FUNCTIONAL SERVICING,
PRELIMINARY STORMWATER MANAGEMENT REPORT

SARAH PROPERTIES LTD.

WALDEMAR COMMUNITY
TOWNSHIP OF AMARANTH

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
2800 HIGH POINT DRIVE, SUITE 100
MILTON, ON L9T 6P4

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CROZIER
&ASSOCIATES
Consulting Engineers

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1.0 INTRODUCTION

C.F. Crozier & Associates Inc. (Crozier) was retained by Sarah Properties Ltd. to prepare technical analysis and engineering reports in support of an Official Plan Amendment, Zoning By-law Amendment and Plan of Subdivision application for a proposed residential development in the Community of Waldemar.

This report has been prepared to provide functional servicing design for water, sanitary and preliminary stormwater management for this site and incorporates comments and strategies discussed from the pre-consultation meeting at the Township office on November 14, 2013.

2.0 SITE DESCRIPTION

The properties are described as part of Lots 2 and 3, Concession 10, Township of Amaranth, County of Dufferin and covers an area of 35.02 Ha in the Community of Waldemar. The properties are bounded by active farmlands to the west and south, an abandoned railway corridor to the north and the existing Acchione residential subdivision to the east. Refer to Figure 1 for the Site Location Plan.

The development consists of properties that are currently designated "Rural" and "Hamlet Residential" in the Township of Amaranth Official Plan. The subject lands are presently vacant and used for agricultural purposes or fallow.

The site features a range in topography with flat and gently rolling high ground along the west property line to gradients of approximately 10% and 6% in the northern and southern portions of the property, respectively. The site generally slopes to the north east.

The site includes an existing stormwater drainage facility backing on to the existing houses along the north side of James Street. An existing drainage outlet conveys the flows from the site and external lands, through the existing Acchione subdivision to the Grand River. A development application in the past proposed this drainage facility as part of a future residential subdivision, however the development did not materialize and resulted in the land for the block being deeded to the Township. Besides the existing drainage Block, another adjacent land parcel owned by the Township houses an abandoned well and pump station at the end of James Street in the Acchione Subdivision.

The properties that make up the site limits are being consolidated by Sarah Properties Ltd. under one application for a planning amendment to accommodate a residential subdivision. The Plan of Subdivision application for the proposed development are to be subdivided for single detached houses, local roads, a public park, SWM block and a sewage treatment plant block. The site covers a total site area of 35.02ha (86.54 ac). For the planning application, the properties within the Site will be developed into a proposed 334 unit subdivision. Refer to the Draft Plan of Subdivision prepared by Stanford Consulting & Design Ltd., shown as Figure 2.

2.1 Reference Information

A ground topographic survey was undertaken by Van Harten Surveying in November 2013. Supplementary surveys were completed in May 2014 and November 2014 for the site as well as external areas such as Main Street and Henry Street to facilitate the analysis of external drainage conveyance options to the Grand

River. Further topographic information for adjacent and surrounding properties were derived from Ontario Base Mapping.

In addition, field reconnaissance was completed by CFCA staff to review surveyed information pertaining to existing drainage patterns, stormwater, and servicing the community.

Prior to commencing our work plan, a pre consultation meeting was held with the Township on November 14, 2013. The meeting addressed the required scope of the technical analysis to be undertaken of the existing services within the community and servicing strategy options for the proposed development. From that meeting, and from a letter addressed to Sarah Properties Ltd. from the Town's representative planner, Wellings Planning Consultants Inc. dated October 3, 2013, a list of technical studies required to support the development was prepared. As a result, presented herein is a discussion of the functional servicing, preliminary stormwater management design to support the planning approval strategy and process.

In the absence of Township of Amaranth Engineering Design Standards, we used comparable excerpts from local or relevant municipalities such as the Town of Grand Valley, Town of Caledon, MTO, etc.

3.0 ROAD STANDARD

Access to the subdivision will be through multiple connections to municipal streets; these include access from John Street, James Street, Evans Avenue and through Main Street.

The primary access will be the connection of Street 1 with John Street, while secondary connections will be through James Street, Evans Avenue and Main Street. This will include the re-construction of Main Street south beyond David Street to Evans Street to an urban standard per the 20m Grand Valley ROW standard. Further north, Main Street will be re-instated to existing conditions (rural road standard) with an asphalt road surface and ditch system to match existing grades after the installation of a trunk storm sewer between Street 7 and Henry Street. Refer to Section 5.2.2 for further discussion.

The Draft Plan has proposed several internal roads to facilitate traffic flow and access to the various development blocks. These roadways will be public and assumed by the municipality. These road allowances will be 20.0m wide with an urban cross section per the Road standards of the Town of Grand Valley, consisting of curb and gutter, 8.0m of asphalt road surface, sidewalks and landscaped boulevards.

All roadways will be constructed as per municipal standards and the recommendations of the geotechnical reports completed for the development.

4.0 EXISTING DRAINAGE CONDITIONS

The existing site conditions that affect drainage are outlined in the following sections, providing an overview of the land uses, watershed, local drainage context and surface drainage regimes.

4.1 Watershed Context

The Site is located to the west of the Grand River and within the Grand River Conservation Authority jurisdiction. The lands east of the site on either side of the river have been semi-urbanized over the years with the existing community of Waldemar. We reviewed air photos, topographic data and conducted a site walk to review existing internal and external drainage patterns and infrastructure within the neighbouring subdivision.

4.2 Drainage Pattern

The site naturally drains towards the Grand River with a drainage divide located to the west of the site area. Therefore, the subject lands receive external drainage from approximately 22.0 Ha of the farm lands to the west of the site. The site itself is currently vacant, flows from approximately 24.8 Ha of the site and 22.0 Ha of external areas drain towards the existing stormwater drainage feature and outlets to the existing subdivision via a 600mm CSP behind Lot 11 on James Street. This drainage is then conveyed through the existing subdivision and ultimately to the Grand River. Approximately 10 Ha of the north end of the site drains towards the existing ditch along the abandoned railway corridor (Upper Grand Trailway). This ditch in the north ultimately converges to the Henry Street ditch/sewer system before discharging through the existing 1200mm CSP culvert to the Grand River. Refer to Figure 3 for the Existing Drainage Plan.

4.3 Soil Conditions

The underlying soil conditions were determined using the Soil Survey of Dufferin County (1963). The soils were found to be Huron Loam, Soil Group B, which are described as having good drainage and a relatively low runoff potential. A geotechnical investigation was also undertaken by Terraprobe to confirm the subsurface conditions within the site limits. Refer to Appendix A for information from the Soil Survey of Dufferin County.

4.4 Existing Storm Infrastructure

The existing Acchione subdivision in Waldemar is serviced with a combination of storm sewers and open ditch drainage that convey the flows through the subdivision. A 600mm CSP behind Lot 11 connects to an 800 mm CSP and flows east through a 10 m easement along the property line of Lots 22 and 23 down to Main Street. This sewer connects to a 1200mm CSP flowing north along Main Street into a 1200mm CSP along Henry Street out to the River. This servicing information for the existing subdivision was referenced from the as-constructed drawing prepared for Acchione Construction Company Ltd. dated, January 1986 provided by the Township Engineering Consultant (R.J. Burnside and Associates).

To our knowledge, there are no storm water quality controls within the existing Acchione Subdivision. Further, the drainage from the subject lands and the existing Acchione Subdivision is not subject to quantity controls, and thus any infrastructure appears to be sized for conveyance capacity only.

5.0 STORMWATER MANAGEMENT

The proposed drainage conditions for the Site are outlined in the following sections, providing an overview of the site layout, required infrastructure, minor and major flow routes, stormwater management objectives and proposed controls.

5.1 Stormwater Management Criteria & Objectives

The site is located within close proximity to the Grand River. Per consultation with the Grand River Conservation Authority (GRCA) and Township staff, the following stormwater management criteria are applied to the subject development.

- Water Quantity Control: Given the close proximity to the Grand River, water quantity controls are not required provided that the minor (10-year storm event) and major storm flows can be safely conveyed to the river without adverse flooding impacts to existing storm infrastructure and private property, including within the existing Acchione Subdivision.
- Water Quality Control: Level 1 ('enhanced protection') given Grand River as the ultimate receiver.
- Minor Storm System: minor storm system to be sized to convey the 10-year event.
- External Drainage Management: The proposed stormwater management design to accommodate flows generated from external drainage areas.

5.1.1 Storm Criteria

The Rational method is used to determine design flows for the storm sewer design for the entire contributing area. The intensity-duration frequency (IDF) curves were derived from the rainfall data taken from the Ministry of Transportation Ontario (MTO) IDF data for Waldemar area.

The SCS II 24-hr storm distribution was used in a SWMHYMO hydrologic model to analyze the major flows pre-development and post-development. The Rational method was used for the minor flows for storm sewer design, since the site is subject to quality control only. Runoff Coefficients for the pre-development area were selected based on Curve Numbers assuming a Hydrological Soil Group C. Runoff Coefficients for the post-development area were based on standard single-family suburban runoff coefficients as per Town of Caledon engineering standards. Details on the proposed stormwater management are provided below in section 5.2. See Appendix B for IDF and further hydrological information.

5.2 Proposed Stormwater Management Controls

5.2.1 Proposed Drainage Conditions

It is proposed to outlet the site runoff to two locations, Main Street and the Upper Grand Trailway. The catchment area discharging to Main Street is 53.3 ha including 22.0 ha of external drainage (Outlet 1), herein referred to as the Main Street Catchment, while the catchment area discharging to the Upper Grand Trailway is 12.1 ha (Outlet 2), herein referred to as the Upper Grand Trailway Catchment. Site drainage to the existing outlet behind Lot 11 has been eliminated and will be diverted into the new system.

Outlet 1 – Main Street Catchment

The proposed storm sewer network for this catchment area will include pipes sized to convey the 10-year storm internal to the site as well as the 100-year storm from the EXT-1 Drainage area and the 10-year storm from the EXT-2 Drainage area, with a standard Manning's coefficient of 0.013. The sewer system outlets to an end of pipe quality control SWM facility; refer to Section 5.2.3 for further discussion. The 100 year flows from the subject development and EXT-2 Drainage area will flow overland within the 20.0m Urban Road section. The minor system flows from this catchment area including external flows is 4.2 m^3/s and the major flows (100-year) are 9.9 m^3/s. Refer to the Storm Sewer Design Sheet for minor flows, storm sewer sizing details and the SWMHYMO output for the major flows provided in Appendix B and D respectively.

Outlet 2 – Upper Grand Trailway Catchment

The proposed storm sewer network for this catchment area will include pipes sized to convey the 10-year storm internal to the site with a standard Manning's coefficient of 0.013. The sewer system outlets to an end of pipe quality control SWM facility; refer to Section 5.2.3 for further discussion. The 100 year flows from the catchment area will flow overland within the 20.0m Urban Road section through Block 287 into the Upper Grand Trailway ditch. The minor system flows from this catchment area including external flows is 1.3 m^3/s and the major flows are 3.1 m^3/s. Refer to the Storm Sewer Design Sheet for minor flows, storm sewer sizing details and the SWMHYMO output for the major flows provided in Appendix B and D respectively.

5.2.2 Conveyance of flows to the Grand River

As noted earlier, this area of Waldemar is currently vacant undeveloped land and the neighbouring subdivision is serviced with a storm sewer network through to the Grand River. The proposed development receives external flows from 22.0 Ha of the lands to the west of the site through two inlet locations. However, the existing Acchione subdivision drainage network has only been sized to accommodate the existing flows from the external lands in its undeveloped condition and convey these flows to Grand River.

In order to convey the proposed flows from the subject development to the Grand River and to determine the preferred on-site Stormwater Management, and external conveyance method, three options were examined.

Option 1 – Discharge site drainage to existing outlet

Considering the magnitude of the resulting uncontrolled flows from this development, early in our design phase, the site was modelled in SWMHYMO based on the 24-hr SCS Type II storm and storage requirements were evaluated for post-development to pre-development controls up to the Regional event. Controlling post-development runoff for quantity storage would require a SWM pond. This pond would allow for the use of the existing storm sewer network and outlet to the River and could be sized to meet water quality control requirements.

However, based on the post-development to pre-development controls, this design strategy resulted in a large pond footprint (Block size approximately 2.5 ha). Considering the site gradient changes, this SWM block would have to be especially deep and large to account for grading constraints, as well to maximize serviceable area. Further, we did not believe it to be good practice to rely on the existing 1200mm diameter CSP as the permanent outlet from the new development.

Option 2 – Quality Pond and external conveyance system improvements

As a second option sizing the same pond for quality control only as per Ministry of Environment (MOE) Guidelines for "Enhanced" level protection and erosion control was considered. This resulted in a smaller pond footprint, however, the large uncontrolled flows would require new infrastructure installed to convey these flows to the Grand River. Therefore, this analysis was coupled with exploring new routing options of the flows (in pipe and overland) to the Grand River. This involved modeling conveyance capacities of the existing streets that formed a route to the river.

Option 3 – Oil/Grit Separator units and external conveyance system improvements (Preferred)

This iteration involved the option of installing two Oil/Grit Separator (OGS) units to replace the quality pond noted in Option 2. This option provides the same level of controls as per standard MOE requirements and would result in a lower maintenance cost to the Township. This option would also require new infrastructure installed to convey the proposed flows to the Grand River.

External Conveyance System Improvements

After considering various routing options through David Street, Mill Street and Main Street, it was concluded that the most appropriate outlet for the Main Street Catchment to follow the alignment of the existing storm sewer infrastructure along Main Street to the Grand River. It is proposed to convey the minor storm flows (10-year) from the Main Street Catchment as well as EXT-3 and EXT-4 catchments (Acchione Subdivision) via a proposed trunk storm sewer system to the Henry Street ditch. Refer to the Proposed Storm Servicing Plan Figure (Figure 5) as well as Appendix D for the storm sewer design sheets.

The existing 1200mm CSP along Main Street, will be replaced with a 1500mm sewer along Main Street and an 1800mm sewer along Henry Street, to convey the minor flows from the Main Street catchment area. The sewer discharges into the existing open ditch along Henry Street.

The major flows for approximately 24.7 Ha of the site plus 22.0 Ha of external drainage will converge at Main Street and David Street following which, the flows will be conveyed through the Main Street road allowance. The existing Main Street road allowance consists of a ditch on the west side of the road that ranges from 1m deep to 2.5m deep and flows to the north at approximately 1.5%. Based on the ditch's depth and slope, the capacity of the Main Street road allowance is 6.39 m^3/s. The overland flows from the proposed development will be 5.70 m^3/s (100-Yr flows – 10-Yr flows). Therefore the existing ditch has sufficient capacity to convey the overland flows from the proposed development. The proposed Street 7 and Main Street instersection will be graded to deflect major storm flows into the west ditch.

The existing ditch along the south side of the Upper Grand Trailway does not provide sufficient capacity for the proposed flows. Therefore, a 5m wide by 1m deep ditch along the south side has been proposed. The flows from the Upper Grand Trailway Catchment will flow through the proposed drainage block (Block 287) into the proposed ditch along the abandoned railway corridor, converging to the existing open ditch along Henry Street. A cross section and a detail of this proposed ditch along the Trailway has been provided in Figure 8.

The combined flows (major and minor) from the Main Street and Upper Grand Trailway Catchments will outlet to an open ditch along Henry Street. The existing 1200mm CSP culvert at Mill Street has insufficient capacity to convey the flows from the upstream contributing area. The 100-year storm event has been applied to this crossing as a minimum design standard. To safely convey the 100-year storm (13.05 m^3/s) the existing culvert will be replaced with a 2130mm x 1520mm box culvert. Refer to Appendix C for the CulvertMaster calculation and Appendix B for the SWMHYMO model results.

5.2.3 Quality Control

As previously noted, the Site drains to a watercourse and therefore is required to meet Enhanced level of protection (80% TSS removal) as defined by the MOE SWMPD Manual. Under proposed conditions the site will maintain existing drainage patterns and discharge at two locations. Therefore water quality control will be provided by two Oil/Grit Separators (OGS) designed to provide the full 80% TSS removal. One will be located where proposed Street 7 intersects Main Street to service the Main Street Catchment, while the second OGS will be located in the north end of the site to service the Upper Grand Trailway Catchment, before water is released into the proposed ditch along the Railway corridor, leading to the Grand River.

Main Street Catchment OGS

A Vortechs 2639 CIP OGS has been proposed for the Main Street catchment area. The proposed OGS unit has been sized to treat the required flows per MOE and provide sediment storage. Table 6.3 of the 2003 MOE manual presents annual sediment loading of 1,900 L/ha for 55% imperviousness. For a catchment area of about 24.7 Ha of the developed land, the anticipated annual sediment loading is approximately 46,930 L. The sediment capacity for the 2639 CIP unit is 75,000 L. Thus, the OGS units will require maximum of one cleaning annually, and a maintenance program must be followed as per the manufacturer's recommendation. The OGS sizing calculations are included in Appendix D.

The location of the Main Street proposed OGS has been established based upon the low point within the drainage area as well as proximity to a drainage outlet location. Therefore the 13.7m x 9.1m x 4.3m (inside dimensions) OGS chamber has been proposed at the intersection of Street 7 and Main Street, which allows outlet options to the Grand River through Main Street. Figure 8 has been prepared to demonstrate that the OGS chamber will fit into the 20m R.O.W.

Upper Grand Trailway Catchment OGS

A Vortechs 16000 OGS has been proposed for the Upper Grand Trailway catchment area. The proposed OGS unit has been sized to treat the required flows per MOE as well as provide sediment storage. The sediment capacity for the 16000 unit is 5,430 L. For a catchment area of 9.8 Ha of the developed land, the anticipated annual sediment loading is approximately 18,620 L. Thus, the OGS units will require maximum of 3 cleanings annually, and a maintenance program must be followed as per the manufacturer's recommendation. The OGS sizing calculations are included in Appendix D.

The location of the proposed Oil/Grit Separator has been established based upon the site's proposed northern low point within the drainage area as well as proximity to a drainage outlet location. Therefore the 5.5m x 3.7m x 2.1m (inside dimensions) OGS chamber has been proposed upstream of the drainage block to the proposed ditch, a location that allows outlet options to the Grand River through the proposed ditch along Upper Grand Trailway. Refer to Figure 5A for the location of the OGS units. Figure 8 has been prepared to demonstrate that the OGS chamber will fit into Block 287.

6.0 SANITARY SEWAGE SYSTEM

As a plan of subdivision, the infrastructure will be designed, built and ultimately transferred to the municipality, Township of Amaranth for ownership and operation. As such, all infrastructure will be designed to the municipal criteria.

There are no existing gravity sanitary sewers adjacent to the subject development. Furthermore, the existing Acchione subdivision is comprised of single family residential with individual septic beds. As such, in July 2013, Crozier & Associates presented the idea of installing a centralized communal sewage treatment facility to the Township of Amaranth for the subject development. Township staff were receptive of the idea, therefore, a centralized communal sewage facility has been proposed for this development.

An internal gravity sanitary sewer system will convey on-site wastewater flows to the communal sewage facility located in the southwest corner of the subject lands (Block 282). Due to site grading constraints, the site has been split into two drainage areas a south catchment and a north catchment. Therefore, 24.7 Ha of the site will gravity drain to the treatment facility in Block 282 in the south, while the north 9.3 Ha of the site will gravity drain to a pump station in Block 286. Flows from this pump station will be conveyed through a 75mm forcemain into the gravity system flowing south into the treatment facility. The proposed internal sanitary sewers for both catchment areas will gravity drain to their discharge locations and will conform to the MOE standards. The sewers will be installed within the internal roadway allowance.

The proposed gravity sanitary sewer system and communal sewage facility can be designed to enable existing residential areas, which are currently serviced via individual septic systems, to connect to the proposed gravity sewer system. A sanitary stub at James Street as well as the proposed sanitary sewer leg along Main Street will enable the future extension of the gravity sewer system. Refer to section 6.1.1 for further discussion on the communal sewage treatment facility.

The gravity sanitary sewer is designed based on 450 L/cap.d, a population density of 3.00 ppu, and a peaking factor determined as per the Harmon's Method. A summary of the design flows are presented in Table 1 below, detailed calculations are provided in Appendix D.

Table 1 – Total Estimated Sanitary Design Flows

MOE Method	Average Flow (L/s)	Peak Flow (L/s)
South Catchment	4.53	20.07
North Catchment	0.63	3.71
Total combined	5.22	22.50

Note: References to MOE design guidelines are provided in Appendix D.

As per the MOE, the entire development produces peak flows of 22.50 L/s and will be serviced with a 200mm diameter and 300mm diameter gravity sewer network installed at minimum slopes (0.4%) or to match steeper road grades as necessary. At a slope of 0.4% a 300mm diameter sewer has a capacity of 38.0 L/s and should sufficiently accommodate peak sanitary flows. A schematic sanitary design sheet is provided in Appendix D and the preliminary sewage system layout is reflected on Figure 6.

Each unit will be serviced with a combination of individual and double services as per typical standards. The location of service connections as well as final location and spacing of maintenance holes will be determined during the detailed design stage.

6.1.1 Communal Sewage Treatment Facility

It is proposed to design the sewage facility with the use of a Newterra Microclean Membrane Bioreactor wastewater treatment system. The flows are treated in the facility through membranes to separate solids from treated water, producing higher quality effluent that can be discharged to the surface or into the internal storm sewer network. The detailed design of the treatment facility will be carried out by Newterra, however a Process and Flow Diagram, and a Preliminary Layout are provided in Appendix D. It is understood that Newterra staff have had discussions with MOE & Township staff pertaining to the sizing of the treatment system to be able to ultimately accommodate wastewater flows from existing residential areas of the Town.

6.1.2 Sewage Pump Station

The location of the sewage pump station (SPS) to service the north catchment is within Block 286 and provides the optimum serviceable coverage within the northern catchment area. The location and footprint of the pump station has been sized for the ultimate build out of the subject development.

The sanitary flows for this catchment are designed based on 450 L/cap.d, a population density of 3.00 ppu, and a peaking factor determined as per the Harmon's Method. A summary of the design flows are presented in Table 2 below, detailed calculations are provided in Appendix D.

Table 2 – North Catchment Estimated Sanitary Design Flows

	Average Flow (L/s)	**Peak Flow (L/s)**
MOE Method	0.63	3.71

Note: References to MOE design guidelines are provided in Appendix D.

The SPS is comprised of a 1800mm ø concrete manhole (OPSD 701.010) and has been sized to house a duplex submersible pump system to discharge at a rate greater than the peak inflow of 3.71 L/s for the 9 Ha north catchment area. The duplex pump system will include 1 active pump and 1 standby pump whereby each pump can be phased and sized to discharge average day flows on one pump, and peak day flows respectively. For this stage, a preliminary outflow rate of 8 L/s has been specified. During detailed design each of the pumps and associated assembly will be specified.

The top of the grate of the pump station manhole is set at an elevation of 461.50 and the bottom of the pump station is set at 454.0m. The depth of the pump station is primarily driven by the invert of the gravity line into the pump station. During average flow conditions, the inflow is at 0.63 L/s and will take approximately 67 minutes to fill up to the first level of the wet well. The first pump will be activated and based on the overall combined pumping rate of the two active pumps, will pump out at 8 L/s and take 11.5 minutes to pump down to shutoff level. The second will be activated to pump out flows at greater inflow rates up to the peak inflow rate of 3.71 L/s.

Pumped sewage will discharge through a 75mm ø forcemain to discharge into the gravity system conveying flows south to the treatment facility, with a total head loss equivalent to 19.91m.

Detailed calculations of the pump station and forcemain sizing are provided in Appendix D.

7.0 WATER DISTRIBUTION SYSTEM

Water supply for Waldemar is municipally serviced through two active wells serving the existing community with a third well maintained as a backup. A water reservoir and pump system is located off Station Road, east of the river and services the entire community.

The subject lands are outside of the current service district and require water supply flows that are beyond the capacity of the current water system. Thus, the proposed development will require an expansion of the existing Waldemar municipal water system.

Local watermain for the development will connect off the three access points to the existing 150mm watermain network in the Acchione Subdivision; Main Street, James Street and Evans Avenue. Watermain with a combination of individual and double service connections for each unit will follow the local roadway as per typical standards. The preliminary water distribution system design is illustrated on Figure 5B.

The design of any storage reservoir/pump house expansion works required to provide acceptable water servicing for the subject development will be coordinated with the Township Engineer during the detailed design stage. It is anticipated that the subject development should fall within the same pressure zone of the existing reservoir give that elevation difference between the existing reservoir and the highest point of the subdivision is within 1 typical pressure zone. It is desirable for the Township to have a single municipal water service within the same pressure zone.

The MOE Design Manual was consulted to determine the average and maximum demands generated by the proposed development. The water demand flows are designed based on 450 L/cap.d, a population density of 3.00 ppu, and a max day and peak hour peaking factor determined as per the MOE design manual Table 3-1 . A summary of the results is presented below, and detailed calculations are provided in Appendix A.

Table 3 – Estimated Water Demand Design Flow

	Average Day	**Max Day**	**Peak Hour**
MOE Method	5.22	14.35	21.55

Note: References to MOE design guidelines are provided in Appendix D.

8.0 SITE GRADING

A preliminary grading plan has been prepared given the proposed internal road layout, respecting existing property limit standard criteria. Based on the varied existing site topography, it is anticipated that lot grading will include front to back, back to front, split drainage and walkout conditions. Also, there are areas on site which may warrant retaining walls that will be further analyzed during the detailed design stage.

General consideration for lot grading within the development has been accounted for. However, detailed lot grading will be carried out during detailed design and will follow standard Township design criteria in accordance with the most current engineering design standards.

During this functional review of grading stage, areas of notable grading constraints have been outlined below, and are illustrated on Figure 6.

- Based on existing topography and boundary grading constraints, preliminary road profiles range from 0.5% to 6%.

- Due to the flatter slopes along the west property limit, it is proposed to us a 'saw-toothing' grading pattern for Street 5, with an average grade of 0.6%. The Street 5 road profile must enable the acceptance of stormwater flows from the external drainage area to the west of the site.
- Approximately 300m of the southern property line as well as the western property line will require 3:1 slopes to match existing ground elevations that are higher on the neighbour's side.

As noted previously, the site receives external drainage from the west. The Street 5 preliminary road profile has been set to enable external flows to outlet to the Street 5 drainage system. As noted in Section 5.2, two external flow routes have been provided. Due to site grading constraints, external drainage conveyed within the southernmost drainage easement will enter the storm sewer network during the minor and major storm events. An overland flow route to Street 3 for the said easement may be feasible, subject to detailed design.

9.0 CONCLUSIONS AND RECOMMENDATIONS

We conclude that the proposed development of the subject lands can be readily serviced and meet the objectives of the regulatory agencies.

Access

1. Primary access to the Site will be provided from John Street, while secondary access through James Street, Evans Avenue and Main Street.
2. Several internal roads with a 20.0m right of way have been proposed to facilitate traffic flow and access to the various development blocks.
3. All internal roads will be constructed to Township standards to be assumed by the Township.

Stormwater Management

1. The proposed internal drainage system will be designed to accommodate external drainage areas located to the west of the site.
2. The minor storm system will consist of a storm sewer system sized for the 10 year event. The major storm system will be conveyed within the roadways
3. Water quality control to an 'enhanced' level of protection will be provided via an end-of-pipe SWM facility. Two oil/grit separator units will be employed to treat the water, prior to discharge to the Grand River.
4. Water quantity control is not required. Storm infrastructure improvements along Main Street and Henry Street will enable the safe conveyance of major and minor storm flows to the Grand River.

Sanitary Servicing and Potable Water Supply

1. There is no existing sewage treatment within the village of Waldemar. Therefore, a communal sewage treatment system is proposed to be located in Block 282.
2. An internal gravity sewer system is proposed to convey wastewater to the sewage treatment system. Due to the site grading constraints, 10 ha of the site will drain to an internal pumping station, which will outlet to the internal sewer system via a 75 mm diameter forcemain.

3. The communal sewage treatment system and pump station will be owned and operated by the Township.
4. Potable water will be provided by a proposed municipal watermain connected to the existing watermain at the three access points off Evans Avenue, James Street and Main Street. An expansion to the existing Waldemar Municipal water system will be necessary and will be carried out in phases in consultation with the Township's engineers.

Through the strategies noted above, we have demonstrated the serviceability of the proposed development. Therefore, we recommend approval of all planning applications for the subject lands from the perspective of site grading, stormwater management, and engineering servicing requirements.

Respectfully Submitted,

C.F. CROZIER & ASSOCIATES INC.

Darrin Tone, P. Eng.
Project Engineer

C.F. CROZIER & ASSOCIATES INC.

K.J. Firth, P.Eng.
Associate

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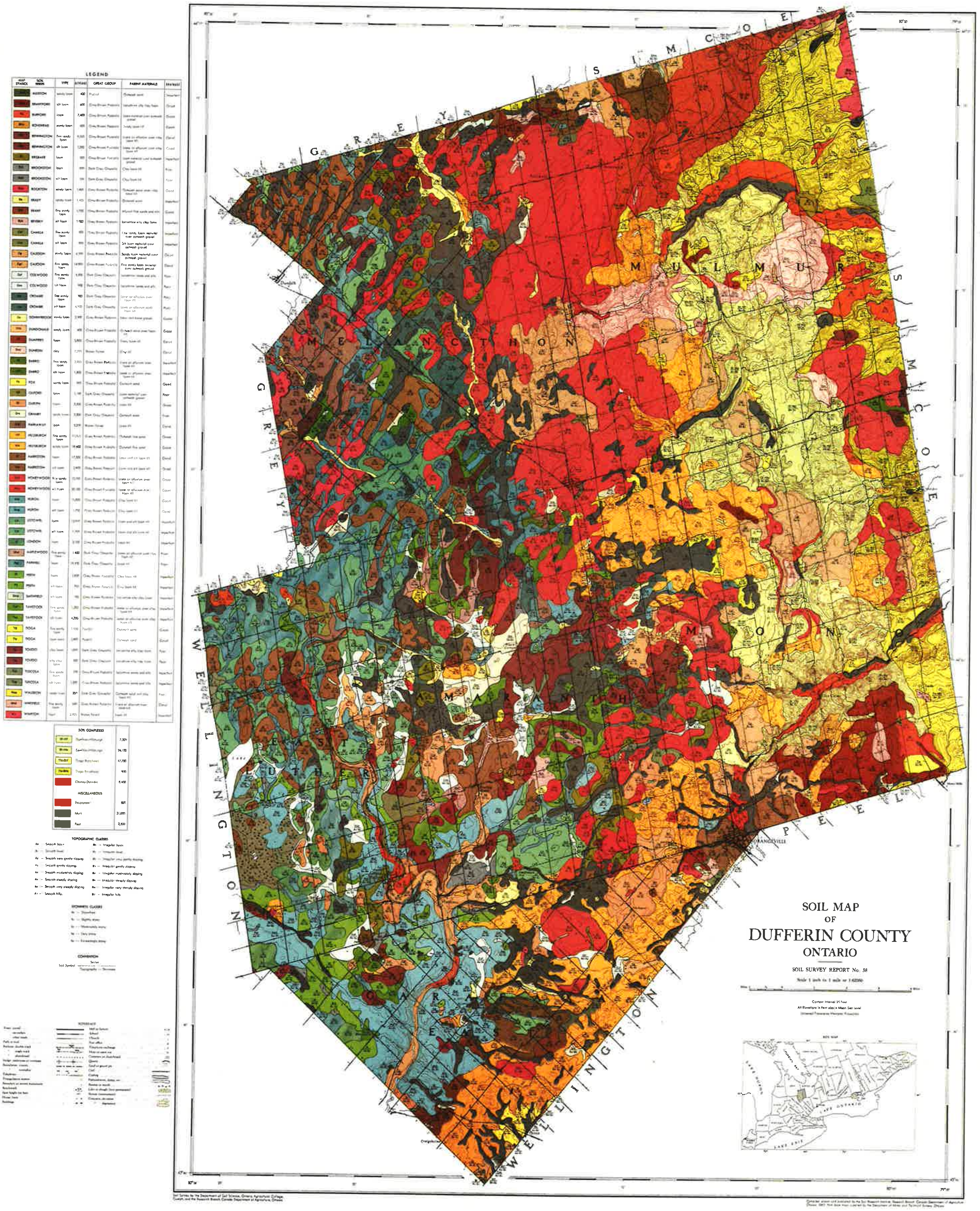
APPENDIX A

Soil Survey of Peel County (1953)



SOIL MAP
OF
DUFFERIN COUNTY
ONTARIO

SOIL SURVEY REPORT No. 38

Contour Interval 25 Feet
All Elevations in Feet above Mean Sea Level

Soil Survey by the Department of Soil Science, Ontario Agricultural College, Guelph, and the Research Branch, Canada Department of Agriculture, Ottawa.

APPENDIX B

Hydrology

Ontario | Ontario.ca

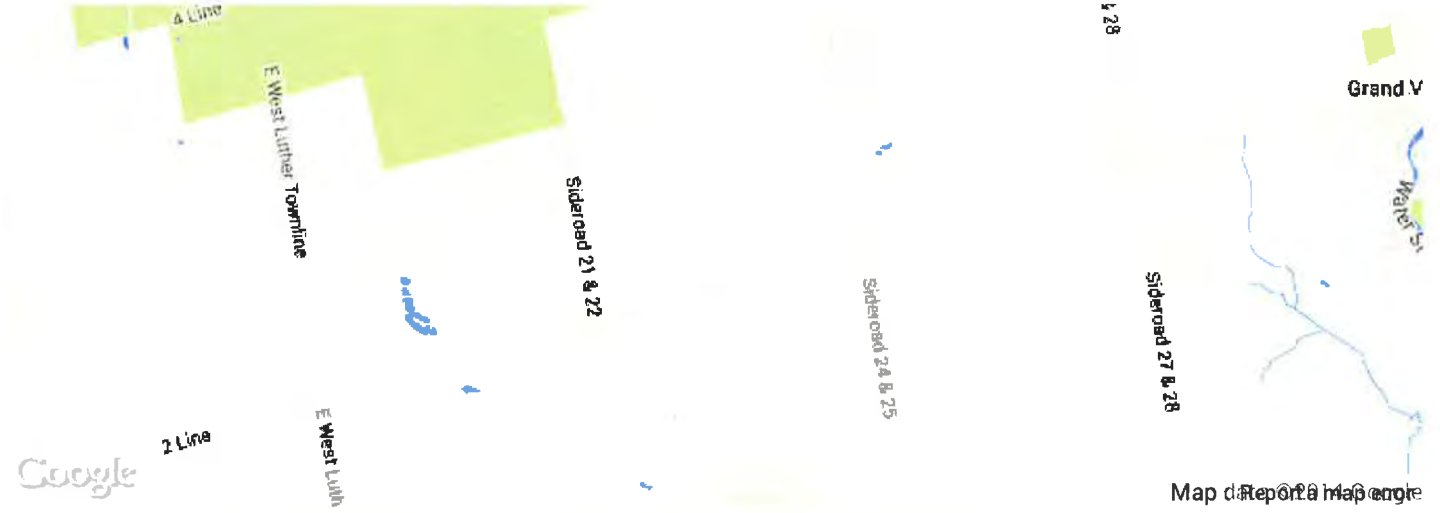
IDF CURVE LOOKUP

Coordinate Selection | Terms of Use | About

Active coordinate

43° 53' 15" N, 80° 17' 14" W (43.887500,-80.287500) Modify selection

Retrieved: Thu, 10 Jul 2014 20:36:27 GMT



Map options: Modify selection | Show/hide gauging stations | Re-center selection

Coordinate summary

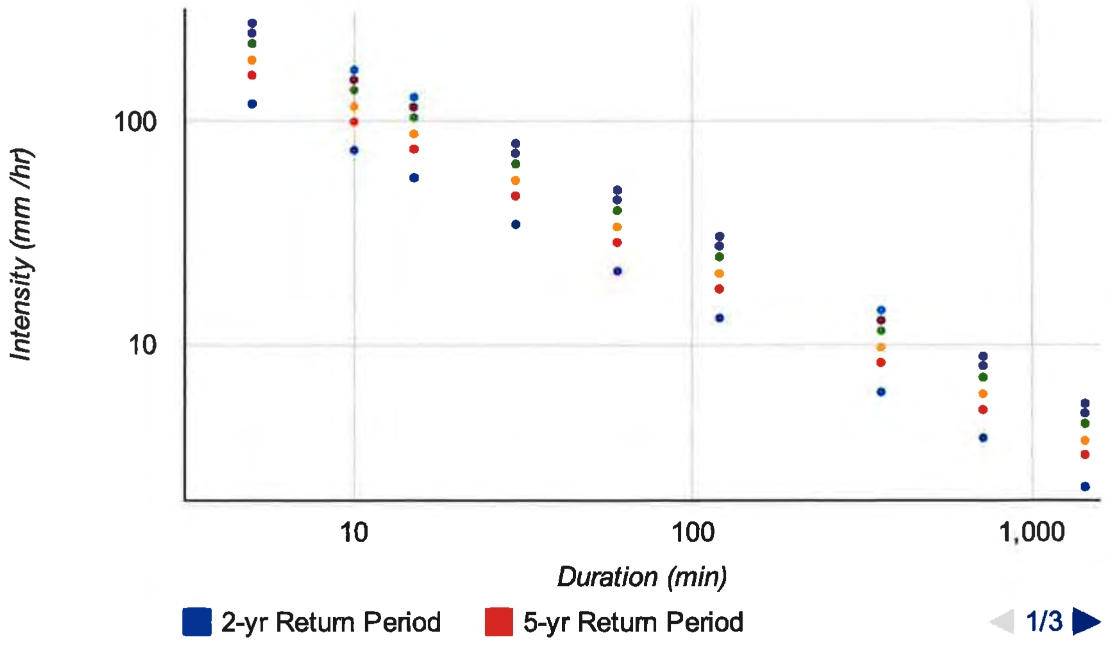
These are the coordinates in the selection.

IDF Curve: 43° 53' 15" N, 80° 17' 14" W (43.887500,-80.287500)

Results

An IDF curve was found for this set of coordinates.

Coordinate: 43.887500,-80.287500



Coefficient summary

Notes

Click a return period in the table header for more detail.

Return period	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
A	21.3	28.7	33.6	39.8	44.4	49.0
B	-0.696	-0.694	-0.693	-0.693	-0.692	-0.693

Statistics

Rainfall intensity (mm hr^{-1})

Duration	**5-min**	**10-min**	**15-min**	**30-min**	**1-hr**	**2-hr**	**6-hr**	**12-hr**	**24-hr**
2-yr	120.1	74.1	55.9	34.5	21.3	13.1	6.1	3.8	2.3
5-yr	161.0	99.5	75.1	46.4	28.7	17.7	8.3	5.1	3.2
10-yr	188.0	116.3	87.8	54.3	33.6	20.8	9.7	6.0	3.7
25-yr	222.7	137.8	104.0	64.3	39.8	24.6	11.5	7.1	4.4
50-yr	247.8	153.4	115.9	71.7	44.4	27.5	12.8	8.0	4.9
100-yr	274.2	169.6	128.1	79.2	49.0	30.3	14.2	8.8	5.4

Terms of Use

You have agreed to the Terms of Use of this site by reviewing, using or otherwise interpreting this data.

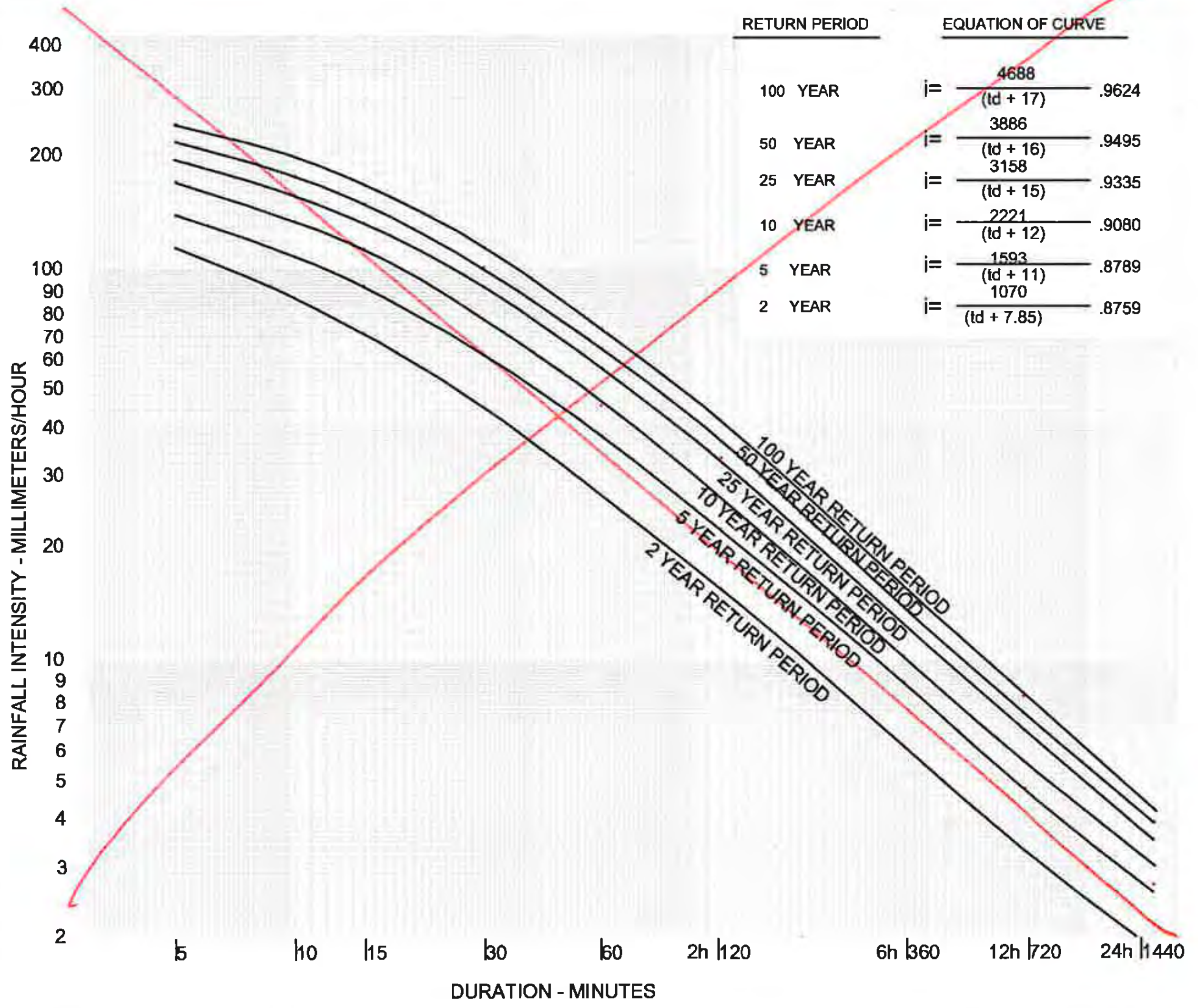
Exit

Ontario Ministry of Transportation | Terms and Conditions | About

Ontario

Last Modified: September 11, 2013

REFER TO MTO IDF INFORMATION. RUNOFF COEFFICIENT SELECTION BELOW



RETURN PERIOD	EQUATION OF CURVE
100 YEAR	$i = \frac{4688}{(td + 17)^{.9624}}$
50 YEAR	$i = \frac{3886}{(td + 16)^{.9495}}$
25 YEAR	$i = \frac{3158}{(td + 15)^{.9335}}$
10 YEAR	$i = \frac{2221}{(td + 12)^{.9080}}$
5 YEAR	$i = \frac{1593}{(td + 11)^{.8789}}$
2 YEAR	$i = \frac{1070}{(td + 7.85)^{.8759}}$

INLET TIMES

SUBURBAN RESIDENTIAL	
(ROOF DRAINS UNCONNECTED)	15 min
(ROOF DRAINS CONNECTED)	10 min
SUBURBAN, COMMERCIAL, INDUSTRIAL MULTIPLE FAMILY	10 min
DOWNTOWN COMMERCIAL, HIGH DENSITY APARTMENTS, EXPRESSWAYS	5 min

RUNOFF COEFFICIENT

COMMERCIAL	
- DOWNTOWN & SUBURBAN SHOPPING	0.90
INDUSTRIAL	
- DOWNTOWN	0.90
- SUBURBAN INDUSTRIAL PARKS	0.75
RESIDENTIAL	
- APARTMENTS	0.75
- ROW DWELLINGS	0.70
- DUPLEX DWELLINGS	0.70
- SEMIDETACHED - DOWNTOWN	0.60
- SINGLE FAMILY - DOWNTOWN	0.60
- SEMIDETACHED - SUBURBAN	0.50
- SINGLE FAMILY - SUBURBAN	0.40
SCHOOLS, CHURCHES, HOSPITALS	0.75
PARKS, CEMETERIES, RAIL YARDS	
(OVER 4 Ha)	0.20
(UNDER 4 Ha)	0.25

TOWN OF CALEDON

RAINFALL INTENSITY CURVES

NO.	REVISION	APR'D	DATE
1	STANDARD 112.01 NOW 104		JUNE 08

APR'D: C.C.
DATE: FEB 2000
DRAWN: BJM
SCALE: N.T.S.

STANDARD No. 104

Table A3: SCS Runoff Curve Numbers for Agricultural Lands

Land use or cover	Treatment or Practice	Hydrologic Condition	Hydrologic soil group A	B	C	D
Fallow	Straight row	--	77	86	91	94
Row crops	Straight row	Poor	72	81	88	91
	Straight row	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	Contoured	Good	65	75	82	86
	Contoured & terraced	Poor	66	74	80	82
	Contoured & terraced	Good	62	71	78	81
Small grain	Straight row	Poor	65	76	84	88
	Straight row	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
	Contoured	Good	61	73	81	84
	Contoured & terraced	Poor	61	72	79	82
	Contoured & terraced	Good	59	70	78	81
Rotation meadow	Straight row	Poor	66	77	85	89
	Straight row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Contoured & terraced	Poor	63	73	80	83
	Contoured & terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Brush		Poor	48	67	77	83
		Fair	35	56	70	77
		Good		48	65	73

From: "Hydrology", Suppl. A to Sec. 4, *Engineering Handbook*, USDA, Soil Conservation Service, 1968

Note: Assumes AMC II, and Ia = 0.2S

Table A4: Antecedent Moisture Conditions

About Antecedent Moisture Conditions		CN for AMC II	AMC I	AMC III
		100	100	100
AMC I	A condition of watershed soils where the soils are dry but not to the wilting point, and when satisfactory plowing or cultivation takes place.	95	87	98
		90	78	96
		85	70	94
		80	63	91
		75	57	88
AMC II	The average case for annual floods, that is, an average of the conditions that have preceded the occurrence of the maximum annual flood on numerous watersheds.	70	51	85
		65	45	82
		60	40	78
		55	35	74
		50	31	70
AMC III	If heavy rainfall or light rainfall and low temperatures have occurred during the 5 days previous to the given storm and the soil is nearly saturated.	45	26	65
		40	22	60
		35	18	55
		30	15	50
		25	12	43
		20	9	37
		15	6	30
		10	4	22
		5	2	13

From: Introduction to Hydrology, Viessman and Lewis, 1996

CROZIER & ASSOCIATES
Consulting Engineers

Project Name: Sarah Properties
Project Number: 743-3507
Date: 2015.04.25
By: A.S.

D.A. NAME	**Main St.**
D.A. AREA (ha)	**42.77**

Hydrologic Parameters: NASHYD Command
Pre Development Drainage Area: Main Street Catchment

Curve Number Calculation

Soil Types Present:

Type	ID	Hydrologic Group	% Area	Area
Loam		B	100	42.77
				0
				0
				0
Total Area				42.77

Impervious Landuses Present:

	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
0		98		98		98		98		98	0	0
0		98		98		98		98		98	0	0
0		98		98		98		98		98	0	0
0		98		98		98		98		98	0	0
Subtotal Area	0		0		0		0		0			

Pervious Landuses Present:

	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
0	0.00		0.00		0.00		0.00		42.77	75	42.77	3207.75
0	0.00		0.00		0.00		0.00		0.00		0.00	0.00
0	0.00		0.00		0.00		0.00		0.00		0.00	0.00
0	0.00		0.00		0.00		0.00		0.00		0.00	0.00
Subtotal Area	0.00		0.00		0.00		0.00		42.77			

Composite Area Calculations	Total Pervious Area	42.77
	Total Impervious Area	0
	% Impervious	0.0
	Composite Curve Number	75.0
	Total Area Check	42.77

Initial Abstraction and Hydraulics Calculations

Initial Abstraction				Composite Curve Number								
				Loam		0		0		0		
Landuse	IA (mm)	Area (ha)	A * IA	RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0	0		0.0		0.0		0.0		0.0	0.0
Meadow	8	0	0		0.0		0.0		0.0		0.0	0.0
Wetland	16	0	0		0.0		0.0		0.0		0.0	0.0
Lawn	5	0	0		0.0		0.0		0.0		0.0	0.0
Cultivated	7	42.77	299.39	0.4	42.8		0.0		0.0		0.0	17.1
Impervious	2	0	0		0.0		0.0		0.0		0.0	0.0
Composite IA		42.77	7	Composite Runoff Coefficient								0.4

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
	750	9	1.20%	0.6	0.07	3.17	2.12	2.12	0.47	0.32	0.98	0.66

Appropriate calculated time to peak:	2.12	Appropriate Method:	Uplands

CROZIER
& ASSOCIATES
Consulting Engineers

Project Name: Sarah Properties
Project Number: 743-3507
Date: 2015.04.25
By: A.S.

D.A. NAME	**Upper**
D.A. AREA (ha)	**9.78**

Hydrologic Parameters: NASHYD Command
Pre Development Drainage Area: Upper Grand Trailway Catchment

Curve Number Calculation

Soil Types Present:

Type	ID	Hydrologic Group	% Area	Area
Loam		B	100	9.78
				0
				0
				0
Total Area				9.78

Impervious Landuses Present:

	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
0		98		98		98		98		98	0	0
0		98		98		98		98		98	0	0
0		98		98		98		98		98	0	0
0		98		98		98		98		98	0	0
Subtotal Area	0		0		0		0		0			

Pervious Landuses Present:

	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
0	0.00		0.00		0.00		0.00		9.78	75	9.78	733.50
0	0.00		0.00		0.00		0.00		0.00		0.00	0.00
0	0.00		0.00		0.00		0.00		0.00		0.00	0.00
0	0.00		0.00		0.00		0.00		0.00		0.00	0.00
Subtotal Area	0.00		0.00		0.00		0.00		9.78			

Composite Area Calculations	Total Pervious Area	9.78
	Total Impervious Area	0
	% Impervious	0.0
	Composite Curve Number	75.0
	Total Area Check	9.78

Initial Abstraction and Hydraulics Calculations

Initial Abstraction				Composite Curve Number								
Landuse	IA (mm)	Area (ha)	A * IA	Loam		0		0		0		
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0	0		0.0		0.0		0.0		0.0	0.0
Meadow	8	0	0		0.0		0.0		0.0		0.0	0.0
Wetland	16	0	0		0.0		0.0		0.0		0.0	0.0
Lawn	5	0	0		0.0		0.0		0.0		0.0	0.0
Cultivated	7	9.78	68.46	0.4	9.8		0.0		0.0		0.0	3.9
Impervious	2	0	0		0.0		0.0		0.0		0.0	0.0
Composite IA		9.78	7	Composite Runoff Coefficient								0.4

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
	300	13	4.33%	0.6	0.12	0.67	0.45	0.45	0.17	0.11	0.41	0.27

Appropriate calculated time to peak:	0.45	Appropriate Method:	Uplands

```
00001> 2     Metric units
00002> *#******************************************************************************
00003> *#  Project Name: [Sarah Properties, Waldemar]    Project Number: [743-3507]
00004> *#  Date        : 25-04-2015
00005> *#  Modeller    : [A.S.]
00006> *#  Company     : C.F. CROZIER $ Associates Inc.
00007> *#  License #   :  3737016
00008> *#******************************************************************************
00009> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
00010> *%                   [  ] <--storm filename, one per line for NSTORM time
00011> *%-----------------|-----------------------------------------------------------|
00012>
00013> *%-----------------|-----------------------------------------------------------|
00014> *%-----------------|---------------------PRE DEVELOPMENT-----------------------|
00015> *%-----------------|-----------------------------------------------------------|
00016> *%-----------------|-----------------------HAZEL 48HR--------------------------|
00017> *%-----------------|----------------------Regional Event-----------------------|
00018> *%-----------------|-----------------------------------------------------------|
00019> READ STORM          STORM_FILENAME=["48REGHAZ.STM"]
00020> *%-----------------|-----------------------------------------------------------|
00021> *%-----------------|----Main Street Catchment 42.60 Ha (incl. External area)---|
00022> *%-----------------|-----------------------------------------------------------|
00023> CALIB NASHYD        ID=[1], NHYD=["Main Street"], DT=[1]min, AREA=[42.6](ha),
00024>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00025>                     N=[3], TP=[2.12]hrs,
00026>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00027> *%-----------------|-----------------------------------------------------------|
00028> *%-----------------|-------------Upper Grand Trail Catchment 9.78 Ha-----------|
00029> *%-----------------|-----------------------------------------------------------|
00030> CALIB NASHYD        ID=[2], NHYD=["Upper Grand"], DT=[1]min, AREA=[9.78](ha),
00031>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00032>                     N=[3], TP=[0.45]hrs,
00033>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00034> *%-----------------|-----------------------------------------------------------|
00035>
00036> *%-----------------|---------------------SCS 24hr Type II----------------------|
00037>
00038> *%-----------------|-----------------------------------------------------------|
00039> *%-----------------|-----------------------100 Yr Event------------------------|
00040> *%-----------------|-----------------------------------------------------------|
00041> MASS STORM          PTOTAL=[129.6](mm), CSDT=[1](min),
00042>                     CURVE_FILENAME=["SCS24HII.MST"]
00043> *%-----------------|-----------------------------------------------------------|
00044> *%-----------------|----Main Street Catchment 42.60 Ha (incl. External area)---|
00045> *%-----------------|-----------------------------------------------------------|
00046> CALIB NASHYD        ID=[1], NHYD=["Main Street"], DT=[1]min, AREA=[42.6](ha),
00047>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00048>                     N=[3], TP=[2.12]hrs,
00049>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00050> *%-----------------|-----------------------------------------------------------|
00051> *%-----------------|-------------Upper Grand Trail Catchment 9.78 Ha-----------|
00052> *%-----------------|-----------------------------------------------------------|
00053> CALIB NASHYD        ID=[2], NHYD=["Upper Grand"], DT=[1]min, AREA=[9.78](ha),
00054>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00055>                     N=[3], TP=[0.45]hrs,
00056>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00057> *%-----------------|-----------------------------------------------------------|
00058>
00059> *%-----------------|-----------------------------------------------------------|
00060> *%-----------------|-----------------------10 Yr Event-------------------------|
00061> *%-----------------|-----------------------------------------------------------|
00062> MASS STORM          PTOTAL=[88.8](mm), CSDT=[1](min),
00063>                     CURVE_FILENAME=["SCS24HII.MST"]
00064> *%-----------------|-----------------------------------------------------------|
00065> *%-----------------|----Main Street Catchment 42.60 Ha (incl. External area)---|
00066> *%-----------------|-----------------------------------------------------------|
00067> CALIB NASHYD        ID=[1], NHYD=["Main Street"], DT=[1]min, AREA=[42.6](ha),
00068>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00069>                     N=[3], TP=[2.12]hrs,
00070>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00071> *%-----------------|-----------------------------------------------------------|
00072> *%-----------------|-------------Upper Grand Trail Catchment 9.78 Ha-----------|
00073> *%-----------------|-----------------------------------------------------------|
00074> CALIB NASHYD        ID=[2], NHYD=["Upper Grand"], DT=[1]min, AREA=[9.78](ha),
00075>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00076>                     N=[3], TP=[0.45]hrs,
00077>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00078> *%-----------------|-----------------------------------------------------------|
00079>
00080> *%-----------------|-----------------------------------------------------------|
00081> *%-----------------|-----------------------5 Yr Event--------------------------|
00082> *%-----------------|-----------------------------------------------------------|
00083> MASS STORM          PTOTAL=[76.8](mm), CSDT=[1](min),
00084>                     CURVE_FILENAME=["SCS24HII.MST"]
00085> *%-----------------|-----------------------------------------------------------|
00086> *%-----------------|----Main Street Catchment 42.60 Ha (incl. External area)---|
00087> *%-----------------|-----------------------------------------------------------|
00088> CALIB NASHYD        ID=[1], NHYD=["Main Street"], DT=[1]min, AREA=[42.6](ha),
00089>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00090>                     N=[3], TP=[2.12]hrs,
00091>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00092> *%-----------------|-----------------------------------------------------------|
00093> *%-----------------|-------------Upper Grand Trail Catchment 9.78 Ha-----------|
00094> *%-----------------|-----------------------------------------------------------|
00095> CALIB NASHYD        ID=[2], NHYD=["Upper Grand"], DT=[1]min, AREA=[9.78](ha),
00096>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00097>                     N=[3], TP=[0.45]hrs,
00098>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00099> *%-----------------|-----------------------------------------------------------|
00100>
00101> *%-----------------|-----------------------------------------------------------|
00102> *%-----------------|-----------------------2 Yr Event--------------------------|
00103> *%-----------------|-----------------------------------------------------------|
00104> MASS STORM          PTOTAL=[55.2](mm), CSDT=[1](min),
00105>                     CURVE_FILENAME=["SCS24HII.MST"]
00106> *%-----------------|-----------------------------------------------------------|
00107> *%-----------------|----Main Street Catchment 42.60 Ha (incl. External area)---|
00108> *%-----------------|-----------------------------------------------------------|
00109> CALIB NASHYD        ID=[1], NHYD=["Main Street"], DT=[1]min, AREA=[42.6](ha),
00110>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00111>                     N=[3], TP=[2.12]hrs,
00112>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00113> *%-----------------|-----------------------------------------------------------|
00114> *%-----------------|-------------Upper Grand Trail Catchment 9.78 Ha-----------|
00115> *%-----------------|-----------------------------------------------------------|
00116> CALIB NASHYD        ID=[2], NHYD=["Upper Grand"], DT=[1]min, AREA=[9.78](ha),
00117>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00118>                     N=[3], TP=[0.45]hrs,
00119>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00120> *%-----------------|-----------------------------------------------------------|
00121>
00122> *%-----------------|-----------------------------------------------------------|
00123> *%-----------------|---------------------POST DEVELOPMENT----------------------|
00124> *%-----------------|-----------------------------------------------------------|
00125> *%-----------------|-----------------------HAZEL 48HR--------------------------|
00126> *%-----------------|-----------------------------------------------------------|
00127> READ STORM          STORM_FILENAME=["48REGHAZ.STM"]
00128> *%-----------------|-----------------------------------------------------------|
00129> *%-----------------|---------- Main Street Catchments 1 to 9 = 25.8 Ha --------|
00130> *%-----------------|-----------------------------------------------------------|
00131> CALIB STANDHYD      ID=[1], NHYD=["Main Street Drainage"], DT=[1](min), AREA=[25
00132>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00133>                     SCS curve number CN=[90],
00134>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00135>                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
00136>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00137>                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
00138>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00139> *%-----------------|-----------------------------------------------------------|
00140> *%-----------------|-------------------External Lands 22.00 Ha-----------------|
00141> *%-----------------|-----------------------------------------------------------|
00142> CALIB NASHYD        ID=[2], NHYD=["External Drainage"], DT=[1]min, AREA=[22.00](
00143>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00144>                     N=[3], TP=[2.28]hrs,
00145>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00146> *%-----------------|-----------------------------------------------------------|
00147> *%-----------------|------------------- EXT - 3 = 5.5 Ha ----------------------|
00148> *%-----------------|-----------------------------------------------------------|
00149> CALIB STANDHYD      ID=[3], NHYD=["Ext-3"], DT=[1](min), AREA=[5.5](ha),
00150>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00151>                     SCS curve number CN=[90],
00152>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00153>                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
00154>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00155>                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
00156>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00157> *%-----------------|-----------------------------------------------------------|
00158> *%-----------------|-------------------- EXT - 4 = 1.8 Ha ---------------------|
00159> *%-----------------|-----------------------------------------------------------|
00160> CALIB STANDHYD      ID=[4], NHYD=["Ext-4"], DT=[1](min), AREA=[1.8](ha),
00161>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00162>                     SCS curve number CN=[90],
00163>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00164>                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
00165>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00166>                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
00167>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00168> *%-----------------|-----------------------------------------------------------|
00169>
00170> *%-----------------|------------------------Add Areas -------------------------|
00171> *%-----------------|-----------------------------------------------------------|
00172> ADD HYD             IDsum=[5], NHYD=["Combined Flow"], IDs to add=[1,2,3,4]
00173> *%-----------------|-----------------------------------------------------------|
00174>
00175> *%-----------------|-----------------------------------------------------------|
00176> *%-----------------|------------ Upper Grand Trail Catchment 8 ----------------|
00177> *%-----------------|-----------------------------------------------------------|
00178> CALIB STANDHYD      ID=[1], NHYD=["Upper Grand"], DT=[1](min), AREA=[9.3](ha),
00179>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00180>                     SCS curve number CN=[90],
00181>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00182>                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
00183>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00184>                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
00185>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00186> *%-----------------|-----------------------------------------------------------|
00187> *%-----------------|-------------------- EXT - 5 = 1.02 Ha --------------------|
00188> *%-----------------|-----------------------------------------------------------|
00189> CALIB STANDHYD      ID=[2], NHYD=["Ext-4"], DT=[1](min), AREA=[1.02](ha),
00190>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00191>                     SCS curve number CN=[90],
00192>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00193>                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
00194>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00195>                                          LGI=[150](m), MNI=[0.013], SCI=[0](min)
00196>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00197> *%-----------------|-----------------------------------------------------------|
00198>
00199> *%-----------------|-------------------- Add Total Areas ----------------------|
00200> *%-----------------|-----------------------------------------------------------|
00201> ADD HYD             IDsum=[3], NHYD=["Combined Flow"], IDs to add=[1,2,5]
00202> *%-----------------|-----------------------------------------------------------|
00203>
00204>
00205>
00206> *%-----------------|-----------------------------------------------------------|
00207> *%-----------------|-----------------------100 Yr Event------------------------|
00208> *%-----------------|-----------------------------------------------------------|
00209> MASS STORM          PTOTAL=[129.6](mm), CSDT=[1](min),
00210>                     CURVE_FILENAME=["SCS24HII.MST"]
00211> *%-----------------|-----------------------------------------------------------|
00212> *%-----------------|---------- Main Street Catchments 1 to 9 = 25.8 Ha --------|
00213> *%-----------------|-----------------------------------------------------------|
00214> CALIB STANDHYD      ID=[1], NHYD=["Main Street Drainage"], DT=[1](min), AREA=[25
00215>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00216>                     SCS curve number CN=[90],
00217>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00218>                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
00219>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00220>                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
00221>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00222> *%-----------------|-----------------------------------------------------------|
00223> *%-----------------|-------------------External Lands 22.00 Ha-----------------|
00224> *%-----------------|-----------------------------------------------------------|
00225> CALIB NASHYD        ID=[2], NHYD=["External Drainage"], DT=[1]min, AREA=[22.00](
00226>                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
00227>                     N=[3], TP=[2.28]hrs,
00228>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00229> *%-----------------|-----------------------------------------------------------|
00230> *%-----------------|------------------- EXT - 3 = 5.5 Ha ----------------------|
00231> *%-----------------|-----------------------------------------------------------|
00232> CALIB STANDHYD      ID=[3], NHYD=["Ext-3"], DT=[1](min), AREA=[5.5](ha),
00233>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00234>                     SCS curve number CN=[90],
00235>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00236>                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
00237>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00238>                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
00239>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00240> *%-----------------|-----------------------------------------------------------|
00241> *%-----------------|-------------------- EXT - 4 = 1.8 Ha ---------------------|
00242> *%-----------------|-----------------------------------------------------------|
00243> CALIB STANDHYD      ID=[4], NHYD=["Ext-4"], DT=[1](min), AREA=[1.8](ha),
00244>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00245>                     SCS curve number CN=[90],
00246>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00247>                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
00248>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00249>                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
00250>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00251> *%-----------------|-----------------------------------------------------------|
00252>
00253> *%-----------------|------------------------Add Areas -------------------------|
00254> *%-----------------|-----------------------------------------------------------|
00255> ADD HYD             IDsum=[5], NHYD=["Combined Flow"], IDs to add=[1,2,3,4]
00256> *%-----------------|-----------------------------------------------------------|
00257>
00258> *%-----------------|-----------------------------------------------------------|
00259> *%-----------------|------------ Upper Grand Trail Catchment 8 ----------------|
00260> *%-----------------|-----------------------------------------------------------|
00261> CALIB STANDHYD      ID=[1], NHYD=["Upper Grand"], DT=[1](min), AREA=[9.3](ha),
00262>                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00263>                     SCS curve number CN=[90],
00264>                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
00265>                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
00266>                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
00267>                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
00268>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00269> *%-----------------|-----------------------------------------------------------|
00270> *%-----------------|-------------------- EXT - 5 = 1.02 Ha --------------------|
```

```
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[2], NHYD=["Ext-4"], DT=[1](min), AREA=[1.02](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[150](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|-------------------- Add Total Areas ----------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[3], NHYD=["Combined Flow"], IDs to add=[1,2,5]
*%------------------|-----------------------------------------------------------|

*%------------------|-----------------------------------------------------------|
*%------------------|-----------------------10 Yr Event-------------------------|
*%------------------|-----------------------------------------------------------|
MASS STORM           PTOTAL=[88.8](mm), CSDT=[1](min),
                     CURVE_FILENAME=["SCS24HII.MST"]
*%------------------|-----------------------------------------------------------|
*%------------------|---------- Main Street Catchments 1 to 9 = 25.8 Ha --------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Main Street Drainage"], DT=[1](min), AREA=[25
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------External Lands 22.00 Ha-----------------|
*%------------------|-----------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["External Drainage"], DT=[1]min, AREA=[22.00](
                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
                     N=[3], TP=[2.28]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|------------------- EXT - 3 = 5.5 Ha ----------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[3], NHYD=["Ext-3"], DT=[1](min), AREA=[5.5](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------- EXT - 4 = 1.8 Ha ---------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[4], NHYD=["Ext-4"], DT=[1](min), AREA=[1.8](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|------------------------Add Areas -------------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[5], NHYD=["Combined Flow"], IDs to add=[1,2,3,4]
*%------------------|-----------------------------------------------------------|

*%------------------|-----------------------------------------------------------|
*%------------------|------------ Upper Grand Trail Catchment 8 ----------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Upper Grand"], DT=[1](min), AREA=[9.3](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------- EXT - 5 = 1.02 Ha --------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[2], NHYD=["Ext-4"], DT=[1](min), AREA=[1.02](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[150](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|-------------------- Add Total Areas ----------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[3], NHYD=["Combined Flow"], IDs to add=[1,2,5]
*%------------------|-----------------------------------------------------------|


*%------------------|-----------------------------------------------------------|
*%------------------|------------------------5 Yr Event-------------------------|
*%------------------|-----------------------------------------------------------|
MASS STORM           PTOTAL=[76.8](mm), CSDT=[1](min),
                     CURVE_FILENAME=["SCS24HII.MST"]
*%------------------|-----------------------------------------------------------|
*%------------------|---------- Main Street Catchments 1 to 9 = 25.8 Ha --------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Main Street Drainage"], DT=[1](min), AREA=[25
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------External Lands 22.00 Ha-----------------|
*%------------------|-----------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["External Drainage"], DT=[1]min, AREA=[22.00](
                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
                     N=[3], TP=[2.28]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|------------------- EXT - 3 = 5.5 Ha ----------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[3], NHYD=["Ext-3"], DT=[1](min), AREA=[5.5](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------- EXT - 4 = 1.8 Ha ---------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[4], NHYD=["Ext-4"], DT=[1](min), AREA=[1.8](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|------------------------Add Areas -------------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[5], NHYD=["Combined Flow"], IDs to add=[1,2,3,4]
*%------------------|-----------------------------------------------------------|

*%------------------|-----------------------------------------------------------|
*%------------------|------------ Upper Grand Trail Catchment 8 ----------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Upper Grand"], DT=[1](min), AREA=[9.3](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------- EXT - 5 = 1.02 Ha --------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[2], NHYD=["Ext-4"], DT=[1](min), AREA=[1.02](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[150](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|-------------------- Add Total Areas ----------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[3], NHYD=["Combined Flow"], IDs to add=[1,2,5]
*%------------------|-----------------------------------------------------------|

*%------------------|-----------------------------------------------------------|
*%------------------|------------------------2 Yr Event-------------------------|
*%------------------|-----------------------------------------------------------|
MASS STORM           PTOTAL=[55.2](mm), CSDT=[1](min),
                     CURVE_FILENAME=["SCS24HII.MST"]
*%------------------|-----------------------------------------------------------|
*%------------------|---------- Main Street Catchments 1 to 9 = 25.8 Ha --------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Main Street Drainage"], DT=[1](min), AREA=[25
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------External Lands 22.00 Ha-----------------|
*%------------------|-----------------------------------------------------------|
CALIB NASHYD         ID=[2], NHYD=["External Drainage"], DT=[1]min, AREA=[22.00](
                     DWF=[0](cms),  CN/C=[61], IA=[8](mm),
                     N=[3], TP=[2.28]hrs,
                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|------------------- EXT - 3 = 5.5 Ha ----------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[3], NHYD=["Ext-3"], DT=[1](min), AREA=[5.5](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------- EXT - 4 = 1.8 Ha ---------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[4], NHYD=["Ext-4"], DT=[1](min), AREA=[1.8](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[200](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|------------------------Add Areas -------------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[5], NHYD=["Combined Flow"], IDs to add=[1,2,3,4]
*%------------------|-----------------------------------------------------------|

*%------------------|-----------------------------------------------------------|
*%------------------|------------ Upper Grand Trail Catchment 8 ----------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Upper Grand"], DT=[1](min), AREA=[9.3](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[40](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[600](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|
*%------------------|-------------------- EXT - 5 = 1.02 Ha --------------------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[2], NHYD=["Ext-4"], DT=[1](min), AREA=[1.02](ha),
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[90],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                          LGP=[60](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                          LGI=[150](m), MNI=[0.013], SCI=[0](min)
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%------------------|-----------------------------------------------------------|

*%------------------|-------------------- Add Total Areas ----------------------|
*%------------------|-----------------------------------------------------------|
ADD HYD              IDsum=[3], NHYD=["Combined Flow"], IDs to add=[1,2,5]
*%------------------|-----------------------------------------------------------|

*%------------------|-----------------------------------------------------------|
*%------------------|------------------------25mm Event-------------------------|
*%------------------|-----------------------------------------------------------|
MASS STORM           PTOTAL=[25](mm), CSDT=[1](min),
                     CURVE_FILENAME=["SCS24HII.MST"]
*%------------------|-----------------------------------------------------------|
*%------------------|---------- Main Street Catchments 1 to 9 = 25.8 Ha --------|
*%------------------|-----------------------------------------------------------|
CALIB STANDHYD       ID=[1], NHYD=["Main Street Drainage"], DT=[1](min), AREA=[25
                     XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
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                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                         LGP=[40](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                         LGI=[600](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*%-----------------|-------------------External Lands 22.00 Ha-----------------|
*%-----------------|-----------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["External Drainage"], DT=[1]min, AREA=[22.00](
                    DWF=[0](cms),  CN/C=[61], IA=[8](mm),
                    N=[3], TP=[2.28]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*%-----------------|-----------------------------------------------------------|
*%-----------------|------------------- EXT - 3 = 5.5 Ha ----------------------|
*%-----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[3], NHYD=["Ext-3"], DT=[1](min), AREA=[5.5](ha),
                    XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                         LGP=[60](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                         LGI=[200](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*%-----------------|-------------------- EXT - 4 = 1.8 Ha ---------------------|
*%-----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[4], NHYD=["Ext-4"], DT=[1](min), AREA=[1.8](ha),
                    XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                         LGP=[40](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                         LGI=[200](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|

*%-----------------|------------------------Add Areas -------------------------|
*%-----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[5], NHYD=["Combined Flow"], IDs to add=[1,2,3,4]
*%-----------------|-----------------------------------------------------------|

*%-----------------|-----------------------------------------------------------|
*%-----------------|------------ Upper Grand Trail Catchment 8 ----------------|
*%-----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[1], NHYD=["Upper Grand"], DT=[1](min), AREA=[9.3](ha),
                    XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                         LGP=[40](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                         LGI=[600](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*%-----------------|-------------------- EXT - 5 = 1.02 Ha --------------------|
*%-----------------|-----------------------------------------------------------|
CALIB STANDHYD      ID=[2], NHYD=["Ext-4"], DT=[1](min), AREA=[1.02](ha),
                    XIMP=[0.35], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[90],
                    Pervious   surfaces: IAper=[5](mm), SLPP=[2](%),
                                         LGP=[60](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[2](mm), SLPI=[2](%),
                                         LGI=[150](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|

*%-----------------|-------------------- Add Total Areas ----------------------|
*%-----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["Combined Flow"], IDs to add=[1,2,5]
*%-----------------|-----------------------------------------------------------|

*%-----------------|-----------------------------------------------------------|
FINISH
```

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

   SSSSS  W   W   M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W   MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W   M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W    M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W    M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 3737016
        StormWater Management HYdrologic Model            999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05 ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ********************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: C.F. Crozier & Associates Inc.               +++++++++
 +++++++++                Collingwood          SERIAL#:3737016         +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************

 ***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
 *****----------------------------------------------------------------------*****
 *****    ID:  Hydrograph IDentification numbers, (1-10).                   *****
 *****  NHYD:  Hydrograph reference numbers, (6 digits or characters).      *****
 *****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).    *****
 ***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).      *****
 ***** TpeakDate_hh:mm is the date and time of the peak flow.               *****
 *****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).         *****
 *****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).         *****
 *****     *:  see WARNING or NOTE message printed at end of run.           *****
 *****    **:  see  ERROR  message printed at end of run.                   *****
 ********************************************************************************
 ********************************************************************************

:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 ***********************   S U M M A R Y   O U T P U T   ***********************
 ********************************************************************************
 *         DATE: 2015-05-04     TIME: 20:48:16     RUN COUNTER: 000061         *
 ********************************************************************************
 * Input   filename: I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\20150501.dat     *
 * Output  filename: I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\20150501.out     *
 * Summary filename: I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\20150501.sum     *
 * User comments:                                                               *
 * 1:___________________________________________________________________________*
 * 2:___________________________________________________________________________*
 * 3:___________________________________________________________________________*
 ********************************************************************************


#*******************************************************************************
#  Project Name: [Sarah Properties, Waldemar]    Project Number: [743-3507]
#  Date        : 25-04-2015
#  Modeller    : [A.S.]
#  Company     : C.F. CROZIER $ Associates Inc.
#  License #   :  3737016
#*******************************************************************************
 RUN:COMMAND#
 001:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   0 ]
      [NRUN  =   1 ]
 001:0002-----------------------------------------------------------------------
     READ STORM
      Filename = 48REGHAZ.STM
      Comment  =
      [SDT=60.00:SDUR=  48.00:PTOT= 285.08]
 001:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:Main Stree    42.60    2.764 No_date   48:10  174.70
      [CN= 61.0: N= 3.00]
      [Tp= 2.12:DT= 1.00]
 001:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:Upper Gran     9.78    1.052 No_date   46:14  174.70
      [CN= 61.0: N= 3.00]
      [Tp=  .45:DT= 1.00]
 001:0005-----------------------------------------------------------------------
     MASS STORM
      Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
      Comment  = 24 hour SCS II storm mass curve
      [SDT= 1.00:SDUR=  24.00:PTOT= 129.60]
 001:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:Main Stree    42.60     .997 No_date   14:32   52.07
      [CN= 61.0: N= 3.00]
      [Tp= 2.12:DT= 1.00]
 001:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:Upper Gran     9.78     .726 No_date   12:34   52.07
      [CN= 61.0: N= 3.00]
      [Tp=  .45:DT= 1.00]
 001:0008-----------------------------------------------------------------------
     MASS STORM
      Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
      Comment  = 24 hour SCS II storm mass curve
      [SDT= 1.00:SDUR=  24.00:PTOT=  88.80]
 001:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:Main Stree    42.60     .504 No_date   14:35   26.85
      [CN= 61.0: N= 3.00]
      [Tp= 2.12:DT= 1.00]
 001:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:Upper Gran     9.78     .367 No_date   12:35   26.85
      [CN= 61.0: N= 3.00]
      [Tp=  .45:DT= 1.00]
 001:0011-----------------------------------------------------------------------
     MASS STORM
      Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
      Comment  = 24 hour SCS II storm mass curve
      [SDT= 1.00:SDUR=  24.00:PTOT=  76.80]
 001:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:Main Stree    42.60     .381 No_date   14:37   20.47
      [CN= 61.0: N= 3.00]
      [Tp= 2.12:DT= 1.00]
 001:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:Upper Gran     9.78     .277 No_date   12:35   20.47
      [CN= 61.0: N= 3.00]
      [Tp=  .45:DT= 1.00]
 001:0014-----------------------------------------------------------------------
     MASS STORM
      Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
      Comment  = 24 hour SCS II storm mass curve
      [SDT= 1.00:SDUR=  24.00:PTOT=  55.20]
 001:0015---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       01:Main Stree    42.60     .192 No_date   14:41   10.63
      [CN= 61.0: N= 3.00]
      [Tp= 2.12:DT= 1.00]
 001:0016---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:Upper Gran     9.78     .140 No_date   12:36   10.63
      [CN= 61.0: N= 3.00]
      [Tp=  .45:DT= 1.00]
 001:0017-----------------------------------------------------------------------
     READ STORM
      Filename = 48REGHAZ.STM
      Comment  =
      [SDT=60.00:SDUR=  48.00:PTOT= 285.08]
 001:0018---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     01:Main Stree    25.80    3.707 No_date   46:00  270.25
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
 001:0019---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:External D    22.00    1.379 No_date   48:17  174.70
      [CN= 61.0: N= 3.00]
      [Tp= 2.28:DT= 1.00]
 001:0020---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:Ext-3          5.50     .796 No_date   46:00  270.25
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
 001:0021---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     04:Ext-4          1.80     .262 No_date   46:00  270.26
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
 001:0022---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:Main Stree    25.80    3.707 No_date   46:00  270.25
                      + 02:External D    22.00    1.379 No_date   48:17  174.70
                      + 03:Ext-3          5.50     .796 No_date   46:00  270.25
                      + 04:Ext-4          1.80     .262 No_date   46:00  270.26
      [DT= 1.00]  SUM=  05:Combined F    55.10    5.523 No_date   46:00  232.10
 001:0023---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     01:Upper Gran     9.30    1.336 No_date   46:00  270.26
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
 001:0024---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:Ext-4          1.02     .148 No_date   46:00  270.25
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 150.:MNI=.013:SCI=   .0]
 001:0025---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:Upper Gran     9.30    1.336 No_date   46:00  270.26
                      + 02:Ext-4          1.02     .148 No_date   46:00  270.25
                      + 05:Combined F    55.10    5.523 No_date   46:00  232.10
      [DT= 1.00]  SUM=  03:Combined F    65.42    7.008 No_date   46:00  238.12
 001:0026-----------------------------------------------------------------------
     MASS STORM
      Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
      Comment  = 24 hour SCS II storm mass curve
      [SDT= 1.00:SDUR=  24.00:PTOT= 129.60]
 001:0027---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     01:Main Stree    25.80    7.649 No_date   12:14  115.65
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
 001:0028---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:External D    22.00     .487 No_date   14:43   52.07
      [CN= 61.0: N= 3.00]
      [Tp= 2.28:DT= 1.00]
 001:0029---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:Ext-3          5.50    1.718 No_date   12:12  115.65
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
 001:0030---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     04:Ext-4          1.80     .600 No_date   12:12  115.65
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
 001:0031---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:Main Stree    25.80    7.649 No_date   12:14  115.65
                      + 02:External D    22.00     .487 No_date   14:43   52.07
                      + 03:Ext-3          5.50    1.718 No_date   12:12  115.65
                      + 04:Ext-4          1.80     .600 No_date   12:12  115.65
      [DT= 1.00]  SUM=  05:Combined F    55.10    9.985 No_date   12:13   90.26
 001:0032---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     01:Upper Gran     9.30    2.757 No_date   12:14  115.65
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
 001:0033---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     02:Ext-4          1.02     .328 No_date   12:12  115.65
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 150.:MNI=.013:SCI=   .0]
 001:0034---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     ADD HYD            01:Upper Gran     9.30    2.757 No_date   12:14  115.65
                      + 02:Ext-4          1.02     .328 No_date   12:12  115.65
                      + 05:Combined F    55.10    9.985 No_date   12:13   90.26
      [DT= 1.00]  SUM=  03:Combined F    65.42   13.050 No_date   12:13   94.27
 001:0035-----------------------------------------------------------------------
     MASS STORM
      Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
      Comment  = 24 hour SCS II storm mass curve
      [SDT= 1.00:SDUR=  24.00:PTOT=  88.80]
 001:0036---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     01:Main Stree    25.80    4.797 No_date   12:14   75.52
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
 001:0037---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB NASHYD       02:External D    22.00     .246 No_date   14:47   26.85
      [CN= 61.0: N= 3.00]
      [Tp= 2.28:DT= 1.00]
 001:0038---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     03:Ext-3          5.50    1.081 No_date   12:12   75.52
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
 001:0039---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
     CALIB STANDHYD     04:Ext-4          1.80     .379 No_date   12:12   75.52
      [XIMP=.35:TIMP=.55]
      [LOSS= 2 :CN= 90.0]
```

```
00271>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00272>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00273>  001:0040---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00274>      ADD HYD            01:Main Stree    25.80    4.797 No_date   12:14   75.52
00275>                       + 02:External D    22.00     .246 No_date   14:47   26.85
00276>                       + 03:Ext-3          5.50    1.081 No_date   12:12   75.52
00277>                       + 04:Ext-4          1.80     .379 No_date   12:12   75.52
00278>       [DT= 1.00]  SUM=  05:Combined F    55.10    6.221 No_date   12:14   56.08
00279>  001:0041---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00280>      CALIB STANDHYD     01:Upper Gran     9.30    1.729 No_date   12:14   75.52
00281>       [XIMP=.35:TIMP=.55]
00282>       [LOSS= 2 :CN= 90.0]
00283>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00284>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00285>  001:0042---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00286>      CALIB STANDHYD     02:Ext-4          1.02     .203 No_date   12:12   75.52
00287>       [XIMP=.35:TIMP=.55]
00288>       [LOSS= 2 :CN= 90.0]
00289>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00290>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 150.:MNI=.013:SCI=   .0]
00291>  001:0043---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00292>      ADD HYD            01:Upper Gran     9.30    1.729 No_date   12:14   75.52
00293>                       + 02:Ext-4          1.02     .203 No_date   12:12   75.52
00294>                       + 05:Combined F    55.10    6.221 No_date   12:14   56.08
00295>       [DT= 1.00]  SUM=  03:Combined F    65.42    8.142 No_date   12:14   59.15
00296>  001:0044-----------------------------------------------------------------------
00297>      MASS STORM
00298>       Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
00299>       Comment  = 24 hour SCS II storm mass curve
00300>       [SDT= 1.00:SDUR=  24.00:PTOT=  76.80]
00301>  001:0045---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00302>      CALIB STANDHYD     01:Main Stree    25.80    3.939 No_date   12:15   63.82
00303>       [XIMP=.35:TIMP=.55]
00304>       [LOSS= 2 :CN= 90.0]
00305>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00306>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00307>  001:0046---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00308>      CALIB NASHYD       02:External D    22.00     .186 No_date   14:49   20.47
00309>       [CN= 61.0: N= 3.00]
00310>       [Tp= 2.28:DT= 1.00]
00311>  001:0047---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00312>      CALIB STANDHYD     03:Ext-3          5.50     .889 No_date   12:12   63.82
00313>       [XIMP=.35:TIMP=.55]
00314>       [LOSS= 2 :CN= 90.0]
00315>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00316>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00317>  001:0048---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00318>      CALIB STANDHYD     04:Ext-4          1.80     .313 No_date   12:12   63.82
00319>       [XIMP=.35:TIMP=.55]
00320>       [LOSS= 2 :CN= 90.0]
00321>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00322>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00323>  001:0049---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00324>      ADD HYD            01:Main Stree    25.80    3.939 No_date   12:15   63.82
00325>                       + 02:External D    22.00     .186 No_date   14:49   20.47
00326>                       + 03:Ext-3          5.50     .889 No_date   12:12   63.82
00327>                       + 04:Ext-4          1.80     .313 No_date   12:12   63.82
00328>       [DT= 1.00]  SUM=  05:Combined F    55.10    5.103 No_date   12:14   46.51
00329>  001:0050---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00330>      CALIB STANDHYD     01:Upper Gran     9.30    1.420 No_date   12:15   63.82
00331>       [XIMP=.35:TIMP=.55]
00332>       [LOSS= 2 :CN= 90.0]
00333>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00334>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00335>  001:0051---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00336>      CALIB STANDHYD     02:Ext-4          1.02     .170 No_date   12:12   63.82
00337>       [XIMP=.35:TIMP=.55]
00338>       [LOSS= 2 :CN= 90.0]
00339>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00340>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 150.:MNI=.013:SCI=   .0]
00341>  001:0052---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00342>      ADD HYD            01:Upper Gran     9.30    1.420 No_date   12:15   63.82
00343>                       + 02:Ext-4          1.02     .170 No_date   12:12   63.82
00344>                       + 05:Combined F    55.10    5.103 No_date   12:14   46.51
00345>       [DT= 1.00]  SUM=  03:Combined F    65.42    6.682 No_date   12:14   49.24
00346>  001:0053-----------------------------------------------------------------------
00347>      MASS STORM
00348>       Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
00349>       Comment  = 24 hour SCS II storm mass curve
00350>       [SDT= 1.00:SDUR=  24.00:PTOT=  55.20]
00351>  001:0054---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00352>      CALIB STANDHYD     01:Main Stree    25.80    2.450 No_date   12:16   43.03
00353>       [XIMP=.35:TIMP=.55]
00354>       [LOSS= 2 :CN= 90.0]
00355>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00356>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00357>  001:0055---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00358>      CALIB NASHYD       02:External D    22.00     .094 No_date   14:53   10.63
00359>       [CN= 61.0: N= 3.00]
00360>       [Tp= 2.28:DT= 1.00]
00361>  001:0056---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00362>      CALIB STANDHYD     03:Ext-3          5.50     .567 No_date   12:13   43.03
00363>       [XIMP=.35:TIMP=.55]
00364>       [LOSS= 2 :CN= 90.0]
00365>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00366>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00367>  001:0057---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00368>      CALIB STANDHYD     04:Ext-4          1.80     .201 No_date   12:13   43.03
00369>       [XIMP=.35:TIMP=.55]
00370>       [LOSS= 2 :CN= 90.0]
00371>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00372>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00373>  001:0058---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00374>      ADD HYD            01:Main Stree    25.80    2.450 No_date   12:16   43.03
00375>                       + 02:External D    22.00     .094 No_date   14:53   10.63
00376>                       + 03:Ext-3          5.50     .567 No_date   12:13   43.03
00377>                       + 04:Ext-4          1.80     .201 No_date   12:13   43.03
00378>       [DT= 1.00]  SUM=  05:Combined F    55.10    3.178 No_date   12:15   30.09
00379>  001:0059---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00380>      CALIB STANDHYD     01:Upper Gran     9.30     .883 No_date   12:16   43.03
00381>       [XIMP=.35:TIMP=.55]
00382>       [LOSS= 2 :CN= 90.0]
00383>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00384>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00385>  001:0060---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00386>      CALIB STANDHYD     02:Ext-4          1.02     .106 No_date   12:12   43.03
00387>       [XIMP=.35:TIMP=.55]
00388>       [LOSS= 2 :CN= 90.0]
00389>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00390>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 150.:MNI=.013:SCI=   .0]
00391>  001:0061---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00392>      ADD HYD            01:Upper Gran     9.30     .883 No_date   12:16   43.03
00393>                       + 02:Ext-4          1.02     .106 No_date   12:12   43.03
00394>                       + 05:Combined F    55.10    3.178 No_date   12:15   30.09
00395>       [DT= 1.00]  SUM=  03:Combined F    65.42    4.152 No_date   12:15   32.14
00396>  001:0062-----------------------------------------------------------------------
00397>      MASS STORM
00398>       Filename = I:\700\743SAR~1\3507WA~1\DESIGN\SWM\HYMO\SCS24HII.MST
00399>       Comment  = 24 hour SCS II storm mass curve
00400>       [SDT= 1.00:SDUR=  24.00:PTOT=  25.00]
00401>  001:0063---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00402>      CALIB STANDHYD     01:Main Stree    25.80     .723 No_date   12:17   15.39
00403>       [XIMP=.35:TIMP=.55]
00404>       [LOSS= 2 :CN= 90.0]
00405>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00406>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00407>  001:0064---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00408>      CALIB NASHYD       02:External D    22.00     .012 No_date   15:16    1.61
00409>       [CN= 61.0: N= 3.00]
00410>       [Tp= 2.28:DT= 1.00]
00411>  001:0065---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00412>      CALIB STANDHYD     03:Ext-3          5.50     .174 No_date   12:13   15.39
00413>       [XIMP=.35:TIMP=.55]
00414>       [LOSS= 2 :CN= 90.0]
00415>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00416>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00417>  001:0066---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00418>      CALIB STANDHYD     04:Ext-4          1.80     .061 No_date   12:13   15.39
00419>       [XIMP=.35:TIMP=.55]
00420>       [LOSS= 2 :CN= 90.0]
00421>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00422>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 200.:MNI=.013:SCI=   .0]
00423>  001:0067---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00424>      ADD HYD            01:Main Stree    25.80     .723 No_date   12:17   15.39
00425>                       + 02:External D    22.00     .012 No_date   15:16    1.61
00426>                       + 03:Ext-3          5.50     .174 No_date   12:13   15.39
00427>                       + 04:Ext-4          1.80     .061 No_date   12:13   15.39
00428>       [DT= 1.00]  SUM=  05:Combined F    55.10     .932 No_date   12:15    9.89
00429>  001:0068---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00430>      CALIB STANDHYD     01:Upper Gran     9.30     .261 No_date   12:17   15.39
00431>       [XIMP=.35:TIMP=.55]
00432>       [LOSS= 2 :CN= 90.0]
00433>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  40.:MNP=.250:SCP=   .0]
00434>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 600.:MNI=.013:SCI=   .0]
00435>  001:0069---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00436>      CALIB STANDHYD     02:Ext-4          1.02     .033 No_date   12:12   15.39
00437>       [XIMP=.35:TIMP=.55]
00438>       [LOSS= 2 :CN= 90.0]
00439>       [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  60.:MNP=.250:SCP=   .0]
00440>       [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI= 150.:MNI=.013:SCI=   .0]
00441>  001:0070---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-
00442>      ADD HYD            01:Upper Gran     9.30     .261 No_date   12:17   15.39
00443>                       + 02:Ext-4          1.02     .033 No_date   12:12   15.39
00444>                       + 05:Combined F    55.10     .932 No_date   12:15    9.89
00445>       [DT= 1.00]  SUM=  03:Combined F    65.42    1.217 No_date   12:16   10.76
00446>  001:0071-----------------------------------------------------------------------
00447>       FINISH
00448> --------------------------------------------------------------------------------
00449> ********************************************************************************
00450>      WARNINGS / ERRORS / NOTES
00451>      -------------------------
00452>    Simulation ended on 2015-05-04     at 20:48:18
00453> ================================================================================
00454>
00455>
```

APPENDIX C

Hydraulics

Worksheet for 20m ROW (Street 7/Main)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.400	%
Discharge	3.90	m³/s

Section Definitions

Station (m)	Elevation (m)
0+0.00	0.174
0+5.15	0.020
0+5.65	-0.131
1+0.00	0.000
1+4.35	-0.131
1+4.70	0.020
2+0.00	0.174

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+0.00, 0.174)	(2+0.00, 0.174)	0.026

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.25	m
Elevation Range	-0.1305 to 0.1740 m	
Flow Area	2.15	m²
Wetted Perimeter	16.5982	m
Hydraulic Radius	0.13	m
Top Width	16.5385	m

Worksheet for 20m ROW (Street 7/Main)

Results

Normal Depth		0.25	m
Critical Depth		0.31	m
Critical Slope		1.23396	%
Velocity		1.81	m/s
Velocity Head		0.17	m
Specific Energy		0.42	m
Froude Number		1.61	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	m
Length	0.0000	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.25	m
Critical Depth	0.31	m
Channel Slope	3.400	%
Critical Slope	1.23396	%

Cross Section for 20m ROW (Street 7/Main)

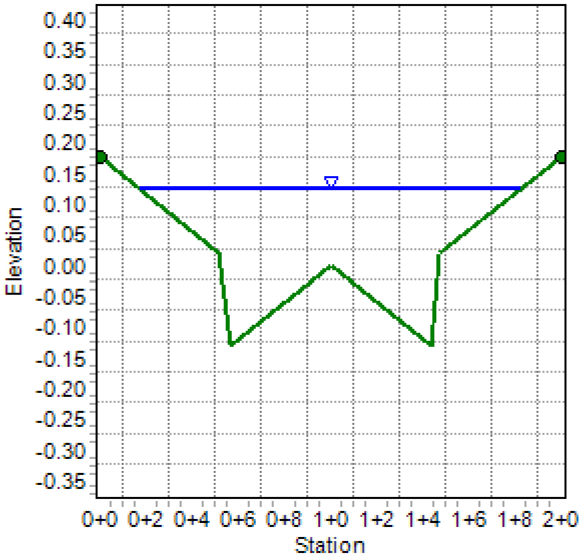
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.400	%
Normal Depth	0.25	m
Discharge	3.90	m³/s

Cross Section Image



Worksheet for Ex. Main Street West Ditch Capacity (Per Topo Survey)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.500	%
Normal Depth	1.00	m
Left Side Slope	33.33	%
Right Side Slope	33.33	%

Results

Discharge	6.39	m^3/s
Flow Area	3.00	m^2
Wetted Perimeter	20.75	ft
Hydraulic Radius	0.47	m
Top Width	19.69	ft
Critical Depth	0.98	m
Critical Slope	1.63231	%
Velocity	2.13	m/s
Velocity Head	0.23	m
Specific Energy	1.23	m
Froude Number	0.96	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.0000	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	1.00	m
Critical Depth	0.98	m
Channel Slope	1.500	%
Critical Slope	1.63231	%

Worksheet for Ex. Main Street West Ditch Capacity (Per Topo Survey)

Messages

Notes

Depth at intersection of Main Street and David Street

Cross Section for Ex. Main Street West Ditch Capacity (Per Topo

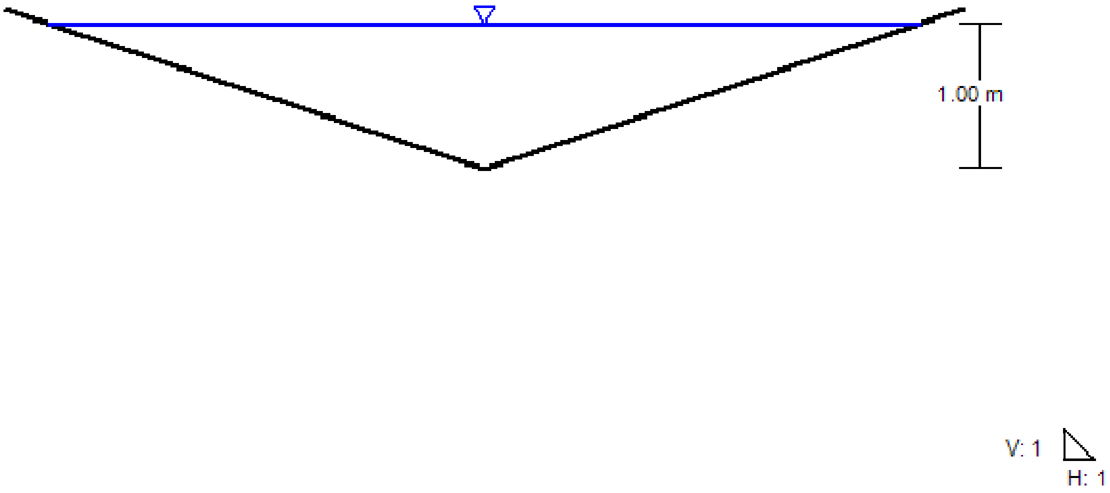
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.500	%
Normal Depth	1.00	m
Left Side Slope	33.33	%
Right Side Slope	33.33	%
Discharge	6.39	m³/s

Cross Section Image



Worksheet for Main Street Ditch - Pr. Flows

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.500	%
Left Side Slope	33.33	%
Right Side Slope	33.33	%
Discharge	5.70	m³/s

Results

Normal Depth	0.96	m
Flow Area	2.76	m²
Wetted Perimeter	19.89	ft
Hydraulic Radius	0.45	m
Top Width	18.87	ft
Critical Depth	0.94	m
Critical Slope	1.65718	%
Velocity	2.07	m/s
Velocity Head	0.22	m
Specific Energy	1.18	m
Froude Number	0.95	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.0000	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.96	m
Critical Depth	0.94	m
Channel Slope	1.500	%
Critical Slope	1.65718	%

Cross Section for Main Street Ditch - Pr. Flows

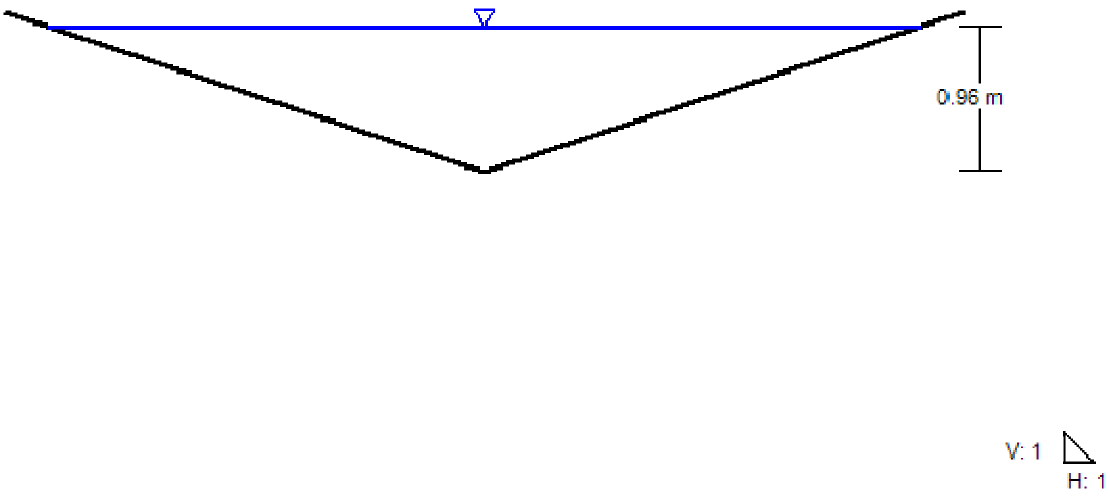
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	1.500	%
Normal Depth	0.96	m
Left Side Slope	33.33	%
Right Side Slope	33.33	%
Discharge	5.70	m³/s

Cross Section Image



Worksheet for 20m ROW (Henry St)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.800	%
Discharge	13.05	m³/s

Section Definitions

Station (m)	Elevation (m)
0+0.00	0.020
0+4.00	-0.581
0+8.00	0.020
0+8.50	-0.131
1+3.00	0.000
1+7.50	-0.131
1+8.00	0.020
2+2.00	-1.481
2+6.00	0.020

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+0.00, 0.020)	(2+6.00, 0.020)	0.026

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.43	m
Elevation Range	-1.4805 to 0.0195 m	
Flow Area	7.59	m²
Wetted Perimeter	21.4467	m

Worksheet for 20m ROW (Henry St)

Results

Hydraulic Radius	0.35	m
Top Width	20.8225	m
Normal Depth	1.43	m
Critical Depth	1.34	m
Critical Slope	0.90272	%
Velocity	1.72	m/s
Velocity Head	0.15	m
Specific Energy	1.58	m
Froude Number	0.91	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.0000	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	1.43	m
Critical Depth	1.34	m
Channel Slope	0.800	%
Critical Slope	0.90272	%

Cross Section for 20m ROW (Henry St)

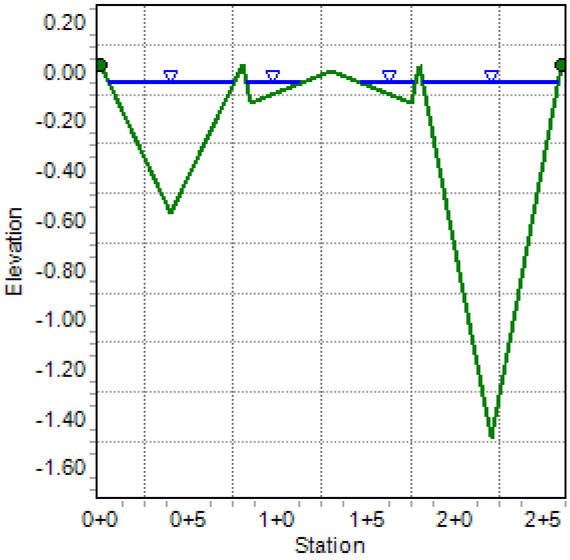
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.800	%
Normal Depth	1.43	m
Discharge	13.05	m³/s

Cross Section Image



Culvert Design Report
N/A

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Eleva	451.30	m	Discharge	13.0500	m³/s
Headwater Depth/Height	1.90		Tailwater Elevation	446.00	m
Inlet Control HW Elev.	451.30	m	Control Type	Inlet Control	
Outlet Control HW Elev.	450.91	m			

Grades

Upstream Invert	448.40	m	Downstream Invert	448.00	m
Length	40.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile

Profile	S2		Depth, Downstream	1.26	m
Slope Type	Steep		Normal Depth	1.17	m
Flow Regime	Supercritical		Critical Depth	1.52	m
Velocity Downstream	4.84	m/s	Critical Slope	0.008024	m/m

Section

Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.13	m
Section Size	2130 x 1520 mm		Rise	1.52	m
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	450.91	m	Upstream Velocity Head	0.82	m
Ke	0.20		Entrance Loss	0.16	m

Inlet Control Properties

Inlet Control HW Elev.	451.30	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.3	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

APPENDIX D

Municipal Servicing

Sarah Properties - STORM SEWER DESIGN SHEET
(10yr Site + External Flows)

PROJECT: Sarah Properties - Waldemar Subdivision
PROJECT No.: 743-3507
FILE: Storm Sewer Design
Design: AS Check:
DATE: March 5, 2014
Updated: April 7, 2015 Updated By: NEM

100 YEAR - WALDEMAR IDF CURVE COEFFICIENTS

A 49 B -0.693

10 YEAR - WALDEMAR IDF CURVE COEFFICIENTS

A 33.6 B -0.693

Revised: 5/2/2015

INITIAL TIME OF CONCENTRATION 10.00

MANNINGS "n" 0.013

Areas	FR MH NO	TO MH NO	AREA ID	AREA (A) Ha	RUN-OFF COEFF	A x C	Cummul. A x C	TIME OF CONC. min	I mm/hr	Q l/sec	SLOPE %	PIPE DIA. mm	VEL. m/sec	LENGTH m	TIME OF FLOW min	CAPACITY l/sec	% CAPACITY
	MHA 31	MHA23	1D	0.280	0.500	0.140	0.140	10.00	116.30	**45.27**	0.50	300	0.97	108.0	1.86	**68.38**	**66.20**
	CB 1	MHA 23	1C	0.300	0.500	0.150	0.150	10.00	116.30	**48.50**	0.50	300	0.97	60.0	1.03	**68.38**	**70.93**
	MHA 23	MHA 22	1B	1.170	0.500	0.585	0.875	11.86	103.33	**251.36**	0.50	600	1.54	83.0	0.90	**434.17**	**57.89**
	MHA 22	MHA 19	1A, 1E	1.150	0.500	0.575	1.450	12.76	98.22	**395.93**	0.50	675	1.66	94.0	0.94	**594.39**	**66.61**
AREAS 1, 2, 4	MHA 28	MHA 27	2D	0.490	0.500	0.245	0.245	10.00	116.30	**79.22**	0.60	375	1.23	65.0	0.88	**135.81**	**58.33**
	MHA 27	MHA 20	2B, EXT-2	0.600	0.500	0.300	0.545	10.88	109.69	**245.20**	0.40	600	1.37	93.0	1.13	**388.33**	**63.14**
	MHA 21	MHA 20	2A, EXT-1	0.960	0.500	0.480	0.480	10.00	116.30	**487.20**	1.40	600	2.57	78.0	0.51	**726.51**	**67.06**
	MHA 20	MHA 19	2C	1.530	0.500	0.765	1.790	12.01	102.44	**920.78**	1.40	750	2.98	133.0	0.74	**1317.25**	**69.90**
	MHA 19	MHA 18	4C	0.560	0.500	0.280	3.520	13.70	93.49	**1325.81**	0.50	1050	2.23	85.0	0.64	**1930.91**	**68.66**
	MHA 18	MHA 03	4B	1.270	0.500	0.635	4.155	14.34	90.60	**1457.46**	0.50	1050	2.23	90.0	0.67	**1930.91**	**75.48**
AREAS 4A, 4D	CB 2	MHA 44	4A	0.570	0.500	0.285	0.285	10.00	116.30	**92.15**	0.50	450	1.27	85.0	1.12	**201.60**	**45.71**
	MHA 44	MHA 02	4D	0.900	0.500	0.450	0.735	11.12	108.07	**220.82**	0.50	525	1.40	70.0	0.83	**304.10**	**72.62**
	MHA 07	MHA 06	3A	1.020	0.500	0.510	0.510	10.00	116.30	**164.90**	2.50	375	2.51	110.0	0.73	**277.22**	**59.48**
	MHA 06	MHA 05	3B	0.640	0.500	0.320	0.830	10.73	110.76	**255.57**	1.50	450	2.20	120.0	0.91	**349.18**	**73.19**
	MHA 05	MHA 04	3E	0.600	0.500	0.300	1.130	11.64	104.68	**328.84**	1.50	525	2.43	93.0	0.64	**526.72**	**62.43**
	MHA 17	MHA 16	3C	1.520	0.500	0.760	0.760	10.00	116.30	**245.73**	2.50	450	2.83	120.0	0.71	**450.79**	**54.51**
	MHA 16	MHA 04	3D	0.540	0.500	0.270	1.030	10.71	110.94	**317.66**	0.50	600	1.54	120.0	1.30	**434.17**	**73.16**
	MHA 04	MHA 03	3H	0.60	0.500	0.300	2.460	12.28	100.88	**689.93**	2.50	600	3.43	90.0	0.44	**970.84**	**71.07**
	MHA 15	MHA 14	3F	1.14	0.500	0.570	0.570	10.00	116.30	**184.30**	2.50	375	2.51	95.0	0.63	**277.22**	**66.48**
	MHA 14	MHA 03	3G	0.54	0.500	0.270	0.840	10.63	111.48	**260.32**	1.50	450	2.20	117.0	0.89	**349.18**	**74.55**
AREAS 3, 5, 7	MHA 03	MHA 02	3M	0.60	0.500	0.300	7.755	15.01	87.76	**2303.07**	2.50	1050	4.99	97.0	0.32	**4317.66**	**53.34**
	MHA 13	MHA 12	3N	0.900	0.500	0.450	0.450	10.00	116.30	**145.50**	2.50	375	2.51	90.0	0.60	**277.22**	**52.48**

CROZIER
&ASSOCIATES
Consulting Engineers

Sarah Properties - STORM SEWER DESIGN SHEET
(10yr Site + External Flows)

PROJECT: Sarah Properties - Waldemar Subdivision
PROJECT No.: 743-3507
FILE: Storm Sewer Design
Design: AS Check:
DATE: March 5, 2014
Updated: April 7, 2015 Updated By: NEM

100 YEAR - WALDEMAR IDF CURVE COEFFICIENTS
A 49 B -0.693

10 YEAR - WALDEMAR IDF CURVE COEFFICIENTS
A 33.6 B -0.693

Revised: 5/2/2015 INITIAL TIME OF CONCENTRATION 10.00 MANNINGS "n" 0.013

Areas	**FR MH NO**	**TO MH NO**	**AREA ID**	**AREA (A) Ha**	**RUN-OFF COEFF**	**A x C**	**Cummul. A x C**	**TIME OF CONC. min**	**I mm/hr**	**Q l/sec**	**SLOPE %**	**PIPE DIA. mm**	**VEL. m/sec**	**LENGTH m**	**TIME OF FLOW min**	**CAPACITY l/sec**	**% CAPACITY**
	MHA 12	MHA 11	3O	0.720	0.500	0.360	0.810	10.60	111.72	**251.57**	1.50	450	2.20	90.0	0.68	**349.18**	**72.05**
	MHA 11	MHA 10	3P	0.800	0.500	0.400	1.210	11.28	106.99	**359.88**	3.50	450	3.35	103.0	0.51	**533.38**	**67.47**
	MHA 10	MHA 09	3I	0.450	0.500	0.225	1.435	11.79	103.75	**413.87**	2.50	525	3.14	95.0	0.50	**679.99**	**60.86**
	MHA 09	MHA 37	3J	0.220	0.500	0.110	1.545	12.30	100.78	**432.86**	0.50	750	1.78	25.0	0.23	**787.21**	**54.99**
	MHA 36	MHA 37	5	1.000	0.500	0.500	0.500	10.00	116.30	**161.66**	0.50	525	1.40	45.0	0.53	**304.10**	**53.16**
	MHA 37	MHA 08	3K	0.360	0.500	0.180	2.225	12.53	99.47	**615.29**	0.50	750	1.78	42.0	0.39	**787.21**	**78.16**
	MHA 08	MHA 02	3L	0.350	0.500	0.175	2.400	12.92	97.37	**649.63**	2.50	750	3.98	104.0	0.44	**1760.25**	**36.91**
	MHA 02	MHA 01	7	0.650	0.500	0.325	11.215	15.34	86.47	**3107.03**	2.50	1200	5.45	120.0	0.37	**6164.43**	**50.40**
AREAS 6, 8, 9	MHA 34	MHA 33	6A	1.200	0.500	0.600	0.600	10.00	116.30	**194.00**	4.50	375	3.37	42.0	0.21	**371.93**	**52.16**
	MHA 38	MHA 33	6B	1.000	0.500	0.500	0.500	10.00	116.30	**161.66**	0.50	525	1.40	51.0	0.61	**304.10**	**53.16**
	MHA 33	MHA 32	8	0.920	0.500	0.460	1.560	10.61	111.66	**484.27**	0.50	750	1.78	112.0	1.05	**787.21**	**61.52**
	MHA 32	MHA 01	9	0.810	0.500	0.405	1.965	11.65	104.61	**571.44**	0.50	750	1.78	143.0	1.34	**787.21**	**72.59**
MAIN ST	MHA 01	MHA 40		5.22	0.500	2.610	15.790	15.70	85.07	**4145.14**	4.60	1050	6.76	102.0	0.25	**5856.75**	**70.78**
	MHA 40	MHA 41	EXT-3	0.00	0.500	0.000	15.790	15.96	84.14	**4104.28**	0.50	1650	3.01	25.0	0.14	**6444.89**	**63.68**
	MHA 41	MHA 42		0.00	0.500	0.000	15.790	16.09	83.64	**4082.27**	0.50	1650	3.01	165.0	0.91	**6444.89**	**63.34**
	MHA 42	MHA 43	EXT-4	1.80	0.550	0.990	16.780	17.01	80.50	**4166.17**	4.90	1650	9.44	30.0	0.05	**20175.69**	**20.65**
	MHA 43	HW	-	0.00	0.000	0.000	16.780	17.06	80.33	**4158.08**	1.00	1650	4.26	15.0	0.06	**9114.45**	**45.62**
DITCH	HW	DITCH END	-	0.00	0.000	0.000	16.780	17.12	80.14	**4149.18**	1.00		0.00	17.0	N/A	**N/A**	**N/A**

CROZIER
&ASSOCIATES
Consulting Engineers

Sarah Properties - STORM SEWER DESIGN SHEET
(10yr Site + External Flows)

PROJECT: Sarah Properties - Waldemar Subdivision
PROJECT No.: 743-3507
FILE: Storm Sewer Design
Design: AS Check:
DATE: March 5, 2014
Updated: April 7, 2015 Updated By: NEM

100 YEAR - WALDEMAR IDF CURVE COEFFICIENTS
A 49 B -0.693

10 YEAR - WALDEMAR IDF CURVE COEFFICIENTS
A 33.6 B -0.693

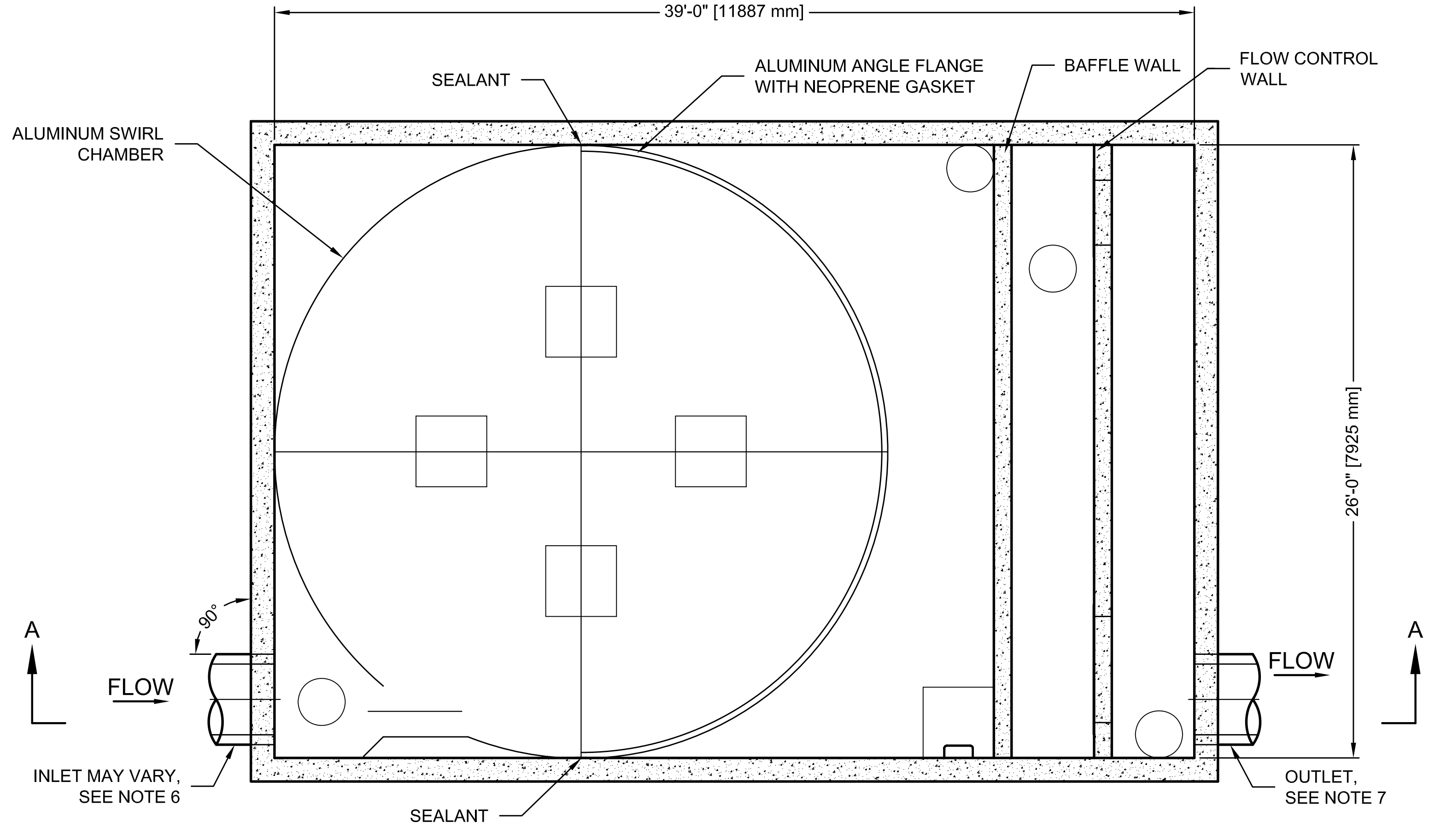
Revised: 5/2/2015 INITIAL TIME OF CONCENTRATION 10.00 MANNINGS "n" 0.013

Areas	FR MH NO	TO MH NO	AREA ID	AREA (A) Ha	RUN-OFF COEFF	A x C	Cummul. A x C	TIME OF CONC. min	I mm/hr	Q l/sec	SLOPE %	PIPE DIA. mm	VEL. m/sec	LENGTH m	TIME OF FLOW min	CAPACITY l/sec	% CAPACITY
SEPARATE CONTROL - AREA 8	MHA 25	MHA 26	8A	1.050	0.500	0.525	0.525	10.00	116.30	**169.75**	0.50	525	1.40	135.0	1.60	**304.10**	**55.82**
	MHA 26	MHA 29	8D	1.090	0.500	0.545	1.070	11.60	104.93	**312.11**	4.50	525	4.21	100.0	0.40	**912.30**	**34.21**
	MHA 24	MHA 29	8C	1.480	0.500	0.740	0.740	10.00	116.30	**239.26**	2.50	450	2.83	147.0	0.86	**450.79**	**53.08**
	MHA 29	MHA 49	8G	0.730	0.500	0.365	2.175	12.00	102.52	**619.87**	3.50	525	3.72	60.0	0.27	**804.57**	**77.04**
	MHA 56	MHA 46	8B	0.810	0.500	0.405	0.405	10.00	116.30	**130.95**	4.50	300	2.90	90.0	0.52	**205.13**	**63.84**
	MHA 46	MHA 47	8F	0.710	0.500	0.355	0.760	10.52	112.31	**237.30**	1.50	450	2.20	22.0	0.17	**349.18**	**67.96**
	MHA 47	MHA 48	8E	0.770	0.500	0.385	1.145	10.68	111.09	**353.62**	4.50	450	3.80	75.0	0.33	**604.80**	**58.47**
	MHA 48	MHA 49	8H	0.850	0.500	0.425	1.570	11.01	108.78	**474.80**	0.50	750	1.78	110.0	1.03	**787.21**	**60.31**
	MHA 49	MHA 54	8I	1.530	0.500	0.765	4.510	12.27	100.95	**1265.74**	0.50	1050	2.23	30.0	0.22	**1930.91**	**65.55**
	MHA 54	OUTLET		0.000	0.500	0.000	4.510	12.49	99.69	**1249.95**	0.50	1050	2.23	55.0	0.41	**1930.91**	**64.73**
CULVERT	DITCH END	CULVERT	-	0.00	0.000	0.000	21.290	17.12	80.14	**5153.90**	1.00		0.00	18.0	N/A	**N/A**	**N/A**

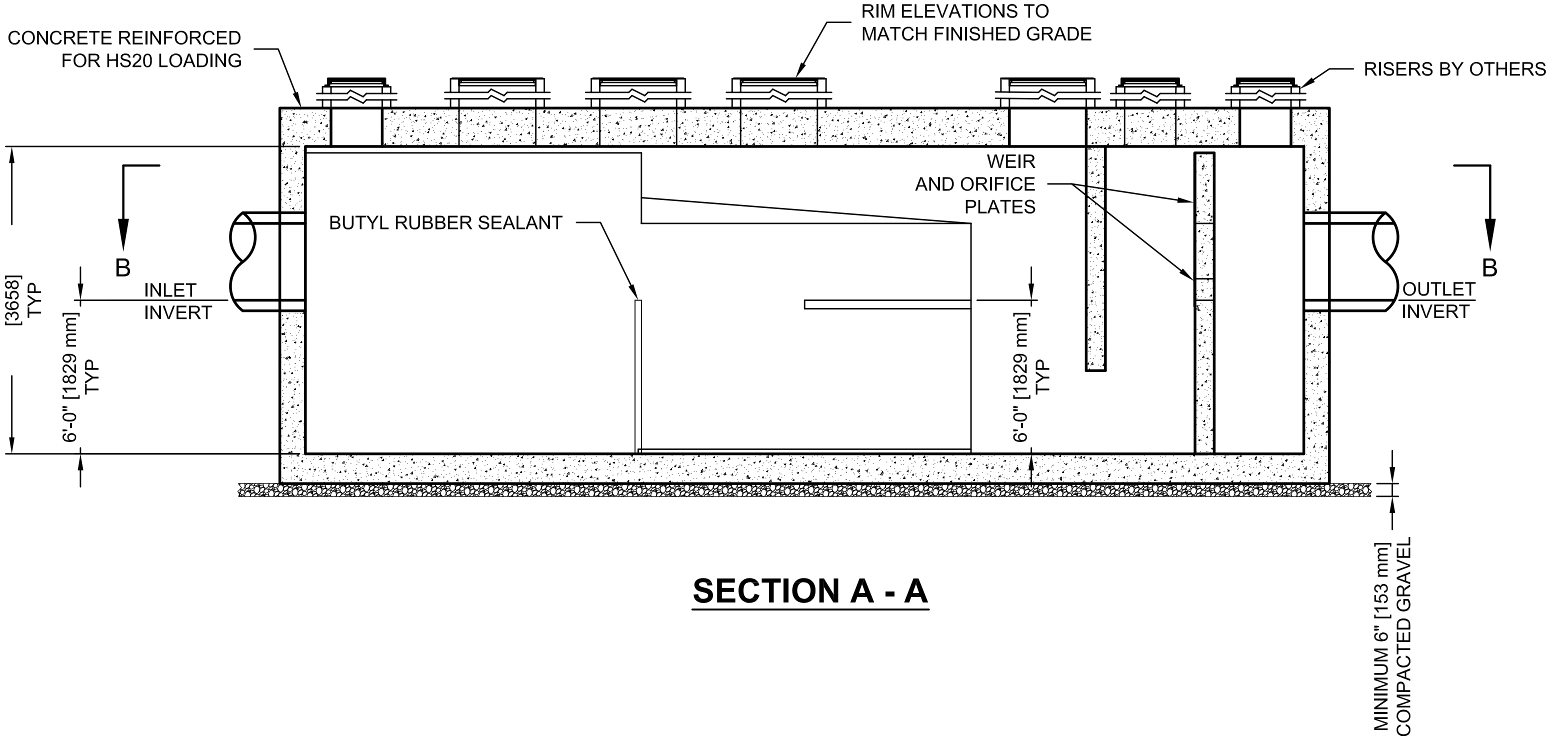
VORTECHS 2639CIP DESIGN NOTES

VORTECHS 2639CIP RATED TREATMENT CAPACITY IS 118 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

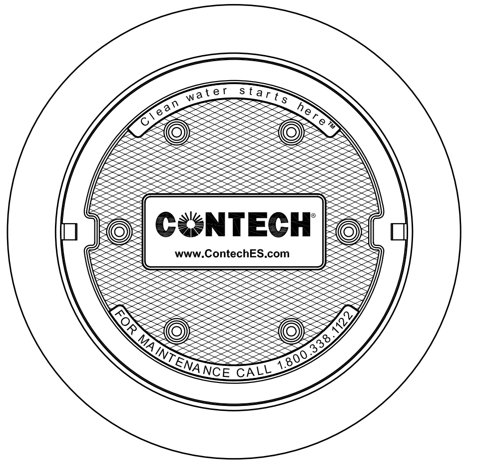
THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS REPRESENTATIVE. www.ContechES.com



PLAN VIEW B - B



SECTION A - A



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (CFS)			*
PEAK FLOW RATE (CFS)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL ALUMINUM COMPONENTS, ACCESS FRAMES, COVERS, AND HATCHES; MASTIC/SEALANTS AND HARDWARE FOR INSTALLATION, UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. CONTECH SHALL PROVIDE SITE SPECIFIC STRUCTURAL DESIGNS UTILIZING SITE SPECIFIC EARTH COVER AND GROUNDWATER ELEVATIONS. ENGINEER OF RECORD TO CONFIRM ACTUAL SITE INFORMATION. CASTINGS SHALL MEET MINIMUM AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. INLET PIPE(S) MUST BE PERPENDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES

A. ESTIMATED CONCRETE VOLUME FOR VORTECHS SYSTEM APPROXIMATELY 220 CUBIC YARDS. ESTIMATED TIME TO INSTALL ALUMINUM COMPONENTS - 20 MAN-HOURS PER SYSTEM. MATERIALS AND LABOR PROVIDED BY CONTRACTOR.
B. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
C. SITE SERVICES TO BE DONE BY CONTRACTOR INCLUDE CAST-IN-PLACE CONCRETE WORK, EXCAVATION, DEWATERING, BEDDING, BACKFILL, SURFACE RESTORATION, BLASTING (IF ANY) AND ANY OTHER SITE SPECIFIC ISSUES.
D. CONTRACTOR TO PROVIDE ALL EQUIPMENT AND RIGGING REQUIRED TO LIFT AND SET THE SWIRL CHAMBER, WEIR & ORIFICE FLOW CONTROLS, ACCESSWAY HATCHES, AND CASTINGS.
E. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
F. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
G. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.
H. CONTECH WILL PROVIDE ON-SITE REPRESENTATION LIMITED TO 8 HOURS PER PROJECT FOR THE SUPERVISION OF THE FINAL ASSEMBLY OF ALL VORTECHS SYSTEM COMPONENTS INSIDE THE CONCRETE STRUCTURE, IF NECESSARY.
I. INSTALLATION AND ASSEMBLY TOOL CHECKLISTS AND INSTRUCTIONS AVAILABLE UPON REQUEST.

Vortechs®

THIS PRODUCT MAY BE PROTECTED BY THE FOLLOWING
U.S. PATENT: 5,759,415; RELATED FOREIGN PATENTS.

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CAST-IN-PLACE VORTECHS 2639CIP
STANDARD DETAIL

C:\USERS\FISHERS\DESKTOP\LOGO UPDATE\VORTECHS CIP\NEED NOTES\GOOD\2639CIP.DWG 9/18/2012 10:34 AM

VORTECHS SYSTEM® ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON AN AVERAGE PARTICLE SIZE OF 80 MICRONS

Sarah Properties - Waldemar Development
Amaranth, ON
Model 2639CIP OFF-LINE
Peak Treatment Capacity 3342 l/s

Design Ratio[1] = $\dfrac{\text{(56 hectares) x (0.35) x (2.775)}}{\text{(49.34 m2)}}$ **= 1.1**

Bypass occurs at an elevation of 458.53 m (at approximately 11 l/s/m2)

Rainfall Intensity mm/hr	Operating Rate[2] % of capacity	Flow Treated (l/s)	% Total Rainfall Volume[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.5	0.8	27.3	11.2%	98.0%	11.0%
1.0	1.6	54.7	10.6%	98.0%	10.4%
1.5	2.5	82.0	9.4%	98.0%	9.2%
2.0	3.3	109.3	8.1%	98.0%	8.0%
2.5	4.1	136.7	6.3%	98.0%	6.2%
3.0	4.9	164.0	5.6%	98.0%	5.5%
3.6	5.7	191.3	4.7%	98.0%	4.6%
4.1	6.5	218.7	5.0%	98.0%	4.9%
4.6	7.4	246.0	4.1%	97.6%	4.0%
5.1	8.2	273.4	4.0%	96.9%	3.8%
6.4	10.2	341.7	5.1%	96.0%	4.9%
7.6	12.3	410.0	4.6%	94.7%	4.3%
8.9	14.3	478.4	3.8%	92.8%	3.5%
10.2	16.0	534.7	2.7%	90.6%	2.5%
11.4	16.3	543.4	1.7%	90.6%	1.6%
12.7	17.7	591.5	2.5%	89.9%	2.3%
19.1	18.3	610.6	2.9%	88.8%	2.5%
25.4	19.5	652.5	1.7%	88.0%	1.5%
38.1	24.5	819.1	0.4%	85.3%	0.4%
50.8	35.2	1177.2	0.2%	79.4%	0.1%
					91.2%

% rain falling at >50.8 mm/hr or bypassing treatment =	5.4%
Assumed removal efficiency for bypassed flows =	0.0%
Removal Efficiency Adjustment[5] =	6.5%
Predicted Net Annual Load Removal Efficiency =	**85%**

1 - Design Ratio = (Total Drainage Area) x (Runoff Coefficient) x (Rational Method Conversion) / Grit Chamber Area
- The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
- The rational method conversion based on the units in the above equation is 2.775.

2 - Operating Rate (% of capacity) = percentage of peak operating rate of 68 l/s/m^2.

3 - Based On 21 Years of Hourly Rainfall Data From Canadian Rainfall Station 6110557, Barrie, ON

4 - Based on Contech Stormwater Solutions laboratory verified removal of an average particle size of 80 microns (see Vortechs Guide).

5- Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

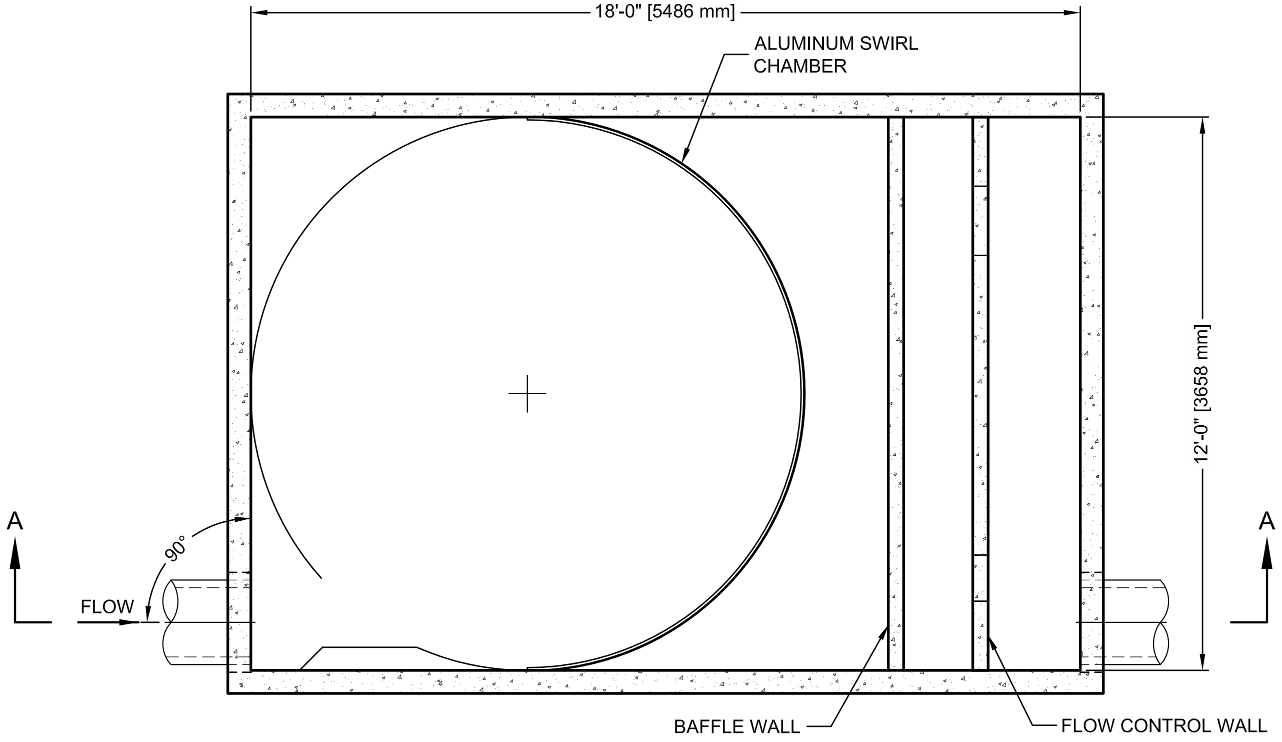
Calculated by: JAK 4/14/2015

Checked by:

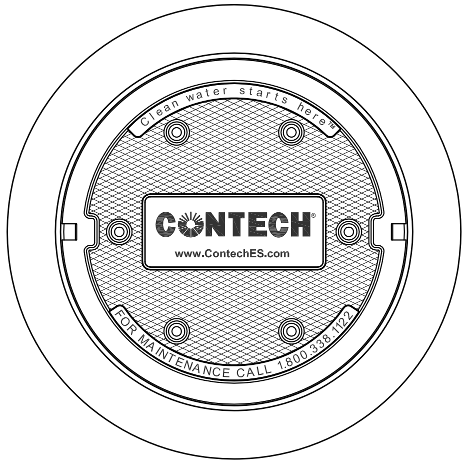
VORTECHS 16000 DESIGN NOTES

VORTECHS 16000 RATED TREATMENT CAPACITY IS 25 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS , PLEASE CONTACT YOUR CONTECH CONSTRUCTION PRODUCTS REPRESENTATIVE. www.ContechES.com



SECTION B-B



FRAME AND COVER

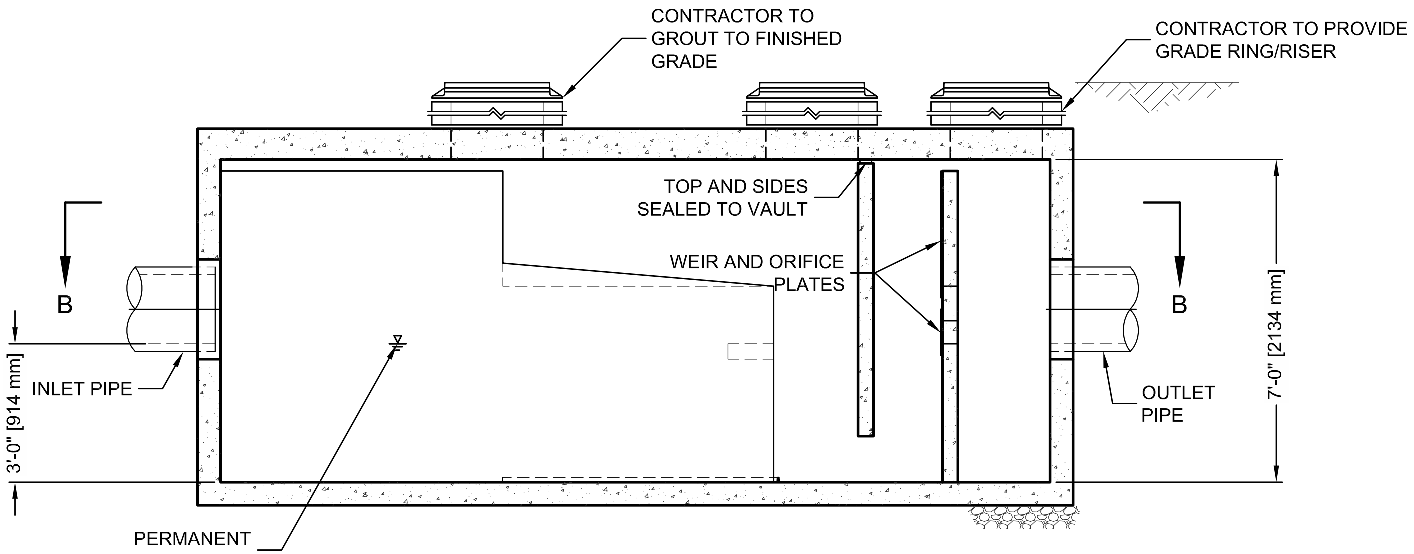
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (CFS)			*
PEAK FLOW RATE (CFS)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD



SECTION A-A

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. INLET PIPE(S) MUST BE PERPEDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTECHS STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

Vortechs®

THIS PRODUCT MAY BE PROTECTED BY THE FOLLOWING U.S. PATENT: 5,759,415; RELATED FOREIGN PATENTS.

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

VORTECHS 16000
STANDARD DETAIL

I:\COMMON\CAD\TREATMENT\20 VORTECHS\40 STANDARD DRAWINGS\DWG\VX-16000-DTL.DWG 8/6/2014 2:41 PM

VORTECHS SYSTEM® ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON AN AVERAGE PARTICLE SIZE OF 80 MICRONS
SARAH PROPERTIES - WALDEMAR DEVELOPMENT
AMARANTH, ON
MODEL 16000 OFF-LINE
SITE DESIGNATION NORTH

Design Ratio[1] = $\frac{(9\ \text{hectares}) \times (0.5) \times (2.775)}{(10.5\ \text{m2})}$ **= 1.18**

Bypass occurs at an elevation of 0.94m (at approximately 34 l/s/m2)

Rainfall Intensity mm/hr	Operating Rate[2] % of capacity	Flow Treated (l/s)	% Total Rainfall Volume[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.5	0.9	6.2	11.2%	100.0%	11.2%
1.0	1.8	12.5	10.6%	98.0%	10.4%
1.5	2.6	18.7	9.4%	98.0%	9.2%
2.0	3.5	25.0	8.1%	98.0%	8.0%
2.5	4.4	31.2	6.3%	98.0%	6.2%
3.0	5.3	37.5	5.6%	98.0%	5.5%
3.6	6.2	43.7	4.7%	98.0%	4.6%
4.1	7.1	50.0	5.0%	97.6%	4.8%
4.6	7.9	56.2	4.1%	97.6%	4.0%
5.1	8.8	62.4	4.0%	96.9%	3.8%
6.4	11.0	78.1	5.1%	95.3%	4.9%
7.6	13.2	93.7	4.6%	93.8%	4.3%
8.9	15.4	109.3	3.8%	91.8%	3.5%
10.2	17.6	124.9	2.8%	89.9%	2.5%
11.4	19.8	140.5	2.0%	88.0%	1.7%
12.7	22.1	156.1	2.9%	86.1%	2.5%
19.1	33.1	234.2	4.8%	80.4%	3.9%
25.4	44.1	312.2	3.5%	71.7%	2.5%
38.1	66.2	468.3	1.0%	53.0%	0.5%
50.8	88.2	624.5	0.3%	21.2%	0.1%
					94.2%

Predicted Annual Runoff Volume Treated =	93.4%
Assumed removal efficiency for bypassed flows =	0.0%
Estimated reduction in efficiency[5] =	6.5%
Predicted Net Annual Load Removal Efficiency =	**88%**

1 - Design Ratio = (Total Drainage Area) x (Runoff Coefficient) x (Rational Method Conversion) / Grit Chamber Area

- The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
- The rational method conversion based on the units in the above equation is 2.775.

2 - Operating Rate (% of capacity) = percentage of peak operating rate of 68 l/s/m^2.

3 - Based On 21 Years of Hourly Rainfall Data From Canadian Rainfall Station 6110557, Barrie, ON

4 - Based on Contech Construction Products laboratory verified removal of an average particle size of 80 microns (see Vortechs Guide).

5- Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Calculated by: JAK 4/7

Checked by:

CROZIER & ASSOCIATES
Consulting Engineers

Project: Waldemar Development
Project No.: 743-3507

File: Design
Design by: DD
Check by: AS

Date: 3/7/2013
Updated: 25/04/2015

Sanitary Demand Calculations
WALDEMAR DEVELOPMENT

Site Area (Residential) = 25 ha
No. of Units = 334
Population Density = 3.00 persons per unit

Population, p = 1002 persons

Sanitary Design Flow - MOE Method:

<u>Residential Sewage Flow:</u>

q = 450.00 L/cap.day — MOE Design Guidelines - 5.5.2 Domestic Sewage Flows

Average Daily Flow = 5.22 L/s

<u>Peak Flow:</u>

Q(d) = pqM/86.4 + IA
Harmon Factor, M = 3.80
q = 450.00 L/cap.day
Population, p = 1.00 (thousands)
Infiltration, I = 0.107 L/ha.s — MOE Design Guidelines - Appendix A
Area, A = 25 ha

Peak Flow = 22.50 L/s

CROZIER & ASSOCIATES
Consulting Engineers

Project: Waldemar Development
Project No.: 743-3507

File: Design
Design by: DD
Check by: AS

Date: 3/7/2013
Updated: 25/04/2015

Sanitary Demand Calculations
WALDEMAR DEVELOPMENT

Site Area (Residential) = 10 ha
No. of Units = 40
Population Density = 3.00 persons per unit

Population, p = 120 persons

Sanitary Design Flow - MOE Method:

Residential Sewage Flow:
q = 450.00 L/cap.day MOE Design Guidelines - 5.5.2 Domestic Sewage Flows

Average Daily Flow = 0.63 L/s

Peak Flow:
Q(d) = pqM/86.4 + IA
Harmon Factor, M = 4.22
q = 450.00 L/cap.day
Population, p = 0.12 (thousands)
Infiltration, I = 0.107 L/ha.s MOE Design Guidelines - Appendix A
Area, A = 10 ha

Peak Flow = 3.71 L/s

tributary area is poorly defined, or where the financial burden on present users would be too severe, the sewage system design may be based on more restricted approaches. In these cases the design period should be at least 20 years.

For the estimation of future sewage flow rates for municipal sewage collection systems, the designer should make reference to the Official Plan (or Draft Official Plan) of the municipality. Such official plans will contain future population densities and land uses.

If no official plan or draft plan exist, the designer should size sanitary sewers for population densities of at least 25 persons per gross hectare. This minimum level of population density will generally be suitable for rural municipalities only. If the municipality already has higher population densities, the designer should use similar or higher densities for new growth areas.

Sanitary sewer capacities should be designed for the estimated ultimate tributary population, except where parts of the systems can be readily increased in capacity. Similarly, consideration should be given to the maximum anticipated capacity of institutions, industrial parks and other sewage sources. For details on design flows refer to *Section 8.5.4 - Sewage flows*.

5.5.2 Design Sewage Flows

Sanitary sewage flows are made up of wastewater discharges from residential, commercial, institutional and industrial establishments, plus extraneous flow components from such sources as groundwater and surface runoff.

The peak sewage flow rates, for which sewer system capacity is to be provided, should be calculated for all flow contributors, for present and future conditions. In addition to being able to carry the peak flows, sewers should be able to develop sufficient flow velocity to transport the sewage solids, thus avoiding deposition and the development of nuisance conditions under lesser flow rates.

5.5.2.1 Domestic Sewage Flows

The following criteria should be used in determining peak sewage flows for municipal sewer design for residential areas:

- Design population derived from drainage area and expected maximum population over the design period;
- Average daily domestic flow (exclusive of extraneous flows) of 225 to 450 L/(cap·d) [59 to 119 US gal/(cap·d)];
- Peak Extraneous Flow; and
- Peak domestic sewage flows to be calculated using the following formula:

sewage treatment facility. However, as the design period for pumping stations and treatment facilities is generally less than that of the sewers (i.e., 10-20 years vs 20-40 years) a lesser extraneous flow allowance should be used. Also, while the allowance is made in sewer design it is assumed that the actual volumes received will be substantially less because of the controls and inspections which are undertaken during and after construction.

Therefore, in the design of any new pumping station or treatment facilities complementary to a new collector sewer system an extraneous flow allowance of 90 L/cap. d (average) and 227 L/cap.d (peak) should be made.

This design value, when applied against the typical plan of subdivision, is approximately equivalent to;

a) 0.043 L/ha. s (average) - 0.107 L/ha, s (peak)

b) 0.308 L/ha. s (average) - 0.776 L/mm0/100 m/hr

(peak)

Assessment of Existing Sewage VJorks

The capital and operating costs associated with new sewerage works facilities are increasing steadily. In addition, the Ministry's "Water Management - Goals Policies, Objectives and Implementation Procedures of the Ministry of the Environment" requires that all Certificates of Approval for new sewage treatment facilities contain the effluent requirements for the facility.

Accordingly, studies to ascertain the extent and source of extraneous flows are becoming more important.

Experience in the United States has indicated that if the extraneous flow, based upon the highest weekly average

WALDEMAR DEVELOPMENT

SANITARY SEWER DESIGN MODEL

PROJECT NO. 743-3507
DESIGN: DD
DATE: 03/12/2014
CHECK:
REVISED: 4/28/2015
REVISED BY: NEM

N = 0.013
Population= 3.0 p.p.u.
Single Dwelling

Peak Factor (M) = 1+(14/4+(P/1000)^0.5)
Avg. Daily/Capita Flow = 450 L/cap.d
Q infiltration = 0.107 L/ha.s

Location	FROM MH	TO MH	CATCHMENT ID	Length (m)	Area (ha)	Residential Units	Pop. (person)	Cumul. Area (ha)	Cumul. Pop. (person)	Pop. Flow Q(p) (L/s)	Peak Factor	Peak Design Flow (L/s)	Peak Infiltration Flow (L/s)	Total Infiltration Flow (L/s)	Combined (L/s)	Pipe Diam (mm)	Slope (m/m)	Cap. (L/s)	Full Flow Vel. (m/s)	Q/Qcap %
	S11	S12	F	154	1.69	18	54	1.69	54	0.28	4.31	1.21	0.18	0.18	**1.39**	200	0.004	**20.74**	**0.66**	6.71
	S12	S24	JJ	100	0.32	2	6	2.01	60	0.31	4.30	1.34	0.03	0.22	**1.56**	200	0.004	**20.74**	**0.66**	7.51
	S10	S24	O	154	1.66	16	48	1.66	48	0.25	4.32	1.08	0.18	0.18	**1.26**	200	0.004	**20.74**	**0.66**	6.06
	S24	S41	R	60	0.46	4	12	4.13	120	0.63	4.22	2.64	0.18	0.44	**3.08**	200	0.004	**20.74**	**0.66**	14.85
	S46	S49	G	135	1.41	15	45	1.41	45	0.23	4.32	1.01	0.05	0.15	**1.16**	200	0.004	**20.74**	**0.66**	5.61
	S49	S39	H	26	0.73	5	15	2.14	60	0.31	4.30	1.34	0.15	0.23	**1.57**	200	0.004	**20.74**	**0.66**	7.58
	S39	S40	P	78	0.55	5	15	2.69	75	0.39	4.28	1.67	0.06	0.29	**1.96**	200	0.004	**20.74**	**0.66**	9.44
	S40	S41	Q	108	0.92	9	27	3.61	102	0.53	4.24	2.25	0.10	0.39	**2.64**	200	0.004	**20.74**	**0.66**	12.72
	S41	S48	S	40	0.26	2	6	8.00	228	1.19	4.13	4.90	0.03	0.86	**5.76**	200	0.004	**20.74**	**0.66**	27.75
	S43	S42	T	70	0.98	9	27	0.98	27	0.14	4.36	0.61	0.10	0.10	**0.72**	200	0.004	**20.74**	**0.66**	3.46
	S42	S48	KK	30	0.27	3	9	1.25	36	0.19	4.34	0.81	0.03	0.13	**0.95**	200	0.004	**20.74**	**0.66**	4.57
pump	S48	S09	-	?	0.00	0	0	9.25	264	1.38	4.10	5.64	0.00	0.99	**6.63**	200	0.004	**20.74**	**0.66**	31.96
	S09	S08	N	65	1.04	9	27	10.29	291	1.52	4.08	6.19	0.11	1.10	**7.29**	200	0.004	**20.74**	**0.66**	35.15
	S08	S07	M	94	0.89	8	24	11.18	315	1.64	4.07	6.68	0.10	1.20	**7.87**	200	0.004	**20.74**	**0.66**	37.95
	S23	S22	E	83	1.12	11	33	1.12	33	0.17	4.35	0.75	0.12	0.12	**0.87**	200	0.004	**20.74**	**0.66**	4.18
	S22	S21	D	94	0.88	9	27	2.00	60	0.31	4.30	1.34	0.09	0.21	**1.56**	200	0.004	**20.74**	**0.66**	7.51
	S21	S07	L	140	0.79	7	21	2.79	81	0.42	4.27	1.80	0.08	0.30	**2.10**	200	0.004	**20.74**	**0.66**	10.12
	S07	S06	X	175	1.50	15	45	15.47	441	2.30	4.00	9.19	0.16	1.66	**10.85**	200	0.004	**20.74**	**0.66**	52.29
	S50	S20	C	154	1.34	15	45	1.34	45	0.23	4.32	1.01	0.14	0.14	**1.16**	200	0.004	**20.74**	**0.66**	5.58
	S18	S20	B	273	2.66	30	90	2.66	90	0.47	4.26	1.99	0.28	0.28	**2.28**	200	0.004	**20.74**	**0.66**	10.99
	S20	S19	K	92	0.61	0	0	4.61	135	0.70	4.21	2.96	0.07	0.49	**3.45**	200	0.004	**20.74**	**0.66**	16.63
	S17	S19	J	250	2.24	25	75	2.24	75	0.39	4.28	1.67	0.24	0.24	**1.91**	200	0.004	**20.74**	**0.66**	9.21
	S19	S06	LL	95	0.53	0	0	7.38	210	1.09	4.14	4.53	0.06	0.79	**5.32**	200	0.004	**20.74**	**0.66**	25.64
	S16	S06	V	230	2.07	22	66	2.07	66	0.34	4.29	1.47	0.22	0.22	**1.70**	200	0.004	**20.74**	**0.66**	8.17
	S06	S05	W	91	0.26	1	3	25.18	720	3.75	3.89	14.58	0.03	2.69	**17.27**	300	0.014	**114.42**	**1.62**	15.10
	S26	S05	BB	84	0.77	7	21	0.77	21	0.11	4.38	0.48	0.08	0.08	**0.56**	300	0.002	**43.25**	**0.61**	1.30
	S37	S05	AA	95	1.01	11	33	1.01	33	0.17	4.35	0.75	0.11	0.11	**0.86**	200	0.004	**20.74**	**0.66**	4.12
	S05	S35	EE	45	0.08	0	0	27.04	774	4.03	3.87	15.60	0.01	2.89	**18.49**	300	0.024	**149.81**	**2.12**	12.34
	S35	S33	FF	75	0.76	6	18	27.80	792	4.13	3.86	15.93	0.08	2.97	**18.91**	300	0.015	**118.43**	**1.68**	15.97
	S33	S28	GG	140	0.60	6	18	28.40	810	4.22	3.86	16.27	0.06	3.04	**19.31**	300	0.011	**101.42**	**1.43**	19.04
	S36	S04	Y	66	0.60	6	18	0.60	18	0.09	4.39	0.41	0.06	0.06	**0.48**	200	0.004	**20.74**	**0.66**	2.29
	S04	S30	Z	23	0.19	2	6	0.79	24	0.13	4.37	0.55	0.02	0.08	**0.63**	200	0.004	**20.74**	**0.66**	3.04
	S30	S29	MM	47	0.22	1	3	1.01	27	0.14	4.36	0.61	0.02	0.11	**0.72**	200	0.004	**20.74**	**0.66**	3.48
	S29	S28	DD	78	0.74	6	18	1.75	45	0.23	4.32	1.01	0.08	0.19	**1.20**	200	0.004	**20.74**	**0.66**	5.79
	S28	S02	HH	115	0.21	1	3	30.36	858	4.47	3.84	17.17	0.02	3.25	**20.42**	300	0.004	**61.16**	**0.87**	33.38
	S15	S14	A	100	0.83	6	18	0.83	18	0.09	4.39	0.41	0.09	0.09	**0.50**	200	0.004	**20.74**	**0.66**	2.41
	S14	S13	I	93	0.93	9	27	1.76	45	0.23	4.32	1.01	0.10	0.19	**1.20**	200	0.004	**20.74**	**0.66**	5.79
	S13	S03	U	100	0.87	9	27	2.63	72	0.38	4.28	1.60	0.09	0.28	**1.89**	200	0.004	**20.74**	**0.66**	9.09
	S03	S02	CC	135	1.21	13	39	3.84	111	0.58	4.23	2.45	0.13	0.41	**2.86**	200	0.004	**20.74**	**0.66**	13.77
	S02	S01	II	105	1.05	10	30	35.25	999	5.20	3.80	19.77	0.11	3.77	**23.55**	300	0.005	**68.38**	**0.97**	34.43
	S01	Treatment Facility	-	24	0.00	0	0	35.25	999	5.20	3.80	19.77	0.00	3.77	**23.55**	300	0.005	**68.38**	**0.97**	34.43

Notes: Assumed 3.0 p.p.u for site population
Average daily flow rate Based on 450 L/cap*d as per MOE Standards

CROZIER & ASSOCIATES
Consulting Engineers

Project: Sarah Properties - Waldemar
Project No.: 743-3507
File: Design
Design by: DD
Check by: AS
Date: 7/9/2014
Updated: 25/04/2015

Pump Spreadsheet

All inputs that must be manually entered by the user have been highlighted in green. All other outputs will be generated from these values.

In flows

In Flow Rate	L/s
average	0.63
max day	3.71

In Flow Rate	L/min	cu.m/s	USgpm
average	37.8	0.00063	10.0
max day	222.6	0.00371	58.8

Storage Tank Dimensions (Pump Station)

Tank Dimensions (metric)	Dimensions (m)
Length	
Width	
Diameter	1.800
1800mm Manhole	

Tank Level	Geodetic Elevation (m)	Depth (m)	Volume (cu.m)	Volume (L)
Top	461.50	1.5	3.82	3817.0
Alarm	460.00	1	2.54	2544.7
Start pt. 2	459.00	2	5.09	5089.4
Start pt. 1	457.00	2	5.09	5089.4
Low Level	455.00	1	2.54	2544.7
Bottom	454.00	-	-	-
	Total	7.50	19.09	19085.18

Time to Fill Storage Tank

	Average In Flow (L/s) =	0.63	**Max In Flow (L/s) =**	3.71
Tank Level	Seconds	Minutes	Seconds	Minutes
Top	6058.8	101.0	1028.9	17.1
Alarm	4039.2	67.3	685.9	11.4
Start pt. 2	8078.4	134.6	1371.8	22.9
Start pt. 1	8078.4	134.6	1371.8	22.9
Low Level	4039.2	67.3	685.9	11.4
Bottom	-	-	-	-
Total	30293.9	504.9	5144.3	85.7

The above table summarizes the amount of time it would take to fill each section of the storage tank based on the rate of flow coming into the tank.

CROZIER & ASSOCIATES
Consulting Engineers

Project:	Sarah Properties - Waldemar	File:	Design	Date:	7/9/2014
Project No.:	743-3507	Design by:	DD	Updated:	25/04/2015
		Check by:	AS		

Pump Spreadsheet

Head Losses

Static Head		
Start Elevation =	455.00	Pump Station Elevation
Discharge Elevation =	463.00	Septic Treatment Area Elevation
Static Head =	**8**	m

Static Head = Discharge Elevation - Start Elevation

	Friction Head	Inputs:		
D =	Pipe Diameter =	75.00	mm	Forcemain
C =	Pipe Material Coeff. =	120.00		
L =	Pipe Length =	200.00	m	
Q =	Discharge Rate =	8.00	L/s	Assumed >= inflow
h =	Head Loss =	**11.84**	m	

HIDDEN

Pipe Diameter =	*2.95*	*in*	*L =*	*656.20*	*ft*
Pipe Material Coeff. =	*120.00*		*Q =*	*126.72*	*Usgpm*
Pipe Length =	*656.20*	*ft*	*D =*	*2.95*	*in*
Discharge Rate =	*126.72*	*USgpm*	*h =*	*0.21*	*ft*
Head Loss =	*38.86*	*ft*			

Friction Head = 0.002083*L*(100/C)^1.85*(Q^1.85/D^4.87)
For imperial units

	Fitting Losses		
v =	Velocity =	1.81	m/s
D =	Pipe Diameter =	75.00	mm
A =	Cross Section Area =	0.44	sq.m
Q =	Discharge Rate =	8.00	L/s
C =	Pipe Material Coeff. =	120.00	
	Head Loss =	**0.06**	m

Fitting Losses = 0.002083*Le*(100/C)^1.85*(Q^1.85/D^4.87)
For imperial units

Pipe Fittings	Coeff. (K)	No. of Parts	
Globe Valve	10	0	
Angle Valve	5	0	
Swing Check Valve	2.5	0	
Gate Valve	0.19	1	
Close Return Bend	2.2	0	
Standard Tee	1.8	2	
Standard Elbow	0.9	3	
Medium Sweep Elbow	0.75	0	
Long Sweep Elbow	0.6	0	
	∑ K =	**6.49**	
	Equivalent Length (Le) =	**1.08**	m

Equivalent Length (Le) = ∑K*v^2/(2*g)

Total Dynamic Head				
8.00	**L**	**@**	**19.91**	m
126.72	**USgpm**	**@**	**65.32**	ft

Draw Down Time

Inflow (L/s)	Pump Timing (s)	Pumping Timing (min)
0.63	690.6	11.5
3.71	1186.3	19.8

CROZIER & ASSOCIATES
Consulting Engineers

Project: Sarah Properties - Waldemar
Project No.: 743-3507

File: Design
Design by: DD
Check by: AS

Date: 7/9/2014
Updated: 25/04/2015

Pump Spreadsheet

Summary System Curve

C =	120.00	
Inflow =	3.71	L/s
Pump Rate =	8.00	L/s
Start pt. 1 Volume =	5089.38	L
Static Head =	8.00	m
Pipe Length =	200.00	m
∑ K =	6.49	
Pipe Diameter =	75.00	mm

			Pump Multiple x	1.00
Dimension	Imperial		Metric	
Q =	126.72	Usgpm	8.00	L/s
Le =	3.56	ft	1.08	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	5.94	ft/s	1.81	m/s
TDH =	65.32	ft	19.91	m

			Pump Multiple x	0.25
Dimension	Imperial		Metric	
Q =	31.68	Usgpm	2.00	L/s
Le =	0.22	ft	0.07	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	1.49	ft/s	0.45	m/s
TDH =	29.24	ft	8.91	m

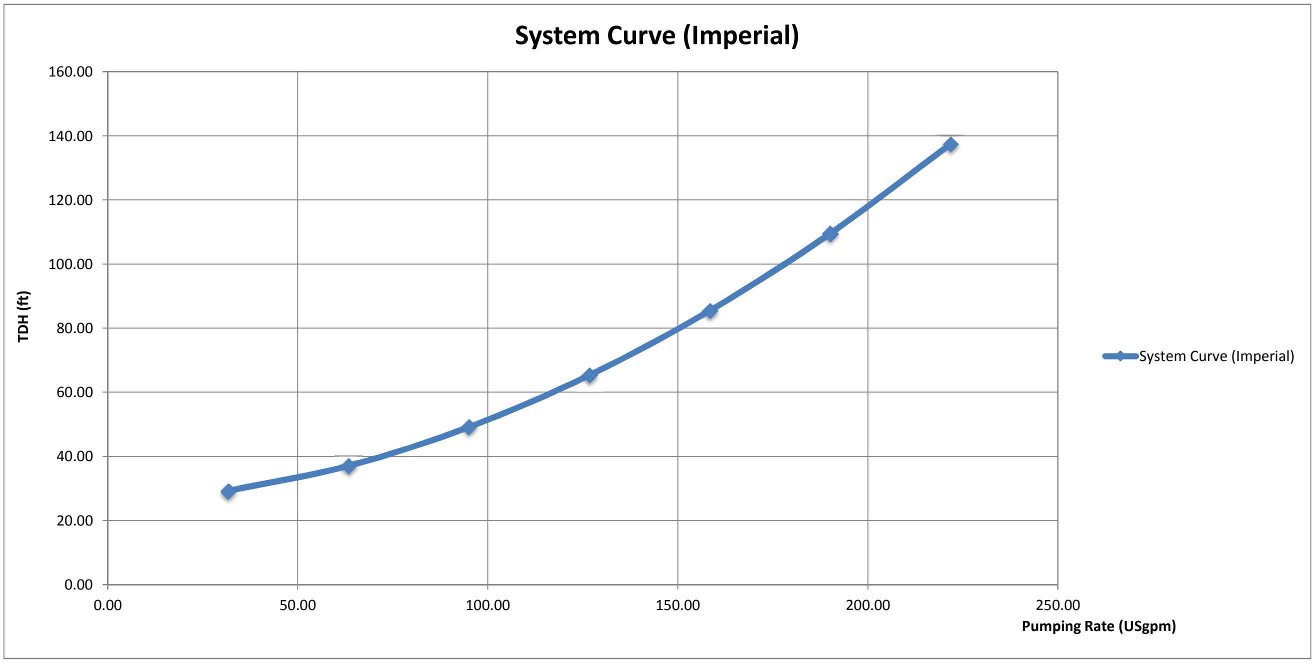
			Pump Multiple x	1.25
Dimension	Imperial		Metric	
Q =	158.40	Usgpm	10.00	L/s
Le =	5.56	ft	1.69	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	7.43	ft/s	2.26	m/s
TDH =	85.46	ft	26.05	m

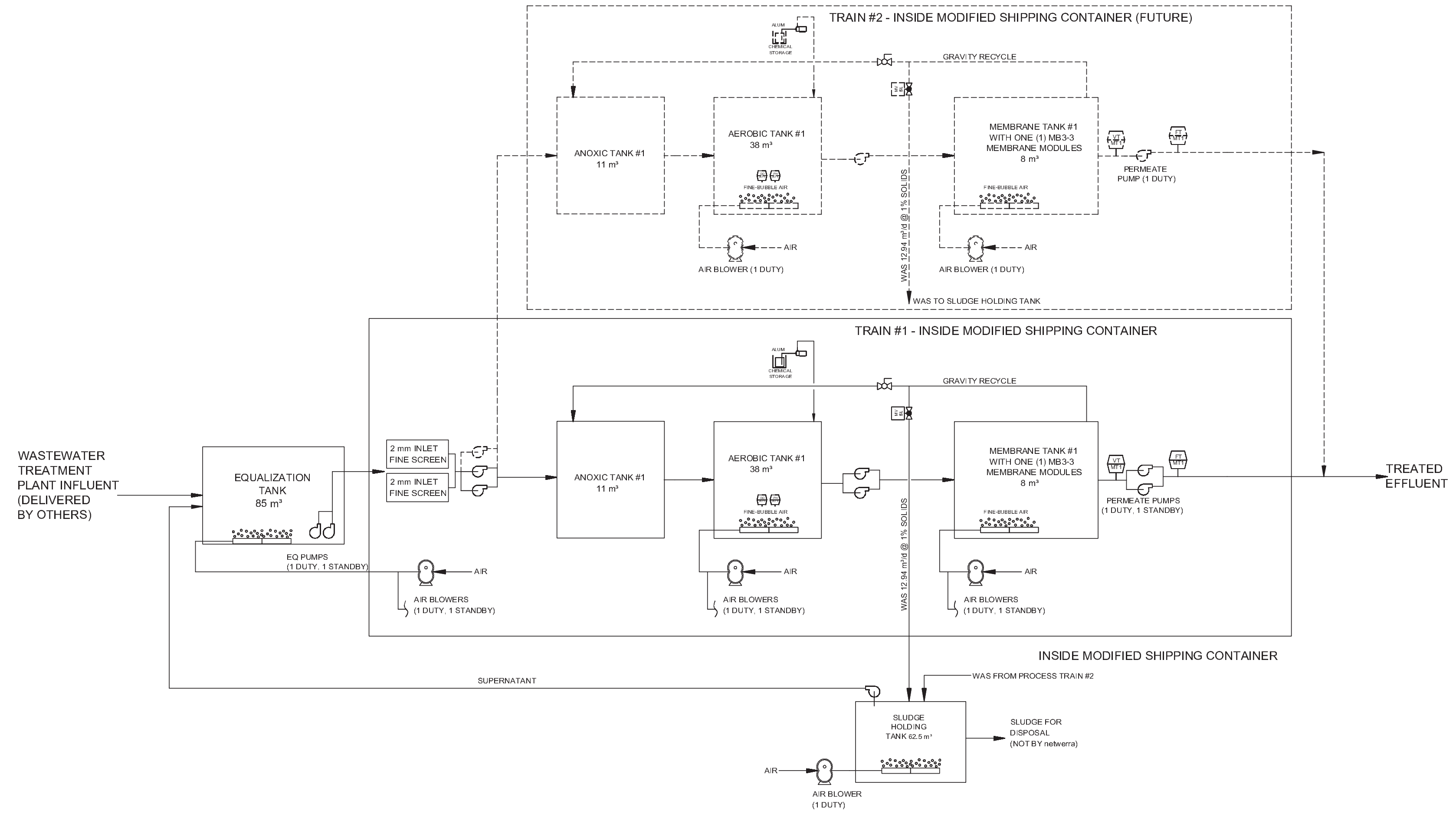
			Pump Multiple x	0.50
Dimension	Imperial		Metric	
Q =	63.36	Usgpm	4.00	L/s
Le =	0.89	ft	0.27	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	2.97	ft/s	0.91	m/s
TDH =	37.04	ft	11.29	m

			Pump Multiple x	1.50
Dimension	Imperial		Metric	
Q =	190.08	Usgpm	12.00	L/s
Le =	8.01	ft	2.44	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	8.91	ft/s	2.72	m/s
TDH =	109.53	ft	33.38	m

			Pump Multiple x	0.75
Dimension	Imperial		Metric	
Q =	95.04	Usgpm	6.00	L/s
Le =	2.00	ft	0.61	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	4.46	ft/s	1.36	m/s
TDH =	49.14	ft	14.98	m

			Pump Multiple x	1.75
Dimension	Imperial		Metric	
Q =	221.76	Usgpm	14.00	L/s
Le =	10.90	ft	3.32	m
D =	2.95	in	75.00	mm
A =	6.85	sq.in	0.00	sq.m
v =	10.40	ft/s	3.17	m/s
TDH =	137.49	ft	41.91	m





NOTES

newterra

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www.newterra.com

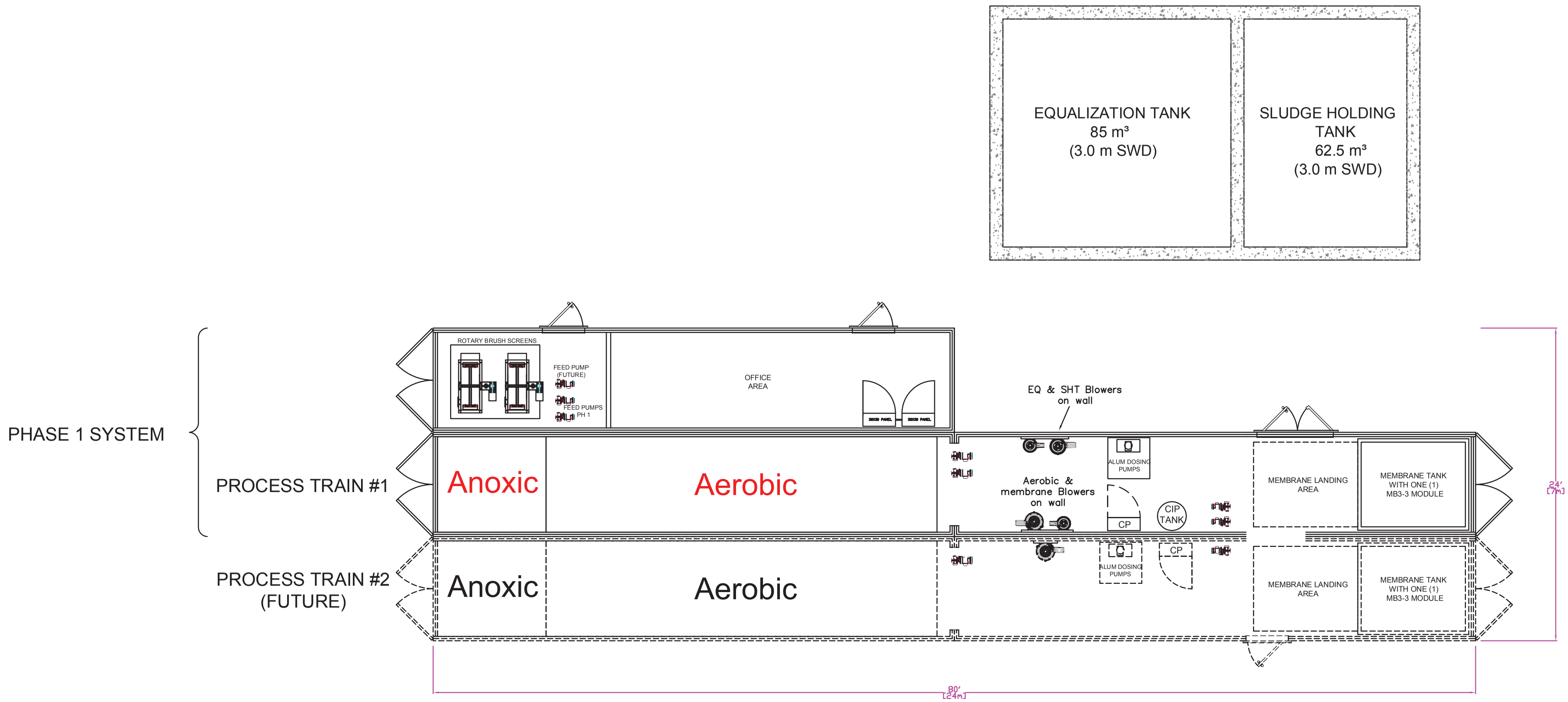
R2	FOR QUOTE	03/27/15	NK
R1	FOR QUOTE	10/28/14	JVDH
R0	FOR QUOTE	10/09/14	JSN
LEVEL	REVISION	DATE (mm/dd/yy)	BY

PROJECT NUMBER
1502057

TITLE AND LOCATION
PROCESS FLOW DIAGRAM
newterra MicroClear™ MBR WWTP
Waldemar WWTP, ON

CUSTOMER
Sarah Properties

DRAWN BY	DATE	SHEET	SHEETS
NK	03/27/15	1	1



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R1	FOR QUOTE	10/16/14	NK
R0	FOR QUOTE	10/14/14	JV

PROJECT NUMBER
1502057

TITLE AND LOCATION
PROCESS FLOW DIAGRAM
newterra MicroClear™ MBR WWTP
WALDEMAR DEVELOPMENT, ON

CUSTOMER
SARAH PROPERTIES

DRAWN BY	DATE	SHEET	SHEETS
NK	03/26/15	1	1

CROZIER
&ASSOCIATES
Consulting Engineers

Project: Waldemar Development
Project No.: 743-3507
File: Design
Design by: AS
Check by:
Date: 3/7/2013
Updated: 25/04/2015

Water Demand Calculations
WALDEMAR DEVELOPMENT

Site Area (Residential) =	35.2	ha	
No. of Units =	334		
Population Density =	3.00	persons per unit	MOE Design Guide - Design Pop. And Future Land Use
Population, p =	1002	persons	

Water Demand Flow - MOE Method:

DOMESTIC

Recommended Maximum Average Day Flows:

	Residential		450 L/c.d	MOE Design Manual 3.4.2
	Population		1002 persons	
			450,900 L/d	
TOTAL AVERAGE FLOW			450,900 L/d	
			313.13 L/min	
			5.22 L/s	
Peak Factors:	Max Day	2.75		MOE Design Manual, Table 3-1
	Peak Hourly	4.13		
TOTAL MAX DAY FLOW			1,239,975 L/d	
			861 L/min	
			14.35 L/s	
TOTAL PEAK HOURLY FLOW			1,862,217 L/d	
			1,293 L/min	
			21.55 L/s	

Storage Requirement = A + B+ C

Fire Storage Duration	=	2 Hours	MOE Design Manual, Table 8-1
A = Fire Storage	=	38 L/s	MOE Design Manual, Table 8-1
	=	273,600 L	
B = 25% MAX DAY	=	4 L/s	
	=	28,800 L	
C = 25% x A + B	=	11 L/s	
		79,200 L	
Storage	=	**53 L/s**	
	=		
Fire Storage	=	**381,600** L	
		381.60 m^3	

Table 3-1: Peaking Factors

POPULATION	MINIMUM RATE FACTOR (MINIMUM HOUR)	MAXIMUM DAY FACTOR	PEAK RATE FACTOR (PEAK HOUR)
500 - 1 000	0.40	2.75	4.13
1 001 - 2 000	0.45	2.50	3.75
2 001 - 3 000	0.45	2.25	3.38
3 001 - 10 000	0.50	2.00	3.00
10 001 - 25 000	0.60	1.90	2.85
25 001 - 50 000	0.65	1.80	2.70
50 001 - 75 000	0.65	1.75	2.62
75 001 -150 000	0.70	1.65	2.48
greater than 150 000	0.80	1.50	2.25

3.4.3 Commercial and Institutional Water Demands

Institutional and commercial flows should be determined by using historical records, where available. Where no records are available, the values in Table 3.2 should be used. For other commercial and tourist-commercial areas, an allowance of 28 $m^3/(ha{\cdot}d)$ [3000 USgal/(acre·d)] average flow should be used in the absence of reliable flow data.

When using the above unit demands, maximum day and peak rate factors should be developed. For establishments in operation for only a portion of the day such as schools and shopping plazas, the water usage should also be factored accordingly. For instance, with schools operating for 8 hours per day, the water use rate would be at an average rate of 70 L/(student·day) [19 USgal/(student·day)] x 24/8 or 210 L/student (55 USgal/student) over the 8-hour period of operation. The water use will drop to a residual amount during the remainder of the day. Schools generally do not exhibit large maximum day to average day ratios and a factor of 1.5 will generally cover this variation. For estimation of ***peak demand*** rates, an assessment of the water-using fixtures is generally necessary and a fixture-unit approach should be used.

8.4.1 Chemical Disinfection Contact & Water Treatment Plant Storage

Any volume required to provide chemical disinfection contact time is not available for storage and should not be included in storage calculations. Refer to *Section 5.9 – Disinfection* for more information on primary disinfection and contact time.

8.4.2 Sizing Treated Water Storage for Systems Providing Fire Protection

The following method for sizing water storage needs may not fulfill the fire protection requirements of the municipality insurance company or the Fire Underwriters Survey. For fire flow requirements, refer to the latest edition of the Fire Underwriters Survey document *Water Supply for Public Fire Protection*[12]. Historically, small municipalities in Ontario have used the following criteria.

Table 8-1: Fire Flow Requirements

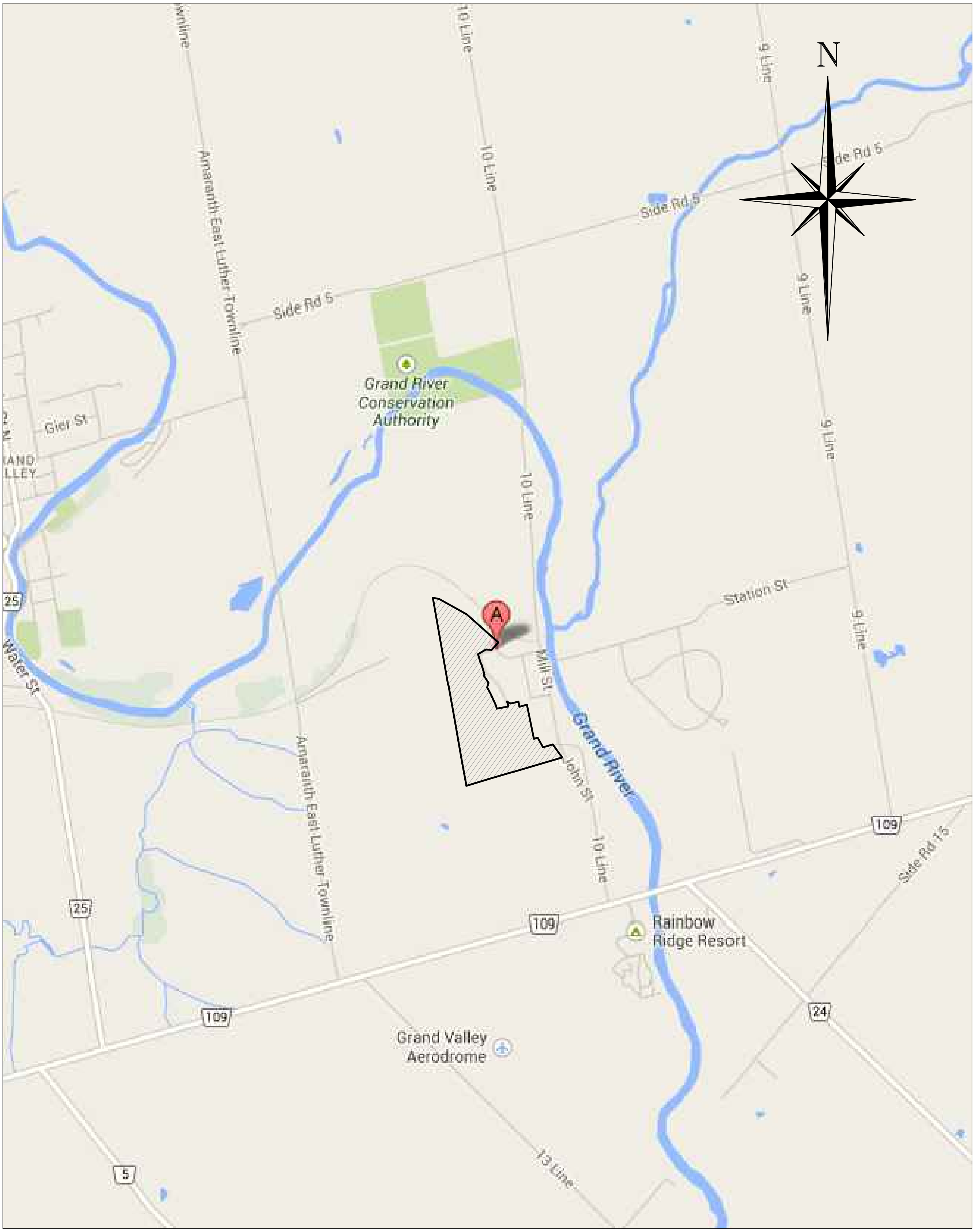
EQUIVALENT POPULATION[1]	SUGGESTED FIRE FLOW (L/s)	DURATION (HOURS)
500 – 1 000	38 (10 ft/s)	2
1 000	64 (17 ft/s)	2
1 500	79 (21 ft/s)	2
2 000	95 (25 ft/s)	2
3 000	110 (29 ft/s)	2
4 000	125 (33 ft/s)	2
5 000	144 (38 ft/s)	2
6 000	159 (42 ft/s)	3
10 000	189 (50 ft/s)	3
13 000	220 (58 ft/s)	3
17 000	250 (66 ft/s)	4
27 000	318 (84 ft/s)	5
33 000	348 (92 ft/s)	5
40 000	378 (100 ft/s)	6
Note [1]: When determining the fire flow allowance for commercial or industrial areas, it is recommended that the area occupied by the commercial/industrial complex be considered at an equivalent population density to the surrounding residential lands.		

---

[12] Fire Underwriters Survey is a national organization administered by (c/o) CGI Insurance Business Services, 150 Commerce Valley Drive, Lockbox 200, Markham ON L3T 7Z3, 905-882-6300, in Ontario

LIST OF FIGURES

Figure 1: Site Location
Figure 2: Draft Plan of Subdivision
Figure 3: Pre-Development Drainage Plan
Figure 4: Post Development Drainage Plan
Figure 5: Storm Servicing Plan
Figure 6: Sanitary and Water Servicing Plan
Figure 7: Preliminary Grading Plan
Figure 8: Details



Legend

▨ = SUBJECT LANDS

Project

SARAH PROPERTIES LTD.
WALDEMAR DEVELOPMENT
TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

Drawing

SITE LOCATION

CROZIER
&ASSOCIATES
Consulting Engineers

2800 High Point Drive
Suite 100
Milton, ON L9T 6P4
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca

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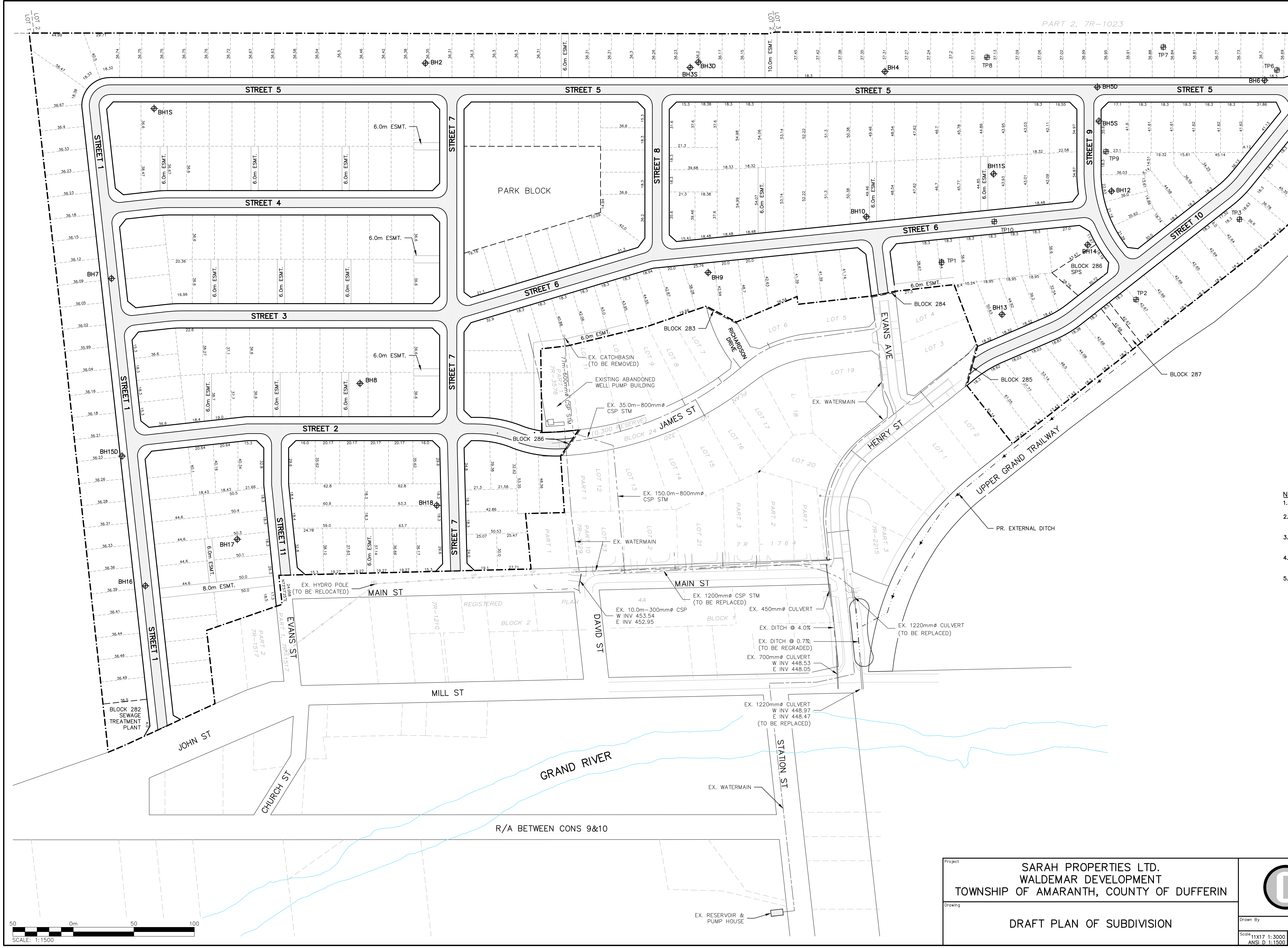
Scale	N.T.S.	Date	05/04/2015	Check By	K.J.F.
				Drawing	FIG–1



LEGEND

- PROPERTY LINE
- EX. WATERCOURSE (GRAND RIVER)
- RIGHT OF WAY
- BLOCK LINE
- LOT LINE
- EASEMENT (ESMT.) LINE
- EDGE OF PAVEMENT
- BH# BOREHOLE
- TP10 TEST PIT
- HP EXISTING OVERHEAD HYDRO & HYDRO POLE
- PROPOSED DITCH

NOTES :

1. TOPOGRAPHIC SURVEY WAS COMPLETED BY VAN HARTEN LTD., DATED NOVEMBER, 2013.
2. TOPOGRAPHIC INFORMATION FOR ADJACENT & SURROUNDING AREAS WAS DEVELOPED FROM ONTARIO BASE MAPPING SURVEY, CIRCA 1981 PROVIDED BY FIRST BASE SOLUTION.
3. LOCATION OF EXISTING UNDERGROUND STORM AND WATERMAIN SCANNED FROM AS BUILT DRAWINGS BY R.J. BURNSIDE CIRCA 1980 AND SUBJECT TO VERIFICATION.
4. PROXIMITY OF EXTERNAL EXISTING DRAINAGE BOUNDARY WAS GROUND TRUTHED BY C. F. CROZIER AND ASSOCIATES, OCTOBER 15, 2013.
5. BOREHOLES AND TEST PITS PER GEOTECHNICAL INVESTIGATION REPORT PROVIDED BY TERRAPROBE, REPORT REF. NO. 13–13–3198, DATED APRIL, 2014.

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Project
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Drawing
DRAFT PLAN OF SUBDIVISION

CROZIER
&ASSOCIATES
Consulting Engineers

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

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Scale	11X17 1:3000 ANSI D 1:1500	Date	05/04/2015	Check By	K.J.F.
Drawing	FIG–2				

LEGEND

— — · —	SUBJECT PROPERTY
≈	EX. WATERCOURSE (GRAND RIVER)
— 451 —	EX. CONTOUR (1.0m INTERVALS)
— 450 —	EX. CONTOUR (5.0m INTERVALS)
◯	TREE AREA
⇨	EX. OVERLAND FLOW ROUTE
XXX	STORM CATCHMENT AREA ID
X.XX	STORM CATCHMENT RUN–OFF CO–EFFICIENT
XX.X	STORM CATCHMENT AREA (ha)
▬ ▬ ▬	EX. DRAINAGE BOUNDARY
⌖ BH#	BOREHOLE
⊞ TP10	TEST PIT

NOTES :

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Project
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WALDEMAR DEVELOPMENT
TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

Drawing
PRE–DEVELOPMENT DRAINAGE PLAN

CROZIER
&ASSOCIATES
Consulting Engineers
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
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Project 743–3507
Scale 11X17 1:5000 ANSI D 1:2500
Date 05/04/2015
Check By K.J.F.
Drawing FIG–3

LEGEND

- PROPERTY LINE
- EX. WATERCOURSE (GRAND RIVER)
- EX. CONTOUR (1.0m INTERVALS)
- EXISTING STORM SEWER
- EXISTING DITCH
- TREE AREA
- RIGHT OF WAY
- BLOCK LINE
- LOT LINE
- EASEMENT LINE
- BH# BOREHOLE
- TP10 TEST PIT
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED STORM CATCHBASIN & LEAD
- PROPOSED OIL / GRIT SEPARATOR
- EX. OVERLAND FLOW ROUTE
- PR. OVERLAND FLOW ROUTE
- X — STORM CATCHMENT AREA ID
- X.X — STORM CATCHMENT RUN-OFF CO-EFFICIENT
- X.XX — STORM CATCHMENT AREA (ha)
- PROPOSED DRAINAGE BOUNDARY
- PROPOSED DITCH

NOTES :

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5. BOREHOLES AND TEST PITS PER GEOTECHNICAL INVESTIGATION REPORT PROVIDED BY TERRAPROBE, REPORT REF. NO. 13-13-3198, DATED APRIL, 2014.

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TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

Drawing
PROPOSED POST-DEVELOPMENT DRAINAGE PLAN

CROZIER
&ASSOCIATES
Consulting Engineers

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
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Scale	11X17 1:3000 ANSI D 1:1500	Date	05/04/2015	Check By	K.J.F.
Drawing	FIG-4				

LEGEND

- PROPERTY LINE
- EX. WATERCOURSE (GRAND RIVER)
- EX. CONTOUR (1.0m INTERVALS)
- EXISTING DITCH
- EXISTING STORM SEWER
- TREE AREA
- RIGHT OF WAY
- BLOCK LINE
- LOT LINE
- EASEMENT LINE
- ⊕ BH# BOREHOLE
- ⊞ TP10 TEST PIT
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED STORM CATCHBASIN & LEAD
- PROPOSED OIL / GRIT SEPARATOR
- PROPOSED DITCH

NOTES :

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Project
SARAH PROPERTIES LTD.
WALDEMAR DEVELOPMENT
TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

Drawing
STORM SERVICING PLAN

CROZIER
&ASSOCIATES
Consulting Engineers

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

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Scale 11X17 1:3000 ANSI D 1:1500	Date 05/04/2015	Check By K.J.F.	Drawing FIG-5

LEGEND

PROPERTY LINE
EX. WATERCOURSE (GRAND RIVER)
EXISTING WATERMAIN
EXISTING DITCH
PROPOSED SANITARY SEWER & MANHOLE
PROPOSED WATERMAIN
PROPOSED FIRE HYDRANT
TREE AREA
RIGHT OF WAY
BLOCK LINE
LOT LINE
EASEMENT LINE
FM PROPOSED SANITARY FORCEMAIN
BH# BOREHOLE
TP10 TEST PIT

NOTE :
ALL SANITARY SEWERS ARE PVC 200mmø UNLESS SPECIFIED OTHERWISE.

NOTES :

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Project
SARAH PROPERTIES LTD.
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TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

Drawing
SANITARY AND WATER SERVICING PLAN

CROZIER
&ASSOCIATES
Consulting Engineers

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
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Scale	11X17 1:3000 ANSI D 1:1500	Date	05/04/2015	Check By	K.J.F.
Drawing	FIG–6				

LEGEND

PROPERTY LINE
EX. WATERCOURSE
EX. CONTOUR (1.0m INTERVALS)
EXISTING DITCH
● PROPOSED STORM MANHOLE
● PROPOSED SANITARY MANHOLE
PROPOSED FIRE HYDRANT
TREE AREA
RIGHT OF WAY
BLOCK LINE
LOT LINE
EASEMENT LINE
EDGE OF PAVEMENT
x 280.12 PROPOSED GRADE
x 280.12 PROPOSED GRADE (MATCH TO EX.)
2.0% PROPOSED DITCH
2.0% PROPOSED OVERLAND SLOPE
BH# BOREHOLE
TP10 TEST PIT

NOTES :

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TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

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&ASSOCIATES
Consulting Engineers
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Suite 100
Milton, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

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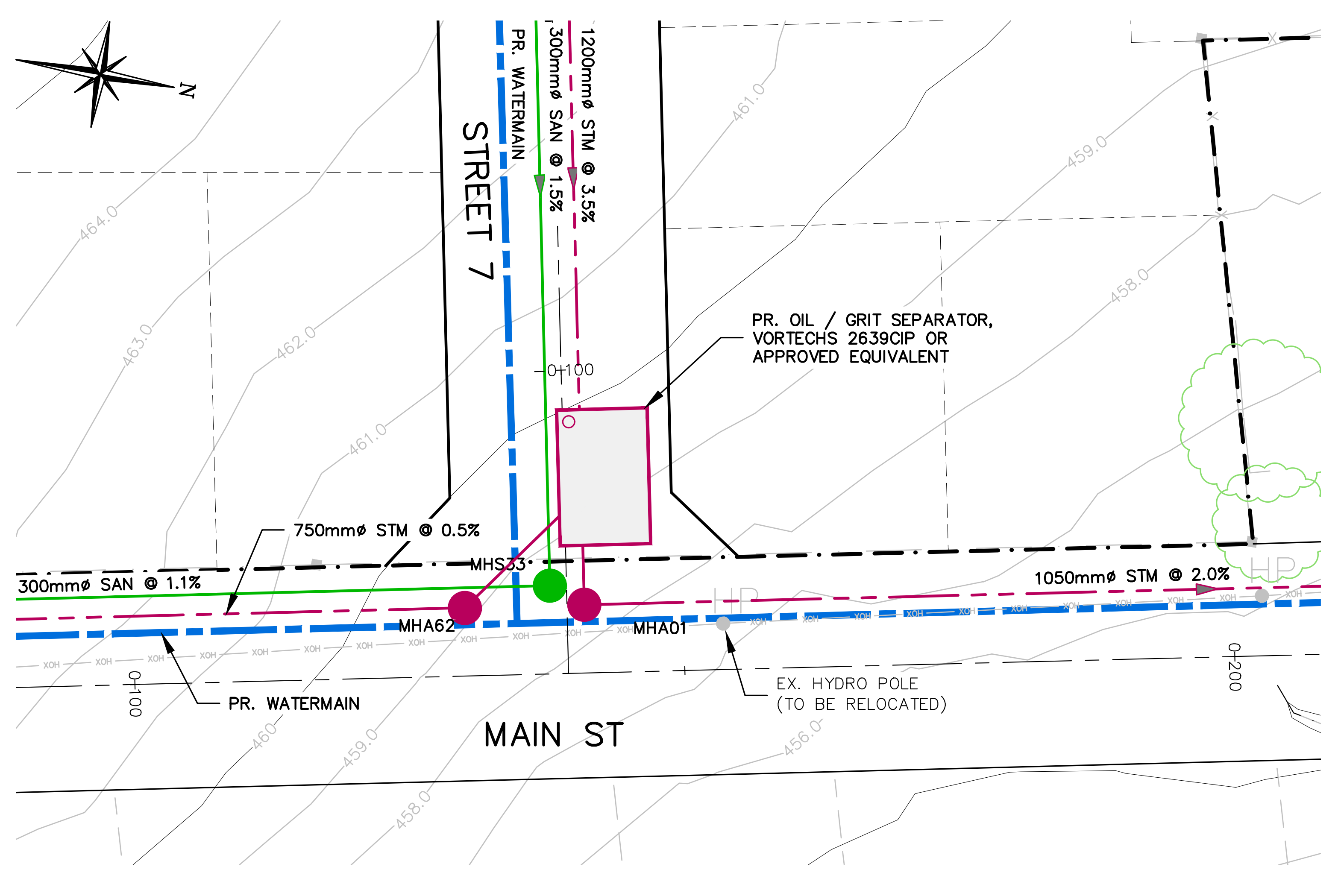
Scale 11X17 1:3000 ANSI D 1:1500	Date 05/04/2015	Check By K.J.F.	Drawing FIG–7

DETAIL 'A'

SCALE 1:500



DETAIL 'B'

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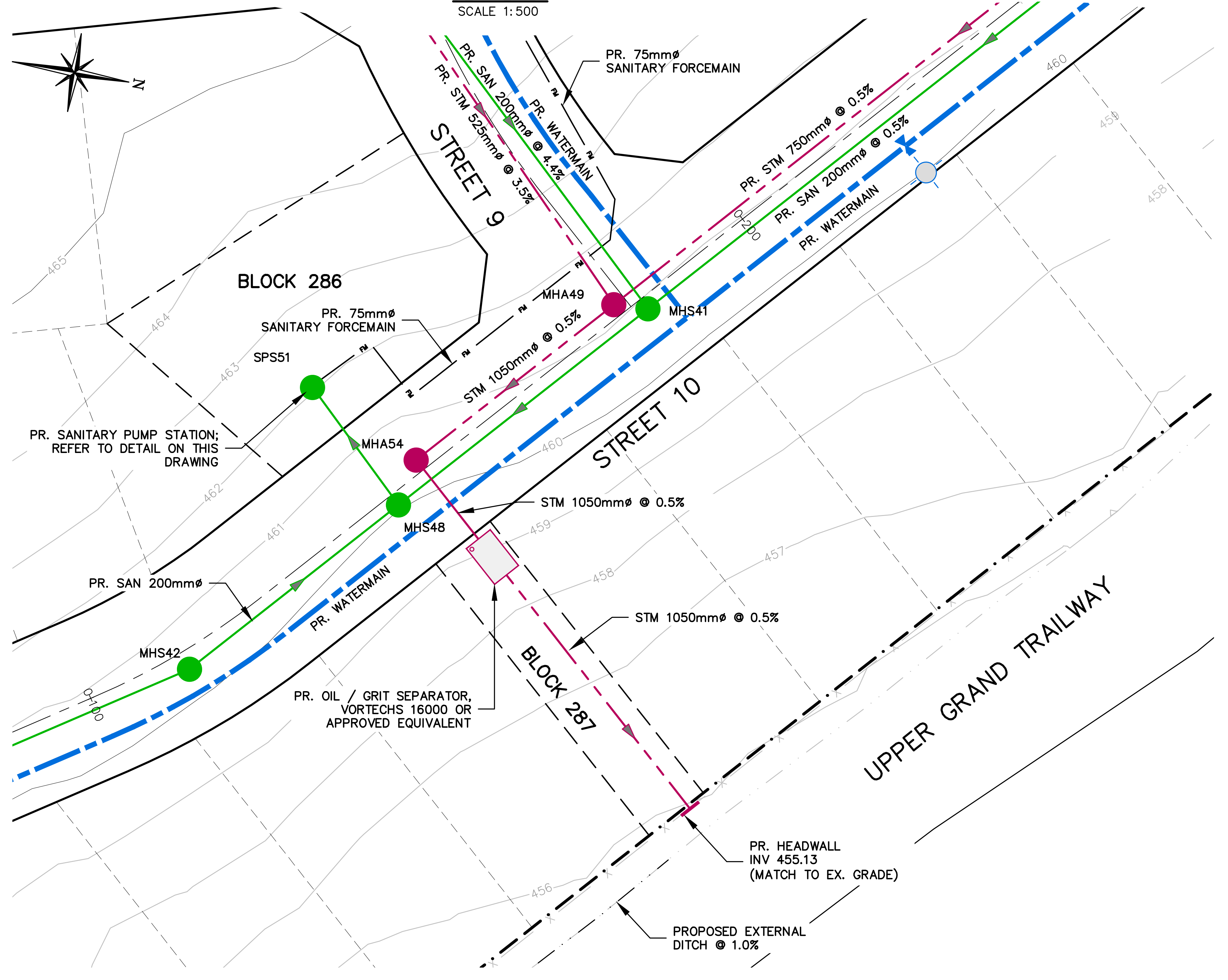

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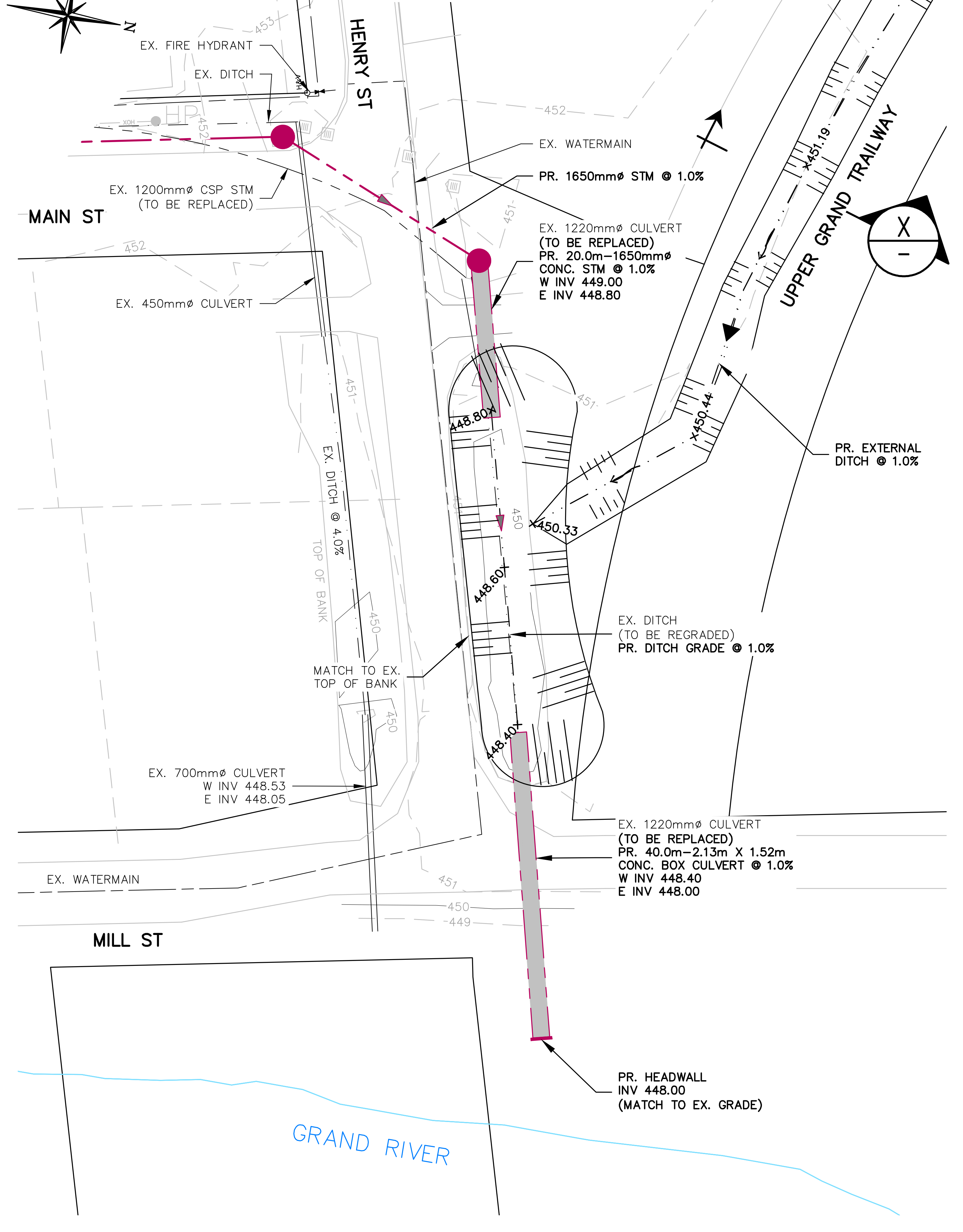
5. BOREHOLES AND TEST PITS PER GEOTECHNICAL INVESTIGATION REPORT PROVIDED BY TERRAPROBE, REPORT REF. NO. 13–13–3198, DATED APRIL, 2014.

LEGEND

— — · —	PROPERTY LINE
—450.0—	EX. CONTOUR (1.0m INTERVALS)
———	EXISTING WATERMAIN AND VALVE & BOX
———	EXISTING STORM SEWER
— · · —	EXISTING DITCH
●——▶	PROPOSED SANITARY SEWER
⋈— — —	PROPOSED WATERMAIN
⌖ ⋈	PROPOSED FIRE HYDRANT
●— — ▶	PROPOSED STORM SEWER & MANHOLE
———	RIGHT OF WAY
— — —	BLOCK LINE
- - - -	LOT LINE
— FM —	PROPOSED SANITARY FORCEMAIN
⌖ BH#	BOREHOLE
⊞ TP10	TEST PIT
— · · ▶	PROPOSED DITCH

DETAIL 'C'

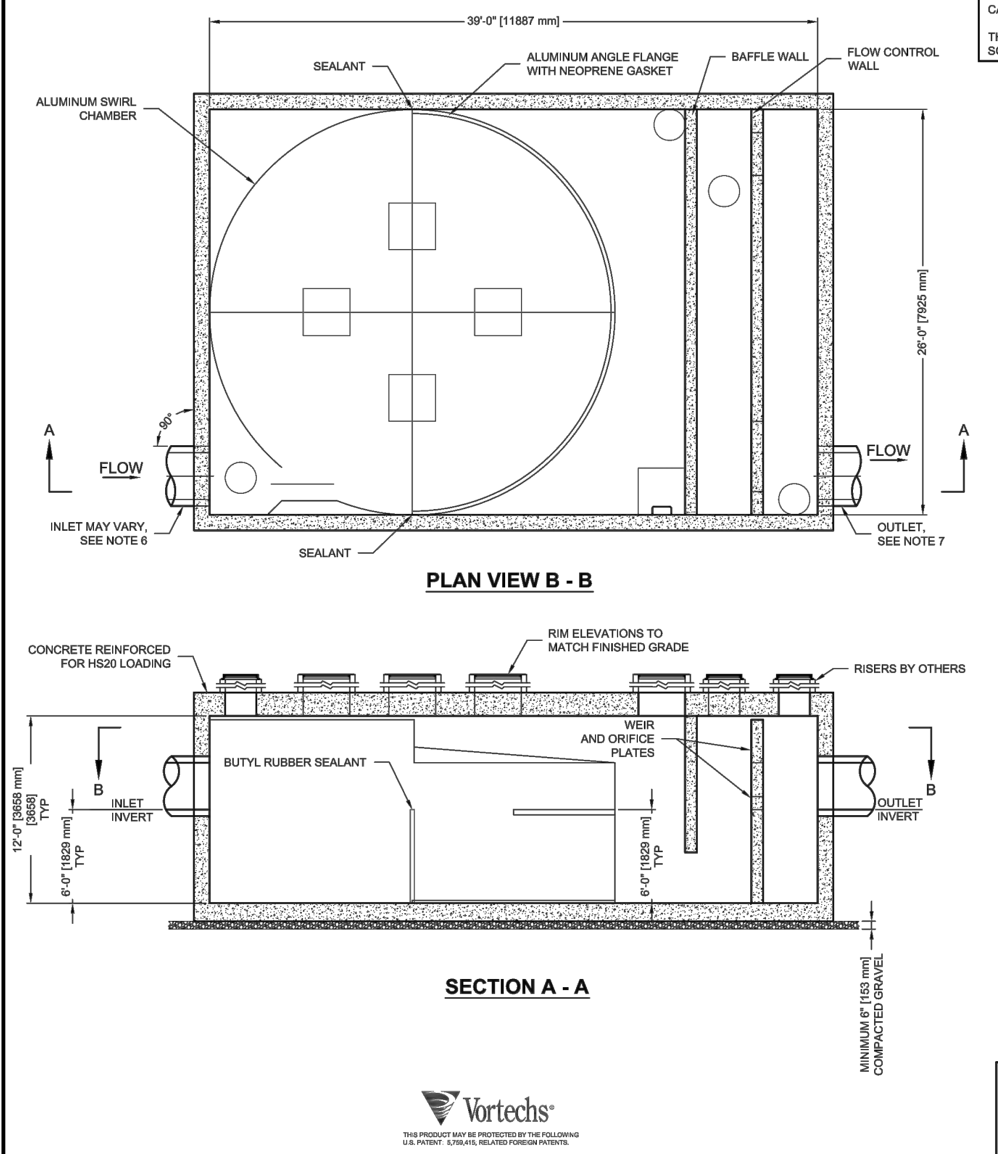
SCALE 1:500

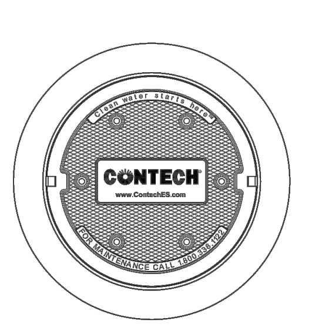


VORTECHS 2639CIP DESIGN NOTES

VORTECHS 2639CIP RATED TREATMENT CAPACITY IS 118 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS REPRESENTATIVE. www.ContechES.com





FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (CFS)			*
PEAK FLOW RATE (CFS)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL ALUMINUM COMPONENTS, ACCESS FRAMES, COVERS, AND HATCHES; MASTIC/SEALANTS AND HARDWARE FOR INSTALLATION, UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. CONTECH SHALL PROVIDE SITE SPECIFIC STRUCTURAL DESIGNS UTILIZING SITE SPECIFIC EARTH COVER AND GROUNDWATER ELEVATIONS. ENGINEER OF RECORD TO CONFIRM ACTUAL SITE INFORMATION. CASTINGS SHALL MEET MINIMUM AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. INLET PIPE(S) MUST BE PERPENDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES

A. ESTIMATED CONCRETE VOLUME FOR VORTECHS SYSTEM APPROXIMATELY 220 CUBIC YARDS. ESTIMATED TIME TO INSTALL ALUMINUM COMPONENTS - 20 MAN-HOURS PER SYSTEM. MATERIALS AND LABOR PROVIDED BY CONTRACTOR.
B. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
C. SITE SERVICES TO BE DONE BY CONTRACTOR INCLUDE CAST-IN-PLACE CONCRETE WORK, EXCAVATION, DEWATERING, BEDDING, BACKFILL, SURFACE RESTORATION, BLASTING (IF ANY) AND ANY OTHER SITE SPECIFIC ISSUES.
D. CONTRACTOR TO PROVIDE ALL EQUIPMENT AND RIGGING REQUIRED TO LIFT AND SET THE SWIRL CHAMBER, WEIR & ORIFICE FLOW CONTROLS, ACCESSWAY HATCHES, AND CASTINGS.
E. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
F. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
G. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.
H. CONTECH WILL PROVIDE ON-SITE REPRESENTATION LIMITED TO 8 HOURS PER PROJECT FOR THE SUPERVISION OF THE FINAL ASSEMBLY OF ALL VORTECHS SYSTEM COMPONENTS INSIDE THE CONCRETE STRUCTURE, IF NECESSARY.
I. INSTALLATION AND ASSEMBLY TOOL CHECKLISTS AND INSTRUCTIONS AVAILABLE UPON REQUEST.

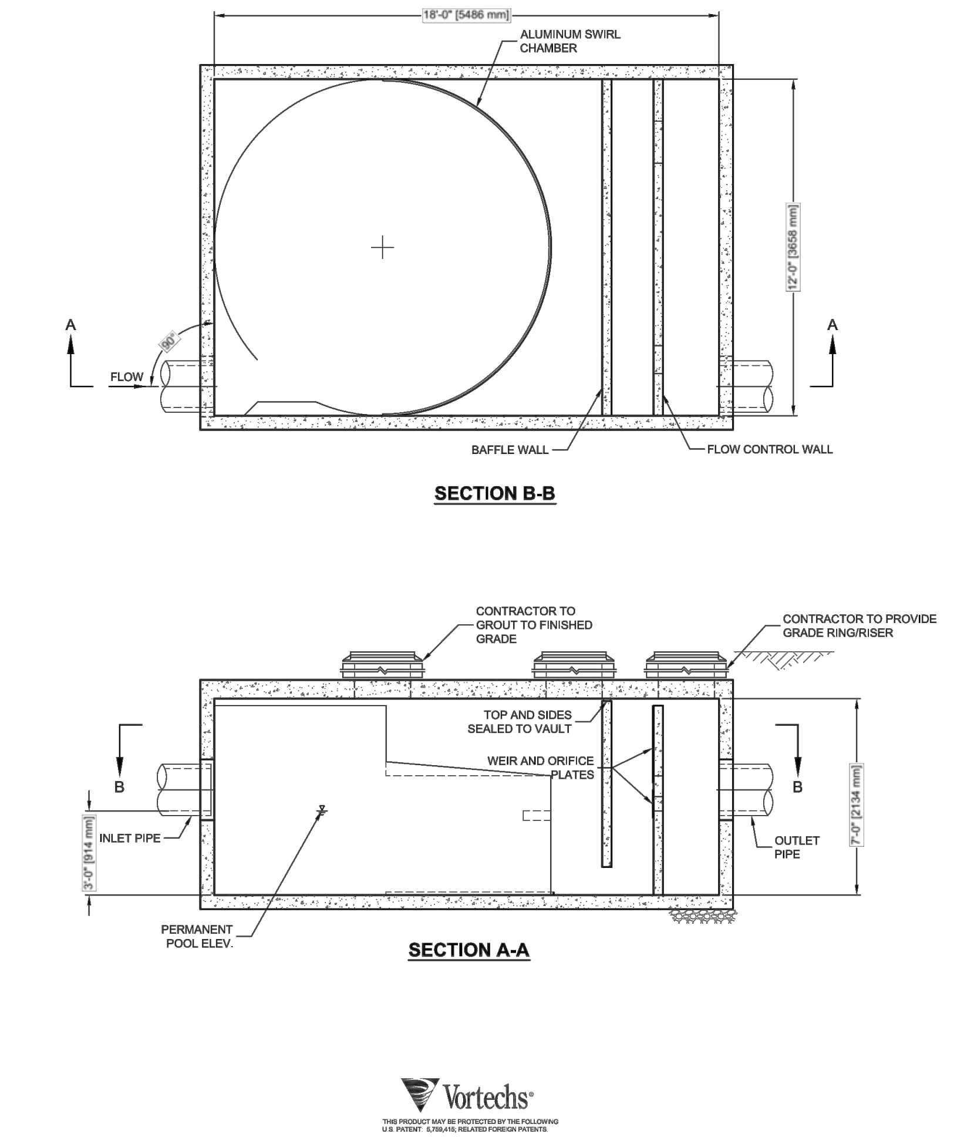
CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

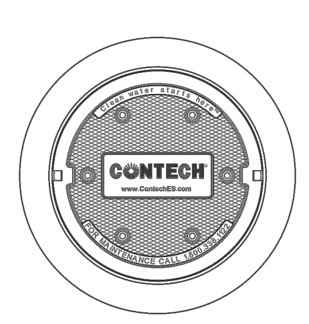
CAST-IN-PLACE VORTECHS 2639CIP
STANDARD DETAIL

VORTECHS 16000 DESIGN NOTES

VORTECHS 16000 RATED TREATMENT CAPACITY IS 25 CFS, OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED RATED TREATMENT CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD INLET/OUTLET CONFIGURATION IS SHOWN. FOR OTHER CONFIGURATION OPTIONS , PLEASE CONTACT YOUR CONTECH CONSTRUCTION PRODUCTS REPRESENTATIVE. www.ContechES.com





FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (CFS)			*
PEAK FLOW RATE (CFS)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. VORTECHS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. INLET PIPE(S) MUST BE PERPEDICULAR TO THE VAULT AND AT THE CORNER TO INTRODUCE THE FLOW TANGENTIALLY TO THE SWIRL CHAMBER. DUAL INLETS NOT TO HAVE OPPOSING TANGENTIAL FLOW DIRECTIONS.
7. OUTLET PIPE(S) MUST BE DOWN STREAM OF THE FLOW CONTROL BAFFLE AND MAY BE LOCATED ON THE SIDE OR END OF THE VAULT. THE FLOW CONTROL WALL MAY BE TURNED TO ACCOMODATE OUTLET PIPE KNOCKOUTS ON THE SIDE OF THE VAULT.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTECHS STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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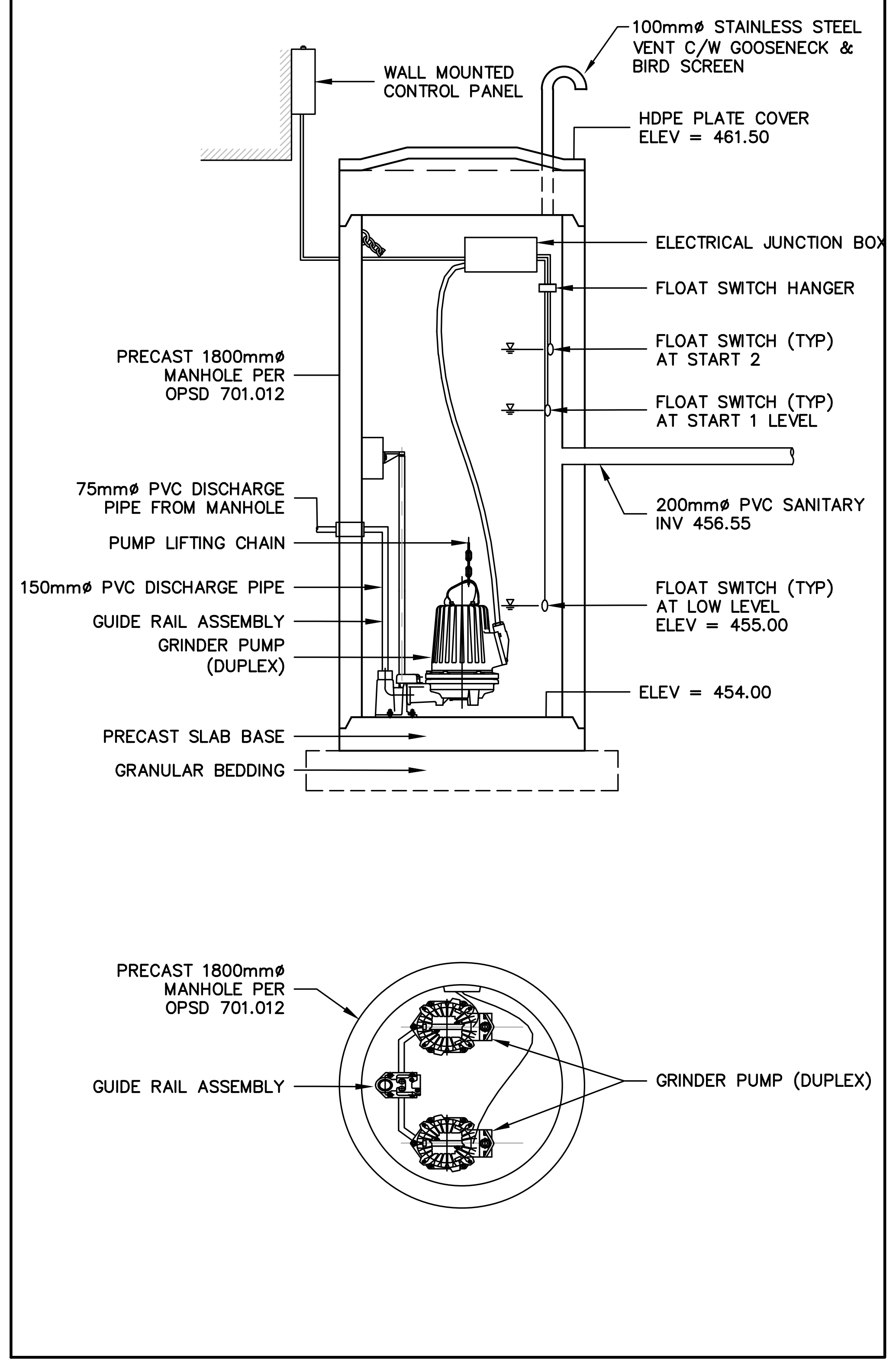
VORTECHS 16000
STANDARD DETAIL

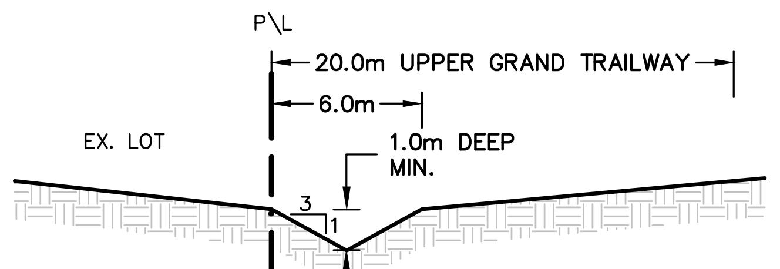
SANITARY PUMP STATION DETAIL (BLOCK 286)

SCALE: N.T.S.



SECTION 'X'
EXTERNAL DITCH SECTION

SCALE: N.T.S.



PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project
SARAH PROPERTIES LTD.
WALDEMAR DEVELOPMENT
TOWNSHIP OF AMARANTH, COUNTY OF DUFFERIN

Drawing
DETAILS

CROZIER
& ASSOCIATES
Consulting Engineers

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn By	M.J.	Design By	K.J.F.	Project	743–3507		
Scale	N.T.S.	Date	05/04/2015	Check By	K.J.F.	Drawing	FIG–8