Civil and Municipal Engineering

# ARK Engineering and Development

## Conceptual Serviceability Brief

Cedar Lakes Subdivision
Phases 3 - 4
Ottawa (Greely), Ontario

Prepared For
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**LOT 7 AND 8,**
**CONCESSION 3**

**WATER SUPPLY, SEWAGE,**
**GRADING AND STORMWATER**

**CONCEPTUAL SERVICEABILITY BRIEF**

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**APPENDICES**

# CONCEPTUAL SERVICEABILITY BRIEF

## 1.0 BACKGROUND

### 1.1 General

The proposed development site situated on Lot 7 and 8 of Concession 3 consists of approximately 48 ha and is situated West of the Stagecoach Rd. and South of Courtland Grove Crescent (see location map SK-1). The proposed subdivision will consist of 71 lots, which are all a minimum one acre in size and are to be developed on full private services and roadside drainage ditches.

### 1.2 Existing Services

This area of development in Greely has no existing sanitary, watermain and storm sewers to services this proposed subdivision. Therefore, this rural development will be constructed as follows:

- All dwellings will have their own:
    1. wells for domestic water usage
    2. septic systems for sewage treatment

- Roadside ditches and culvert crossings will be proposed and sized to accommodate the 10yr storm as a minimum to drain the lots and roads

- Three stormwater management ponds are proposed to ensure that the pre to post conditions of the site are respected after development.

- An internal road network as shown in the SK-2 drawing in Appendix A is being proposed which will provide this subdivision with three connection access points, one by the existing Phase 1, the second by Deermeadow Dr. and the other off of Stagecoach Rd.

- Hydro, Bell Cable and Gas were not part of this preliminary serviceability study; it should be verified prior to proceeding with the first design submission.

## 2.0 PROPOSED SERVICES

### 2.1 Water Supply

As previously mentioned, all dwellings will have their own individual wells in order to supply domestic water. These wells will have to be drilled by a licensed water well contractor and its construction method will have to be in accordance to the recommendations of the Hydrogeological report dated December 27, 2023 which was prepared by Gemtec. All new wells shall have a minimum casing length of 40.0m. Once the well is drilled, a Certificate of Well Compliance and a MOE Well Record shall be provided to the City of Ottawa.

### 2.2 Sewage

Since no sanitary sewer pipes are available for this area, septic systems for every dwelling are proposed which is typical in a rural setting. These septic systems must be designed and installed carefully to protect the surrounding water resources. The proposed designs must be submitted, approved and then inspected by the local Ottawa Septic System Office (OSSO).

## 3.0 STORMWATER MANAGEMENT

The SWM report will have to be written/designed in conjunction with the approved Stantec Consulting Ltd: "Greely/Shields Creek Stormwater and Drainage Study", 2002, which fall within the Middle Castor River Subwatershed.

In order to meet the MOE quality and quantity control criteria, Stormwater Management Ponds (SWM) are required. Due to the existing site topography, two stormwater management ponds will be be constructed as shown on sketch SK-2. The proposed pond locations are as shown on the sketch SK-2, and will intercept control and treat runoff which currently drains from the North to the South. The pond outlets will be via two existing Tributaries 1 and 2 open ditch from this site which ultimately discharges into Grey's Creek Municipal Drain (refer to Figure 4.9.2 for site outlet locations, identified as SNC18 and SNC 20 and Figure 4.12.1 also depicts existing drainage outlets.)

These two existing tributary outlets were utilized at the time of registration of Cedar Lake Phase 1 Plan 4M-1479 and Phase 2 Plan 4M-1555. The City of Ottawa has registered easements along the entire drainage corridor within the land of this application, for outlet maintenance, Parts 1-5 on Plan 4R-26960, and the drainage system is currently receiving pre development flows from subject lands for the phases 3 and 4, approved as flow conveyers in ECA #8672-94QRSV.

Section 4.0 of the report will demonstrate that the post-development flows will adhere to the existing pre-developments flows and that the proposed stormwater management pond areas are sufficient to comply to this criteria.

The following are some Design Objectives and Criteria which will be analyzed:
The design criteria and guidelines used for the stormwater management of the subject subdivision are based on the October 2012 City of Ottawa Sewer Design Guidelines and subsequent technical memorandums, as well as generally accepted stormwater management design guidelines. The design guidelines used for the SWM design of the subject site include the following:

- City of Ottawa Sewer Design Guidelines, October 2012
- The September 2016 City of Ottawa Technical Bulletin PIEDTB-2016-01
- The March 2018 City of Ottawa Technical Bulletin ISTB-2018-01
- The MECP Stormwater Management Planning and Design Manual, March 2003

Additional design criteria are based on generally accepted stormwater management design guidelines. The specific criteria used for the minor and major system and SWM pond design are presented below:

### 3.1 Minor System

- Roadside ditches and driveway culverts are to be designed to provide, at a minimum, a 2-year level of service. That is, for a 2-year design storm, all surface drainage draining to the SWM pond shall be contained within the roadside ditches.
- All driveway culverts shall be a minimum of 500 mm in diameter.

### 3.2 Major System

- The 100-year Water surface elevation in the roadside ditch should not exceed the lowest ground elevation around the perimeter of the adjacent building.
- The spread of major system flows for the 100-year + 20% stress test shall not exceed the building's lowest opening.
- Roof leaders shall be installed to direct the runoff to grassed areas.

### 3.3 Quality and Quantity Control Design

- As per Stantec's "Greely/Shield Creek Stormwater and Drainage Study" for future developments with stormwater management (SWM) controls, the recommended SWM strategy is to control the 2-year post-development flow to 50% of predevelopment peak flow and control 5-year to 100-year post-development peak flows to match pre-development conditions.
- The site is required to provide an Enhanced level of protection for stormwater quality or 80% long-term removal of suspended solids as per the MECP Stormwater Management Planning and Design Manual.

## 4.0 POND DESIGN AND SIZING

**Existing pre-development 100yr flows**

As this report is "conceptual" only the 100yr flows will be analyzed to ensure that it meets all requirements for pond sizing of the major storm event. The existing 100yr peak design flows have been estimated at the proposed outlets for Ponds 1 and 2 of the development. These flow results were obtained using the Transportation o Flood Discharge Method from the MTO Drainage Manual (equation 8.31) relative to Stantec's flows for a larger area (GY013 = 210.82ha @ 3,135 L/s) per the "Greely/Shields Creek Stormwater and Drainage Study" October 2002 report, refer to Appendix B. Note that this method of pro-rating existing flows was previously presented and approved for Cedar Lakes Phases 1 and 2, in Table 1 of the JF Sabourin Stormwater Management Plan and Pond Design Brief dated January 2012.

**Pond 1**
Drainage Area = 13.79ha
Discharge from existing Western pond from the north = 272 L/s
100yr storm release = 678 L/s (including the ex. discharge of 272 L/s)

**Pond 2**
Drainage Area = 24.01ha
Discharge from existing Eastern pond from the north = 459 L/s
100yr storm release = 1,074 L/s (including the ex. discharge of 459 L/s)

**Description of SWM Pond 1**

As shown on SK-2 in Appendix A, the proposed stormwater management facility will have one cell of an approximate area of 3,100 $m^2$. In accordance with the requirements of the MOW SWMPD Manual (March 2003, the will have the following components:

i) A main pond cell,
ii) A quantity control outlet at the end of the main pond cell

The pond was designed based on local site conditions to achieve the necessary quantity control. As per MOE guidelines, the required permanent pool volume for enhanced protection is 772$m^3$ and the required detention volume is 552$m^3$ for an area of 13.79ha at 14% imperviousness. This provides a total required pond volume of 1,324$m^3$. The provided permanent pool volume of 5,150$m^3$ exceeds the required MOE volume for enhanced protection set for 80% long-term TSS removal. Also, the required extended detention volume of 552$m^3$ will be provided with the required drawdown time between 24 and 48 hours based on the pond outlets at the final design stage.

**Description of SWM Pond 2**

As shown on SK-2 in Appendix A, the proposed stormwater management facility will have one cell of an approximate area of 4,200$m^2$. In accordance with the requirements of the MOW SWMPD Manual (March 2003, the will have the following components:

i) A main pond cell,
ii) A quantity control outlet at the end of the main pond cell

The pond was designed based on local site conditions to achieve the necessary quantity control. As per MOE guidelines, the required permanent pool volume for enhanced protection is 1,345$m^3$ and the required detention volume is 960$m^3$ for an area of 24.01ha at 14% imperviousness. This provides a total required pond volume of 2,305$m^3$. The provided permanent pool volume of 6,850$m^3$ exceeds the required MOE volume for enhanced protection set for 80% long-term TSS removal. Also, the required extended detention volume of 960$m^3$ will be provided with the required drawdown time between 24 and 48 hours based on the pond outlets at the final design stage.

**Main Pond Cells**

**SWM Pond 1 Main Cell**

As per the drawing SK-2, at a permanent pool elevation of 96.55m, the main pond cell will have a surface area of 3,100$m^2$ (approx. 100m long by 31m wide). The side slope of the main pond cell will be 3H:1V from the pond bottom of 92.35m up to and elevation of 95.35m, 7H:1V from an elevation of 95.35m to the permanent pool at 96.55m and 3H:1V from the permanent pool at 97.25m.

The permanent pool has a depth of 4.20m based on the bottom elevation of 92.35m and a volume of approximately of 5,150$m^3$. As discussed above, the provided permanent pool volume exceeds the 772$m^3$ volume required by the MOE. The proposed extended detention volume will be designed at approximately 620$m^3$, which also exceeds the 552$m^3$, volume required by the MOE.

**SWM Pond 2 Main Cell**

As per the drawing SK-2, at a permanent pool elevation of 97.60m, the main pond cell will have a surface area of 4,200$m^2$ (approx. base of 140m long by height of 60m). The side slope of the main pond cell will be 3H:1V from the pond bottom of 93.40m up to and elevation of 96.40m, 7H:1V from an elevation of 96.40m to the permanent pool at 97.60m and 3H:1V from the permanent pool at 98.25m.

The permanent pool has a depth of 4.20m based on the bottom elevation of 92.35m and a volume of approximately of 6,850$m^3$. As discussed above, the provided permanent pool volume exceeds the 1,345$m^3$ volume required by the MOE. The proposed extended detention volume will be design at approximately 1,050$m^3$, which also exceeds the 960$m^3$, volume required by the MOE.

**Pond levels and outflows**

Based on the allowable pre-existing 100yr target flows pro-rated from the "Greely/Shields Creek Stormwater and Drainage Study" October 2002 report, the maximum 100yr pond elevations were calculated and results can be found in Appendix B.

Pond 1 will store a volume of 1,172$m^3$ which represents a depth of storage of 0.38m above permanent pond elevation of 96.55m. As such the 100yr elevation is tabulated at 96.93m.

Pond 2 will store a volume of 2,169$m^3$ which represents a depth of storage of 0.52m above permanent pond elevation of 97.60m. As such the 100yr elevation is tabulated at 98.12m.

**Tributary 1 with Grey's Creek Municipal Drain**

The confluence of Tributary 1 with Grey's Creek Municipal Drain is 665m downstream from the proposed Pond 1. The 100-year water level on Grey's Creek Municipal Drain at this location has been interpolated as 94.71m, 1.84m below the channel invert at the property boundary. As such, the 100-year water level on Grey's Creek Municipal Drain will not interfere with the hydraulics of Pond 1.

**Tributary 2 with Grey's Creek Municipal Drain**

The confluence of Tributary 2 with Grey's Creek Municipal Drain is 1,240m downstream from the proposed Pond 2. The 100-year water level on Grey's Creek Municipal Drain at this location has been interpolated as 93.15m, 4.45m below the channel invert at the property boundary. As such, the 100-year water level on Grey's Creek Municipal Drain will not interfere with the hydraulics of Pond 2.

As it may be seen above, the 100yr post-development outflows from SWM Pond 1 and 2 to Tributary 1 and 2 respectively will be controlled to pre-development levels as per Stantec's pro-rated flows. This design methodology applied is consistent with the previously approved for Cedar Lakes Phases 1 and 2, of the JF Sabourin Stormwater Management Plan and Pond Design Brief dated January 2012.

## 5.0 SILTATION AND EROSION CONTROL

In order to minimize the transfer of silt off-site or to the proposed SWM ponds during construction activities, the following measures should be implemented if deemed necessary:

i) Silt control fences can be installed as required in order to prevent the movement of silt off-site during rainfall events.
ii) Regular cleaning of adjacent roads can be undertaken during the construction activities.
iii) Silt check dams can be installed along drainage swales in order to prevent the transfer of silt off-site where silt laden surface flows may be anticipated.
iv) Regular inspection and maintenance of any silt control measures should be undertaken until the site has been stabilized.
v) Any erosion and sediment control devices should be removed after the site has been stabilized.

## 6.0 SWM FACILITY MAINATENANCE PROGRAM

During the construction of the subdivision, ongoing maintenance activities for the SWM ponds should include, but not be limited be to, the following;

**Spring:**

i) a general clean-up should be undertaken each spring to remove trash from the pond surface and surrounding area, including the access road;
ii) a visual inspection of inlet and outlet structures to ensure free flowing conditions and correct possible undercutting problems if necessary; and
iii) a visual inspection of berms to check for animal burrows that may deteriorate the structural integrity of the embankments. Existing burrows should be filled as soon as possible.

**Summer:**

i) regular (e.g. monthly) visual inspection of inlet and outlet structures to ascertain that they are unobstructed and free of debris (remove debris and sediment if necessary);
ii) visual inspections of inlet and outlet structures during and following any significant rainfall events (10 mm or more within four hours) to ensure that the pond is functioning properly; and to enhance water quality benefits and discourage waterfowl access, grass cutting shall not be undertaken within 3 m of the permanent pool. In areas where grass cutting must be undertaken for aesthetic reasons, grass clippings should be ejected upland (away from the pond or other drainage works) to reduce the potential for organic loading in the ponds. Grass should never be cut to lengths of less than 10 cm.

**Fall:**

i) weeds, if deemed to be invasive and effecting the operation of the ponds, should be selectively removed to prevent the destruction of surrounding vegetation.

**Winter:**

i) No special provisions are anticipated at this time for the operation of the proposed SWM ponds during the winter**.**

## 7.0 SITE GRADING

A preliminary permissible grade raise restriction has been provided by Paterson Group for the southwest portion of the site where a silty clay deposit was encountered and is set between 2.0 m to 2.5m. Footings bearing upon a sand/silty sand, glacial till or bedrock bearing medium will not be subject any grade raise restrictions. This is shown on the Paterson Group, Drawing PG6871-2 - Permissible Grade Raise Plan included in Appendix 2.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other solutions may be recommended by the geotechnical consultant, if required, to mitigate the risks of unacceptable long-term post-construction total and differential settlements.

## 8.0 CONCLUSION

From the above statements the following can be concluded:

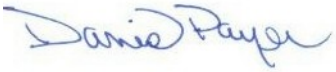
This entire site can be serviced as proposed above. All dwelling are to be serviced on private wells with 40.0m casings and septic systems approved by OSSO. The Geotechnical report determine the permissible grade raise of up to 2.0m-2.5m in the South-Western corner.

It has been confirmed that the capacity of the proposed major drainage systems is sufficient to convey the 100-year design storm flows to the ponds, and that the ponds have sufficient capacity to provide the required quantity and quality controls. It also has been demonstrated the that pond outflows will respect the existing pre-development flows for the 100yr storm event in the two downstream Tributaries 1 and Tributary 2. This design methodology applied is consistent with the previously approved for Cedar Lakes Phases 1 and 2, of the JF Sabourin Stormwater Management Plan and Pond Design Brief dated January 2012

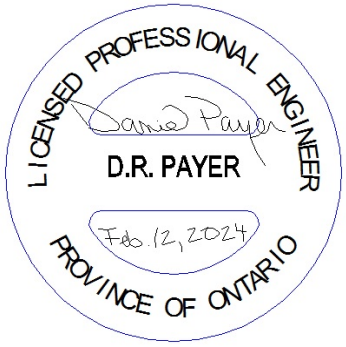
Recommendations for silt and erosion control strategies and for maintenance and monitoring during construction are provided in Section 5.0 and 6.0.

In conclusion, the proposed conceptual design satisfies all selected design guidelines and requirements.

Prepared by:
**ARK Engineering and Development**



Daniel Payer, P.Eng.
President



**APPENDIX "A"**

| | |
|---|---|
| SK-1 | Location Map |
| Figure 4.9.2 | Geomorphic Stream Reaches |
| Figure 4.12.1 | Greely/Shields Creek Stormwater and Drainage Study |
| SK-2 | Storm Drainage and Macro Grading Plan |
| SK-3 | Figure 7.1- Greely/Shields Creek Stormwater and Drainage Study Sub Area Discretization for Existing Conditions |
| EC-1 | Erosion and Sediment Control Plan |


| | | | |
|---|---|---|---|
| | LOCATION MAP<br><br>CITY OF OTTAWA - Formerly TOWNSHIP OF OSGOODE | Completed By: ARK ENGINEERING AND DEVELOPMENT<br>Scale: 1:6000 / Date: DEC 2023 | Drawing No.: SK-1 |

# Shields Creek Subwatershed Study

## GEOMORPHIC STREAM REACHES

**Legend**

- Reach Breaks
- Roads
- Watercourse
- Ponds
- Study Area Boundary
- Subwatershed

FINDLAY CREEK

MOSQUITO CREEK

NORTH CASTOR / SHIELDS CREEK

MIDDLE CASTOR RIVER

RIDEAU

ALBION

BANK

PARKWAY

JOHN QUINN

SALE BARN

OLD PRESCOTT

BOWERSVILLE

MITCH OWENS

DOWNEY

MANOTICK STATION

APPLE ORCHARD

STAGECOACH

NICK ADAMS

GREY'S CREEK

STONE SCHOOL

N

0 500 1,000

Meters

engineers architects planners

PARISH geomorphic

Jacques Whitford
Environmental, Geotechnical and Risk Management Consultants

Blackport & Associates

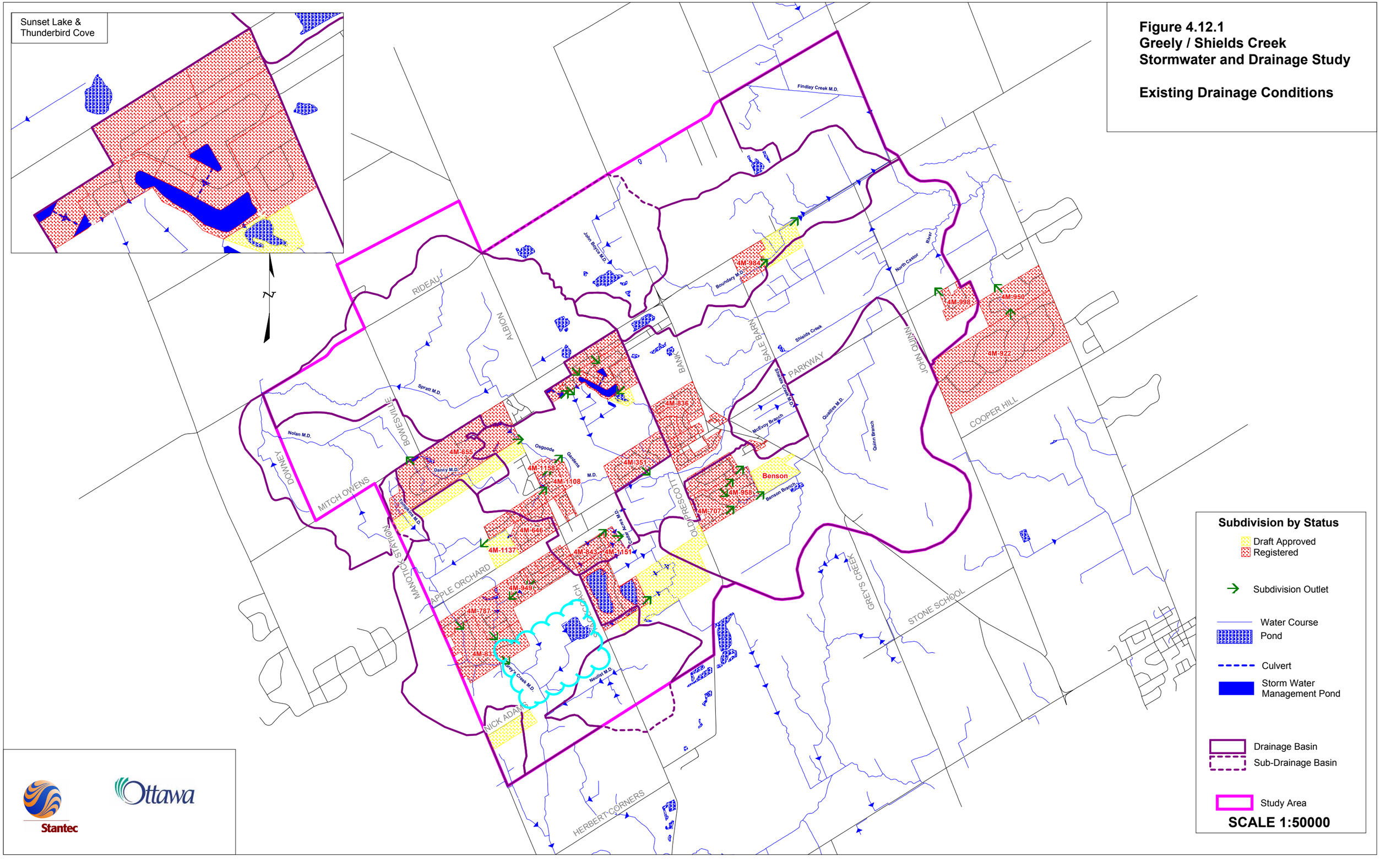
Donald G. Weatherbe Associates Inc.

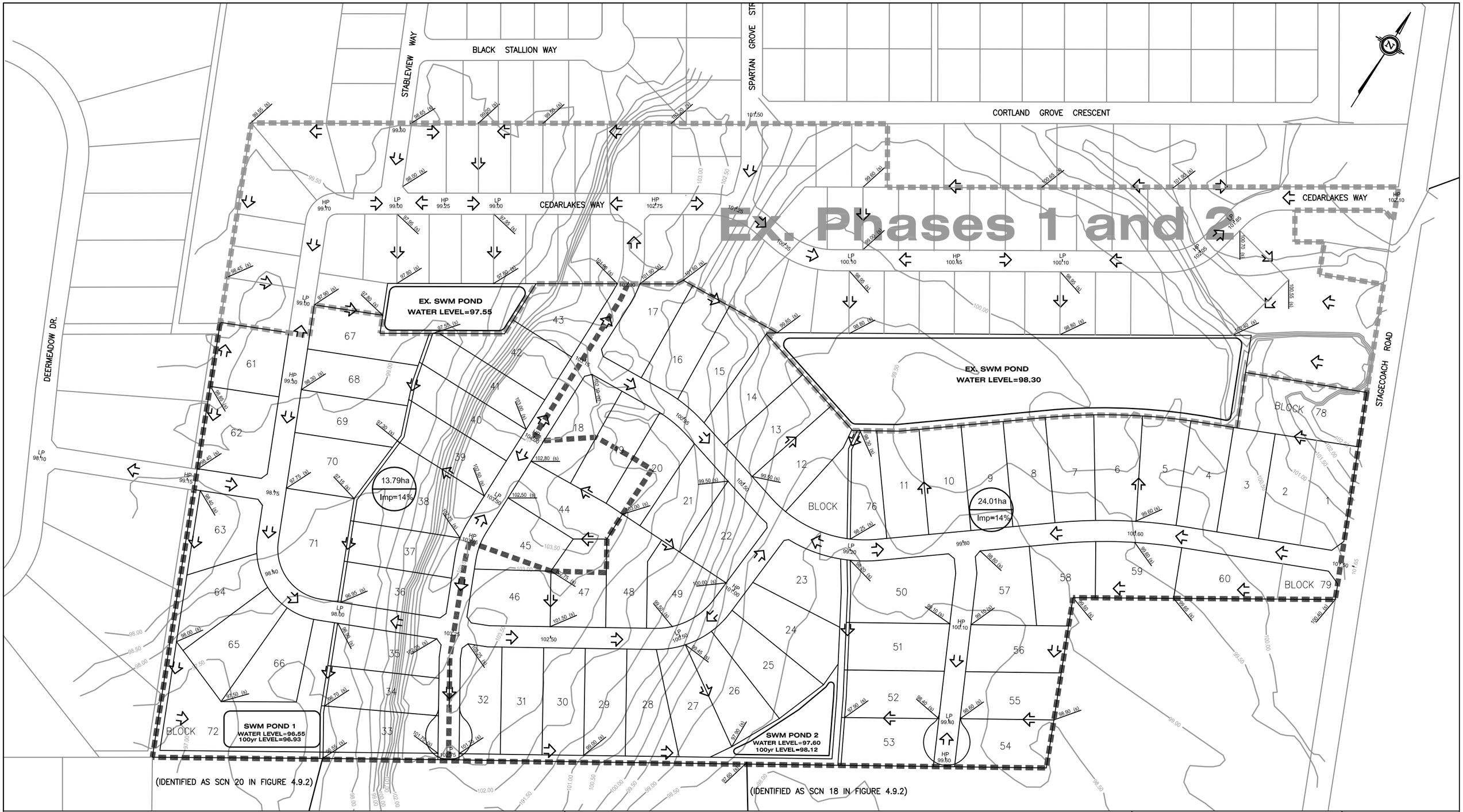
June 28, 2004

**Figure 4.9.2**

# Figure 4.12.1
# Greely / Shields Creek
# Stormwater and Drainage Study

## Existing Drainage Conditions






## LEGEND:

- RUNOFF FLOW DIRECTION
- DRAINAGE AREA BOUNDARY
- 97.55 (s) PROPOSED SWALE AND DITCH ELEVATIONS
- 98.55 PROPOSED CENTER LINE OF ROAD ELEVATIONS

# STORM DRAINAGE AND MACRO GRADING PLAN
# CEDAR LAKES - PHASES 3 to 4

## CITY OF OTTAWA - Formerly TOWNSHIP OF OSGOODE

Completed By:
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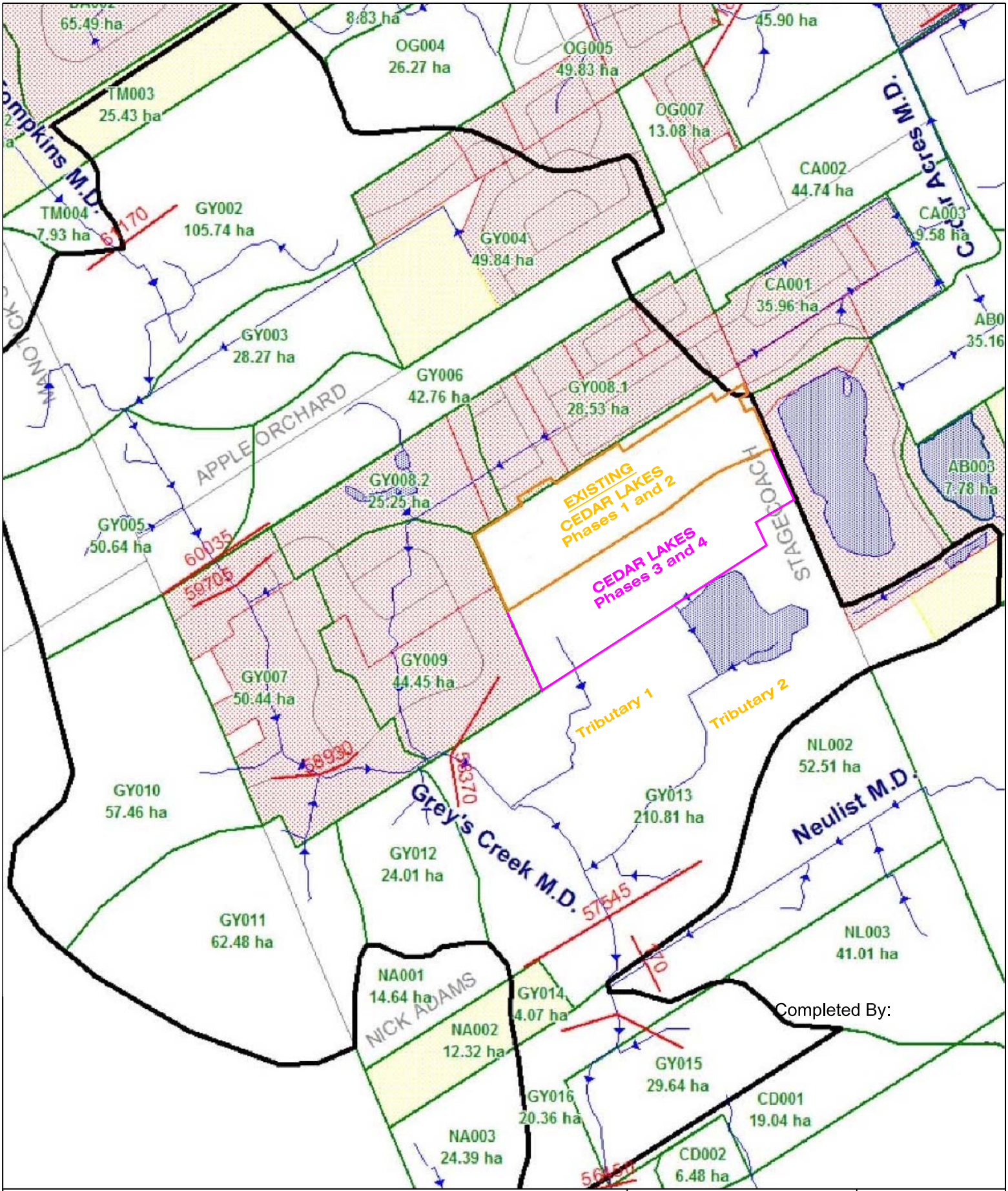
Scale:
NTS

Date:
FEB 2024

Drawing No.:
SK-2




Completed By:

Figure 7.1 (excerpt)

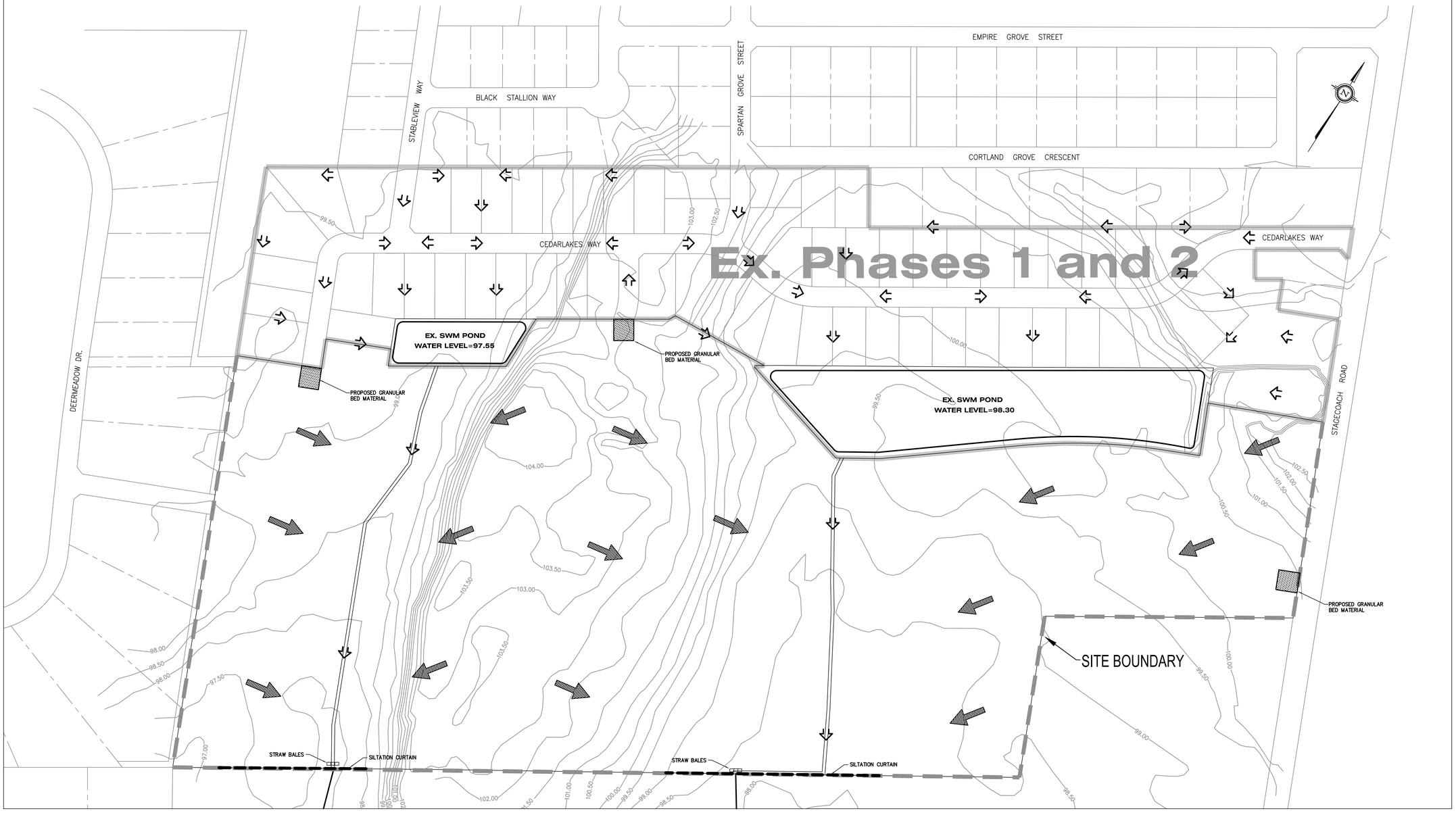
Greely /Shields Creek Stormwater and Drainage Study
Sub Area Discretization for Existing Condition
Stantec October 2002

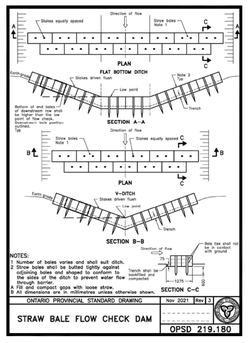
ARK ENGINEERING AND DEVELOPMENT

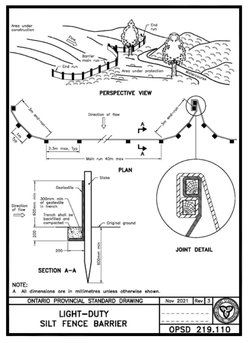
Scale: NTS

Date: FEB 2024

Drawing No.: SK-3

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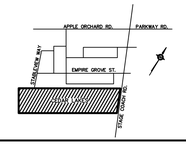
Legend

- SITE BOUNDARY
- DIRECTION OF SHEET FLOW DRAINAGE
- SILTATION CURTAIN
- STRAW BALES

Notes

1) STRAW BALES SHOULD BE INSTALLED AS PER OPSD 219.180
2) STRAW BALES MAY BE INSTALLED ALONG THE VARIOUS SWALES (MAN MADE OR EXISTING) WHERE JUDGED NECESSARY BY THE ENGINEER AND/OR THE CITY OF OTTAWA'S INSPECTOR.
3) ALL SEDIMENT CONTROL LOCATIONS MUST BE INSPECTED ON A REGULAR BASIS ESPECIALLY FOLLOWING A RAINFALL EVENT. SEDIMENTS SHALL BE REMOVED AND CONTROLS REINSTALLED AS NECESSARY.
4) SHOULD IT BE IMPOSSIBLE TO PREVENT OVERLAND SHEET FLOW TO AN EXTERNAL AREA DURING THE CONSTRUCTION PHASE; SUCH AREA SHALL BE PROTECTED WITH A SILT FENCE AS PER OPSD 219.110 TO ENSURE FLOW IS MAINTAINED ON-SITE.
5) ANY MATERIAL STOCKPILES SHOULD BE LOCATED ON FLAT AREAS WELL AWAY FROM ANY DRAINAGE OUTLETS. ALL STOCKPILES ARE TO BE TO BE STABILIZED BY VEGETATION AND/OR GEOTEXTILE. STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS FEASIBLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN 7 DAYS AFTER THE CONSTRUCTION ACTIVITY HAS TEMPORARILY OR PERMANENTLY CEASED.
6) STOCKPILES AS WELL AS EQUIPMENT FUELING AND MAINTENANCE AREAS WILL BE LOCATED A MINIMUM OF 30m FROM THE DITCH AND OTHER CONVEYANCE ROUTES.
7) PREPARATIONS TO RESPOND TO ANY ACCIDENTAL SPILLS, INCLUDING KEEPING A SPILLS RESPONSE KIT ON SITE, WILL BE MAINTAINED DURING THE CONSTRUCTION PHASE.
8) NO SEDIMENT CONTROL STRUCTURES SHALL BE REMOVED UNLESS DEEMED UNNECESSARY.
9) THE SEDIMENT AND EROSION CONTROL MEASURES MAY BE MODIFIED IN THE FIELD AT THE DISCRETION OF THE CITY OF OTTAWA SITE INSPECTOR.
10) THIS PLAN IS A "LIVING DOCUMENT" AND THAT ANY MODIFICATION TO THE PLAN SHALL BE SUBMITTED TO THE SATISFACTION OF SNC AND MAY BE MODIFIED BY SNC STAFF.

Key Plan




Revision

| | | |
|---|---|---|
| 0. | SUBMITTED FOR APPROVAL | JAN 4/24 |

Seal


Client / Project

6980848 CANADA CORPORATION

CEDAR LAKES - Phases 3 - 4

Drawing Name

EROSION and SEDIMENT CONTROL PLAN

Scale

1:2000 0 20 60 100m

| Revision | Sheet | Drawing No. |
|---|---|---|
| REV-0 | 1 of 1 | EC-1 |

**APPENDIX "B"**

Pond 1 and 2 – Design requirement calculations

**Existing Peak Design Outlfows vs Target Post Flows**

| Design Storms | Peak Flows ($m^3/s$) | | | |
|---|---|---|---|---|
| | Pond 1 (13.79ha) | | Pond 2 (24.01ha) | |
| | Stantec Results* | Target Post Flows | Stantec Results* | Target Post Flows |
| 4 hr - 25mm Storm | 0.034 | 0.034 | 0.051 | 0.051 |
| 2 yr - 3hr Chicago | 0.060 | **0.030** | 0.091 | **0.045** |
| 5 yr - 3hr Chicago | 0.107 | 0.107 | 0.163 | 0.163 |
| 25 yr - 3hr Chicago | 0.199 | 0.199 | 0.301 | 0.301 |
| 100 yr - 3hr Chicago | 0.296 | **0.296** | 0.448 | **0.448** |
| 2 yr - 24 hr SCS Type II | 0.090 | **0.045** | 0.136 | **0.068** |
| 5 yr - 24 hr SCS Type II | 0.155 | 0.155 | 0.235 | 0.235 |
| 10 yr - 24 hr SCS Type II | 0.206 | 0.206 | 0.312 | 0.312 |
| 25 yr - 24 hr SCS Type II | 0.277 | 0.277 | 0.419 | 0.419 |
| 50 yr - 24 hr SCS Type II | 0.337 | 0.337 | 0.510 | 0.510 |
| 100 yr - 24 hr SCS Type II | 0.406 | **0.406** | 0.615 | **0.615** |

* Results obtained by pro-rating Stantec's flows per the "Greely/Shields Creek Stormwaterand Drainage Study" report

| Design Storms | GY013 Q as per Stantec Areas (m3/s) |
|---|---|
| Ch 4h 25 mm | 0.261 |
| Ch 3h 2 yr | 0.464 |
| Ch 3h 5 yr | 0.829 |
| Ch 3h 25 yr | 1.537 |
| Ch 3h 100 yr | 2.287 |
| SCS 24 hr 2 yr | 0.695 |
| SCS 24 hr 5 yr | 1.199 |
| SCS 24 hr 10 yr | 1.593 |
| SCS 24 hr 25 yr | 2.139 |
| SCS 24 hr 50 yr | 2.602 |
| SCS 24 hr 100 yr | 3.135 |

So for example, equation 8.31:

Pro-Rated flow for Pond 1 - 100-year 24-hour SCS design storm would be 3.135 $m^3/s$ x (13.79 ha / 210.82 ha)$^{0.75}$ = 0.406 $m^3/s$.

# POND 1 - STORAGE REQUIREMENT

## 1.0 Pre-development Site Conditions:

### 1.1 Allowable (predevelopment) Flow Rate:

Site Area, A: **13.79** ha

**Q100yr allowable = 678 L/sec**

## 2.0 Post-Development Site Conditions:

### 2.1 Overall Runoff Coefficient for Site and Sub-Catchment Area

**Runoff Coefficient Table**

| Sub-catchment Area | Area (Ha) "A" | Runoff Coefficient "C" | "A x C" |
|---|---|---|---|
| **1** | 13.7900 | 0.30 | 4.137 |

Area = 13.7900
Cavg = 0.30

### 2.2 Total Site Stormwater Storage Requirements (100 year storm event)

**Storage Table**

| $t_c$ min. | I (100 yr) mm/hr | $Q_{actual}$ L/sec. | $Q_{allowable}$ L/sec. | $Q_{stored}$ L/sec. | $V_{stored}$ $m^3$ | | |
|---|---|---|---|---|---|---|---|
| 5 | 291.2 | 3346.8 | 678.0 | 2668.8 | 801 | 0 | 0 |
| 10 | 214.3 | 2462.9 | 678.0 | 1784.9 | 1071 | 0 | 0 |
| 15 | 171.5 | 1970.6 | 678.0 | 1292.6 | 1163 | 0 | 0 |
| **20** | **144.0** | **1654.8** | **678.0** | **976.8** | **1172** | **144** | **20** |
| 25 | 124.6 | 1431.4 | 678.0 | 753.4 | 1130 | 0 | 0 |
| 30 | 110.3 | 1267.3 | 678.0 | 589.3 | 1061 | 0 | 0 |

**Volume Stored 1172 $m^3$**
**I (100 yr) 144.0 mm/hr**
**$t_c$ 20 min.**

# Pond 2 - STORAGE REQUIREMENT

## 1.0 Pre-development Site Conditions:

### 1.1 Allowable (predevelopment) Flow Rate:

Site Area, A: **24.01** ha

**Q100yr allowable = 1074 L/sec**

## 2.0 Post-Development Site Conditions:

### 2.1 Overall Runoff Coefficient for Site and Sub-Catchment Area

**Runoff Coefficient Table**

| Sub-catchment Area | Area (Ha) "A" | Runoff Coefficient "C" | "A x C" |
|---|---|---|---|
| **1** | 24.01 | 0.30 | 7.203 |

Area = 24.01
Cavg = 0.30

### 2.2 Total Site Stormwater Storage Requirements (100 year storm event)

**Storage Table**

| $t_c$ min. | I (100 yr) mm/hr | $Q_{actual}$ L/sec. | $Q_{allowable}$ L/sec. | $Q_{stored}$ L/sec. | $V_{stored}$ $m^3$ | | |
|---|---|---|---|---|---|---|---|
| 5 | 291.2 | 5827.2 | 1074.0 | 4753.2 | 1426 | 0 | 0 |
| 10 | 214.3 | 4288.2 | 1074.0 | 3214.2 | 1929 | 0 | 0 |
| 15 | 171.5 | 3431.0 | 1074.0 | 2357.0 | 2121 | 0 | 0 |
| **20** | **144.0** | **2881.2** | **1074.0** | **1807.2** | **2169** | **144** | **20** |
| 25 | 124.6 | 2492.2 | 1074.0 | 1418.2 | 2127 | 0 | 0 |
| 30 | 110.3 | 2206.5 | 1074.0 | 1132.5 | 2039 | 0 | 0 |

**Volume Stored 2169 $m^3$**
**I (100 yr) 144.0 mm/hr**
**$t_c$ 20 min.**

**Quality Pond Sizing**

| Protection Level | SWMP Type | Imp 35% |
|---|---|---|
| 80% | Wet Pond | 140 $m^3$/ha |

**Pond 1**

| | | | |
|---|---|---|---|
| Area = | 13.79 | **As Per MOEE** | |
| Imp = | 14% | Required Pond Volume = | 96 $m^3$/ha |
| | | Total Pond Volume = | 1324 $m^3$ |
| | | Permanent Pool = | 772 $m^3$ |
| | | Ext. Det. Volume = | 552 $m^3$ |

Pond 2

| | | | |
|---|---|---|---|
| Area = | 24.01 | **As Per MOEE** | |
| Imp = | 14% | Required Pond Volume = | 96 $m^3$/ha |
| | | Total Pond Volume = | 2305 $m^3$ |
| | | Permanent Pool = | 1345 $m^3$ |
| | | Ext. Det. Volume = | 960 $m^3$ |