5.0 STORMWATER MANAGEMENT DESIGN

5.1 General

As outlined in the previous section, a storm drainage system is required to convey stormwater runoff from residential, commercial, industrial and roadway areas. With rare exception, stormwater runoff must be treated and controlled prior to release to natural stream corridors. The Ontario Ministry of the Environment released the Stormwater Management Planning and Design Manual (SWM Manual) in March 2003. Ontario Ministry of the environment Preferred criteria shall be used for the design of all SWM facilities. This document provides guidelines relating to the treatment and control of stormwater runoff. The overall purpose of this section is to provide principles to augment the SWM Manual, and successors thereof, to facilitate integration, utilization, environmental enhancement and maintenance of stormwater management practices in the Town of New Tecumseth.

One of the key stakeholders in the design and approval of stormwater management practices is the Conservation Authority. A majority of the Town of New Tecumseth is located in the jurisdiction of the Nottawasaga Valley Conservation Authority (NVCA), while a smaller area in the southeast corner of the Town is in the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA). Consulting Engineers responsible for the implementation of stormwater management practices shall consult both the Town of New Tecumseth and the Conservation Authority to confirm/clarify issues, policies and design requirements.

5.2 Reporting Requirements

This section includes a list of documentation that shall be included, where applicable, within a Stormwater Management Report. The Consulting Engineering shall contact the Conservation Authority to identify any additional reporting requirements. The report shall be prepared to support the design of the storm drainage and stormwater management system, plus include pertinent details relating to sediment and erosion control. A separate stand-alone report shall be prepared to address SWM facility operation and maintenance.

One of the key objectives of the stormwater management report is to clearly identify how applicable recommendations from Subwatershed Studies, Master Drainage Plans or Functional Servicing, Geotechnical, Environmental or Hydrogeological Reports have been incorporated into the final design.

5.2.1 Storm Drainage

The following items shall be discussed in the Stormwater Management Report, where appropriate:

- Major and minor system design criteria.
- Storm sewer outlet location.
- External drainage.
- Foundation drainage.
- Dual drainage analysis.
- Table summarizing overland flow at key locations.
- Hydraulic grade line (HGL) analysis.
- Table summarizing minimum basement elevations.

5.2.2 Stormwater Management

The following items shall be discussed in the Stormwater Management Report, where appropriate:

- Stormwater management design criteria.
- Excerpts from Subwatershed Study or Master Drainage Plan.
- Review of quality control practices and selection of appropriate measures.
- Table summarizing calculation of site imperviousness.
- Table summarizing pre and post-development modelling parameters.
- Table summarizing stage, storage and discharge characteristics of the facility, including tailwater effects.
- Table summarizing pre and post-development peak flows and storage volumes, based on output from hydrologic modelling or comparison to volumes and target peak flows identified in previous studies.
- Table to summarize and compare required permanent pool, erosion control and flood control to actual volumes provided.
- Sample or supporting calculations, including digital files, for the following:
    - Sediment forebay sizing;
    - Extended detention drawdown duration;
    - Stage-storage-discharge curves, including tailwater effects;

  - Overflow spillway capacity;
  - Major system inlet capacity, assuming 50% blockage and bar area;
  - Erosion protection at facility inlet, outlet and overflow spillway; and
  - Sediment accumulation and sediment drying area.
- A hard copy of the detailed output file for one storm event for each of the pre and post-development hydrologic models. The remaining storm events shall be documented by summary output files. A copy of the digital hydrologic modelling files shall be forwarded by diskette or e-mail.

The SWM facility plans should identify the following:

- NWL, extended detention level, HWL on plan view, plus a summary table for modelled storm events;
- Existing and proposed contours and spot elevations, including side slopes;
- Limits of construction and grading;
- Borehole locations and vertical soil logs shown adjacent to sections;
- Location of fencing limits and facility signage;
- Section and details of major overland flow routes;
- Section and details of maintenance access roads;
- Section and details of inlet and outlet structure;
- Section and details of erosion protection at inlet, outlet structure and on overflow spillway;
- Section and details of sediment drying area (if applicable); and
- Section and details of sediment forebay and berm, including lining.

5.2.3 Erosion and Sediment Control

The following items shall be discussed in the Stormwater Management Report, where appropriate:

- Proposed sediment and erosion control measures before, during and after municipal servicing construction;
- Construction sequencing; and
- Calculations for sizing of temporary sediment control ponds.

5.2.4 Figures and Drawings

The following figures and engineering drawings shall be included in the Stormwater Management Report, where appropriate:

- Site Location Plan.
- Pre-Development Drainage Plan (with hydrologic model catchment numbers).
- Post-Development Drainage Plan (with hydrologic model catchment numbers).
- Pre and Post-Development Model Schematic(s).
- Storm Drainage Plan(s).
- External Storm Drainage Plan(s).
- Sediment and Erosion Control Plan.
- SWM Facility Plan(s).
- SWM Facility Landscape /Planting Design Plan

5.2.5 SWM Facility Operation and Maintenance Report

A stand-alone SWM facility operation and maintenance report shall be prepared for submission to the Town of New Tecumseth and the Conservation Authority for review. The following items shall be discussed, where appropriate:

- A brief discussion of the SWM facility design elements and their function.
- A list of maintenance activities and estimated timing, including responsibility for maintenance, based on Section 6.3 of the SWM Manual.
- A detailed description of the procedures to be undertaken during sediment removal.

5.3 Hydrologic Modelling

5.3.1 Meteorology

Proper implementation of hydrologic modelling, whether it involves the use of a computer model or the Rational Method, requires precipitation data. The NVCA Standard Hydrologic Parameters shall apply for all computations.

For computer modelling, a Chicago storm distribution shall be used for the 1:2 year to 1:100 year design storm events using the following values:

- Storm Duration 4 hours
- Storm Time Step 5 minutes (or as specified by the Conservation Authority)
- Time to Peak Ratio 0.33

The intensity-duration-frequency (IDF) curve information has been provided in Section 4.4.2 and shall be used to generate the Chicago design storm events in computer models.

For modeling the 25 mm storm event to design the erosion control storage for a SWM facility, the Consulting Engineer shall use the following 4-hour Chicago storm distribution.

Time (min)	Intensity (mm/hr)	Time (min)	Intensity (mm/hr)	Time (min)	Intensity (mm/hr)	Time (min)	Intensity (mm/hr)
5	1.43	65	6.03	125	4.18	185	1.97
10	1.52	70	8.92	130	3.80	190	1.89
15	1.62	75	17.69	135	3.48	195	1.82
20	1.73	80	87.18	140	3.22	200	1.75
25	1.87	85	34.64	145	3.00	205	1.69
30	2.03	90	17.96	150	2.80	210	1.64
35	2.22	95	12.02	155	2.64	215	1.59
40	2.46	100	9.05	160	2.49	220	1.54
45	2.77	105	7.28	165	2.36	225	1.49
50	3.18	110	6.11	170	2.25	230	1.45
55	3.74	115	5.28	175	2.15	235	1.41
60	4.60	120	4.66	180	2.05	240	1.37

In the event that modelling of the Regional Storm event is required, the 12-hour Timmins historical event shall apply and shall be modelled assuming average antecedent moisture conditions (AMC II).

5.3.2 Computer Models

Computer modelling shall be undertaken using a hydrologic model approved by the Conservation Authority to determine pre-development and post-development peak flows and to design stormwater management facilities. Computer models presently approved for use include: Visual OTTHYMO, SWMHYMO, OTTHYMO, GAWSER and SWMM. Any proposal to use a different model shall be approved by the Town of New Tecumseth and the Conservation Authority. The NVCA Hydrology Standards should be referenced for the computer model reporting requirements, and the NVCA Standard Hydrologic Parameters shall apply for all input parameters.

To ensure consistency between hydrologic modelling and the Rational Method, the following expression shall be used to convert the average weighted runoff coefficient to an imperviousness value:

$$TIMP = \frac{C_{avg} - 0.2}{0.7}$$

where: $TIMP$ is the total impervious ratio (dimensionless)
C_{avg} is the average weighted runoff coefficient (dimensionless)

For hydrologic models, such as Visual OTTHYMO, that use the total impervious ratio (TIMP) and the total directly connected impervious area (XIMP), the value of XIMP shall be set equal to TIMP. The total impervious ratio value shall also be used determining the required permanent pool storage for stormwater management facilities.

5.4 Lot Level and Conveyance Stormwater Controls

Where possible, lot level and conveyance controls shall be implemented to enhance the overall performance of a storm drainage system, including those systems with end-of-pipe SWM facilities. In addition, these controls may be appropriate for smaller re-development or capital works projects.

The following practices are endorsed by the Town of New Tecumseth, where deemed appropriate. Specific design criteria for some of these practices are documented in the subsequent sections. Detailed design of these measures shall be undertaken in accordance with Section 4.5 of the SWM Manual and in consultation with the Town of New Tecumseth and the Conservation Authority:

- Roof top storage
- Parking area storage
- Underground pipe storage
- Roof leader and sump pump discharge to soakaway pits
- Infiltration trenches
- Grassed swales
- Pervious pipe systems
- Vegetated filter strips
- Stream and valley corridor buffer strips

The following practices are not endorsed by the Town of New Tecumseth:

- Reduced lot grading
- Roof leader to ponding areas
-
-

5.4.1 Roof Top, Parking Area and Underground Storage

The use of roof top, parking area and underground storage to provide peak flow control shall be considered on a site specific basis by the Town. The allowable release rates to the receiving minor (storm sewer) system shall be established in master servicing plans and, in cases where these plans are not available, should generally be controlled to a rate of 180 L/s/ha, unless otherwise deemed appropriate by the Town and/or NVCA. On-site storage is required to control up to and including the 100-year rainfall event. On-site controls should generally be avoided on school sites and other sensitive institutional uses.

Where rooftop storage is specified, the Consulting Engineer shall provide copies of the manufacturer's specifications, including design discharge rates, to the Town for review. The structural and mechanical engineers shall be advised to ensure the roof structure and vertical drain pipes are designed to account for the roof top storage.

In cases where surface storage is proposed, the maximum ponding depth in paved areas shall be 0.20m, and the maximum ponding depth in landscaped areas shall be 0.3m for Residential Areas and 0.3m for Commercial/ Industrial Areas. The grading plan shall demonstrate that a safe overland flow route that outlets to the street network or natural corridor and ponding depths will not exceed the permitted maximums even in the event that a catchbasin lead or grate is completely blocked. Flow from catchbasins or manholes shall be restricted using reduced catchbasin leads or alternatively orifice plates at discretion of the Town.

Where underground storage is proposed, calculations shall be provided to the Town of New Tecumseth demonstrating that the hydraulic grade line (HGL) will not result in property damage during 1:100 year storm conditions. The HGL shall demonstrate that the 5-year return flow is contained within the storm sewer system and all other storm flows shall not exceed the maximum allowable ponding.

To ensure the continued function of peak flow reduction practices, such as roof top, parking area and underground storage, a control maintenance hole and reduced orifice pipe shall be located in accordance with TNT.SD. 202. The orifice equation (refer to Section 5.5.11) shall be employed with an orifice flow coefficient of 0.64 to calculate the design release rate.

If an oil/grit separator is being used to provide stormwater quality control, the separator shall be located downstream of the reduced pipe in accordance with TNT.SD. 202. In addition, the Consulting Engineer shall provide flow calculations illustrating that the separation between the reduced pipe and the oil/grit separator is sufficient to reduce the flow jet velocity in the reduced pipe to the design velocity required for removal of suspended solids by the oil/grit separator.

5.4.2 Roof Leader and Sump Pump Discharge to Soakaway Pits

Soakaway pits for individual dwelling units may be appropriate when soils have a percolation rate greater than 15 mm/hr and sufficient area is available for installation. The Town of New Tecumseth and the Conservation Authority shall be consulted to determine when the use of soakaway pits is appropriate.

5.4.3 Infiltration Trenches and Pervious Pipe Systems

Similar to soakaway pits, infiltration trenches and pervious pipe systems can be effective for infiltrating roof runoff, foundation drainage and lot runoff. Pre-treatment of road drainage to remove suspended solids is required prior to conveyance through these systems. The Town of New Tecumseth and the Conservation Authority shall be consulted to determine when the use of infiltration trenches and pervious pipe systems is appropriate.

5.5 End-of-Pipe Stormwater Management (SWM) Facilities

5.5.1 Types of Facilities

There are five primary types of end-of-pipe SWM facilities that are described by the SWM Manual: wet ponds, wetlands, dry ponds, infiltration basins and oil/grit separators.

Valdor , in keeping with MOE preferred criteria?

- Wet ponds typically refer to facilities that have a permanent pool depth greater than 1.0 m, thus not promoting the growth of emergent or floating aquatic plant species. Table 4.6 of the SWM Manual lists the general design guidelines for wet ponds. Reference shall be made to Town of New Tecumseth Standard Drawing TNT.SD 501.
- Wetlands typically refer to facilities that have a permanent pool depth less than or equal to 0.3 m, thus promoting the growth of emergent or floating aquatic plant species. Table 4.7 of the SWM Manual lists the general design guidelines for wetlands. Reference shall be made to Town of New Tecumseth Standard Drawing TNT.SD 502.
- Dry ponds and infiltration basins are generally not permitted without permission of the Town of New Tecumseth and the Conservation Authority.
- Oil/grit separators may be used for water quality control for smaller re-development projects (< 2 hectares) or capital works projects, subject to approval of the Town of New Tecumseth and the Conservation Authority.

Where space is available, either on-site or at a downstream storm sewer outfall (provided sufficient public lands exist), conventional wet ponds and wetlands are most capable of achieving the required levels of stormwater control.

5.5.2 Level of Service and SWM Facility Sizing

SWM facilities typically provide up to three different levels of control: water quality control, erosion control and flood control. The level of service shall be based on criteria established in the appropriate Subwatershed Study or Master Drainage Plan for the area. Stormwater control requirements are often location specific and should be confirmed through consultation with the Town of New Tecumseth and the Conservation Authority. The SWM facilities shall be sized to accommodate a minimum level of control as follows:

- The permanent pool shall be sized based on the imperviousness of the contributing development (Sections 4.4.2 and 5.3.2) and Table 3.2 of the SWM Manual. The SWM facility block shall be included in the total drainage area with an imperviousness of 50%.
- The erosion control storage shall be sized to accommodate the total runoff volume from the development during a 4-hour, 25 mm Chicago storm event (Section 5.3.1). The erosion control storage volume shall be released over a minimum of 24 hours.
- The flood storage requirements shall be sized using an appropriate hydrologic model (Section 5.3.2) and controlling peak flows up to the design event.

5.5.3 SWM Facility Drainage Area

All SWM facilities shall be designed to serve the area within the development boundary, plus convey surface runoff from any external area to their natural or alternative approved outlet. The total area tributary to a SWM facility shall be determined by referencing the appropriate Subwatershed Study or Master Drainage Plan for the area. In the absence of such reports, the Consulting Engineer shall delineate the pre-development contributing area using appropriate topographic references. The Consulting Engineer shall consult with the Town of New Tecumseth and the Conservation Authority to determine whether external flows shall be considered at existing pre-development or future post-development levels.

5.5.4 Interim or Temporary SWM Facilities

In situations where the ultimate downstream facilities have not been constructed and/or where trunk storm sewers have not been completed to convey storm drainage to the ultimate facility, interim or temporary on-site facilities may be considered by the Town of New Tecumseth and the Conservation Authority. Interim or temporary SWM facilities shall be subject to the same design criteria as permanent SWM facilities.

5.5.5 SWM Facility Depths and Freeboard

The maximum SWM facility depths for wet ponds and wetlands shall be as follows:

	Wet Pond	Wetland
Permanent Pool	1.0 m to 2.5 m (Average 1.5 m)[1]	0.15 m to 0.30 m (80%) 1.0 m to 2.0 m (20%)[2]
Erosion Control	1.0 m	1.0 m
Flood Control	2.0 m	2.0 m
Overall Maximum[3]	4.5 m	4.0 m

Other considerations include:

- The sediment forebay(s) and outlet plunge pool of a wet pond shall only comprise between 20% and 33% of the total permanent pool area at the normal water level (NWL), but for wetlands they shall be limited to a maximum of 20%.
- For wetlands, a localized plunge pool shall be provided at the outlet to facilitate the use of a reverse-slope pipe outlet.
- Micropool areas may be permitted in wetlands and shall not exceed a maximum permanent pool depth of 0.60 m, nor shall micropools exceed 5% of the total permanent pool area measured at the normal water level. Reference shall be made to Town of New Tecumseth Standard Drawing TNT.SD 504.
- The use of erosion control storage for flood control storage is considered acceptable to the Town of New Tecumseth if approved by the Conservation Authority.
- The top of the SWM facility berm shall be located a minimum of 0.30 m above the highest design water level in the facility to provide adequate freeboard.
- The design water level shall be based on the greater of the 100-year storm or regulatory storm event.

5.5.6 Side Slopes

The maximum SWM facility side slopes for wet ponds and wetlands shall be as outlined in MOE SWM Planning and Design Manual:

Valdor , update as per MOE preferred design criteria.

	Wet Pond	Wetland
Initial 3.0 m from Streetline or Lot Line	6H:1V	6H:1V
Above erosion control	3H:1V to 6H:1V	3H:1V to 6H:1V
Erosion control	5H:1V	5H:1V
Initial 1.0 m Depth of Permanent Pool	5H:1V	5H:1V
Remaining Depth of Permanent Pool	3H:1V	5H:1V

The primary objective of varying the side slopes is to provide for safe public access and aesthetic benefit. Steeper slope areas shall require denser plantings (refer to Section 5.5.15). The NWL shall be curvilinear and avoid straight lines, where possible. The use of retaining or natural stone walls is to be avoided within the pond block unless approved by the Town.

5.5.7 Geotechnical Issues

All SWM facility designs are to be reviewed by a qualified geotechnical consultant. A report shall be produced that addresses the following issues:

[1] The average is defined as the total volume of the permanent pool divided by the total surface area of the permanent pool at the normal water level.

[2] Sediment forebay and plunge pool areas only.

[3] Excludes minimum 0.30 m freeboard from high water level (HWL) to the top of pond.

- Maximum side slope recommendations based on native soils.
- Appropriateness of native soil re-use for pond berm construction, including compaction recommendations.
- Pond liner requirements. For ponds requiring a liner, preference should be given to using clay where possible, or an acceptable alternative.
- Possible groundwater impacts on pond and its structures (e.g., uplift).

The Consulting Engineer shall be responsible for determining whether a SWM facility berm is classified as a dam under the Ontario Lakes and Rivers Improvement Act, which at the time of writing is administered by the Ministry of Natural Resources (MNR).

5.5.8 Inlet Structures

Valdor , include OPSD for chain link fence OPSD – 972.131?

The following general principles are to be applied when designing storm sewer inlets to a SWM facility:

- The number of storm sewer inlets shall be limited to one, where possible, and the inlet(s) shall discharge into the sediment forebay.
- Headwall designs shall conform to OPSD 804.03 for pipes less than 900 mm in diameter. OPSD 804.02 shall be applied for pipes 900 mm in diameter or greater and shall be complemented by armourstone wing walls.
- Headwall grates, as per OPSD 804.05, shall be specified for all headwalls.
- The storm sewer invert at the inlet shall match the NWL.
- Headwalls and wing walls shall be protected by a 1200 mm height black vinyl chain link fence, and the posts shall be cored into the concrete headwall and/or armourstone wing walls.
- All exposed concrete faces shall be treated with natural Wiarton stone cladding and copping stone or must be treated with a commercially available form liner in a mason stone cut relief (Dayton Superior Pattern #1506SYM or #1502ES Cut Block Ashlar Stone or approved equivalent).
- Erosion protection shall be provided between the headwall and the sediment forebay bottom. The protection shall match the width of the headwall at the inlet and shall flare 1.5 m on either side of the headwall at the sediment forebay bottom. Protection shall consist of riverstone or rip-rap underlain with geotextile fabric. Appropriate stone sizing calculations shall be provided by the Consulting Engineer.
- A geodetic benchmark shall be established on the top of the headwall to assist in future monitoring of the normal water level.

5.5.9 Sediment Forebay

The sediment forebay shall be designed in accordance with the criteria outlined in Section 4.6.2 of the SWM Manual, and detailed calculations shall be included in the Stormwater Management Report. Other design features shall include:

- The sediment forebay shall be a minimum of 1.0 m in depth and a maximum of 2.0 m in depth. Reference shall be made to Town of New Tecumseth Standard Drawing TNT.SD 503.
- The Consulting Engineer must demonstrate that the anticipated 10-year sediment accumulation (based on Table 6.3 in the SWM Manual) will generate a sediment depth equal to or less than one half the total depth of the sediment forebay.
- The bottom of the forebay, not including side slopes, shall be lined with 300 mm of 50 mm crusher run limestone to support sediment removal equipment and to act as an indicator of the original forebay bottom during cleanout.
- A dewatering sump shall be installed in the forebay(s), although the preference would be a gravity outlet. Reference shall be made to Town of New Tecumseth Standard Drawing TNT.SD 505.
- The top of the sediment forebay berm shall be located 0.30 m below the normal water level and consist of a minimum 2.0 m top width and 3H:1V side slopes.

5.5.10 Sediment Drying Area

A sediment drying area shall be provided and designed as follows:

- The drying area shall be located immediately adjacent to the maintenance access road and at or above the 1:2 year storm level in the SWM facility.
- The area allotted for sediment drying shall be sized for the anticipated 10-year sediment accumulation calculated from Table 6.3 in the SWM Manual. Sizing calculations shall be provided by the Consulting Engineer, assuming a maximum height of 1.5 m and sediment slopes of 10H:1V on all sides of the sediment pile.

- The drying area shall be graded with a 2.0% cross-fall with drainage directed towards the SWM facility.
- Surface treatment of the storage area shall be consistent with the topsoil and seeding requirements for the remainder of the SWM facility, but no trees or shrubs shall be planted within the drying area.

5.5.11 Outlet Structures

Outlet structures shall be designed as follows:

- Reverse-slope outlet pipes shall be used for both wet pond and wetland facilities. An outlet plunge pool shall be provided for wetlands to ensure sufficient permanent pool depth is provided to mitigate thermal impacts.
- In keeping with MOE guidelines, consideration shall be given to installation of a control valve as part of the outlet structure.
- Reference shall be made to Town of New Tecumseth Standard Drawing TNT.SD 506 when designing orifice plates. The minimum orifice diameter is 75 mm. Flow through the orifice shall be calculated as:

$$Q_o = K \cdot A \cdot \sqrt{2\,g\,H} = K \cdot \frac{\pi \cdot D^2}{4} \cdot \sqrt{2\,g\,H}$$

where: Q_o is the flow through orifice (m^3/s)
A is the cross-sectional area of orifice (m^2)
K is the orifice flow coefficeint (0.60 for sharp-edged orifice)
D is the diameter of orifice (m)

The variable *H* is the driving head acting on the orifice and shall be calculated as:

$H = WSE - Centroid$	if $Centroid \geq TW$	*OR*
$H = WSE - TW$	if $Centroid < TW$	*OR*
$H = 0$	if $WSE \leq TW$	

where: *WSE* is the water surface elevation in the facility (m)
Centroid is the centroid elevation of orifice (m)
TW is the tailwater elevation in outlet structure (m)

- Flow across sharp-crested weirs shall be calculated as:

$$Q_w = F \cdot \left(0.40 + 0.05\frac{H}{P}\right) \cdot \sqrt{2g} \cdot L \cdot H^{1.5}$$

where: Q_w is the flow over weir (m^3/s)
H is the upstream head acting on weir (m)
P is the height of weir (m)
L is the length of weir (m)

The variable *F* accounts for submerged conditions (i.e., the tailwater is higher than the weir crest) and shall be calculated as follows:

$$F = \left[1 - \left(\frac{TW - Crest}{H}\right)^{1.5}\right]^{0.385} \qquad [6]$$

where: *TW* is the tailwater elevation in outlet structure (m)
Crest is the crest elevation of weir (m)

- Outlet control structure calculations shall be provided in the Stormwater Management Report and must consider tailwater impacts from the receiving watercourse or receiving storm sewer.
- All exposed concrete faces shall be treated with natural Wiarton stone cladding and copping stone or must be treated with a commercially available form liner in a mason stone cut relief (Dayton Superior Pattern #1506SYM or #1502ES Cut Block Ashlar Stone or approved equivalent).
- Where site grading permits, maintenance pipes and a control valve shall be installed to facilitate gravity drawdown of the SWM facility.

5.5.12 Overflow Spillways

SWM facilities shall provide an overflow spillway to allow stormwater to safely exit the facility in the event that the outlet structure fails or a storm greater than the 1:100 year event is experienced by the facility. The spillway shall be designed as follows:

- The spillway shall be designed to convey the greater of the uncontrolled 1:100 year storm peak flow or the uncontrolled Regional Storm peak flow, based on the 12-hour Timmins historical event and average antecedent moisture conditions (AMC II), while maintaining a 0.3 m freeboard to the top of the facility in keeping with NVCA recommendations
- The invert of the spillway shall be at or above the HWL in the facility.
- Erosion protection shall be provided on the top, downslope and base of the spillway based on flow velocity calculations.
- If the maintenance access road traverses the spillway, the surface treatment shall be consistent with the access road design.
- Side slopes at the spillway ends shall be a maximum of 3H:1V or 10H:1V if the spillway is part of the access road.
- Where possible, the spillway elevation shall be located above the Regional Storm elevation in the receiving watercourse.
- Flow over the spillway shall be calculated using the broad-crested weir equation:

$$Q_s = 1.67 \cdot L \cdot H^{1.5}$$

where: Q_s is the flow over the spillway (m^3/s)
H is the upstream head acting on the spillway (m)
L is the length of spillway base, excluding side slopes (m)

5.5.13 Maintenance Access

A maintenance access roadway shall be provided from municipal road allowances to the facility inlet headwall, control structure(s) and outlet headwall. The access roadway shall be looped to avoid dead-end access, unless approved otherwise by the Town of New Tecumseth. The access roadway shall be designed as follows:

- The minimum roadway width shall be 4.0 m.
- The maximum roadway gradient shall be 10%.
- The maximum crossfall shall be 2.0%.
- The minimum centreline radius shall be 12.0 m.
- Within the facility, the roadway shall typically be located at the predicted 1:2 year storm water level or such that standard maintenance equipment can reach to the center of the facility.
- The roadway shall be setback a minimum of 3.0 m from the nearest residential lot line.
- The road base is to consist of 300 mm of 50 mm crusher run limestone and cap with 100 mm of 20 mm crusher run limestone, where appropriate. Where the access roadway will also be used as part of a walkway or trail system, the surface treatment shall be confirmed with the Town of New Tecumseth.
- Concrete sidewalk across the access roadway shall be a minimum of 200 mm thick with wire mesh reinforcing.

5.5.14 Maintenance By-Pass Pipe

In order to minimize disruption during maintenance activities due to runoff entering the facility, maintenance by-pass pipes shall be provided to convey flows around the facility. The by-pass pipe shall be constructed in accordance with the following:

- Required to convey 70% of the 2-year storm peak flow.
- Flows shall be blocked from entering by-pass pipe during normal SWM facility operating conditions.
- Flows shall be diverted into the by-pass pipe during maintenance periods of the SWM facility, however, flows in excess of the by-pass design flow shall overflow into the SWM facility.
- The slope of the pipe shall be sufficient to pass the design flow without surcharge, unless it can be demonstrated that the resultant headwater does not result in an overflow to the SWM facility and that there are no upstream impacts due to surcharge (e.g., basement flooding, etc.).
- The combined capacity of the by-pass pipe and the overflow to the SWM facility must be equal to or greater than the 10-year storm peak flow rate.

5.5.15 Fencing and Warning Signs

Valdor , confirm fencing requirements as per MOE preferred criteria.

Fencing shall be required where residential lots or blocks abut the SWM facility. Fencing shall not be required where the facility abuts open space, EPA lands or a municipal road allowance. Fencing, where required, shall be 1.5 m high black vinyl chainlink fence in accordance with OPSD 900.01. The fence posts shall be offset 0.05 m within the SWM facility block with the chainlink mesh on the outside (i.e., lot side) of the posts.

Warning signs are to be installed near pedestrian traffic routes or walkways located within or adjacent to the SWM facility. The number of signs shall be determined by the Town of New Tecumseth on a site specific basis. Sign wording and layout shall conform to Town of New Tecumseth Standard Drawing TNT.SD 507.

5.5.16 Landscape Guidelines

SWM Facility landscaping shall be designed in accordance with Section 4.6.1 of the SWM Manual using native plant species. The Landscape Architect shall also reference Appendix E of the SWM Manual and Section 09 Landscape and Urban Design for acceptable Deciduous and Coniferous Species suitable for plantings within Town's SWM facilities.

The Conservation Authority shall also be contacted for more information, including additional plant species, topsoil depths and composition and appropriate seed mixtures and application methods.

SWM facility planting strategies shall consider five separate zones, which are defined by frequency and duration of inundation.

Zone	Depth	Plant Types
Deep Water	> 0.5 m	Aquatics & Submergents
Shallow Water Areas	0.3 m to 0.5 m	Submergents & Emergents
Shoreline Fringe	Permanent Pool Area	Sedges, Rushes, Ferns & Shrubs
Flood Fringe	Wetted Perimeter to HWL	Moisture tolerant herbaceous & woody species
Upland Areas	Above erosion control	Drought tolerant herbaceous and woody species

The following are the minimum recommended sizes of plant materials stated in accordance with the Canadian Nursery Trades Association Standards:

- Deciduous Trees (minimum caliper): 50 mm
- Coniferous Trees (minimum height): 1.2 m ht. above root ball
- Deciduous and Coniferous Shrubs: 0.6 m ht.

The following are minimum recommended plant densities:

- Deciduous and Coniferous Trees: 1 tree per 50 m^2
- Shrubs: 1 plant per m^2 (5H:1V side slope or flatter)
  2 plants per m^2 (4H:1V side slope)
  4 plants per m^2 (3H:1V side slope)
- Wet Pond Aquatics: 1.5 m band around the NWL spaced at 1.0 m on centre
- Wetland Aquatics: Throughout the permanent pool spaced at 1.5 m on centre

Other planting strategies, such as barrier planting, weir planting or waterfowl barriers shall be designed on a site specific basis, based on consultation with the Conservation Authority.

5.5.17 As-Constructed Information Requirements

An as-constructed topographic survey and engineering plans of the SWM facility shall be required along with calculations to verify the following:

- Actual permanent pool volume
- Actual active storage volume
- Location and elevation of facility berms
- Locations, invert elevations and sizes of pipes, inlets and orifices for the control structure

The Consulting Engineer shall certify that the as-constructed SWM facility has been built and is performing in accordance with the engineering plans and stormwater management report. In addition, the Landscape Architect shall certify that the SWM facility landscape design has been implemented in accordance with the approved landscape plans.

5.6 Sediment and Erosion Control Plans

A sediment and erosion control plan shall be prepared for all sites and submitted for review to the Town of New Tecumseth and the Conservation Authority. The plan shall consider all phases of construction from topsoil stripping and earthworks to ultimate site stabilization. All erosion and sediment controls are considered temporary applications and are to be constructed prior to any disturbance of land, and shall be maintained until the site has been stabilized to a condition that is equal to, or better than, the existing.[4]

The sediment and erosion control plan may include measures such as, but not limited to:

- Temporary sediment control ponds;
- Sediment control fences;
- Topsoil stockpile locations and footprint;
- Rock check dams;
- Vegetation buffer zones and tree preservation zones;
- Locations of all trees that are to be retained;
- Stone mud mats;
- Erosion control blankets; and
- Catchbasin sediment traps.

All measures are to be designed in accordance with the Town of New Tecumseth and Conservation Authority standards. During the period of de-stabilization, the measures shall be monitored, maintained and upgraded (if necessary) until site stabilization has occurred to the satisfaction of the Town of New Tecumseth and Conservation Authority.

The Consulting Engineer shall provide weekly written reports to the Town of New Tecumseth and Conservation Authority that outline the status of the erosion and sediment controls. These reports shall be prepared and submitted for the duration of the project until the disturbed areas have been stabilized to the satisfaction of the Town o New Tecumseth and Conservation Authority and the measures have been removed.

Valdor,

please note, that as per NVCA Engineering Development Review Guidelines, dated September 2009, Section 4, the existing below noted document “Technical Design Guidelines, Standards and Policies for Siltation and Erosion Control” was replaced by “Erosion & Sediment Control Guidelines for Urban Construction” developed by the Greater Golden Horseshoe Area Conservation Authorities, dated December 2006.

Please update all references.

[4] Technical Guidelines, Standards, and Policies for Siltation and Erosion Control, NVCA, July 2003.