER

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

AREA LOCATION MAP

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

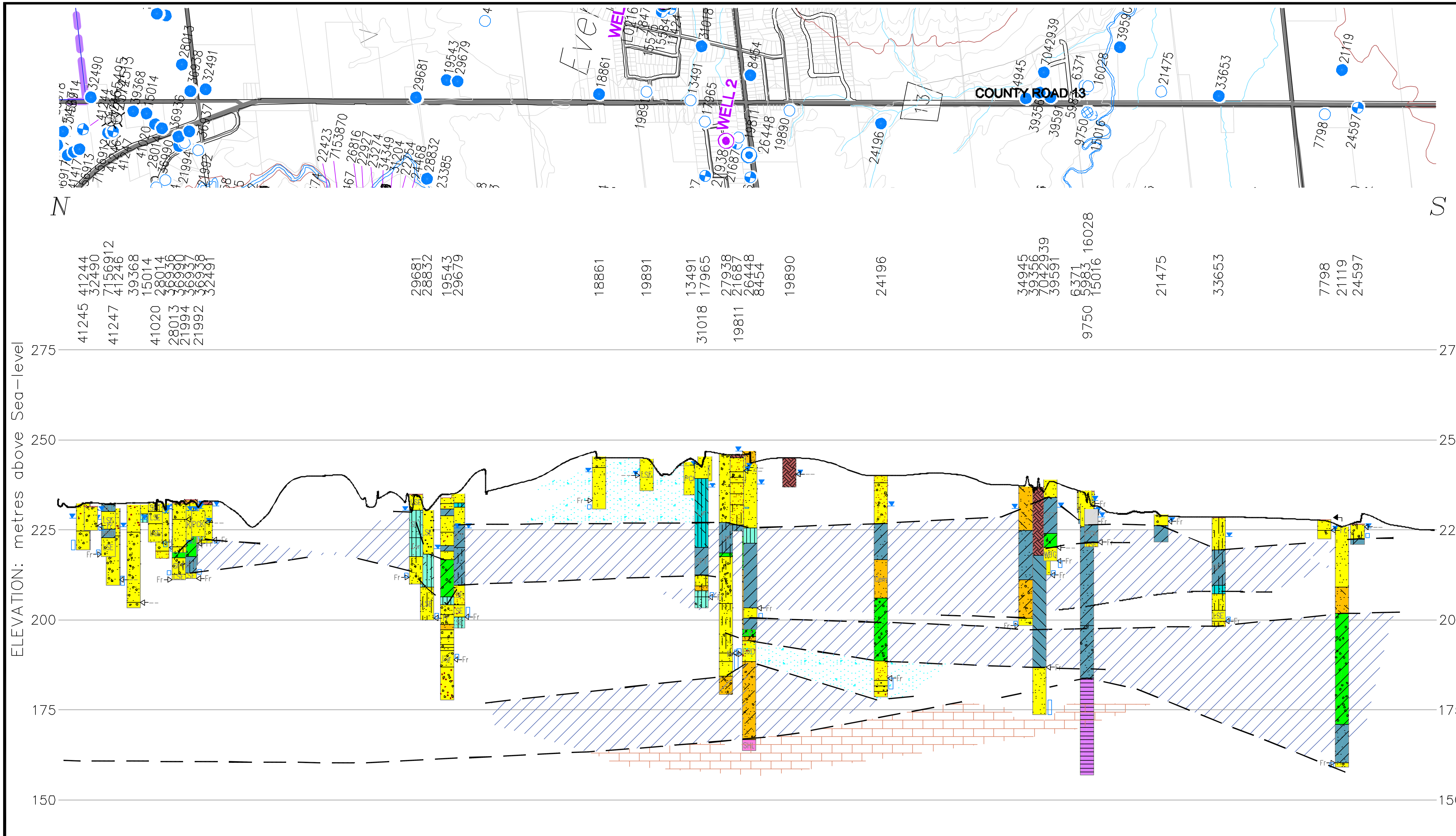
SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	

FILE No. 1211700033ABMAP.dwg

PROJECT No. 12-1170-0033 REV.

FIGURE 1

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABMAP.dwg\1211700033ABMAP.dwg: [Figure 1]



REFER TO FIGURE 7 FOR HYDROGEOLOGICAL SYMBOLS

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FILE No.	1211700033ABMAP.dwg
PROJECT No.	12-1170-0033
REV.	

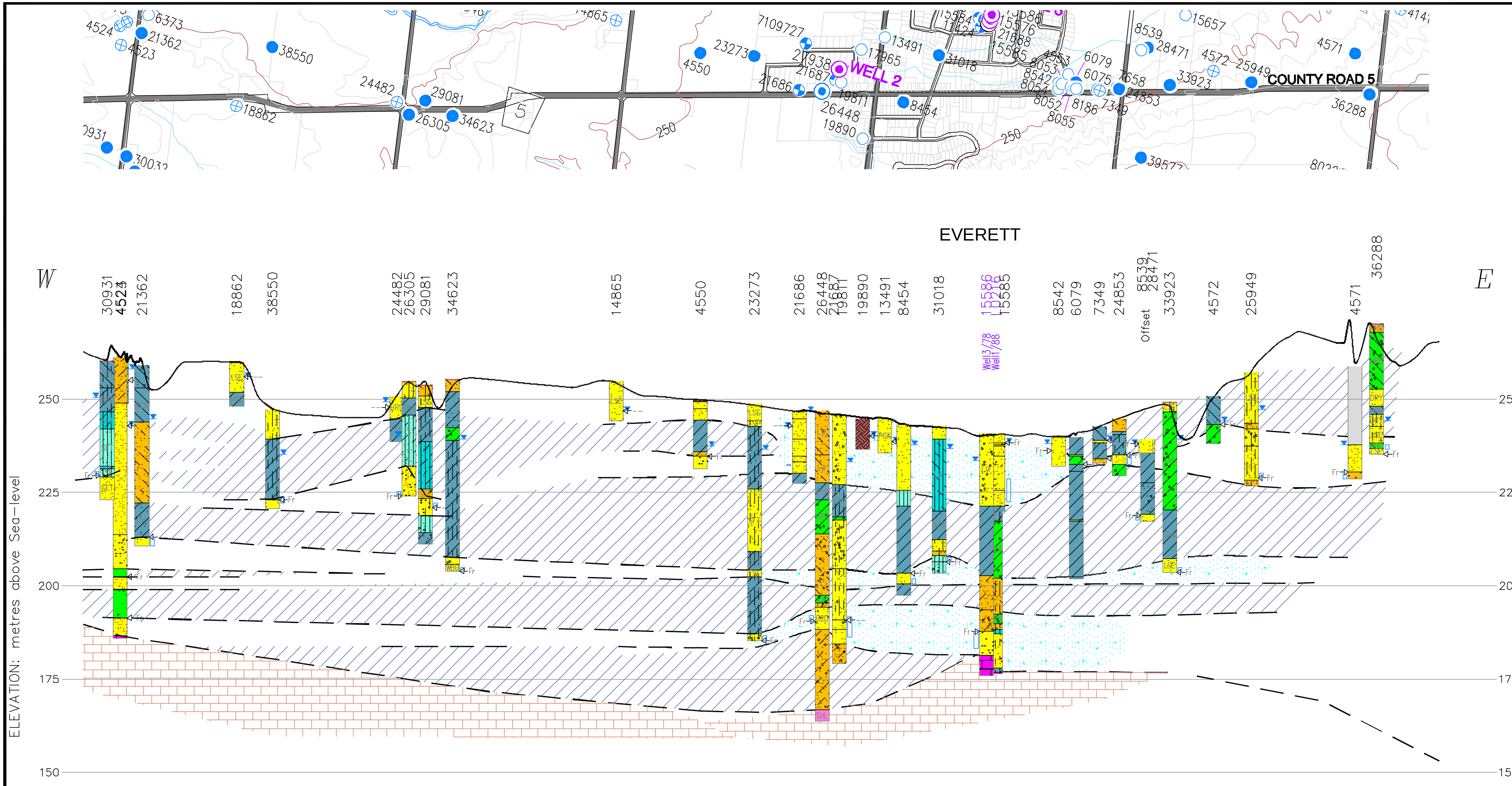
TITLE

CROSS-SECTION B - B'

EVERETT CLASS EA: WATER SUPPLY

FIGURE 5

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABMAP.dwg



0 100 250 500 1000

SCALE 1:20000 metres

Plotted Tabloid 11x17

REFER TO FIGURE 7 FOR HYDROGEOLOGICAL SYMBOLS

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABMAP.dwg

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN	TITLE	CROSS-SECTION A - A'
DATE	30 OCT 2012		
DESIGN			
CAD	J REGIER		
FILE No. 1211700033ABMAP.dwg	CHECK	EVERETT CLASS EA: WATER SUPPLY	FIGURE 4
PROJECT No. 12-1170-0033 REV.	REVIEW		

STRATIGRAPHIC PATTERN

- Unoxidized CLAY, Blue, Grey, White, or Undefined CLAY
- Oxidized CLAY, Brown, Red, Yellow
- SILT
- SAND
- GRAVEL
- STONES, Rounded GRAVEL, PEBBLES
- BOULDER
- TILL
- SHALE
- DOLOSTONE
- LIMESTONE
- CRYSTALLINE ROCK

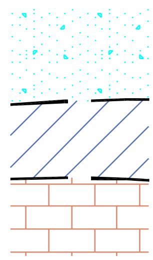
	SECONDARY/ SOME	TRACE	MINOR	
Clayey				Clay
Silty				Silt
Sandy				Granular

- Screen
- Recorded Static Water Level
- Water Producing Zone
- Flowing Well
- 23453 MOE Recorded Private Well

GENERIC MATERIALS

- UNKNOWN OR PREVIOUSLY DUG
- PEAT/LOAM
- SANDS & GRAVELS
- GRANULAR TILL
- SILT
- SILT CLAYEY
- CLAY
- TILL
- LIMESTONES
- SHALES

STRATIGRAPHY (see Notes)



AQUIFER

HYDROSTRATIGRAPHIC CONTACT

CONFINING MATERIAL

BEDROCK
LIMESTONE OR SHALE

MAP SYMBOLS

- Shallow Dug or Bored <10 m
- Deep Bored Well >10 m
- Drilled Overburden Well
- Test or Observation Well
- Test Pit
- Drilled Bedrock Well
- Sandpoint
- Municipal / Public Supply

NOTES

On all sections, boundaries between soil strata have been determined only at well and test well locations. Between the wells and test wells, boundaries are not proven but are assumed from geological evidence.

Wells are located to MOE Water Well Bulletin Data. Locations and elevations are subject to field verification.

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FILE No.	1211700033ABMAP.dwg
PROJECT No.	12-1170-0033
REV.	

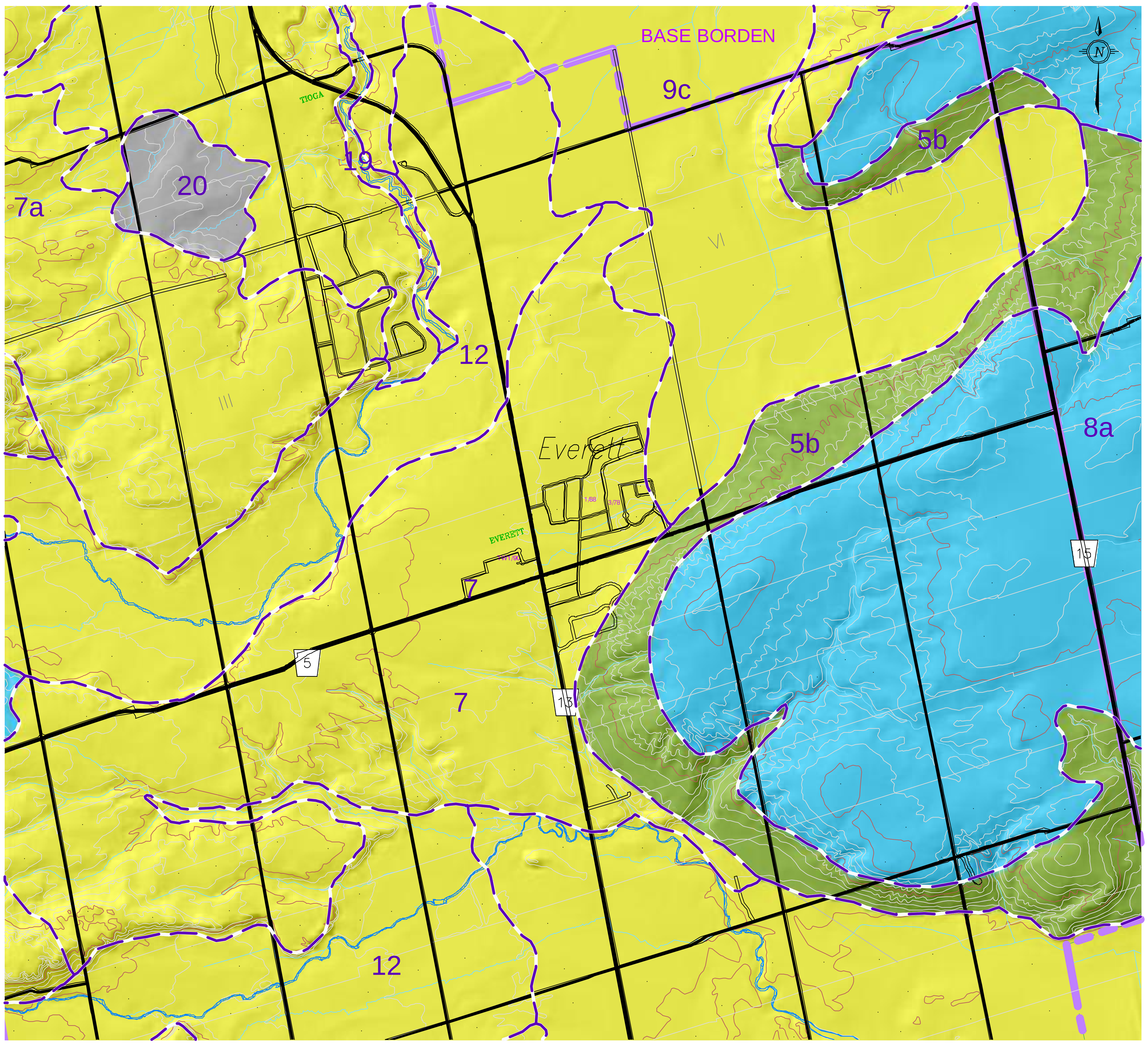
TITLE

HYDROGEOLOGICAL SYMBOLS

EVERETT CLASS EA : WATER SUPPLY

FIGURE 7

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABMAP.dwg



LEGEND:

20	Organic Deposits
19	Fluvial Silt, Sand, Gravel
12	Fluvial Sand
9c	Glaciolacustrine Silt & Sand Deposits
8a	Glaciolacustrine Deep Water Deposits
7	Glaciofluvial Outwash Sand & Gravel
7a	Distal Sand & Gravel
5b	Ablation Till

REFERENCES:

MAPPING BASED 2006 OGS/GSC DIGITAL COMPILATION, QUEEN'S PRINTER

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

QUATERNARY GEOLOGY MAP

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

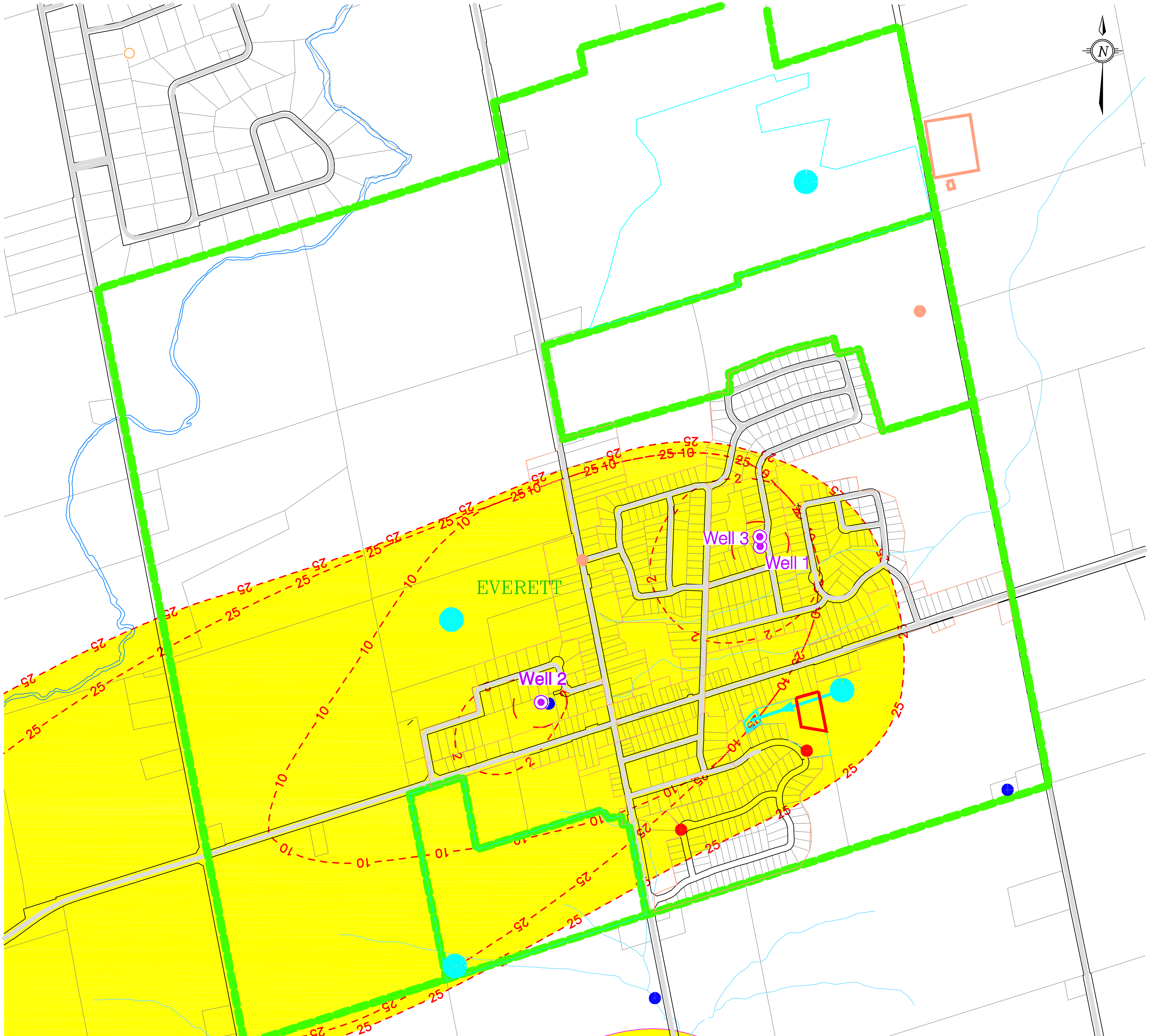
SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	

FILE No. 1211700033ABQUAT.dwg

PROJECT No. 12-1170-0033 REV.

FIGURE 2

PLOT DATE: October 30, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA – Greenland)\–AB–\1211700033ABQUAT.dwg1211700033ABQUAT.dwg: [Figure 2]



LEGEND:

- Secondary Plan Boundary
- Proposed WWTP & Tile Bed
- Proposed Pumping Station
- Proposed Stormwater Pond
- Existing Municipal Water Well / Infrastructure
- Existing Septic Treatment Infrastructure
- 25 Municipal Water Well Capture Zone, Time of Travel

REFERENCES:

MAPPING BASED ON ESSA TOWNSHIP, PLANNING DEPARTMENT

CAPTURE ZONES, SIMCOE COUNTY GROUNDWATER STUDY, 2005

DATUM IS UTM NAD 83 ZONE 17

0 250 500 1000 2500

SCALE 1:30000 metres

Plotted Tabloid 11x17

TITLE

SITE LOCATION MAP CAPTURE ZONES

EVERETT CLASS EA: WATER SUPPLY

Golder Associates
Barrie, Ontario, Canada

SCALE	AS SHOWN
DATE	30 OCT 2012
DESIGN	
CAD	J REGIER
CHECK	
REVIEW	
FIGURE	3

FILE No. 1211700033ABPLAN.dwg

PROJECT No. 12-1170-0033 REV.

PLOT DATE: November 02, 2012
FILENAME: T:\Projects\2012\12-1170-0033 (Everett, Class EA - Greenland)\-AB-\1211700033ABPLAN.dwg\1211700033ABPLAN.dwg: [Figure 3]

TABLES

Table 2
Township of Adjala - Tosorontio, Everett Water Supply
Combined Interference Among Municipal Well

THEIS EQUATION: s = (Q/(4PIT) LN ((2.25Tt)/(r2S))

Q m3/day	Well discharge	s m	Drawdown at distance r
T m2/day	Aquifer Transmissivity	t days	Time since pumping started or stopped
S	Aquifer storativity	r m	Distance from well

Maxmum Day Demand

Q (m^3/day)	T (m^2/day)	S	t (days)	INTERFERENCE AT RADIUS SHOWN (m) r (m) =	0.3	100	750	1000	2000
Well 1 - (Grohal #1)									
1960	205	1.E-04	90		16.9	8.1	5.0	4.6	3.5
New Well 2 (Grohal #2)									
1294	205	1.E-04	90		11.2	5.3	3.3	3.0	2.3
Well 3 (Ballpark)									
1960	205	1.E-04	90		16.9	8.1	5.0	4.6	3.5

MDD = 5,214 m^3/day	Pumping Level (m)	Interference From Well 1	Well 2	Well 3	Combined interference Pumping Level (m)	Depth to Top of Screen (m)	Pumping Level above Screen (m)
Well 1 - (Grohal #1)	27.4	0	8.1	5.0	40.5	56.0	15.5
New Well 2 (Grohal #2)	18.3	8.1	0	5.0	31.4	54.0	22.6
Well 3 (Ballpark)	26.5	5.0	3.3	0	34.8	56.0	21.2

Average Day Demand

Q (m^3/day)	T (m^2/day)	S	t (days)	INTERFERENCE AT RADIUS SHOWN (m) r (m) =	0.3	100	750	1000	2000
Well 1 - (Grohal #1)									
980	205	1.E-04	3650		9.9	5.5	3.9	3.7	3.2
New Well 2 (Grohal #2)									
647	205	1.E-04	3650		6.5	3.6	2.6	2.4	2.1
Well 3 (Ballpark)									
980	205	1.E-04	3650		9.9	5.5	3.9	3.7	3.2

ADD = 2,606 m^3/day	Pumping Level (m)	Interference From Well 1	Well 2	Well 3	Combined interference Pumping Level (m)	Depth to Top of Screen (m)	Pumping Level above Screen (m)
Well 1 - (Grohal #1)	27.4	0	5.5	3.9	36.8	56.0	19.2
New Well 2 (Grohal #2)	18.3	5.5	0	3.9	27.7	54.0	26.3
Well 3 (Ballpark)	26.5	3.9	2.6	0	33.0	56.0	23.0

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

P.W.#1---1988. PW1-88 (TW2-88)

County or District	Township, Borough, City, Town, Village	Con., Block, Tract, Survey, etc.	Lot
County of Simcoe	Township of Tosorontio(Everett)	Conc # 5	11

Owner (Surname first)	Address	Date completed
Township of Tosorontio	R.R. # 3 Everett ,Ontario..	day 31 mo Jan yr 89

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

General Colour	Most Common Material	Other Materials	General Description	Depth – Feet From	To
Brown	sand	clay streaks	layered	0	44
Brown	sand(silty)	clay seams	layered	44	63
Grey	clay	slit	soft	63	76
Grey	clay	stones gravel seams	hardpacked	76	127
Brown	sand(silty)	gravel,clay seams	layered	127	158
Grey	clay	stones	hard	158	167
Grey	sand	silty clay	layered	167	172
Grey	silt	sandy clay	layered	172	176
Brown	sand	fine gravel silt	layered	176	205
Grey	clay(sandy)	silt stones	hardpacked	205	210
Grey	rock	fractured	layered	210	216

K packer +leader 5'-10"

WATER RECORD

Water found at – feet	Kind of water
184-204	☒ Fresh

CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth – Feet From	To
10	☒ Steel	.375	184	+2.4

SCREEN

Slot no.	Diameter	Length
	9 1/2 inches	20 feet

Material and type: S.S. wire wd — Depth to top of screen: 184 feet

PLUGGING & SEALING RECORD

Depth set at – feet From	To	Material and type
184	91	drill cuttings
91	5	cement grout
5	0	backfill

PUMPING TEST

Pumping test method: ☒ Pump ☐ Bailer — Pumping rate: 360 GPM — Duration of pumping: 24 hrs 0 mins

Static level: 25.40 feet — Water level end of pumping: 115 feet

If flowing give rate: — Pump intake set at: 160 feet — Water at end of test: ☒ Clear ☐ Cloudy

Recommended pump type: ☐ Shallow ☒ Deep — Recommended pump setting: 150 feet — Recommended pumping rate: 350 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.

50493

FINAL STATUS OF WELL

☒ Water supply ☐ Observation well ☐ Test hole ☐ Recharge well ☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Unfinished ☐ Dewatering

WATER USE

☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Other ☐ Commercial ☒ Municipal ☐ Public supply ☐ Cooling or air conditioning ☐ Not used

METHOD OF CONSTRUCTION

☐ Cable tool ☒ Rotary (conventional) ☐ Rotary (reverse) ☐ Rotary (air) ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving ☐ Digging ☐ Other

CONTRACTOR

Name of well contractor: Northern Well Drilling Limited — Well contractor's licence number: 3903

Address: P.O. Box 358 Unionville,Ont.

Name of well technician: Jerry W. Fenwick — Well technician's licence number: T-0001

Signature of technician/contractor — Submission date: 31 mo mar. 89

OFFICE USE ONLY

CONTRACTOR'S COPY

TABLE C

Geologic Units at Borehole 5 (Everett Ball Park Well)

Geologic Unit	Depth (m)	Elevation (m a.m.s.l.)	Description
Sand	0-17.1	247.4-230.3	Shallow aquifer
Clay	17.1-22.0	230.3-225.4	
Clayey gravel	22.0-28.1	225.4-219.3	
Sand and gravel	28.1-44.2	219.3-203.2	Middle aquifer
Clay	44.2-47.3	203.2-200.1	
Silty sand	47.3-49.7	200.1-197.7	
Clay	49.7-51.5	197.7-195.9	
Sand	51.5-57.3	195.9-190.1	Deep aquifer
Clay	57.3-58.0	190.1-189.4	
Sand with silt	58.0-69.5	189.4-177.9	Deep aquifer
Clay	69.5-74.7	177.9-172.7	

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

County or District	Township, Borough, City, Town, Village	Con., Block, Tract, Survey, etc.	Lot
Simcoe	Tosorontio	V	11

Owner (Surname First)	Address	Date Completed
Twp. of Tosorontio	Everett, R. R. #3	Day 28 Mo 08 Yr 78

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

General Colour	Most Common Material	Other Materials	General Description	Depth – Feet From	To
	sand	streaks of gravel		0	64
	clay			64	125
	sand	clay		125	155
	sand	gravel, clay		155	174
	coarse sand			174	195
	limestone		broken	196	207
	limestone			207	213

WATER RECORD

Water Found at – Feet	Kind of Water
174-195	☒ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral

CASING & OPEN HOLE RECORD

Inside Diam. Inches	Material	Wall Thickness Inches	Depth – Feet From	To
6	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open Hole	0.188	+ 1	178
	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open Hole			
	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open Hole			

SCREEN

Size of Opening	Diameter	Length
10ft. x 14 slot 5ft. x 16 slot	6 inches	15 feet

Material and Type	Depth to Top of Screen
stainless steel wire wound	packer: 174 feet

PLUGGING & SEALING RECORD

Depth Set At – Feet From	To	Material and Type	Cement Grout, Lead Packer, etc.

PUMPING TEST

Pumping Test Method	Pumping Rate	Duration of Pumping
☒ Pump ☐ Bailer	148 GPM	24 hours

Static Level	Water Level End of Pumping	15 Minutes	30 Minutes	45 Minutes	60 Minutes
24.42 feet	59.27 feet	45.64 feet	46.28 feet	46.56 feet	46.76 feet

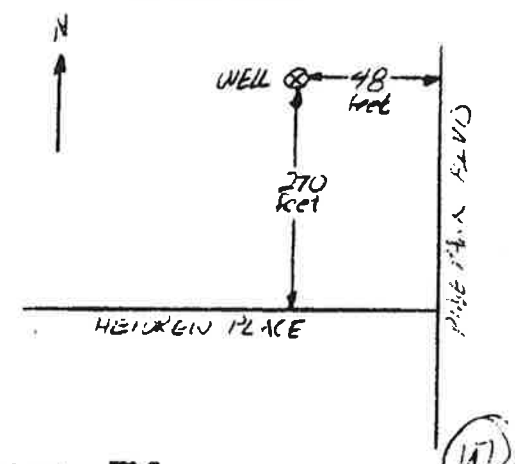
Water levels during: ☒ Pumping ☐ Recovery

If Flowing Give Rate	Pump Intake Set At	Water at End of Test
GPM	154 feet	☒ Clear ☐ Cloudy

Recommended Pump Type	Recommended Pump Setting	Recommended Pumping Rate
☐ Shallow ☒ Deep	100 feet	150 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



FINAL STATUS OF WELL

☒ Water Supply ☐ Observation Well ☐ Test Hole ☐ Recharge Well ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Quality ☐ Unfinished

WATER USE

☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Other ☐ Commercial ☐ Municipal ☐ Public Supply ☐ Cooling or Air Conditioning ☒ Not Used

METHOD OF DRILLING

☐ Cable Tool ☒ Rotary (Conventional) ☐ Rotary (Reverse) ☐ Rotary (Air) ☐ Air Percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving

Drillers Remarks: PW-3

CONTRACTOR

Name of Well Contractor: Snider Drilling Limited, — Licence Number: 4816

Address: Craighurst, Ontario.

Name of Driller or Boring: Phillip Brown. — Licence Number:

Signature of Contractor: Ralph Snider. — Submission Date: Day ____ Mo ____ Yr ____

OFFICE USE ONLY

OWNER'S COPY

FORM NO. 0506

APPENDIX A

Water and Sewage: Demands/Flows

From Greenland Consulting Engineers, 2012.

Water and Sewage Demands/Flows

A. Historical Water Demands, Peaking Factors and Per Capita Daily Demands

Year	*Average Daily Demand (m^3/d)	*Maximum Daily Demand (m^3/d)	Maximum Daily Demand Peaking Factor	**Peak Hour Peaking Factor (For Population 2,000)
2009	399.50	1,044.90	2.62	3.75
2010	394.20	976.30	2.48	3.75
2011	368.20	796.80	2.16	3.75
Total	1,161.90	2,818.00		
Average	**387.30**	**939.33**	**2.43**	**3.75**
Connections	643.00			
Persons Per Unit	3.00			
Population	1,929.00			
Per Capita Day Demand (L/c/d)	200.78	486.95		

***Source: Burnside Technical Memorandum (16 August 2011) re. R&M Homes Subdivsion Review**
**** Source: Peak Hour Peaking Factor form MOE Guidelines**

B. Historical Sewage Flow

New Horizons is the only Subdivison in Everett with existing muncipal sewage collection/treatment.
Remaining existing areas serviced by septic systems.

Historcial Average Daily Flow	74.00	m^3/d
Service Population	300.00	persons
Average Flow Per Capita	246.67	L/c/d

***Source: County Simcoe Visioning Strategy**

C. Future Water Distribution and Treatment Data

Since the historical per capita average daily demand is low when compared with MOE values,
future development per capita flow is based on the following (for average daily demand)

246.67	L/c/d average sewage flow in New Horizon Sewage Plant
10.00	% Increase for Water Use over Sewage Use
271.33	L/c/d average daily water useage
275.00	L/c/d average daily water useage (rounded)
Varies	Maximum Daily Demand Peaking Factor Per MOE Guidelines

For existing areas the historical average daily demand water data will be used.
As such the following presents water demands for future existing and future growth scenarios:

Average Daily Demand	Population	Maximum Daily Demand Peaking Factor	Maximum Daily Demand Existing Areas (m^3/d)	Maximum Daily Demand Future Areas (m^3/d)	Total (m^3/d)
Existing	1,929.00	1.00	387.30	0.00	387.30
Phase 1	3,500.00	1.00	387.30	432.03	819.33
Phase 2	7,000.00	1.00	387.30	1,394.53	1,781.83
Phase 3	10,000.00	1.00	387.30	2,219.53	2,606.83

Maximum Daily Demand	Population	Maximum Daily Demand Peaking Factor	Maximum Daily Demand Existing Areas (m^3/d)	Maximum Daily Demand Future Areas (m^3/d)	Total (m^3/d)
Existing	1,929.00	2.43	939.33	0.00	939.33
Phase 1	3,500.00	2.23	864.51	964.34	1,828.85
Phase 2	7,000.00	2.11	816.10	2,938.46	3,754.56
Phase 3	10,000.00	2.00	774.60	4,439.05	5,213.65

Peak Hour Demand	Population	Maximum Daily Demand Peaking Factor	Maximum Daily Demand Existing Areas (m^3/d)	Maximum Daily Demand Future Areas (m^3/d)	Total (m^3/d)
Existing	1,929.00	3.75	1,452.38	0.00	1,452.38
Phase 1	3,500.00	3.35	1,298.56	1,448.52	2,747.08
Phase 2	7,000.00	3.16	1,224.97	4,410.68	5,635.66
Phase 3	10,000.00	3.00	1,161.90	6,658.58	7,820.48

D. Future Sewage Collection and Treatment Data

Sewage Collection for New and Existing Areas Based Upon		450 L/c/d average daily flow * Harmon Peaking Factor + I/I Allowance
Sewage Treatment	Existing Per Capita Avg. Flow	246 L/c/d average daily flow from New Horizon Subdivsion
		248 L/c/d average daily flow (90% Water Average Daily Demand)
		247 Average L/c/d
		90 L/c/d extraneous flow allowance
		337 Total L/c/d
		340 Total L/c/d - to be used in Study.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
121 Commerce Park Drive, Unit L
Barrie, Ontario, L4N 8X1
Canada
T: +1 (705) 722 4492

Golder Associates

APPENDIX SS-D

Greenland International Consulting Ltd. - Pine River Assimilative Capacity Study (August 2012)

APPENDIX SS-E

Sanitary Sewer Design Spreadsheets

Everett Sanitary Sewer System - OPTION C

Design Data:	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
New Horizon Subdivision																						
Phase 1	3A	2A	3	8	8	4.00	0.55	0.55	0.00	0.00	4.00	0.04	0.17	0.01	0.18	0.40	49.0	200	20.74	0.66	0.9	20.6
Forcemain Wet Well - PS2	1A	FM	3	8	33	4.00	0.58	2.06	0.00	0.00	4.00	0.17	0.70	0.03	**0.73**	0.48	60.0	200	22.72	0.72	3.2	22.0
New Horizon Subdivision																						
Phase 2	10A	9A	6	17	17	4.00	1.12	1.12	0.00	0.00	4.00	0.09	0.35	0.02	0.36	0.95	73.4	200	31.97	1.02	1.1	31.6
Forcemain - NH (To VZ)	21A	FM	6	17	292	4.00	0.00	12.31	0.00	0.00	4.00	1.52	6.08	0.30	**6.39**	0.40	15.0	200	20.74	0.66	30.8	14.4
Future Parcel 2																						
F2 (Grav. To WN)			393	1127	1127	3.77		0.00	0.00	0.00	4.00	5.87	22.11	1.17	*23.28*	0.70	690.0	200	27.44	0.87	84.8	4.2
Walton Subdivision																						
WN (Grav. To W-TS)			238	684	1811	3.62		0.00	0.00	0.00	4.00	9.43	34.13	1.89	*36.02*	0.60	690.0	250	46.06	0.94	78.2	10.0
Future Parcel 3																						
F3 (Grav to W-TS)	**DS**	**4.5m**	119	341	341	4.00		0.00	0.00	0.00	4.00	1.78	7.10	0.36	*7.46*	0.50	530.0	200	23.19	0.74	32.2	15.7
Walton Trunk Sewer (CR13)																						
W-TS (Grav. To TS1)			14	39	2191	3.55		0.00	0.00	0.00	4.00	11.41	40.56	2.28	*42.84*	0.15	579.0	375	67.91	0.61	63.1	25.1
Vanderzaag Subdivision																						
VZ (Grav. To MS)	**DS**	**2.5m**	34	95	386	4.00		0.00	0.00	0.00	4.00	2.01	8.05	0.40	*8.45*	0.30	468.0	200	17.96	0.57	47.1	9.5
Blanchard Subdivision																						
BL (Grav. To CR5-W)	**DS**	**4.4m**	33	92	92	4.00		0.00	0.00	0.00	4.00	0.48	1.91	0.10	*2.01*	0.50	850.0	200	23.19	0.74	8.7	21.2
CR5 - West																						
CR5-W (Grav. To TS1)	**DS**	**4.1m**	30	83	175	4.00		0.00	0.00	0.00	4.00	0.91	3.65	0.18	*3.83*	0.70	668.0	200	27.44	0.87	14.0	23.6
Future Parcel 4																						
F4 (Grav to CR5-E)			378	1084	1084	3.78		0.00	0.00	0.00	4.00	5.65	21.33	1.13	*22.45*	3.94	660.0	200	65.10	2.07	34.5	42.6
CR5 - East																						
CR5-E (Grav to MS)			38	106	1190	3.75		0.00	0.00	0.00	4.00	6.20	23.24	1.24	*24.48*	0.30	404.0	250	32.57	0.66	75.1	8.1
Main St.																						
MS (Grav. To TS1)			53	147	4089	3.32		0.00	0.00	0.00	4.00	21.30	70.81	4.26	*75.07*	0.15	450.0	450	110.42	0.69	68.0	35.3
Trunk Sewer 1																						

Everett Sanitary Sewer System - OPTION C

Design Data:	**Areas**	**Infiltration**	**Flows (Colour Coded In Description)**
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

			NON-ICI						ICI			FLOWS				SEWER DESIGN						
SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
TS1 (Grav to TS2)			10	28	4117	3.32		0.00	0.00	0.00	4.00	21.44	71.24	4.29	*75.53*	0.15	525.0	450	110.42	0.69	68.4	34.9
Trunk Sewer 2 (CR13 North)																						
TS2 (Grav to RM-MH1072)		1072	17	47	4165	3.32		0.00	0.00	0.00	4.00	21.69	71.96	4.34	*76.30*	0.15	457.0	450	110.42	0.69	69.1	34.1
Moore Ave. Subdiv. - South																						
MA - S (Grav. To WA-N)			26	72	72	4.00		0.00	0.00	0.00	4.00	0.38	1.51	0.08	*1.58*	0.40	343.0	200	20.74	0.66	7.6	19.2
Wales Ave. - South																						
WA-S (Grav to WA-N)			16	44	44	4.00		0.00	0.00	0.00	4.00	0.23	0.93	0.05	*0.97*	0.30	345.0	200	17.96	0.57	5.4	17.0
Wales Ave. - North																						
WA-N (Grav to EG-N)			22	61	178	4.00		0.00	0.00	0.00	4.00	0.93	3.71	0.19	*3.89*	0.30	315.0	200	17.96	0.57	21.7	14.1
Cumac Subdivision - East																						
CM-E (Grav to EMT)			21	58	58	4.00		0.00	0.00	0.00	4.00	0.30	1.22	0.06	*1.28*	0.40	468.0	200	20.74	0.66	6.2	19.5
Grohal Subdivision -South																						
GH-S (Grav to CM-W)			22	61	61	4.00		0.00	0.00	0.00	4.00	0.32	1.27	0.06	*1.34*	0.30	254.0	200	17.96	0.57	7.4	16.6
Cumac Subdivision - West																						
CM-W (Grav to EMT)			52	145	206	4.00		0.00	0.00	0.00	4.00	1.07	4.29	0.21	*4.50*	0.30	541.0	200	17.96	0.57	25.1	13.5
Sanitary Easement																						
EMT (Grav to EG-S)			0	0	264	4.00		0.00	0.00	0.00	4.00	1.38	5.50	0.28	*5.78*	0.30	251.0	200	17.96	0.57	32.2	12.2
Grohal Subdivision - North																						
GH-N (Grav to EG-S)			35	97	97	4.00		0.00	0.00	0.00	4.00	0.51	2.03	0.10	*2.13*	0.40	425.0	200	20.74	0.66	10.3	18.6
Everett Glen Sub. South																						
EG-S (Grav to EG-N)			32	89	361	4.00		0.00	0.00	0.00	4.00	1.88	7.53	0.38	*7.91*	0.30	477.0	200	17.96	0.57	44.0	10.1
Moore Ave. Subdiv. - North																						
MA-N (Grav. To EG-N)			52	145	217	4.00		0.00	0.00	0.00	4.00	1.13	4.52	0.23	*4.74*	0.70	545.0	200	27.44	0.87	17.3	22.7
Everett Glen Sub. - North																						
EG-N (Grav to RM - MH1024)		1024	65	181	937	3.82		0.00	0.00	0.00	4.00	4.88	18.63	0.98	*19.61*	0.30	325.0	250	32.57	0.66	60.2	13.0

Everett Sanitary Sewer System - OPTION C

Design Data:

	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	FLOWS ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
Future Parcel 1 - West Trunk																						
F1 (Grav. To RM - MH1072)		1072	934	2681	2681	3.48		0.00	0.00	0.00	4.00	13.96	48.64	2.79	*51.43*	0.70	1700.0	300	80.91	1.14	63.6	29.5
Barzo Subdivision																						
BZ (Grav to RM - MH1001)		1001	473	1357	1357	3.71		0.00	0.00	0.00	4.00	7.07	26.23	1.41	*27.64*	0.30	1200.0	250	32.57	0.66	84.9	4.9
R&M Homes Subdivision																						
Street 'B'	1044	1045	2	6	6	4.00		0.00	0.00	0.00	4.00	0.03	0.12	0.01	*0.12*	1.00	16.1	200	32.80	1.04	0.4	32.7
Street 'B'	1045	1046	16	44	50	4.00		0.00	0.00	0.00	4.00	0.26	1.04	0.05	*1.09*	0.40	107.8	200	20.74	0.66	5.3	19.6
Street 'B'	1071	1046	14	39	39	4.00		0.00				0.20	0.81	0.04	*0.85*	0.40	101.5	200	20.74	0.66	4.1	19.9
Commercial		1063	0	170	170	4.00	1.52	1.52	0.00	0.00	4.00	0.89	3.55	0.18	*3.72*	0.50	49.5	200	23.19	0.74	16.1	19.5
Street 'D'	1046	1047	0	259	259	4.00		0.00	0.00	0.00	4.00	1.35	5.40	0.27	*5.67*	0.40	58.4	200	20.74	0.66	27.3	15.1
Street 'D'	1047	1048	13	36	295	4.00		0.00	0.00	0.00	4.00	1.54	6.15	0.31	*6.46*	0.60	57.1	200	25.41	0.81	25.4	18.9
Street 'D'	1048	1049	15	42	337	4.00		0.00	0.00	0.00	4.00	1.76	7.02	0.35	*7.37*	0.60	98.6	200	25.41	0.81	29.0	18.0
Street 'C'	1040	1041	13	36	36	4.00		0.00	0.00	0.00	4.00	0.19	0.75	0.04	*0.79*	1.00	68.7	200	32.80	1.04	2.4	32.0
Street 'C'	1041	1042	15	42	78	4.00		0.00	0.00	0.00	4.00	0.41	1.62	0.08	*1.70*	0.40	97.6	200	20.74	0.66	8.2	19.0
Street 'C'	1042	1043	1	3	81	4.00		0.00	0.00	0.00	4.00	0.42	1.68	0.08	*1.76*	0.50	13.4	200	23.19	0.74	7.6	21.4
Street 'C'	1043	1049	6	17	97	4.00		0.00	0.00	0.00	4.00	0.51	2.03	0.10	*2.13*	0.50	90.8	200	23.19	0.74	9.2	21.1
Street 'D'	1049	1050	4	11	445	4.00		0.00	0.00	0.00	4.00	2.32	9.28	0.46	*9.74*	0.40	64.5	200	20.74	0.66	47.0	11.0
Street 'D'	1050	1051	5	14	459	3.99		0.00	0.00	0.00	4.00	2.39	9.55	0.48	*10.03*	0.40	70.1	200	20.74	0.66	48.4	10.7
Street 'D'	1051	1052	0	0	459	3.99		0.00	0.00	0.00	4.00	2.39	9.55	0.48	*10.03*	0.40	20.9	200	20.74	0.66	48.4	10.7
Street 'E'	1037	1038	9	25	25	4.00		0.00	0.00	0.00	4.00	0.13	0.52	0.03	*0.55*	0.40	76.5	200	20.74	0.66	2.6	20.2
Street 'E'	1038	1039	3	8	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	26.8	200	20.74	0.66	3.5	20.0
Street 'E'	1039	1052	5	14	47	4.00		0.00	0.00	0.00	4.00	0.25	0.98	0.05	*1.03*	0.40	56.0	200	20.74	0.66	5.0	19.7
Street 'E'	1052	1053	0	507	507	3.97		0.00	0.00	0.00	4.00	2.64	10.48	0.53	*11.01*	0.40	27.0	200	20.74	0.66	53.1	9.7
Street 'E'	1053	1054	1	3	509	3.97		0.00	0.00	0.00	4.00	2.65	10.53	0.53	*11.06*	0.40	68.3	200	20.74	0.66	53.3	9.7
Street 'A'	1072	1071	6	17	6862	3.11		0.00	0.00	0.00	4.00	35.74	111.33	7.15	*118.48*	0.18	84.3	450	120.96	0.76	97.9	2.5
Street 'A'	1071	1070	3	8	6871	3.11		0.00	0.00	0.00	4.00	35.78	111.45	7.16	*118.60*	0.18	60.1	450	120.96	0.76	98.1	2.4
Street 'A'	1070	1069	9	25	6896	3.11		0.00	0.00	0.00	4.00	35.91	111.80	7.18	*118.98*	0.18	69.8	450	120.96	0.76	98.4	2.0
Street 'A'	1069	1068	9	25	6921	3.11		0.00	0.00	0.00	4.00	36.04	112.15	7.21	*119.36*	0.18	81.8	450	120.96	0.76	98.7	1.6
Street 'A'	1068	1067	9	25	6946	3.11		0.00	0.00	0.00	4.00	36.18	112.50	7.24	*119.73*	0.18	85.0	450	120.96	0.76	99.0	1.2

Everett Sanitary Sewer System - OPTION C

Design Data:	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
Street 'AA'	1056	1057	8	22	22	4.00		0.00	0.00	0.00	4.00	0.12	0.46	0.02	*0.49*	1.00	68.2	200	32.80	1.04	1.5	32.3
Street 'AA'	1057	1058	5	14	36	4.00		0.00	0.00	0.00	4.00	0.19	0.75	0.04	*0.79*	0.40	73.3	200	20.74	0.66	3.8	20.0
Street 'AA'	1058	1059	8	22	58	4.00		0.00	0.00	0.00	4.00	0.30	1.22	0.06	*1.28*	0.40	80.9	200	20.74	0.66	6.2	19.5
Street 'AA'	1059	1060	3	8	67	4.00		0.00	0.00	0.00	4.00	0.35	1.39	0.07	*1.46*	0.40	49.6	200	20.74	0.66	7.0	19.3
Street 'AA'	1060	1061	2	6	72	4.00		0.00	0.00	0.00	4.00	0.38	1.51	0.08	*1.58*	0.40	42.8	200	20.74	0.66	7.6	19.2
Street 'AA'	1061	1065	2	6	78	4.00		0.00	0.00	0.00	4.00	0.41	1.62	0.08	*1.70*	0.40	37.8	200	20.74	0.66	8.2	19.0
Street 'BB'	1062	1063	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.20	65.1	200	35.93	1.14	1.2	35.5
Street 'BB'	1063	1064	9	25	44	4.00		0.00	0.00	0.00	4.00	0.23	0.93	0.05	*0.97*	0.80	84.4	200	29.34	0.93	3.3	28.4
Street 'BB'	1064	1065	1	3	47	4.00		0.00	0.00	0.00	4.00	0.25	0.98	0.05	*1.03*	0.50	55.1	200	23.19	0.74	4.5	22.2
Street 'AA'	1065	1066	4	11	136	4.00		0.00	0.00	0.00	4.00	0.71	2.84	0.14	*2.98*	0.40	41.8	200	20.74	0.66	14.4	17.8
Street 'AA'	1066	1067	5	14	150	4.00		0.00	0.00	0.00	4.00	0.78	3.13	0.16	*3.28*	0.40	82.1	200	20.74	0.66	15.8	17.5
Street 'A'	1067	1055	4	11	7107	3.10		0.00	0.00	0.00	4.00	37.01	114.76	7.40	*122.16*	0.19	72.7	450	124.27	0.78	98.3	2.1
Street 'A'	1055	1054	1	3	7110	3.10		0.00	0.00	0.00	4.00	37.03	114.79	7.41	*122.20*	0.19	35.2	450	124.27	0.78	98.3	2.1
Street 'E'	1035	1036	1	3	3	4.00		0.00	0.00	0.00	4.00	0.01	0.06	0.00	*0.06*	2.00	8.3	200	46.38	1.48	0.1	46.3
Street 'E'	1036	1054	1	3	6	4.00		0.00	0.00	0.00	4.00	0.03	0.12	0.01	*0.12*	2.00	37.2	200	46.38	1.48	0.3	46.3
Street 'A'	1054	1034	4	11	7636	3.07		0.00	0.00	0.00	4.00	39.77	122.09	7.95	*130.05*	0.22	88.2	450	133.73	0.84	97.2	3.7
Street 'A'	1034	1033	6	17	7652	3.07		0.00	0.00	0.00	4.00	39.86	122.32	7.97	*130.29*	0.22	49.2	450	133.73	0.84	97.4	3.4
Street 'F'	1031	1032	14	39	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	1.00	88.9	200	32.80	1.04	2.6	31.9
Street 'F'	1032	1033	0	0	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	0.40	35.1	200	20.74	0.66	4.1	19.9
Street 'A'	1033	1030	4	11	7702	3.07		0.00	0.00	0.00	4.00	40.12	123.01	8.02	*131.03*	0.22	34.2	450	133.73	0.84	98.0	2.7
Street 'A'	1030	1029	5	14	7716	3.07		0.00	0.00	0.00	4.00	40.19	123.20	8.04	*131.24*	0.22	64.4	450	133.73	0.84	98.1	2.5
Street 'G'	1027	1028	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.00	43.1	200	32.80	1.04	1.3	32.4
Street 'G'	1028	1029	8	22	42	4.00		0.00	0.00	0.00	4.00	0.22	0.87	0.04	*0.91*	0.40	96.6	200	20.74	0.66	4.4	19.8
Street 'A'	1029	1026	8	22	7780	3.06		0.00	0.00	0.00	4.00	40.52	124.08	8.10	*132.19*	0.22	75.3	450	133.73	0.84	98.8	1.5
Street 'A'	1026	1025	10	28	7808	3.06		0.00	0.00	0.00	4.00	40.67	124.46	8.13	*132.60*	0.22	88.7	450	133.73	0.84	99.2	1.1
Street 'L'	1024	1025	3	8	945	3.82		0.00	0.00	0.00	4.00	4.92	18.78	0.98	*19.77*	0.30	92.6	300	52.97	0.75	37.3	33.2
Street 'A'	1025	1023	11	31	8784	3.01		0.00	0.00	0.00	4.00	45.75	137.72	9.15	*146.87*	0.15	93.6	525	166.56	0.77	88.2	19.7
Street 'A'	1023	1022	6	17	8801	3.01		0.00	0.00	0.00	4.00	45.84	137.95	9.17	*147.12*	0.15	47.2	525	166.56	0.77	88.3	19.4
Street 'A'	1022	1021	4	11	8812	3.01		0.00	0.00	0.00	4.00	45.89	138.10	9.18	*147.28*	0.15	51.1	525	166.56	0.77	88.4	19.3
Street 'F'	1008	1009	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.50	45.6	200	40.17	1.28	1.1	39.7
Street 'F'	1009	1010	5	14	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	54.7	200	20.74	0.66	3.5	20.0

Everett Sanitary Sewer System - OPTION C

Design Data:	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
Street 'F'	1010	1012	10	28	61	4.00		0.00	0.00	0.00	4.00	0.32	1.27	0.06	*1.34*	0.40	97.8	200	20.74	0.66	6.4	19.4
Street 'H'	1011	1012	10	28	28	4.00		0.00	0.00	0.00	4.00	0.14	0.58	0.03	*0.61*	1.00	60.0	200	32.80	1.04	1.9	32.2
Street 'F'	1012	1016	10	28	117	4.00		0.00	0.00	0.00	4.00	0.61	2.43	0.12	*2.55*	0.40	100.0	200	20.74	0.66	12.3	18.2
Street 'H'	1013	1014	11	31	31	4.00		0.00	0.00	0.00	4.00	0.16	0.64	0.03	*0.67*	1.00	72.2	200	32.80	1.04	2.0	32.1
Street 'H'	1014	1015	3	8	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	0.40	15.5	200	20.74	0.66	4.1	19.9
Street 'H'	1015	1016	5	14	53	4.00		0.00	0.00	0.00	4.00	0.28	1.10	0.06	*1.16*	0.40	59.8	200	20.74	0.66	5.6	19.6
Street 'F'	1016	1017	16	44	214	4.00		0.00	0.00	0.00	4.00	1.11	4.46	0.22	*4.68*	0.40	88.8	200	20.74	0.66	22.6	16.1
Street 'F'	1017	1018	4	11	225	4.00		0.00	0.00	0.00	4.00	1.17	4.69	0.23	*4.93*	0.40	18.4	200	20.74	0.66	23.7	15.8
Street 'F'	1018	1019	6	17	242	4.00		0.00	0.00	0.00	4.00	1.26	5.04	0.25	*5.29*	0.40	45.1	200	20.74	0.66	25.5	15.5
Street 'F'	1019	1020	4	11	253	4.00		0.00	0.00	0.00	4.00	1.32	5.27	0.26	*5.53*	0.40	32.6	200	20.74	0.66	26.7	15.2
Street 'F'	1020	1021	2	6	259	4.00		0.00	0.00	0.00	4.00	1.35	5.39	0.27	*5.66*	0.40	69.0	200	20.74	0.66	27.3	15.1
Street 'I'	1003	1004	3	8	8	4.00		0.00	0.00	0.00	4.00	0.04	0.17	0.01	*0.18*	1.00	27.6	200	32.80	1.04	0.6	32.6
Street 'I'	1004	1005	12	33	42	4.00		0.00	0.00	0.00	4.00	0.22	0.87	0.04	*0.91*	0.30	109.9	250	32.57	0.66	2.8	31.7
Street 'A'	1001	1002	1	3	1360	3.71		0.00	0.00	0.00	4.00	7.08	26.27	1.42	*27.69*	1.00	10.0	250	59.47	1.21	46.6	31.8
Street 'A'	1002	1005	2	6	1365	3.71		0.00	0.00	0.00	4.00	7.11	26.37	1.42	*27.80*	0.40	20.3	250	37.61	0.77	73.9	9.8
Street 'A'	1005	1006	3	8	1415	3.70		0.00	0.00	0.00	4.00	7.37	27.26	1.47	*28.73*	0.30	62.1	250	32.57	0.66	88.2	3.8
Street 'A'	1006	1007	3	8	1424	3.70		0.00	0.00	0.00	4.00	7.42	27.41	1.48	*28.89*	0.30	47.6	250	32.57	0.66	88.7	3.7
Street 'A'	1007	1021	1	3	1427	3.70		0.00	0.00	0.00	4.00	7.43	27.45	1.49	*28.94*	0.30	51.5	250	32.57	0.66	88.9	3.6
Street 'J'	1021	1000	5	14	10511	2.93		0.00	0.00	0.00	4.00	54.74	160.57	10.95	*171.52*	0.20	110.0	525	192.33	0.89	89.2	20.8
Street 'J'	1081	1080	1	3	3	4.00		0.00	0.00	0.00	4.00	0.01	0.06	0.00	*0.06*	1.00	10.0	200	32.80	1.04	0.2	32.7
Street 'J'	1080	1079	11	31	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	80.3	200	20.74	0.66	3.5	20.0
Street 'J'	1079	1078	13	36	70	4.00		0.00	0.00	0.00	4.00	0.36	1.45	0.07	*1.52*	0.40	81.8	200	20.74	0.66	7.3	19.2
Street 'J'	1078	1077	12	33	103	4.00		0.00	0.00	0.00	4.00	0.54	2.14	0.11	*2.25*	0.40	89.5	200	20.74	0.66	10.8	18.5
Street 'J'	1077	1076	4	11	114	4.00		0.00	0.00	0.00	4.00	0.59	2.37	0.12	*2.49*	0.40	13.8	200	20.74	0.66	12.0	18.3
Street 'J'	1076	1075	7	19	133	4.00		0.00	0.00	0.00	4.00	0.70	2.78	0.14	*2.92*	0.40	31.0	200	20.74	0.66	14.1	17.8
Street 'J'	1075	1074	3	8	142	4.00		0.00	0.00	0.00	4.00	0.74	2.95	0.15	*3.10*	0.40	14.9	200	20.74	0.66	15.0	17.6
Street 'J'	1074	1073	4	11	153	4.00		0.00	0.00	0.00	4.00	0.80	3.19	0.16	*3.34*	0.40	41.1	200	20.74	0.66	16.1	17.4
Street 'J'	1073	1000	2	6	158	4.00		0.00	0.00	0.00	4.00	0.83	3.30	0.17	*3.47*	0.40	18.1	200	20.74	0.66	16.7	17.3
Street 'J'	1000	PS	0	0	10669	2.93		0.00	0.00	0.00	4.00	55.57	162.63	11.11	***173.74***	1.00	17.5	525	430.06	1.99	40.4	256.3

Everett Sanitary Sewer System - OPTION B

Design Data:	**Areas**	**Infiltration**	**Flows (Colour Coded In Description)**
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	SURCH.	% FULL	Res Cap L/S
New Horizon Subdivision																							
Phase 1	3A	2A	3	8	8	4.00	0.55	0.55	0.00	0.00	4.00	0.04	0.17	0.01	0.18	0.40	49.0	200	20.74	0.66		0.9	20.6
Forcemain Wet Well - PS2	1A	FM	3	8	33	4.00	0.58	2.06	0.00	0.00	4.00	0.17	0.70	0.03	**0.73**	0.48	60.0	200	22.72	0.72		3.2	22.0
New Horizon Subdivision																							
Phase 2	10A	9A	6	17	17	4.00	1.12	1.12	0.00	0.00	4.00	0.09	0.35	0.02	0.36	0.95	73.4	200	31.97	1.02		1.1	31.6
Forcemain - NH (To VZ)	21A	FM	6	17	292	4.00	0.00	12.31	0.00	0.00	4.00	1.52	6.08	0.30	**6.39**	0.40	15.0	200	20.74	0.66		30.8	14.4
Future Parcel 2																							
F2 (Grav. To WN)			393	1127	1127	3.77		0.00	0.00	0.00	4.00	5.87	22.11	1.17	*23.28*	0.70	690.0	200	27.44	0.87		84.8	4.2
Walton Subdivision																							
WN (Grav. To W-TS)			238	684	1811	3.62		0.00	0.00	0.00	4.00	9.43	34.13	1.89	*36.02*	0.58	690.0	300	73.65	1.04		48.9	37.6
Future Parcel 3																							
F3 (Grav to W-TS)			119	341	341	4.00		0.00	0.00	0.00	4.00	1.78	7.10	0.36	*7.46*	1.00	530.0	200	32.80	1.04		22.7	25.3
Walton Trunk Sewer (CR13)																							
W-TS (Grav. To MS)			14	39	2191	3.55		0.00	0.00	0.00	4.00	11.41	40.56	2.28	*42.84*	0.22	579.0	300	45.36	0.64		94.5	2.5
Vanderzaag Subdivision																							
VZ (Grav. To TS1)			34	95	386	4.00		0.00	0.00	0.00	4.00	2.01	8.05	0.40	*8.45*	0.30	468.0	200	17.96	0.57		47.1	9.5
Blanchard Subdivision																							
BL (Grav. To CR5-W)			33	92	92	4.00		0.00	0.00	0.00	4.00	0.48	1.91	0.10	*2.01*	0.50	850.0	200	23.19	0.74		8.7	21.2
CR5 - West																							
CR5-W (Grav. To MS)			30	83	175	4.00		0.00	0.00	0.00	4.00	0.91	3.65	0.18	*3.83*	0.70	668.0	200	27.44	0.87		14.0	23.6
CR13 - South																							
CR13-S (Grav to MS)			27	75	75	4.00		0.00	0.00	0.00	4.00	0.39	1.56	0.08	*1.64*	0.30	344.0	200	17.96	0.57		9.1	16.3
Main St.																							
MS (Grav. To TS1)			53	147	2588	3.50		0.00	0.00	0.00	4.00	13.48	47.13	2.70	*49.83*	0.30	450.0	300	52.97	0.75		94.1	3.1
Trunk Sewer - 1																							
TS1 (Grav to TS2)			16	44	3019	3.44		0.00	0.00	0.00	4.00	15.73	54.10	3.15	*57.24*	0.30	345.0	375	96.03	0.87		59.6	38.8
CR13 - North																							
CR13-N(Grav to MA)			16	44	44	4.00		0.00	0.00	0.00	4.00	0.23	0.93	0.05	*0.97*	0.40	371.0	200	20.74	0.66		4.7	19.8
CR13 - Central																							
CR13-C(Grav to MA)			10	28	28	4.00		0.00	0.00	0.00	4.00	0.14	0.58	0.03	*0.61*	0.40	108.0	200	20.74	0.66		2.9	20.1

Everett Sanitary Sewer System - OPTION B

Design Data:

Areas	Infiltration	Flows (Colour Coded In Description)
L/c/d	L/c/d	Industrial cum/ha
450.0	90.0	55.00
	Infiltration L/s/ha	Commercial cum/ha
	0.21	28.00

			NON-ICI						ICI			FLOWS				SEWER DESIGN							
SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	SURCH.	% FULL	Res Cap L/S
Moore Ave. Subdiv. - North																							
MA (Grav. To EG-N)			52	145	217	4.00		0.00	0.00	0.00	4.00	1.13	4.52	0.23	*4.74*	0.70	545.0	200	27.44	0.87		17.3	22.7
Moore Ave. Subdiv. - South																							
MA (Grav. To TS2)			26	72	72	4.00		0.00	0.00	0.00	4.00	0.38	1.51	0.08	*1.58*	0.40	343.0	200	20.74	0.66		7.6	19.2
Trunk Sewer - 2																							
TS2 (Grav to EG-N)			22	61	3153	3.42		0.00	0.00	0.00	4.00	16.42	56.22	3.28	*59.51*	0.30	315.0	375	96.03	0.87		62.0	36.5
CR5 - East																							
CR5-E (Grav to CM-E)			38	106	106	4.00		0.00	0.00	0.00	4.00	0.55	2.20	0.11	*2.31*	0.30	404.0	250	32.57	0.66		7.1	30.3
Future Parcel 4																							
F4 (Grav to CM-E)			378	1084	1084	3.78		0.00	0.00	0.00	4.00	5.65	21.33	1.13	*22.45*	3.94	660.0	250	118.04	2.40		19.0	95.6
Cumac Subdivision - East																							
CM-E (Grav to EMT)			21	58	1248	3.74		0.00	0.00	0.00	4.00	6.50	24.28	1.30	*25.58*	0.40	468.0	250	37.61	0.77		68.0	12.0
Grohal Subdivision -South																							
GH-S (Grav to CM-W)			22	61	61	4.00		0.00	0.00	0.00	4.00	0.32	1.27	0.06	*1.34*	0.30	254.0	200	17.96	0.57		7.4	16.6
Cumac Subdivision - West																							
CM-W (Grav to EMT)			52	145	206	4.00		0.00	0.00	0.00	4.00	1.07	4.29	0.21	*4.50*	0.30	541.0	200	17.96	0.57		25.1	13.5
Sanitary Easement																							
EMT (Grav to EG-S)			0	0	1454	3.69		0.00	0.00	0.00	4.00	7.57	27.93	1.51	*29.45*	0.30	251.0	250	32.57	0.66		90.4	3.1
Grohal Subdivision - North																							
GH-N (Grav to EG-S)			35	97	97	4.00		0.00	0.00	0.00	4.00	0.51	2.03	0.10	*2.13*	0.40	425.0	200	20.74	0.66		10.3	18.6
Everett Glen Sub. South																							
EG-S (Grav to EG-N)			32	89	1551	3.67		0.00	0.00	0.00	4.00	8.08	29.64	1.62	*31.26*	0.30	477.0	250	32.57	0.66		96.0	1.3
Everett Glen Sub. - North																							
EG-N (Grav to RM - MH1024)		1024	65	181	5101	3.24		0.00	0.00	0.00	4.00	26.57	86.00	5.31	*91.32*	0.30	325.0	450	156.16	0.98		58.5	64.8
Future Parcel 1 - West Trunk																							
F1 (Grav. To RM - MH1072)		1072	934	2681	2681	3.48		0.00	0.00	0.00	4.00	13.96	48.64	2.79	*51.43*	0.55	1700.0	300	71.72	1.01		71.7	20.3

Everett Sanitary Sewer System - OPTION B

Design Data:	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	SURCH.	% FULL	Res Cap L/S
Barzo Subdivision																							
BZ (Grav to RM - MH1001)		1001	473	1357	1357	3.71		0.00	0.00	0.00	4.00	7.07	26.23	1.41	*27.64*	0.30	1200.0	250	32.57	0.66		84.9	4.9
R&M Homes Subdivision																							
Street 'B'	1044	1045	2	6	6	4.00		0.00	0.00	0.00	4.00	0.03	0.12	0.01	*0.12*	1.00	16.1	200	32.80	1.04		0.4	32.7
Street 'B'	1045	1046	16	44	50	4.00		0.00	0.00	0.00	4.00	0.26	1.04	0.05	*1.09*	0.40	107.8	200	20.74	0.66		5.3	19.6
Street 'B'	1071	1046	14	39	39	4.00		0.00				0.20	0.81	0.04	*0.85*	0.40	101.5	200	20.74	0.66		4.1	19.9
Commercial		1063	0	170	170	4.00	1.52	1.52	0.00	0.00	4.00	0.89	3.55	0.18	*3.72*	0.50	49.5	200	23.19	0.74		16.1	19.5
Street 'D'	1046	1047	0	259	259	4.00		0.00	0.00	0.00	4.00	1.35	5.40	0.27	*5.67*	0.40	58.4	200	20.74	0.66		27.3	15.1
Street 'D'	1047	1048	13	36	295	4.00		0.00	0.00	0.00	4.00	1.54	6.15	0.31	*6.46*	0.60	57.1	200	25.41	0.81		25.4	18.9
Street 'D'	1048	1049	15	42	337	4.00		0.00	0.00	0.00	4.00	1.76	7.02	0.35	*7.37*	0.60	98.6	200	25.41	0.81		29.0	18.0
Street 'C'	1040	1041	13	36	36	4.00		0.00	0.00	0.00	4.00	0.19	0.75	0.04	*0.79*	1.00	68.7	200	32.80	1.04		2.4	32.0
Street 'C'	1041	1042	15	42	78	4.00		0.00	0.00	0.00	4.00	0.41	1.62	0.08	*1.70*	0.40	97.6	200	20.74	0.66		8.2	19.0
Street 'C'	1042	1043	1	3	81	4.00		0.00	0.00	0.00	4.00	0.42	1.68	0.08	*1.76*	0.50	13.4	200	23.19	0.74		7.6	21.4
Street 'C'	1043	1049	6	17	97	4.00		0.00	0.00	0.00	4.00	0.51	2.03	0.10	*2.13*	0.50	90.8	200	23.19	0.74		9.2	21.1
Street 'D'	1049	1050	4	11	445	4.00		0.00	0.00	0.00	4.00	2.32	9.28	0.46	*9.74*	0.40	64.5	200	20.74	0.66		47.0	11.0
Street 'D'	1050	1051	5	14	459	3.99		0.00	0.00	0.00	4.00	2.39	9.55	0.48	*10.03*	0.40	70.1	200	20.74	0.66		48.4	10.7
Street 'D'	1051	1052	0	0	459	3.99		0.00	0.00	0.00	4.00	2.39	9.55	0.48	*10.03*	0.40	20.9	200	20.74	0.66		48.4	10.7
Street 'E'	1037	1038	9	25	25	4.00		0.00	0.00	0.00	4.00	0.13	0.52	0.03	*0.55*	0.40	76.5	200	20.74	0.66		2.6	20.2
Street 'E'	1038	1039	3	8	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	26.8	200	20.74	0.66		3.5	20.0
Street 'E'	1039	1052	5	14	47	4.00		0.00	0.00	0.00	4.00	0.25	0.98	0.05	*1.03*	0.40	56.0	200	20.74	0.66		5.0	19.7
Street 'E'	1052	1053	0	507	507	3.97		0.00	0.00	0.00	4.00	2.64	10.48	0.53	*11.01*	0.40	27.0	200	20.74	0.66		53.1	9.7
Street 'E'	1053	1054	1	3	509	3.97		0.00	0.00	0.00	4.00	2.65	10.53	0.53	*11.06*	0.40	68.3	200	20.74	0.66		53.3	9.7
Street 'A'	1072	1071	6	17	2698	3.48		0.00	0.00	0.00	4.00	14.05	48.91	2.81	*51.72*	2.50	84.3	300	152.90	2.16		33.8	101.2
Street 'A'	1071	1070	3	8	2706	3.48		0.00	0.00	0.00	4.00	14.09	49.05	2.82	*51.87*	0.40	60.1	300	61.16	0.87		84.8	9.3
Street 'A'	1070	1069	9	25	2731	3.48		0.00	0.00	0.00	4.00	14.22	49.45	2.84	*52.30*	0.40	69.8	300	61.16	0.87		85.5	8.9
Street 'A'	1069	1068	9	25	2756	3.47		0.00	0.00	0.00	4.00	14.35	49.86	2.87	*52.73*	0.40	81.8	300	61.16	0.87		86.2	8.4
Street 'A'	1068	1067	9	25	2781	3.47		0.00	0.00	0.00	4.00	14.48	50.26	2.90	*53.16*	0.40	85.0	300	61.16	0.87		86.9	8.0
Street 'AA'	1056	1057	8	22	22	4.00		0.00	0.00	0.00	4.00	0.12	0.46	0.02	*0.49*	1.00	68.2	200	32.80	1.04		1.5	32.3
Street 'AA'	1057	1058	5	14	36	4.00		0.00	0.00	0.00	4.00	0.19	0.75	0.04	*0.79*	0.40	73.3	200	20.74	0.66		3.8	20.0
Street 'AA'	1058	1059	8	22	58	4.00		0.00	0.00	0.00	4.00	0.30	1.22	0.06	*1.28*	0.40	80.9	200	20.74	0.66		6.2	19.5
Street 'AA'	1059	1060	3	8	67	4.00		0.00	0.00	0.00	4.00	0.35	1.39	0.07	*1.46*	0.40	49.6	200	20.74	0.66		7.0	19.3
Street 'AA'	1060	1061	2	6	72	4.00		0.00	0.00	0.00	4.00	0.38	1.51	0.08	*1.58*	0.40	42.8	200	20.74	0.66		7.6	19.2
Street 'AA'	1061	1065	2	6	78	4.00		0.00	0.00	0.00	4.00	0.41	1.62	0.08	*1.70*	0.40	37.8	200	20.74	0.66		8.2	19.0

Everett Sanitary Sewer System - OPTION B

Design Data:	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

			NON-ICI						ICI			FLOWS				SEWER DESIGN							
SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	SURCH.	% FULL	Res Cap L/S
Street 'BB'	1062	1063	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.20	65.1	200	35.93	1.14		1.2	35.5
Street 'BB'	1063	1064	9	25	44	4.00		0.00	0.00	0.00	4.00	0.23	0.93	0.05	*0.97*	0.80	84.4	200	29.34	0.93		3.3	28.4
Street 'BB'	1064	1065	1	3	47	4.00		0.00	0.00	0.00	4.00	0.25	0.98	0.05	*1.03*	0.50	55.1	200	23.19	0.74		4.5	22.2
Street 'AA'	1065	1066	4	11	136	4.00		0.00	0.00	0.00	4.00	0.71	2.84	0.14	*2.98*	0.40	41.8	200	20.74	0.66		14.4	17.8
Street 'AA'	1066	1067	5	14	150	4.00		0.00	0.00	0.00	4.00	0.78	3.13	0.16	*3.28*	0.40	82.1	200	20.74	0.66		15.8	17.5
Street 'A'	1067	1055	4	11	2942	3.45		0.00	0.00	0.00	4.00	15.32	52.86	3.06	*55.93*	0.40	72.7	300	61.16	0.87		91.4	5.2
Street 'A'	1055	1054	1	3	2945	3.45		0.00	0.00	0.00	4.00	15.34	52.91	3.07	*55.98*	0.40	35.2	300	61.16	0.87		91.5	5.2
Street 'E'	1035	1036	1	3	3	4.00		0.00	0.00	0.00	4.00	0.01	0.06	0.00	*0.06*	2.00	8.3	200	46.38	1.48		0.1	46.3
Street 'E'	1036	1054	1	3	6	4.00		0.00	0.00	0.00	4.00	0.03	0.12	0.01	*0.12*	2.00	37.2	200	46.38	1.48		0.3	46.3
Street 'A'	1054	1034	4	11	3471	3.39		0.00	0.00	0.00	4.00	18.08	61.25	3.62	*64.86*	0.30	88.2	375	96.03	0.87		67.5	31.2
Street 'A'	1034	1033	6	17	3488	3.39		0.00	0.00	0.00	4.00	18.17	61.51	3.63	*65.14*	0.30	49.2	375	96.03	0.87		67.8	30.9
Street 'F'	1031	1032	14	39	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	1.00	88.9	200	32.80	1.04		2.6	31.9
Street 'F'	1032	1033	0	0	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	0.40	35.1	200	20.74	0.66		4.1	19.9
Street 'A'	1033	1030	4	11	3538	3.38		0.00	0.00	0.00	4.00	18.43	62.29	3.69	*65.98*	0.30	34.2	375	96.03	0.87		68.7	30.1
Street 'A'	1030	1029	5	14	3552	3.38		0.00	0.00	0.00	4.00	18.50	62.51	3.70	*66.21*	0.30	64.4	375	96.03	0.87		68.9	29.8
Street 'G'	1027	1028	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.00	43.1	200	32.80	1.04		1.3	32.4
Street 'G'	1028	1029	8	22	42	4.00		0.00	0.00	0.00	4.00	0.22	0.87	0.04	*0.91*	0.40	96.6	200	20.74	0.66		4.4	19.8
Street 'A'	1029	1026	8	22	3616	3.37		0.00	0.00	0.00	4.00	18.83	63.51	3.77	*67.27*	0.30	75.3	375	96.03	0.87		70.1	28.8
Street 'A'	1026	1025	10	28	3644	3.37		0.00	0.00	0.00	4.00	18.98	63.94	3.80	*67.73*	0.30	88.7	375	96.03	0.87		70.5	28.3
Street 'L'	1024	1025	3	8	5110	3.24		0.00	0.00	0.00	4.00	26.61	86.13	5.32	*91.45*	0.30	92.6	450	156.16	0.98		58.6	64.7
Street 'A'	1025	1023	11	31	8784	3.01		0.00	0.00	0.00	4.00	45.75	137.72	9.15	*146.87*	0.30	93.6	450	156.16	0.98		94.1	9.3
Street 'A'	1023	1022	6	17	8801	3.01		0.00	0.00	0.00	4.00	45.84	137.95	9.17	*147.12*	0.30	47.2	450	156.16	0.98		94.2	9.0
Street 'A'	1022	1021	4	11	8812	3.01		0.00	0.00	0.00	4.00	45.89	138.10	9.18	*147.28*	0.30	51.1	450	156.16	0.98		94.3	8.9
Street 'F'	1008	1009	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.50	45.6	200	40.17	1.28		1.1	39.7
Street 'F'	1009	1010	5	14	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	54.7	200	20.74	0.66		3.5	20.0
Street 'F'	1010	1012	10	28	61	4.00		0.00	0.00	0.00	4.00	0.32	1.27	0.06	*1.34*	0.40	97.8	200	20.74	0.66		6.4	19.4
Street 'H'	1011	1012	10	28	28	4.00		0.00	0.00	0.00	4.00	0.14	0.58	0.03	*0.61*	1.00	60.0	200	32.80	1.04		1.9	32.2
Street 'F'	1012	1016	10	28	117	4.00		0.00	0.00	0.00	4.00	0.61	2.43	0.12	*2.55*	0.40	100.0	200	20.74	0.66		12.3	18.2
Street 'H'	1013	1014	11	31	31	4.00		0.00	0.00	0.00	4.00	0.16	0.64	0.03	*0.67*	1.00	72.2	200	32.80	1.04		2.0	32.1
Street 'H'	1014	1015	3	8	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	0.40	15.5	200	20.74	0.66		4.1	19.9
Street 'H'	1015	1016	5	14	53	4.00		0.00	0.00	0.00	4.00	0.28	1.10	0.06	*1.16*	0.40	59.8	200	20.74	0.66		5.6	19.6

Everett Sanitary Sewer System - OPTION B

Design Data:	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

			NON-ICI						ICI			FLOWS				SEWER DESIGN							
SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	SURCH.	% FULL	Res Cap L/S
Street 'F'	1016	1017	16	44	214	4.00		0.00	0.00	0.00	4.00	1.11	4.46	0.22	*4.68*	0.40	88.8	200	20.74	0.66		22.6	16.1
Street 'F'	1017	1018	4	11	225	4.00		0.00	0.00	0.00	4.00	1.17	4.69	0.23	*4.93*	0.40	18.4	200	20.74	0.66		23.7	15.8
Street 'F'	1018	1019	6	17	242	4.00		0.00	0.00	0.00	4.00	1.26	5.04	0.25	*5.29*	0.40	45.1	200	20.74	0.66		25.5	15.5
Street 'F'	1019	1020	4	11	253	4.00		0.00	0.00	0.00	4.00	1.32	5.27	0.26	*5.53*	0.40	32.6	200	20.74	0.66		26.7	15.2
Street 'F'	1020	1021	2	6	259	4.00		0.00	0.00	0.00	4.00	1.35	5.39	0.27	*5.66*	0.40	69.0	200	20.74	0.66		27.3	15.1
Street 'I'	1003	1004	3	8	8	4.00		0.00	0.00	0.00	4.00	0.04	0.17	0.01	*0.18*	1.00	27.6	200	32.80	1.04		0.6	32.6
Street 'I'	1004	1005	12	33	42	4.00		0.00	0.00	0.00	4.00	0.22	0.87	0.04	*0.91*	0.30	109.9	250	32.57	0.66		2.8	31.7
Street 'A'	1001	1002	1	3	1360	3.71		0.00	0.00	0.00	4.00	7.08	26.27	1.42	*27.69*	1.00	10.0	250	59.47	1.21		46.6	31.8
Street 'A'	1002	1005	2	6	1365	3.71		0.00	0.00	0.00	4.00	7.11	26.37	1.42	*27.80*	0.40	20.3	250	37.61	0.77		73.9	9.8
Street 'A'	1005	1006	3	8	1415	3.70		0.00	0.00	0.00	4.00	7.37	27.26	1.47	*28.73*	0.30	62.1	250	32.57	0.66		88.2	3.8
Street 'A'	1006	1007	3	8	1424	3.70		0.00	0.00	0.00	4.00	7.42	27.41	1.48	*28.89*	0.30	47.6	250	32.57	0.66		88.7	3.7
Street 'A'	1007	1021	1	3	1427	3.70		0.00	0.00	0.00	4.00	7.43	27.45	1.49	*28.94*	0.30	51.5	250	32.57	0.66		88.9	3.6
Street 'J'	1021	1000	5	14	10511	2.93		0.00	0.00	0.00	4.00	54.74	160.57	10.95	*171.52*	0.30	110.0	525	235.55	1.09		72.8	64.0
Street 'J'	1081	1080	1	3	3	4.00		0.00	0.00	0.00	4.00	0.01	0.06	0.00	*0.06*	1.00	10.0	200	32.80	1.04		0.2	32.7
Street 'J'	1080	1079	11	31	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	80.3	200	20.74	0.66		3.5	20.0
Street 'J'	1079	1078	13	36	70	4.00		0.00	0.00	0.00	4.00	0.36	1.45	0.07	*1.52*	0.40	81.8	200	20.74	0.66		7.3	19.2
Street 'J'	1078	1077	12	33	103	4.00		0.00	0.00	0.00	4.00	0.54	2.14	0.11	*2.25*	0.40	89.5	200	20.74	0.66		10.8	18.5
Street 'J'	1077	1076	4	11	114	4.00		0.00	0.00	0.00	4.00	0.59	2.37	0.12	*2.49*	0.40	13.8	200	20.74	0.66		12.0	18.3
Street 'J'	1076	1075	7	19	133	4.00		0.00	0.00	0.00	4.00	0.70	2.78	0.14	*2.92*	0.40	31.0	200	20.74	0.66		14.1	17.8
Street 'J'	1075	1074	3	8	142	4.00		0.00	0.00	0.00	4.00	0.74	2.95	0.15	*3.10*	0.40	14.9	200	20.74	0.66		15.0	17.6
Street 'J'	1074	1073	4	11	153	4.00		0.00	0.00	0.00	4.00	0.80	3.19	0.16	*3.34*	0.40	41.1	200	20.74	0.66		16.1	17.4
Street 'J'	1073	1000	2	6	158	4.00		0.00	0.00	0.00	4.00	0.83	3.30	0.17	*3.47*	0.40	18.1	200	20.74	0.66		16.7	17.3
Street 'J'	1000	PS	0	0	10669	2.93		0.00	0.00	0.00	4.00	55.57	162.63	11.11	***173.74***	1.00	17.5	525	430.06	1.99		40.4	256.3

Everett Sanitary Sewer System - OPTION A

Design Data:	**Areas**	**Infiltration**	**Flows (Colour Coded In Description)**
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

			NON-ICI						ICI				FLOWS				SEWER DESIGN					
SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
New Horizon Subdivision																						
Phase 1	3A	2A	3	8	8	4.00	0.55	0.55	0.00	0.00	4.00	0.04	0.17	0.01	0.18	0.40	49.0	200	20.74	0.66	0.9	20.6
Forcemain Wet Well - PS2	1A	FM	3	8	33	4.00	0.58	2.06	0.00	0.00	4.00	0.17	0.70	0.03	**0.73**	0.48	60.0	200	22.72	0.72	3.2	22.0
New Horizon Subdivision																						
Phase 2	10A	9A	6	17	17	4.00	1.12	1.12	0.00	0.00	4.00	0.09	0.35	0.02	0.36	0.95	73.4	200	31.97	1.02	1.1	31.6
Forcemain - NH (To VZ)	21A	FM	6	17	292	4.00	0.00	12.31	0.00	0.00	4.00	1.52	6.08	0.30	**6.39**	0.40	15.0	200	20.74	0.66	30.8	14.4
Future Parcel 2																						
F2 (Grav. To WN)			393	1127	1127	3.77		0.00	0.00	0.00	4.00	5.87	22.11	1.17	*23.28*	0.70	690.0	200	27.44	0.87	84.8	4.2
Walton Subdivision																						
WN (Pump to VZ)			238	684	1811	3.62		0.00	0.00	0.00	4.00	9.43	34.13	1.89	*36.02*	0.70	690.0	250	49.75	1.01	72.4	13.7
Forcemain					2152																	
Future Parcel 3																						
F3 (Grav to VZ)			119	341	341	4.00		0.00	0.00	0.00	4.00	1.78	7.10	0.36	*7.46*	0.50	530.0	200	23.19	0.74	32.2	15.7
Vanderzaag Subdivision																						
VZ (Grav. To TS1)			16	44	2488	3.51		0.00	0.00	0.00	4.00	12.96	45.49	2.59	*48.08*	0.50	468.0	300	68.38	0.97	70.3	20.3
Blanchard Subdivision																						
BL (Grav. To CR5-W)			33	92	92	4.00		0.00	0.00	0.00	4.00	0.48	1.91	0.10	*2.01*	0.50	850.0	200	23.19	0.74	8.7	21.2
CR5 - West																						
CR5-W (Grav. To MS)			30	83	175	4.00		0.00	0.00	0.00	4.00	0.91	3.65	0.18	*3.83*	0.70	668.0	200	27.44	0.87	14.0	23.6
CR13 - South																						
CR13-S (Grav to MS)			27	75	75	4.00		0.00	0.00	0.00	4.00	0.39	1.56	0.08	*1.64*	0.30	344.0	200	17.96	0.57	9.1	16.3
Main St.																						
MS (Grav. To TS1)			53	147	398	4.00		0.00	0.00	0.00	4.00	2.07	8.28	0.41	*8.70*	0.30	450.0	200	17.96	0.57	48.4	9.3
Trunk Sewer - 1																						
TS1 (Grav to TS2)			16	44	2930	3.45		0.00	0.00	0.00	4.00	15.26	52.67	3.05	*55.72*	0.30	345.0	375	96.03	0.87	58.0	40.3
CR13 - North																						
CR13-N(Grav to MA)			16	44	44	4.00		0.00	0.00	0.00	4.00	0.23	0.93	0.05	*0.97*	0.40	371.0	200	20.74	0.66	4.7	19.8
CR13 - Central																						

Everett Sanitary Sewer System - OPTION A

Design Data:	**Areas**	**Infiltration**	**Flows (Colour Coded In Description)**
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	FLOWS PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
CR13-C(Grav to MA)			10	28	28	4.00		0.00	0.00	0.00	4.00	0.14	0.58	0.03	*0.61*	0.40	108.0	200	20.74	0.66	2.9	20.1
Moore Ave. Subdiv. - North																						
MA (Grav. To EG-N)			52	145	217	4.00		0.00	0.00	0.00	4.00	1.13	4.52	0.23	*4.74*	0.70	545.0	200	27.44	0.87	17.3	22.7
Moore Ave. Subdiv. - South																						
MA (Grav. To TS2)			26	72	72	4.00		0.00	0.00	0.00	4.00	0.38	1.51	0.08	*1.58*	0.40	343.0	200	20.74	0.66	7.6	19.2
Trunk Sewer - 2																						
TS2 (Grav to EG-N)			22	61	3064	3.43		0.00	0.00	0.00	4.00	15.96	54.81	3.19	*58.00*	0.30	315.0	375	96.03	0.87	60.4	38.0
CR5 - East																						
CR5-E (Grav to CM-E)			38	106	106	4.00		0.00	0.00	0.00	4.00	0.55	2.20	0.11	*2.31*	0.30	404.0	200	17.96	0.57	12.9	15.7
Future Parcel 4																						
F4 (Grav to CM-E)			378	1084	1084	3.78		0.00	0.00	0.00	4.00	5.65	21.33	1.13	*22.45*	3.94	660.0	200	65.10	2.07	34.5	42.6
Cumac Subdivision - East																						
CM-E (Grav to PS)			21	58	1248	3.74		0.00	0.00	0.00	4.00	6.50	24.28	1.30	*25.58*	0.40	468.0	250	37.61	0.77	68.0	12.0
													PS Capacity		30.08							
Grohal Subdivision -South																						
GH-S (Grav to CM-W)			22	61	61	4.00		0.00	0.00	0.00	4.00	0.32	1.27	0.06	*1.34*	0.30	254.0	200	17.96	0.57	7.4	16.6
Cumac Subdivision - West																						
CM-W (Grav to PS)			52	145	206	4.00		0.00	0.00	0.00	4.00	1.07	4.29	0.21	*4.50*	0.30	541.0	200	17.96	0.57	25.1	13.5
Grohal Subdivision - North																						
GH-N (Grav to EG-S)			35	97	97	4.00		0.00	0.00	0.00	4.00	0.51	2.03	0.10	*2.13*	0.28	425.0	200	17.36	0.55	12.3	15.2
Everett Glen Sub. South																						
EG-S (Grav to EG-N)			32	89	186	4.00		0.00	0.00	0.00	4.00	0.97	3.88	0.19	*4.07*	0.22	477.0	200	15.38	0.49	26.5	11.3
Everett Glen Sub. - North																						
EG-N (Grav to RM - MH1024)		1024	65	181	5101	3.24		0.00	0.00	0.00	4.00	26.57	86.00	5.31	*91.32*	0.30	325.0	450	156.16	0.98	58.5	64.8
Future Parcel 1 - West Trunk																						
F1 (Grav. To RM - MH1072)		1072	934	2681	2681	3.48		0.00	0.00	0.00	4.00	13.96	48.64	2.79	*51.43*	0.55	1700.0	300	71.72	1.01	71.7	20.3

Everett Sanitary Sewer System - OPTION A

Design Data:

Areas	Infiltration	Flows (Colour Coded In Description)
L/c/d	L/c/d	Industrial cum/ha
450.0	90.0	55.00
	Infiltration L/s/ha	Commercial cum/ha
	0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
Barzo Subdivision																						
BZ (Grav to RM - MH1001)		1001	473	1357	1357	3.71		0.00	0.00	0.00	4.00	7.07	26.23	1.41	*27.64*	0.30	1200.0	250	32.57	0.66	84.9	4.9
R&M Homes Subdivision																						
Street 'B'	1044	1045	2	6	6	4.00		0.00	0.00	0.00	4.00	0.03	0.12	0.01	*0.12*	1.00	16.1	200	32.80	1.04	0.4	32.7
Street 'B'	1045	1046	16	44	50	4.00		0.00	0.00	0.00	4.00	0.26	1.04	0.05	*1.09*	0.40	107.8	200	20.74	0.66	5.3	19.6
Street 'B'	1071	1046	14	39	39	4.00		0.00				0.20	0.81	0.04	*0.85*	0.40	101.5	200	20.74	0.66	4.1	19.9
Commercial		1063	0	170	170	4.00	1.52	1.52	0.00	0.00	4.00	0.89	3.55	0.18	*3.72*	0.50	49.5	200	23.19	0.74	16.1	19.5
Street 'D'	1046	1047	0	259	259	4.00		0.00	0.00	0.00	4.00	1.35	5.40	0.27	*5.67*	0.40	58.4	200	20.74	0.66	27.3	15.1
Street 'D'	1047	1048	13	36	295	4.00		0.00	0.00	0.00	4.00	1.54	6.15	0.31	*6.46*	0.60	57.1	200	25.41	0.81	25.4	18.9
Street 'D'	1048	1049	15	42	337	4.00		0.00	0.00	0.00	4.00	1.76	7.02	0.35	*7.37*	0.60	98.6	200	25.41	0.81	29.0	18.0
Street 'C'	1040	1041	13	36	36	4.00		0.00	0.00	0.00	4.00	0.19	0.75	0.04	*0.79*	1.00	68.7	200	32.80	1.04	2.4	32.0
Street 'C'	1041	1042	15	42	78	4.00		0.00	0.00	0.00	4.00	0.41	1.62	0.08	*1.70*	0.40	97.6	200	20.74	0.66	8.2	19.0
Street 'C'	1042	1043	1	3	81	4.00		0.00	0.00	0.00	4.00	0.42	1.68	0.08	*1.76*	0.50	13.4	200	23.19	0.74	7.6	21.4
Street 'C'	1043	1049	6	17	97	4.00		0.00	0.00	0.00	4.00	0.51	2.03	0.10	*2.13*	0.50	90.8	200	23.19	0.74	9.2	21.1
Street 'D'	1049	1050	4	11	445	4.00		0.00	0.00	0.00	4.00	2.32	9.28	0.46	*9.74*	0.40	64.5	200	20.74	0.66	47.0	11.0
Street 'D'	1050	1051	5	14	459	3.99		0.00	0.00	0.00	4.00	2.39	9.55	0.48	*10.03*	0.40	70.1	200	20.74	0.66	48.4	10.7
Street 'D'	1051	1052	0	0	459	3.99		0.00	0.00	0.00	4.00	2.39	9.55	0.48	*10.03*	0.40	20.9	200	20.74	0.66	48.4	10.7
Street 'E'	1037	1038	9	25	25	4.00		0.00	0.00	0.00	4.00	0.13	0.52	0.03	*0.55*	0.40	76.5	200	20.74	0.66	2.6	20.2
Street 'E'	1038	1039	3	8	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	26.8	200	20.74	0.66	3.5	20.0
Street 'E'	1039	1052	5	14	47	4.00		0.00	0.00	0.00	4.00	0.25	0.98	0.05	*1.03*	0.40	56.0	200	20.74	0.66	5.0	19.7
Street 'E'	1052	1053	0	507	507	3.97		0.00	0.00	0.00	4.00	2.64	10.48	0.53	*11.01*	0.40	27.0	200	20.74	0.66	53.1	9.7
Street 'E'	1053	1054	1	3	509	3.97		0.00	0.00	0.00	4.00	2.65	10.53	0.53	*11.06*	0.40	68.3	200	20.74	0.66	53.3	9.7
Street 'A'	1072	1071	6	17	2698	3.48		0.00	0.00	0.00	4.00	14.05	48.91	2.81	*51.72*	2.50	84.3	300	152.90	2.16	33.8	101.2
Street 'A'	1071	1070	3	8	2706	3.48		0.00	0.00	0.00	4.00	14.09	49.05	2.82	*51.87*	0.40	60.1	300	61.16	0.87	84.8	9.3
Street 'A'	1070	1069	9	25	2731	3.48		0.00	0.00	0.00	4.00	14.22	49.45	2.84	*52.30*	0.40	69.8	300	61.16	0.87	85.5	8.9
Street 'A'	1069	1068	9	25	2756	3.47		0.00	0.00	0.00	4.00	14.35	49.86	2.87	*52.73*	0.40	81.8	300	61.16	0.87	86.2	8.4
Street 'A'	1068	1067	9	25	2781	3.47		0.00	0.00	0.00	4.00	14.48	50.26	2.90	*53.16*	0.40	85.0	300	61.16	0.87	86.9	8.0
Street 'AA'	1056	1057	8	22	22	4.00		0.00	0.00	0.00	4.00	0.12	0.46	0.02	*0.49*	1.00	68.2	200	32.80	1.04	1.5	32.3
Street 'AA'	1057	1058	5	14	36	4.00		0.00	0.00	0.00	4.00	0.19	0.75	0.04	*0.79*	0.40	73.3	200	20.74	0.66	3.8	20.0
Street 'AA'	1058	1059	8	22	58	4.00		0.00	0.00	0.00	4.00	0.30	1.22	0.06	*1.28*	0.40	80.9	200	20.74	0.66	6.2	19.5
Street 'AA'	1059	1060	3	8	67	4.00		0.00	0.00	0.00	4.00	0.35	1.39	0.07	*1.46*	0.40	49.6	200	20.74	0.66	7.0	19.3
Street 'AA'	1060	1061	2	6	72	4.00		0.00	0.00	0.00	4.00	0.38	1.51	0.08	*1.58*	0.40	42.8	200	20.74	0.66	7.6	19.2

Everett Sanitary Sewer System - OPTION A

Design Data:

Areas	**Infiltration**	**Flows (Colour Coded In Description)**
L/c/d	L/c/d	Industrial cum/ha
450.0	90.0	55.00
	Infiltration L/s/ha	Commercial cum/ha
	0.21	28.00

SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	NON-ICI Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	FLOWS AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	SEWER DESIGN PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
Street 'AA'	1061	1065	2	6	78	4.00		0.00	0.00	0.00	4.00	0.41	1.62	0.08	*1.70*	0.40	37.8	200	20.74	0.66	8.2	19.0
Street 'BB'	1062	1063	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.20	65.1	200	35.93	1.14	1.2	35.5
Street 'BB'	1063	1064	9	25	44	4.00		0.00	0.00	0.00	4.00	0.23	0.93	0.05	*0.97*	0.80	84.4	200	29.34	0.93	3.3	28.4
Street 'BB'	1064	1065	1	3	47	4.00		0.00	0.00	0.00	4.00	0.25	0.98	0.05	*1.03*	0.50	55.1	200	23.19	0.74	4.5	22.2
Street 'AA'	1065	1066	4	11	136	4.00		0.00	0.00	0.00	4.00	0.71	2.84	0.14	*2.98*	0.40	41.8	200	20.74	0.66	14.4	17.8
Street 'AA'	1066	1067	5	14	150	4.00		0.00	0.00	0.00	4.00	0.78	3.13	0.16	*3.28*	0.40	82.1	200	20.74	0.66	15.8	17.5
Street 'A'	1067	1055	4	11	2942	3.45		0.00	0.00	0.00	4.00	15.32	52.86	3.06	*55.93*	0.40	72.7	300	61.16	0.87	91.4	5.2
Street 'A'	1055	1054	1	3	2945	3.45		0.00	0.00	0.00	4.00	15.34	52.91	3.07	*55.98*	0.40	35.2	300	61.16	0.87	91.5	5.2
Street 'E'	1035	1036	1	3	3	4.00		0.00	0.00	0.00	4.00	0.01	0.06	0.00	*0.06*	2.00	8.3	200	46.38	1.48	0.1	46.3
Street 'E'	1036	1054	1	3	6	4.00		0.00	0.00	0.00	4.00	0.03	0.12	0.01	*0.12*	2.00	37.2	200	46.38	1.48	0.3	46.3
Street 'A'	1054	1034	4	11	3471	3.39		0.00	0.00	0.00	4.00	18.08	61.25	3.62	*64.86*	0.30	88.2	375	96.03	0.87	67.5	31.2
Street 'A'	1034	1033	6	17	3488	3.39		0.00	0.00	0.00	4.00	18.17	61.51	3.63	*65.14*	0.30	49.2	375	96.03	0.87	67.8	30.9
Street 'F'	1031	1032	14	39	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	1.00	88.9	200	32.80	1.04	2.6	31.9
Street 'F'	1032	1033	0	0	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	0.40	35.1	200	20.74	0.66	4.1	19.9
Street 'A'	1033	1030	4	11	3538	3.38		0.00	0.00	0.00	4.00	18.43	62.29	3.69	*65.98*	0.30	34.2	375	96.03	0.87	68.7	30.1
Street 'A'	1030	1029	5	14	3552	3.38		0.00	0.00	0.00	4.00	18.50	62.51	3.70	*66.21*	0.30	64.4	375	96.03	0.87	68.9	29.8
Street 'G'	1027	1028	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.00	43.1	200	32.80	1.04	1.3	32.4
Street 'G'	1028	1029	8	22	42	4.00		0.00	0.00	0.00	4.00	0.22	0.87	0.04	*0.91*	0.40	96.6	200	20.74	0.66	4.4	19.8
Street 'A'	1029	1026	8	22	3616	3.37		0.00	0.00	0.00	4.00	18.83	63.51	3.77	*67.27*	0.30	75.3	375	96.03	0.87	70.1	28.8
Street 'A'	1026	1025	10	28	3644	3.37		0.00	0.00	0.00	4.00	18.98	63.94	3.80	*67.73*	0.30	88.7	375	96.03	0.87	70.5	28.3
Street 'L'	1024	1025	3	8	5110	3.24		0.00	0.00	0.00	4.00	26.61	86.13	5.32	*91.45*	0.30	92.6	450	156.16	0.98	58.6	64.7
Street 'A'	1025	1023	11	31	8784	3.01		0.00	0.00	0.00	4.00	45.75	137.72	9.15	*146.87*	0.30	93.6	450	156.16	0.98	94.1	9.3
Street 'A'	1023	1022	6	17	8801	3.01		0.00	0.00	0.00	4.00	45.84	137.95	9.17	*147.12*	0.30	47.2	450	156.16	0.98	94.2	9.0
Street 'A'	1022	1021	4	11	8812	3.01		0.00	0.00	0.00	4.00	45.89	138.10	9.18	*147.28*	0.30	51.1	450	156.16	0.98	94.3	8.9
Street 'F'	1008	1009	7	19	19	4.00		0.00	0.00	0.00	4.00	0.10	0.41	0.02	*0.43*	1.50	45.6	200	40.17	1.28	1.1	39.7
Street 'F'	1009	1010	5	14	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	54.7	200	20.74	0.66	3.5	20.0
Street 'F'	1010	1012	10	28	61	4.00		0.00	0.00	0.00	4.00	0.32	1.27	0.06	*1.34*	0.40	97.8	200	20.74	0.66	6.4	19.4
Street 'H'	1011	1012	10	28	28	4.00		0.00	0.00	0.00	4.00	0.14	0.58	0.03	*0.61*	1.00	60.0	200	32.80	1.04	1.9	32.2
Street 'F'	1012	1016	10	28	117	4.00		0.00	0.00	0.00	4.00	0.61	2.43	0.12	*2.55*	0.40	100.0	200	20.74	0.66	12.3	18.2

Everett Sanitary Sewer System - OPTION A

Design Data:

	Areas	Infiltration	Flows (Colour Coded In Description)
	L/c/d	L/c/d	Industrial cum/ha
	450.0	90.0	55.00
		Infiltration L/s/ha	Commercial cum/ha
		0.21	28.00

			NON-ICI						ICI			FLOWS				SEWER DESIGN						
SEWER LENGTH DESCRIPTION	U/S MH (FROM)	D/S MH (TO)	Res. Units	Eq. POP	Eq. ACC POP	HARMON PEAKING FACTOR	AREA HA	ACC N-ICI Ha	ICI AREA Ha	ACC ICI Ha	ICI PEAKING FACTOR	AVG FLOW L/S	PEAK FLOW L/S	INFILT. L/S	PEAK FLOW L/S	PIPE SLOPE %	PIPE LENGTH m	PIPE DIA mm	Q FULL L/S	FULL FLOW V M/S	% FULL	Res Cap L/S
Street 'H'	1013	1014	11	31	31	4.00		0.00	0.00	0.00	4.00	0.16	0.64	0.03	*0.67*	1.00	72.2	200	32.80	1.04	2.0	32.1
Street 'H'	1014	1015	3	8	39	4.00		0.00	0.00	0.00	4.00	0.20	0.81	0.04	*0.85*	0.40	15.5	200	20.74	0.66	4.1	19.9
Street 'H'	1015	1016	5	14	53	4.00		0.00	0.00	0.00	4.00	0.28	1.10	0.06	*1.16*	0.40	59.8	200	20.74	0.66	5.6	19.6
Street 'F'	1016	1017	16	44	214	4.00		0.00	0.00	0.00	4.00	1.11	4.46	0.22	*4.68*	0.40	88.8	200	20.74	0.66	22.6	16.1
Street 'F'	1017	1018	4	11	225	4.00		0.00	0.00	0.00	4.00	1.17	4.69	0.23	*4.93*	0.40	18.4	200	20.74	0.66	23.7	15.8
Street 'F'	1018	1019	6	17	242	4.00		0.00	0.00	0.00	4.00	1.26	5.04	0.25	*5.29*	0.40	45.1	200	20.74	0.66	25.5	15.5
Street 'F'	1019	1020	4	11	253	4.00		0.00	0.00	0.00	4.00	1.32	5.27	0.26	*5.53*	0.40	32.6	200	20.74	0.66	26.7	15.2
Street 'F'	1020	1021	2	6	259	4.00		0.00	0.00	0.00	4.00	1.35	5.39	0.27	*5.66*	0.40	69.0	200	20.74	0.66	27.3	15.1
Street 'I'	1003	1004	3	8	8	4.00		0.00	0.00	0.00	4.00	0.04	0.17	0.01	*0.18*	1.00	27.6	200	32.80	1.04	0.6	32.6
Street 'I'	1004	1005	12	33	42	4.00		0.00	0.00	0.00	4.00	0.22	0.87	0.04	*0.91*	0.30	109.9	250	32.57	0.66	2.8	31.7
Street 'A'	1001	1002	1	3	1360	3.71		0.00	0.00	0.00	4.00	7.08	26.27	1.42	*27.69*	1.00	10.0	250	59.47	1.21	46.6	31.8
Street 'A'	1002	1005	2	6	1365	3.71		0.00	0.00	0.00	4.00	7.11	26.37	1.42	*27.80*	0.40	20.3	250	37.61	0.77	73.9	9.8
Street 'A'	1005	1006	3	8	1415	3.70		0.00	0.00	0.00	4.00	7.37	27.26	1.47	*28.73*	0.30	62.1	250	32.57	0.66	88.2	3.8
Street 'A'	1006	1007	3	8	1424	3.70		0.00	0.00	0.00	4.00	7.42	27.41	1.48	*28.89*	0.30	47.6	250	32.57	0.66	88.7	3.7
Street 'A'	1007	1021	1	3	1427	3.70		0.00	0.00	0.00	4.00	7.43	27.45	1.49	*28.94*	0.30	51.5	250	32.57	0.66	88.9	3.6
Street 'J'	1021	1000	5	14	10511	2.93		0.00	0.00	0.00	4.00	54.74	160.57	10.95	*171.52*	0.30	110.0	525	235.55	1.09	72.8	64.0
Street 'J'	1081	1080	1	3	3	4.00		0.00	0.00	0.00	4.00	0.01	0.06	0.00	*0.06*	1.00	10.0	200	32.80	1.04	0.2	32.7
Street 'J'	1080	1079	11	31	33	4.00		0.00	0.00	0.00	4.00	0.17	0.70	0.03	*0.73*	0.40	80.3	200	20.74	0.66	3.5	20.0
Street 'J'	1079	1078	13	36	70	4.00		0.00	0.00	0.00	4.00	0.36	1.45	0.07	*1.52*	0.40	81.8	200	20.74	0.66	7.3	19.2
Street 'J'	1078	1077	12	33	103	4.00		0.00	0.00	0.00	4.00	0.54	2.14	0.11	*2.25*	0.40	89.5	200	20.74	0.66	10.8	18.5
Street 'J'	1077	1076	4	11	114	4.00		0.00	0.00	0.00	4.00	0.59	2.37	0.12	*2.49*	0.40	13.8	200	20.74	0.66	12.0	18.3
Street 'J'	1076	1075	7	19	133	4.00		0.00	0.00	0.00	4.00	0.70	2.78	0.14	*2.92*	0.40	31.0	200	20.74	0.66	14.1	17.8
Street 'J'	1075	1074	3	8	142	4.00		0.00	0.00	0.00	4.00	0.74	2.95	0.15	*3.10*	0.40	14.9	200	20.74	0.66	15.0	17.6
Street 'J'	1074	1073	4	11	153	4.00		0.00	0.00	0.00	4.00	0.80	3.19	0.16	*3.34*	0.40	41.1	200	20.74	0.66	16.1	17.4
Street 'J'	1073	1000	2	6	158	4.00		0.00	0.00	0.00	4.00	0.83	3.30	0.17	*3.47*	0.40	18.1	200	20.74	0.66	16.7	17.3
Street 'J'	1000	PS	0	0	10669	2.93		0.00	0.00	0.00	4.00	55.57	162.63	11.11	***173.74***	1.00	17.5	525	430.06	1.99	40.4	256.3