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Prepared for:

BGIS GLOBAL INTEGRATED SOLUTIONS CANADA LP
4175 14th Avenue
Markham, ON
L3R 0J2

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED
343 Preston Street, Tower II, Suite 1000
Ottawa, ON
K1S 1N4
Tel: 613-728-3571

Stormwater Management Report

Hydro One Operations Centre

3440 Frank Kenny Road, Orléans, ON

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

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1.0 Introduction

1.1 General

This Stormwater Management Brief has been prepared by J.L. Richards & Associates Limited (JLR) on behalf of BGIS to support an application for Hydro One Networks Inc. (HONI) Site Plan Control at 3440 Frank Kenny Road, Ottawa.

BGIS is acting as the construction manager for HONI for a new HYDRO ONE OPERATIONS CENTRE (HONI OC) to be built in Orleans, Ontario. The HONI OC building is to meet HONI's stakeholder requirements, current industry, regulatory, safety and operational standards and to allow HONI to perform its Business Line operations at this site. JLR has been retained to provide professional planning, architectural, engineering, and related technical/design services to complete this project.

JLR prepared a Due Diligence Study of the site in October 2016. The report evaluated two site designs and concluded both options met the requirements needed to construct the permanent OC facility. Reference Section 1.3 of this report for a summary of the findings from the study. Specifically, supporting the Phase 2 development would require a revised Site Plan, Grading, Servicing, and Stormwater Management Plan.

This Stormwater Management Report and plans have been prepared per the following:

- City of Ottawa - Servicing Study Guidelines for Development Applications.
- Ottawa Sewer Design Guidelines (2012) and associated Technical Bulletins.
- JLR. March 2012 (revised July 2012). Stormwater Management Report for the Interim Phase (Phase 1) of the Orleans Operation Centre.
- JLR. October 2016. Due Diligence Study Hydro One Networks Inc. (HONI).
- WSP Golder. (December 2022). *Geotechnical Investigation Proposed Hydro One Operations Facility 3440 Frank Kenny Road Ottawa, Ontario* (R/N 21493887).
- GHD. (November 2022). *Hydrogeological Assessment, Groundwater Level Monitoring, Orleans Operations Centre (OC), 3440 Frank Kenny Road, Navan, Ontario*. (GHD Reference No: 12575389-LTR-3-Spence).
- Bowfin Environmental Consulting Inc. Rev. March 2022. *Fisheries Impact Assessment*, 3440 Frank Kenny Road, Navan, Ontario.

1.2 Site Description and Proposed Development

The total area of the expanded Phase 2 HONI Orleans OC Facility is 2.65 ha. The parcel of land located at 3440 Frank Kenny Road is Part of Lot 10, Concession 8, within the City of Ottawa. Refer to **Figure 1** for the Location Plan. The land parcel is bounded by Frank Kenny Road to the east, a school bus storage yard to the north and an existing farm with a General Agricultural (AG) zoning to the south and west.

As part of Phase 1, the site was partially developed with an interim modular office complex (interim office) with a gravel parking lot, rear lot storage building (2-storey) and associated yard facilities.

The site's topography is relatively flat. The front portion of the site slopes easterly to the existing offsite roadside ditch along Frank Kenny Road. The rear portion of the site slopes southwesterly towards the existing stormwater management facility.

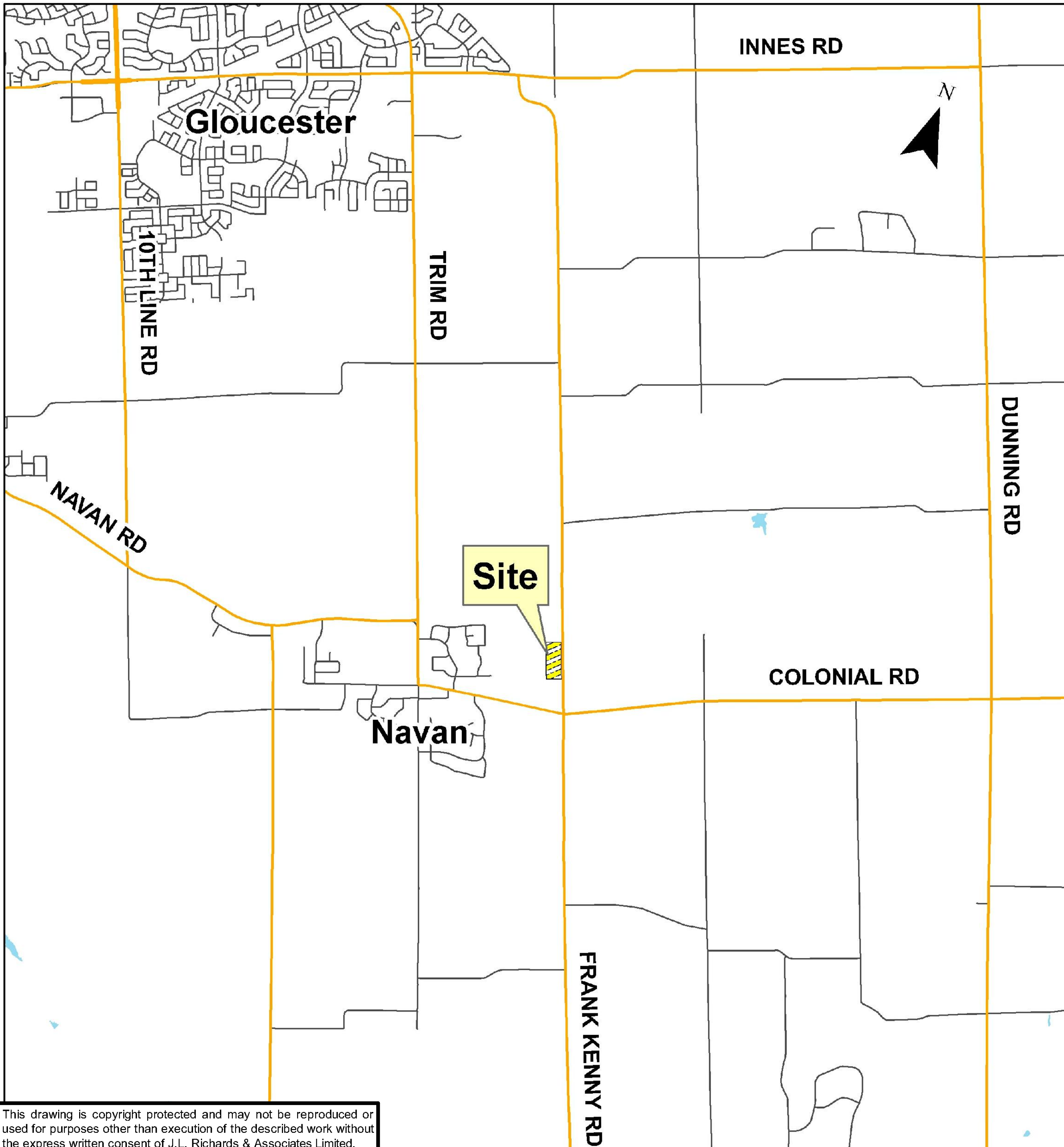
Per the City of Ottawa Comprehensive Zoning By-law 2008-250, the site is within a Rural Heavy Industrial, Rural Exception Zone 35, RH [35r] zone, which permits the development of the proposed operations centre.

As part of Phase 2 development, HONI intends to remove the interim modular office and front gravel parking lot and add a proposed onsite permanent operations centre. The redeveloped site includes a permanent office building (one-storey office with workshop and vehicle storage), a front asphalt parking lot and the expansion of the rear yard facility. The site will also feature various outdoor surface storage areas and an updated stormwater management facility.

1.3 Findings from JLR's Due Diligence Study (October 2016)

JLR prepared a Due Diligence Study for Phase 2 in October 2016 which concluded that the proposed site satisfies the requirements to develop HONI's permanent operations centre. The key findings of this report are as follows:

- The proposed development of an office and service centre complies with the site-specific Zoning By-Law.
- Phase 2 of the development will be subject to Site Plan Approval Revision, Public Consultation and HONI will be required to enter into a Site Plan Agreement.
- A grading and SWM design will be required for the development. The SWM design must be to the satisfaction of the City of Ottawa, the South Nation Conservation Authority and the Ministry of the Environment, Conservation, and Parks (MECP). An amendment to the existing MECP Environmental Compliance Approval (ECA) for the stormwater management works will be required as confirmed by the local district office of the MECP. See Appendix C for a copy of the Phase I Development area ECA.
- Post-development runoff will be conveyed overland towards two (2) outlets:
- The roadside ditch located along Frank Kenny Road; and
- A proposed stormwater management facility is located on the site.
- The fish habitat assessment supports the development 15.0 metres from a watercourse. See the Fish Impact Assessment prepared for the project submitted under separate cover.



PROJECT:

HYDRO ONE - ORLEANS OPERATIONS CENTER

3440 FRANK KENNY ROAD

DRAWING:

KEY LOCATION PLAN

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

DESIGN:	MD
DRAWN:	GC
CHECKED:	DU
PLOTTED:	Mar 29, 2022

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FIGURE 1

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1.4 Geotechnical Considerations

In 2012, WSP Golder (Golder) conducted a geotechnical investigation to support the development of both the interim (Phase 1) and future (Phase 2) sites. The report was updated in March and further revised in December 2022 to provide the construction recommendations for the proposed building foundation (slab-on-grade, wall backfill, Etc.), frost protection, pavement construction, installation of site servicing, and cement type. The report also provides recommendations for installing of the fire tanks, stormwater management facility (SWMF), loading dock ramp, and septic system installation.

The average groundwater level per the geotechnical boring logs for the site ranged from 1.1 to 1.3 metres below the ground surface.

In the spring of 2022, groundwater monitoring wells were installed by GHD. Per the water level records and data analysis, the memorandum seasonal high water groundwater level within the Phase 2 area, was estimated to reach the surface of the ground. Approximately 86.0 m around the proposed building footprint location and 85.1 m near the proposed SWMF.

Refer to Appendix D for a copy of the report and memorandum.

1.5 Approvals

As part of Phase 1 site development, an Environmental Compliance Approval (ECA) approval was obtained for the onsite interim stormwater management system. An amendment to the ECA is required per the site's Phase 2 development. The existing onsite stormwater management facility (swales and dry detention) will be replaced with a larger SWM system designed to service the entire built out site (Phases 1 and 2). Refer to Appendix C for a copy of the approved ECA of the Phase 1 development.

2.0 Surface Drainage

2.1 Pre-Development Conditions

Storm runoff from the Phase 1 area has split drainage flows. The site's front portion drains to the roadside ditch along Frank Kenny Road. The back portion of the site flows to the existing onsite stormwater management facility (grass swales to a dry pond facility with a sand filter and outlet structure). Flows drain via an offsite open ditch (southwest corner) into an existing agricultural drain which ultimately outlets to Bearbrook Creek. This SWM facility was built to service the Phase 1 development to meet the quantity control (1:100 year) and quality treatment requirements. Lot level, conveyance control and a pond bottom sand filter achieve the site's water quality. The SWM system was designed to meet the required minimum normal level of protection of 70% Total Suspended Solids (TSS) removal.

Phase II development area is currently used for agricultural purposes. The site will be cleared, tile drainage removed (if present), and soil prepared (non-suitable building material removed). The existing land surface flows southwest, discharging via the existing culvert (680 x 500 mm) that drains to the southern open ditch.

2.2 Post-Development Condition and Proposed Grading

In the post-condition, the redesigned SWM facility will manage runoff from the entire built-out site (Phases 1 and 2). The site's post-runoff will mimic the pre-condition drainage pattern having split flows. The front eastern portion of the site will convey surface runoff for the site overland towards the existing roadside ditch along Frank Kenny Road. The western portion of the site will convey surface runoff generated by the building rooftops, asphalt parking areas and gravel yard overland toward the new SWMF at the southwest corner. The onsite SWMF will provide quality and quantity control for the site. The post-development offsite flow rate is to release at a controlled rate, equal to the pre-development rates, for all storm events up to and including the 1:100-year occurrence. Reference Appendix B for the Pre- and Post-Development Condition Drainage Area Plans.

2.3 Design Criteria and Servicing Approach

The storm servicing for the redevelopment site is designed to capture stormwater runoff for all storm events, first flush storms up to the 1:100-year occurrence. The stormwater management system for the developed is based on the City of Ottawa Sewer Design Guidelines (recent edition). The design criteria items for the development are as follows:

- Rainfall intensities (Intensity-Duration-Frequency (IDF) curves) per the City's Sewer Design Guidelines. The site was previously assessed using the 3-hour Chicago as the critical event. The 12-hour SCS storm distribution will be included to assess the critical event for storage under a long duration high volume event.
- A dry pond SWMF is to be designed to control the post-development peak flows to the pre-development flow rates. The pond is to be configured to control peak flows for storm events ranging from 1:2 year to a 1:100-year occurrence.
- An enhanced protection level was set as the water quality criterion by the South Nation Conservation (SNC) authority as described in Section 1.3. Based on the Ministry of Environment, Conservation and Parks (MECP) publication entitled "Stormwater Management Planning and Design Manual (March 2003)" (SWMPDM), this protection level is associated with an 80% total suspended solids (TSS) removal, per Table 3.2 of the above-noted publication. Hence, the storm servicing strategy for the entire HONI site (Phase 1 and 2) was developed to meet this storm design criterion.

3.0 Stormwater Management

3.1 Modelling Approach

The stormwater management (pre- and post-conditions) analysis was performed using PCSWMM software. It simulates the hydrologic and hydraulic components of the minor and major storm events (i.e., end-of-pipe dry pond area and outlet, Etc.).

The interim SWM site assessment, accounts for the existing Phase I development and Phase II undeveloped (agricultural land) areas. The revised pre-condition SWM analysis accounts for the area that drains to Frank Kenny Road and/or the new pond outlet. The existing condition model incorporates the design of the current servicing as well as the undeveloped portion of the property.

Uncontrol flows off the grassed raised boundary sides to maintain an open space land use rating. See Appendix E for modelled results.

3.2 Pre-Development Conditions

A hydrological model was developed in the PCSWMM platform to evaluate the pre-development peak flows during the 1:2 year to the 1:100-year design storm events. This is the estimated flow from this site before any development and assumes an open space site.

A two-catchment lumped model was constructed with one catchment for the flows to the east and Frank Kenny Road and one for the flows to the southwest of the site. Under pre-development condition these catchments had very limited impervious cover and, consistent with the Interim Phase Report, the imperviousness of these areas was set to zero. Slopes are taken from the average value of the surface slope within the catchment. The CN values for the site have been taken from the CN value identified in the Interim Phase report, 82. All other parameters are as per the OSGD.

The results of the pre-development model are shown in Table 3-1.

Table 3-1: Pre-Development Runoff Results

Event	Flow to Southwest (L/s)	Flow to Frank Kenny Rd (L/s)
25 mm Event	3	1
1:2 year 3-hour Chicago	10	5
1:5 year 3-hour Chicago	25	14
1:10 year 3-hour Chicago	39	23
1:25 year 3-hour Chicago	60	36
1:50 year 3-hour Chicago	80	46
1:100 year 3-hour Chicago	103	62
Climate Change	160	100
1:100 year 12-hour SCS	163	92

The results indicate that the critical pre-development rate in terms of flow from the site is the 3-hour Chicago storm, as the flows are lower, confirming the critical storm's selection from the previous design.

3.3 Existing Conditions

A hydrological model was developed in PCSWMM to represent the site's current existing conditions. The model consists of the current development site draining into a dry pond with parameters per the original SWMHYMO modelling. The drainage areas have been updated to reflect the current topography as per the latest topography survey. The assessed graded area shows approximately 0.90 ha (less than 1.02 ha permitted) for the developed site flows to the existing onsite SWMF. Note that a portion of the interim condition, gravel employee parking area, drains to the ditch along Frank Kenny Road. The initial design parameter's average weighted value has been adapted to design the proposed Phase II development sub-catchment limits.

The undeveloped portion of the site (south) was simulated using the current site land cover, a mix of farmed row crops, forest, and open-space areas. The CN values applied to these pervious areas are shown in Table 3 2 below. The values used are consistent with Table 5-9 of the City of Ottawa Sewer Design Guidelines (OSDG) and/or Table 2-2 of the USDA Technical Release 55 Manual (TR-55) Urban Hydrology for Small Watersheds, from which Table 5.9 of the OSDG is extracted.

Table 3-2: Pre-Development - Impervious & Weighted CN

Cover	Impervious (%)	CN	S1 Area (ha)	S2 Area (ha)	S4 Area (ha)	S5 Area (ha)
Open Space (>75% grassed)	0	84	0.07	0.07	0.00	0.00
Wood/Grass	0	79	0.30	0.00	0.00	0.00
Row Crops	0	89	0.72	0.18	0.00	0.00
Values from Interim Phase	61	82	0.00	0.13	0.90	0.02
Dry Pond Area (equivalent to a runoff coefficient of 0.5)	42.9	84	0.00	0.00	0.00	0.12
Total			1.09	0.38	0.90	0.14
Weighted Imperviousness			0.20	13.81	60.91	45.7
Weighted CN			85.94	85.60	82	83.70

The southwest existing arched culvert is included in the model. Note the culvert is under a utility easement. See Appendix A.

The results of the existing conditions model are compared in Table 3 3 at the outlet of the existing pond with the previous SWMHYMO modelling. A comparison for the runoff from the entire site under existing conditions versus pre-development conditions to the southwest and Frank Kenny Road are shown in Table 3 4 and Table 3 5 (below), respectively.

Table 3-3: Phase I Development Flows at SWMF Outlet

Event	2012 SWMHYMO Results (l/s)	PCSWMM Model Results (l/s)
1:2 year 3-hour Chicago	20	20
1:5 year 3-hour Chicago	27	24
1:10 year 3-hour Chicago	31	28
1:25 year 3-hour Chicago	38	35

Event	2012 SWMHYMO Results (l/s)	PCSWMM Model Results (l/s)
1:50 year 3-hour Chicago	46	40
1:100 year 3-hour Chicago	58	50

Table 3-4: Southwest Flows - Pre- vs. Existing Flow

Event	Pre-Development Flow to Southwest (l/s)	Existing Flow to Southwest (l/s)
25 mm Event	3	18
1:2 year 3-hour Chicago	10	26
1:5 year 3-hour Chicago	25	41
1:10 year 3-hour Chicago	39	54
1:25 year 3-hour Chicago	60	73
1:50 year 3-hour Chicago	80	89
1:100 year 3-hour Chicago	103	109
Climate Change	160	167
1:100 year 12-hour SCS	163	131

Table 3-5: Flows to Frank Kenny Road – Pre-Development vs. Existing

Event	Pre-Development Flow to Frank Kenny Road (l/s)	Existing Flow to Frank Kenny Road (l/s)
25 mm Event	1	7
1:2 year 3-hour Chicago	5	13
1:5 year 3-hour Chicago	14	28
1:10 year 3-hour Chicago	23	41
1:25 year 3-hour Chicago	36	60
1:50 year 3-hour Chicago	46	75
1:100 year 3-hour Chicago	62	92
Climate Change	100	130
1:100 year 12-hour SCS	92	90

The results at the outlet of the existing pond location (Table 3-3) are consistent with the results at the same location from the original SWMHYMO modelling (10% differential). This supports the revised modelling approach in PCSWMM as being representative of the existing site.

The results in Table 3 4 shows that the existing pond provides peak quantity control for the 1:100 year 3-hour Chicago event with the site release under existing conditions being 109 l/s compared to 103 l/s under pre-development conditions. It is also noted that flows to Frank Kenny Road (Table 3 5) are currently increased significantly from the pre-development condition due to the grading of the parking area allowing part of the runoff to drain to Frank Kenny Road.

3.4 Post-Development Conditions

The post-condition hydrological model accounts for the SWMF, the storm outlet structure (DICB) and the OGS unit. The gravel service yard was considered at a pervious CN value of 91 (per City's design standards). This high number considers the runoff volume versus the infiltration rate of the land surface.

The imperviousness and CN value calculated for the whole site under fully developed conditions are shown in Table 3 6. SWMM hydrology only applies CN values to the pervious component of subcatchments to determine the infiltration component for the precipitation, and there is zero infiltration value off impervious surfaces.

Table 3-6: Impervious and CN Weighted Calculation Values

Cover	Impervious (%)	CN	B1 Area (ha)	B2 Area (ha)	SWM Block (ha)
Asphalt	100		0.01	0.18	0
Roof	100		0	0.21	0
Gravel	0	91	0	1.27	0
Concrete	100		0	0.08	0
Grass	0	84	0.36	0.11	0.31
Total			0.37	1.84	0.31
Weighted Imperviousness			3.25	25.76	50
Weighted CN			84	90.47	84

The area SWMF area assumes that there is water in the pond. Therefore, a higher level of imperviousness compared to typical grass cover has been applied. The modelled discharged flow values (southwest and Frank Kenny Road) are shown in Table 3 7. Modelled results confirm, that the controlled post flow is less than the pre flow for all storm events. Table 3 8, respectively, compares to the pre-development and current flows released for the site.

Table 3-7: Flow to Southwest - Pre-Development, Existing & Post-Controlled

Event	Pre-Development Flow to Southwest (l/s)	Existing Flow to Southwest (l/s)	Post-Controlled Flow to Southwest (l/s)
25 mm Event	3	18	8
1:2 year 3-hour Chicago	10	26	10
1:5 year 3-hour Chicago	25	41	15
1:10 year 3-hour Chicago	39	54	29
1:25 year 3-hour Chicago	60	73	47
1:50 year 3-hour Chicago	80	89	63
1:100 year 3-hour Chicago	103	109	82
Climate Change	160	167	124
1:100 year 12-hour SCS	163	131	111

Modelled results confirm, that the controlled post flow is less than the pre flow for all storm events.

Table 3-8: Flow to Frank Kenny Rd - Pre-Development, Existing & Post-Controlled

Event	Pre-Development Flow to Frank Kenny Road (l/s)	Existing Flow to Frank Kenny Road (l/s)	Post-Controlled Flow to Frank Kenny Road (l/s)
25 mm Event	1	7	2
1:2 year 3-hour Chicago	5	13	5
1:5 year 3-hour Chicago	14	28	14
1:10 year 3-hour Chicago	23	41	21
1:25 year 3-hour Chicago	36	60	32
1:50 year 3-hour Chicago	46	75	42
1:100 year 3-hour Chicago	62	92	55
Climate Change	100	130	86
1:100 year 12-hour SCS	92	90	74

The results confirm that the grassed area with runoff to the ditch system on Frank Kenny Road does not require SWM quantity control to meet the pre-development release rates. The reduction in flow is achieved through the decrease of the overall drainage area.

3.5 Water Quality Unit

An enhanced protection level of 80% TSS removal is targeted for the site as listed in Section 2.3 above. Design target was achieved using the following approach:

1. The pre-treatment of the site's runoff is achieved via the grassed SWM pond (i.e., extended swale area and bottom depressed area) which enhances the filtration of suspended solids.

2. The swale conveys the flow to the dry pond for further treatment utilizing a water quality treatment unit located downstream of the pond outlet structure prior discharging into the existing arch culvert installed underneath the agricultural access road. See Appendix B.

The water quality unit is sized by Contech Engineering Solutions manufacturer to meet regulatory requirements and achieve the 80% TSS removal rate. The proposed unit is the CDS unit PMSU2015-5 whose capacity to treat flows is matching to pond outflow rates released through the proposed outlet structure. The sizing calculations and unit type model are presented in Appendix 'E'.

4.0 Operation of Stormwater Management Measures

4.1 Pond Configuration

The proposed dry pond has a single outlet structure which consists of a modified ditch inlet catch basin (DICB) consisting of a low-flow orifice and a cut-out weir for larger flow events. The structure has a top grate opening outlet for emergency overflows. Also provided is an emergency overflow land weir set along the south edge of the pond, set at the climate change elevation. The outlet structure has an outlet pipe diameter of 450 mm. The low flow orifice is sized to provide flow control for the post-development frequent storm events, up to and including the 1:2-year event, where the outflow from the pond is limited to the 1:2-year allowable release rate under the critical 3-hour Chicago storm distribution. Similarly, the cut-out weir was sized to control less frequent events, again to the critical 3-hour Chicago storm distribution. Once the outlet structure is configured to control pond outflow rates, the 12-hour SCS distribution was run for the 1:100-year event to confirm the maximum operational water level for the pond under the higher runoff volume and to confirm that the pond design satisfies the 300 mm freeboard requirement.

The elevation data for each of the onsite storm control values are provided in Table 4-1.

Table 4-1: Proposed Dry Pond Design Elevations

Attribute	Elevation (m)
Pond Bottom	85.10
Orifice (100 mm diameter low flow outlet)	85.10
Weir (650 mm wide)	85.45
Top-Grate - DICB	85.94

4.2 Pond Operation

The dry pond detains up to the 1:100-year event and releases runoff into the existing ditch downstream at a controlled rate. The operation of the dry pond is detailed in Table 4-2.

Table 4-2: Proposed Dry Pond Operation Flows

Event	Peak inflow (l/s)	Orifice Outflow (l/s)	Weir Outflow (l/s)	Total Peak outflow (l/s)	Water Surface Elevation (m)	Pond Depth (mm)	Volume (m^3)
25 mm Event	30	8	0	8	85.32	220	141
1:2 yr 3-hr Chicago	68	10	0	10	85.38	280	254
1:5 yr 3-hr Chicago	130	11	3	15	85.47	370	421
1:10 yr 3-hr Chicago	177	12	16	28	85.51	410	494
1:25 yr 3-hr Chicago	254	12	34	47	85.54	440	568
1:50 yr 3-hr Chicago	316	12	50	63	85.57	470	623
1:100 yr 3-hr Chicago	384	12	69	81	85.60	500	681
3-hr Chi Climate Change	537	12	112	124	85.66	560	802
1:100 yr 12-hr SCS	440	12	98	110	85.64	540	765
12-hr SCS Climate Change	566	12	151	162	85.70	600	904

The pond operation results confirm that the pond outlet orifice is controlling flows for all storm events up to the 1:2-year return period while the weir is controlling outflow greater than that event. The results for 12-hour SCS storm event are the critical event in terms of pond elevation and the freeboard requirement of 300 mm to the top of bank elevation is achieved under this storm distribution. The operating water level in the pond under the 12-hour SCS storm Climate Change event is 85.70 m, which is 240 mm below pond top of bank elevation. The drawdown time for all events is less than 12 hours.

4.3 Existing Culvert Operation

The existing downstream offsite arched culvert at the outlet of the pond will remain/be preserved. This culvert is within a legal easement area. See Appendix A. Table 4-3 compares the headwater depth and flows to the culvert per the existing conditions compared to the proposed development.

Table 4-3: Existing Culvert Operation Flow Results

Event	Existing Culvert Inflow (l/s)	Post-Development Culvert Inflow (l/s)	Existing Culvert Headwater Depth (m)	Post-Development Culvert Headwater Depth (m)
25 mm Event	18	8	85.18	85.18
1:2 year 3-hour Chicago	26	10	85.18	85.18
1:5 year 3-hour Chicago	41	15	85.18	85.18
1:10 year 3-hour Chicago	53	28	85.19	85.18
1:25 year 3-hour Chicago	72	47	85.19	85.19
1:50 year 3-hour Chicago	88	63	85.20	85.19
1:100 year 3-hour Chicago	109	81	85.21	85.20
Climate Change	168	124	85.25	85.22
1:100 year 12-hour SCS	131	110	85.22	85.21
12-hour SCS Climate Change	199	162	85.28	85.25

The modelled results show that the flow to the culvert is reduced under the post-development SWM onsite flow control and the headwater depths are reduced or similar for larger storm events. The proposed onsite control is suitable for the downstream culvert infrastructure.

5.0 Operation and Maintenance

5.1 Dry Pond

The dry pond is being used for the quality and the quantity onsite control, it needs to be regularly monitored and maintained, ensuring it remains free of debris or any material that would reduce the effective of water treatment and volume held.

Grass cutting within the dry pond is a maintenance activity that is solely undertaken to enhance the aesthetics of the dry pond. Consequently, this task is at the discretion of the owner.

As a minimum, a walk around of the facility should be performed twice a year to remove all debris (i.e., litter, plastic bags/containers, twigs, broken vegetation, Etc.); once after spring thaw and once during the summer/fall or after an extreme storm event. Photographs should be taken during each inspection and good records to be kept in a dedicated logbook. Any damage to landscaped surfaces or rip-rap areas is to be noted. Repairs should be planned and executed shortly after that to prevent further degradation of these surfaces. Should some of the maintenance need to be undertaken with machinery (i.e., bulldozer, loader, shovels, trucks, Etc.), fuelling and greasing should be completed away from the facility and with due care to avoid minor fuel, grease, and oil spills. Grease tubes, oil cans or any such material must be disposed of properly.

HONI will oversee the operation of the SWMF dry pond outlet structure and provide regular site inspections to ensure it performs as designed.

5.2 Water Quality Unit

To ensure optimal performance of the water quality treatment unit (PMSU2015-5), regular minor and major maintenance service is recommended throughout the year. Typically, the CDS unit needs to be inspected before and after rainfall season (November to April), after any major storm events (i.e., 25 mm rainfall event) and in the event of uncontrolled spills that could occur onsite.

The manufacturer's document 'CDS Guide Operation, Design, Performance and Maintenance' details unit inspection, maintenance program and activities. See Appendix E.

6.0 Erosion and Sediment Control Measures

During the construction of the stormwater management facilities, appropriate erosion and sediment control measures, as outlined in the Ministry of Natural Resources and Forestry (MNR) "Guidelines on Erosion and Sediment Control for Urban Construction Sites," will be implemented to trap sediment onsite. See Appendix B Drawing C-004. As a minimum, the following erosion and sedimentation control measures will be provided:

- Supply and install straw bale barriers per OPSD 219.100 and silt fences per OPSD 219.110.
- Supply and install rip-rap c/w geotextile to OPSD 810.010.
- Supply and install silt fence barriers to enclose all borrow and stockpile areas resulting from topsoil stripping activities or any excavating activities (i.e., exact location to be determined during the construction) associated with the construction of the proposed ditch.

Furthermore, if dewatering and pumping operations become necessary, the construction of a detention trap (with filter bags) will be carried out to detain groundwater and promote the settling of sediments.

All control measures will be carried out in accordance with the following documents:

- Toronto and Region Conservation Authority (TRCA). 2019. *Erosion and Sediment Control Guideline for Urban Construction*. Toronto and Region Conservation Authority, Vaughan, Ontario.
- Canadian Standards Association (CSA). 2018. *Erosion and Sediment Control Inspection and Monitoring Standard* (CAN/CSA-W202-18). CSA Group.
- Ontario Ministry of the Environment (OMOE). 2003. *Stormwater Management Planning and Design Manual 2003.* Ontario Ministry of the Environment, Toronto, Ontario.
- Ontario Ministry of the Environment (OMOE). 1998. *Erosion and Sediment Control Training Manual*. OME, Toronto, Ontario.

- The minimum applicable best management practices (BMP) to be followed during the construction for ESC onsite include, but are not limited to:
  - Any stockpiled material will be kept in flat areas during the construction, away from any natural flow paths. If the stockpile is placed in other areas where potential wash-off to the conveyance system is expected, silt fences will be installed to enclose the materials and prevent any wash-off to the conveyance system.
  - All pumped stormwater/groundwater will be filtered through a detention trap before its release.

7.0 Conclusions

This Stormwater Management Report and associated plans outline the proposed stormwater management (SWM) service solution for the Hydro One Networks Inc. project. The SWM strategy for the development (building, parking lot and maintenance yard) consisting of site runoff draining to a grassed dry detention pond. The discharge will be controlled to the allowable release rate, flowing through a storm outlet structure (i.e., catch basin with orifice and weir), then an OGS unit (inline), before discharging offsite to an adjacent offsite ditch.

This report has been prepared for the exclusive use of HONI, for the stated purpose, for the named facility. Its discussions and conclusions are summary in nature and cannot be properly used, interpreted, or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope, and limitations. This report was prepared for the sole benefit and use of HONI and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:

LICENSED PROFESSIONAL ENGINEER
I. DZEPAROSKI
100507767
2022-12-21
PROVINCE OF ONTARIO

Ivan Dzeparoski, P.Eng.
Water Resources Engineer

Reviewed by:

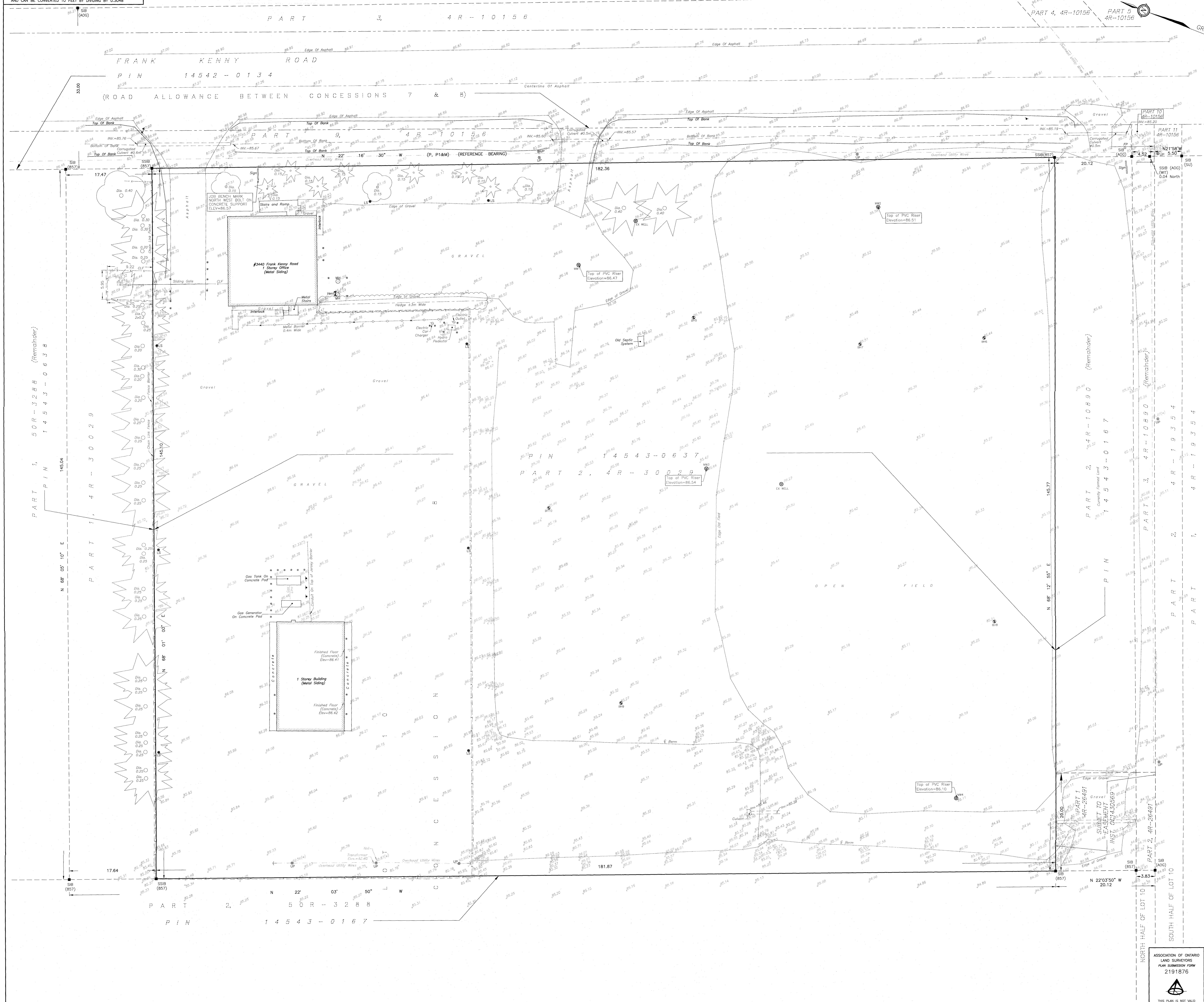
2022-12-21

Marie-France Duthilleul, P.Eng.
Senior Civil Engineer

Appendix A

Site Legal Plan

METRIC
DISTANCES AND ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048



TOPOGRAPHIC SURVEY OF
PART OF LOT 10
CONCESSION 8
GEOGRAPHIC TOWNSHIP OF CUMBERLAND
Now CITY OF OTTAWA

SCALE 1 : 250

0 5 10 20 25 metres

FAIRHALL, MOFFATT & WOODLAND LIMITED
ONTARIO LAND SURVEYORS

ELEVATION NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM (CGVD28).
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT ITS RELATIVE ELEVATION AND DESCRIPTION AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

NOTES

1. BEARINGS ARE GRID, DERIVED FROM THE WESTERLY LIMIT OF FRANK KENNY ROAD AS SHOWN ON PLAN 4R-30029 HAVING A BEARING OF N 22°16'30" W AND ARE REFERRED TO THE CENTRAL MERIDIAN, 76°30'W LONGITUDE MTM ZONE 9, NAD83 ORIGINAL.
2. DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR 0.999981.

UTILITY NOTES

1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ANY UNDERGROUND UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. BEFORE ANY WORK INVOLVING PROBING, EXCAVATING, ETC., A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY.

LEGEND

■	SURVEY MONUMENT FOUND
SSIB	SHORT STANDARD IRON BAR
SIB	STANDARD IRON BAR
IB	IRON BAR
(P)	PLAN 4R-10890
(P1)	PLAN 4R-10156
(S)	SET
(M)	MEASURED
(AOG)	ANNIS, O'SULLIVAN & VOLLEBEKK LTD., O.L.S.
(857)	FAIRHALL, MOFFATT & WOODLAND LIMITED, O.L.S.
(SU)	SOURCE UNKNOWN
(WIT)	WITNESS
PIN	PROPERTY IDENTIFIER NUMBER
	BORE HOLE
	VENT
LS	LAMP STANDARD
UP	UTILITY POLE
	GUY WIRE AND ANCHOR
FH	FIRE HYDRANT
MH	MANHOLE
	SIGN
	BOLLARDS
	SIGN
	CONIFEROUS TREE
	DECIDUOUS TREE
	WELL
FP	FENCE POST
—G—	GAS LINE
	ELECTRIC OUTLET

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT, THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON JUNE 10, 2022.

2022/06/17
DATE

JOHN H. GUTRI
ONTARIO LAND SURVEYOR

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2191876

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29 (3).

Fairhall Moffatt & Woodland
LIMITED
OTTAWA
ONTARIO LAND SURVEYORS
Surveying and Land Information Services

100-600 TERRY FOX DRIVE, KANATA, ONTARIO K2L 4B6
TEL: (613) 591-2580 FAX: (613) 591-1495
www.fmw.on.ca

JOB No.
AC16900

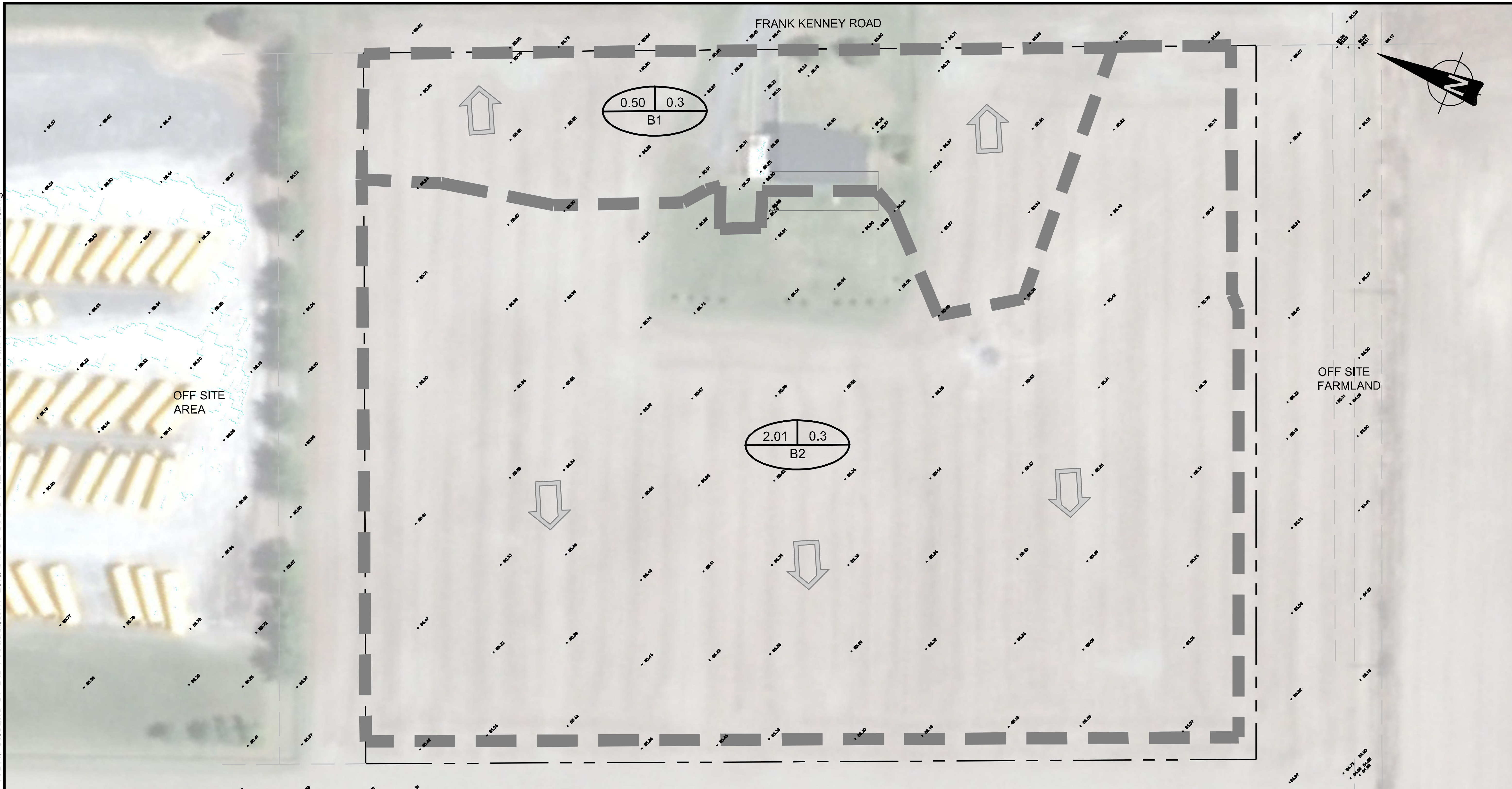
E 389975 , N 5032317

REFERENCE No.
111 (e) - 8 CUMBERLAND

S:\JOBS\AC16900\DWGS 16JUNE2022
TP_AC169.dwg (ss)

Appendix B

Pre- and Post-Development Drainage Plans (Site & Civil Plans under separate cover)



LEGEND

PROPERTY LINE

DRAINAGE BOUNDARY

AREA IN HECTARES

RUNOFF COEFFICIENT

0.21 0.66
B#

AREA ID

DRAINAGE DIRECTION

PROJECT:

HONI ORLEANS OPERATIONS CENTRE
3440 FRANK KENNEY ROAD

DRAWING:

PRE-DEVELOPMENT DRAINAGE PLAN

www.jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	I.D.
DRAWN:	K.T.
CHECKED:	M.D.
JLR #:	31500-000

SCALE 1:750

DRAWING #:
C-000

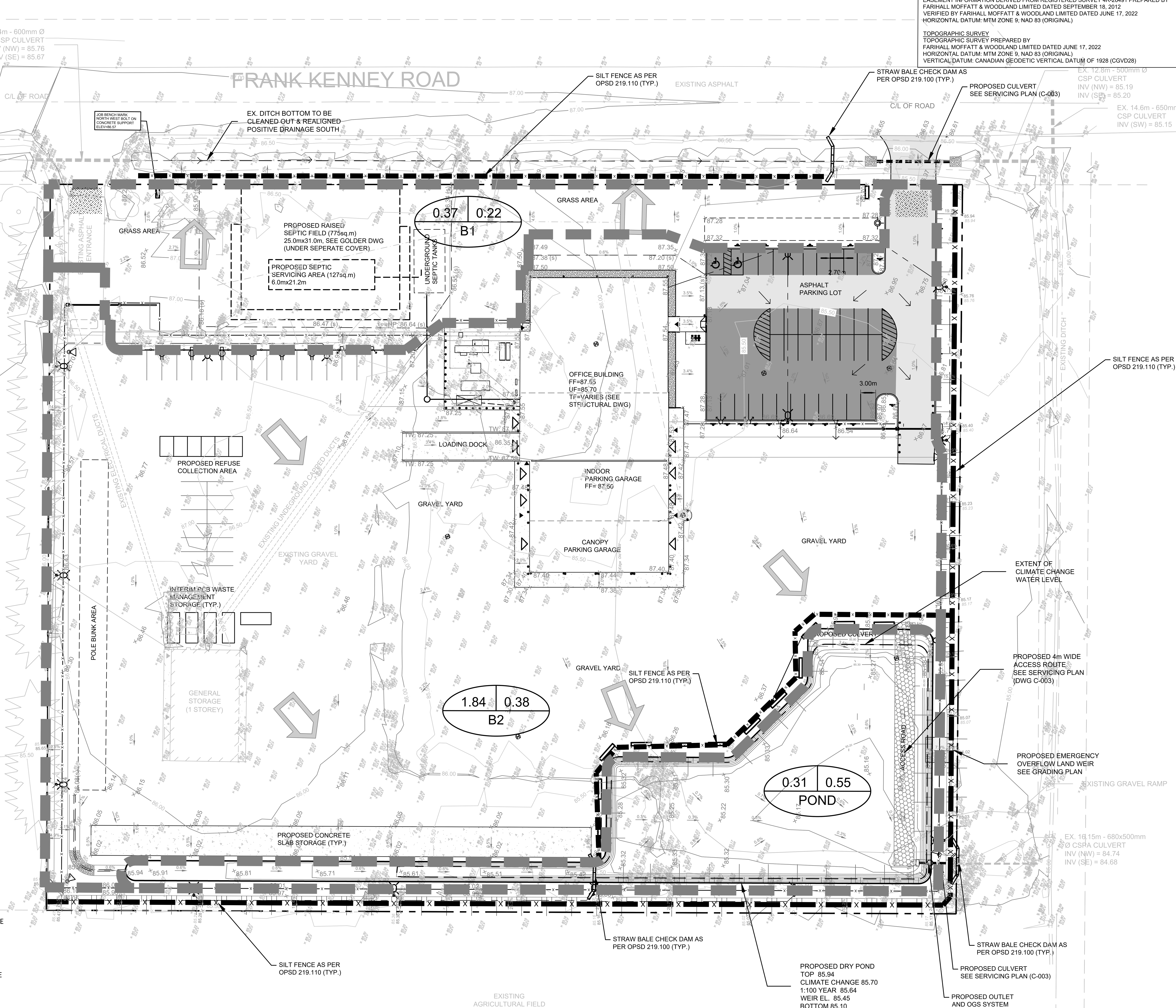
File Location: P:\31000\31500-000 - HONI Orleans OPC\3-Production\1-Civil\31500-000 C PRE-DEVELOPMENT STORM WATER MANAGEMENT.dwg

PLOT DATE: Tuesday, December 20, 2022 9:05:06 AM

NOTE:
BOUNDARY SURVEY
BOUNDARY INFORMATION DERIVED FROM REGISTERED SURVEY 4R-30029 PREPARED BY FARIHALL MOFFATT & WOODLAND LIMITED DATED JANUARY 3, 2017
VERIFIED BY FARIHALL MOFFATT & WOODLAND LIMITED DATED JUNE 17, 2022
HORIZONTAL DATUM: MTM ZONE 9, NAD 83 (ORIGINAL)

EASEMENT SURVEY
EASEMENT INFORMATION DERIVED FROM REGISTERED SURVEY 4R-26491 PREPARED BY FARIHALL MOFFATT & WOODLAND LIMITED DATED SEPTEMBER 18, 2012
VERIFIED BY FARIHALL MOFFATT & WOODLAND LIMITED DATED JUNE 17, 2022
HORIZONTAL DATUM: MTM ZONE 9, NAD 83 (ORIGINAL)

TOPOGRAPHIC SURVEY
TOPOGRAPHIC SURVEY PREPARED BY
FARIHALL MOFFATT & WOODLAND LIMITED DATED JUNE 17, 2022
HORIZONTAL DATUM: MTM ZONE 9, NAD 83 (ORIGINAL)
VERTICAL DATUM: CANADIAN GEODETIC VERTICAL DATUM OF 1928 (CGVD28)



EROSION AND SEDIMENT CONTROL NOTES

1. ALL SEDIMENTATION CONTROL MEASURES ARE TO BE IMPLEMENTED PER OPSS AND OPSD. SILT FENCE BARRIER PER OPSD 219.110.
2. CONTRACTOR TO ENSURE ALL SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED BEFORE WORK AND MAINTAINED DURING THE WORK PHASE TO PREVENT ENTRY OF SEDIMENT INTO THE RECEIVING WATERCOURSES.
3. CONTRACTOR TO ENSURE ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE INSPECTED DAILY AND THEY ARE FUNCTIONING PROPERLY AND ARE BEING MAINTAINED AND/OR UPGRADED AS REQUIRED. IF THE SEDIMENT AND EROSION CONTROL MEASURES ARE NOT FUNCTIONING PROPERLY, NO FURTHER WORK SHALL OCCUR UNTIL THE PROBLEM HAS BEEN ADDRESSED AND RECTIFIED.
4. HYDROSEEDING OF ALL DITCHES IS TO BE PROVIDED IMMEDIATELY FOLLOWING FINAL SHAPING/GRADING.
5. CONTRACTOR TO SUPPLY AND INSTALL STRAW BALE BARRIER (PER OPSD 219.100) UPSTREAM OF ALL CULVERT INSTALLATIONS AND SHALL ONLY BE REMOVED ONCE UPSTREAM VEGETATION HAS BEEN ESTABLISHED.
6. CONTRACTOR TO SUPPLY AND INSTALL SILT FENCE BARRIER (PER OPSD 219.110) TO ENCLOSE ALL BORROW AND STOCKPILE AREAS RESULTING FROM TOPSOIL STRIPPING ACTIVITIES OR ANY EXCAVATING ACTIVITIES.
7. CONTRACTOR TO ENSURE ALL STOCKPILED MATERIALS ARE STORED ON A FLAT AREA ARE STABILIZED AND AWAY FROM ANY FLOW PATHS.
8. IF A STOCKPILE IS PLACED IN AREAS WITH POTENTIAL WASH OFF TO A CONVEYANCE SYSTEM, SILT FENCE BARRIERS (PER OPSD 219.110) WILL NEED TO BE INSTALLED TO ENCLOSE THE MATERIALS AND PREVENT ANY WASH OFF.
9. CONTRACTOR TO ENSURE ALL PUMPED STORMWATER/GROUNDWATER IS FILTERED THROUGH SEDIMENT DEWATERING BAGS BEFORE ITS RELEASE TO THE RECEIVING STREAM.
10. CONTRACTOR TO ENSURE THAT ALL MATERIALS AND EQUIPMENT USED FOR THE PURPOSE OF SITE PREPARATION AND PROJECT COMPLETION ARE OPERATED AND STORED IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCES (I.E., PETROLEUM PRODUCTS, SILT, ETC.) FROM ENTERING THE RECEIVING WATERCOURSE.
11. CONTRACTOR TO ENSURE ANY VEHICLE AND EQUIPMENT RE-FUELLING AND MAINTENANCE TO BE CONDUCTED AWAY FROM DRAINAGE CHANNELS AND ANY PART OF EQUIPMENT ENTERING A CHANNEL TO BE FREE OF FLUID LEAKS AND EXTERNALLY CLEANED/DEGREASED TO PREVENT ANY DELETERIOUS SUBSTANCES FROM ENTERING THE RECEIVING WATERCOURSE.
12. ALL SPILL PREVENTION AND CONTIGENCY PLANS SHALL BE MAINTAINED AND MONITORED/RECORDED ON A REGULAR BASIS AS REQUIRED TO ENSURE CONTAMINANTS DO NOT ENTER THE NATURAL ENVIRONMENT.
13. CONTRACTOR TO ANTICIPATE THE USE OF CONSTRUCTION MAT (GEOTERRA OT EQUIVALENT) WITHIN THE PHASE 2 BUILDING SITE AREA.

File Location: P:\31000\31500-000 - HONI Orleans OPC\3-Production\1-Civil\31500-000 C DRAINAGE & STORM WATER MANAGEMENT.dwg

LEGEND

- PROPOSED LIGHT DUTY SILT FENCE AS PER OPSD 219.110
- PROPERTY LINE
- EXISTING CHAIN LINK FENCE
- EXISTING BUILDING
- PROPOSED LIGHT DUTY STRAW BALE BARRIER AS PER OPSD 219.100
- DRAINAGE BOUNDARY
- AREA IN HECTARES
- RUNOFF COEFFICIENT
- AREA ID (0.21 | 0.66 / 104-710)
- DRAINAGE DIRECTION
- PROPOSED MUD MAT
- EXISTING BOREHOLE

No.	ISSUE / REVISION	DD/MM/YY
03	ISSUED FOR CITY SITE PLAN APPROVAL	21/12/22
02	RE-ISSUED FOR CITY SITE PLAN APPROVAL	12/09/22
01	ISSUED FOR CITY SITE PLAN APPROVAL	06/04/22
00	ISSUED FOR CLIENT REVIEW	04/04/22

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 1:400
0 5 10 20 30m

CLIENT: hydro one BGIS

CONSULTANT: www.jlrichards.ca
J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT:

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER M. DUTHILLEUL 100205184 PROVINCE OF ONTARIO 2022-12-21

PROJECT NORTH

PROJECT:
HYDRO ONE OPERATIONS CENTRE, ORLEANS
3440 FRANK KENNY ROAD

DRAWING:
POST DEVELOPMENT DRAINAGE AND EROSION AND SEDIMENT CONTROL PLAN

DESIGN:	M.D.	
DRAWN:	G.C.	DRAWING #:
CHECKED:	D.U.	C-005
JLR #:	31500-000	

PLOT DATE: December 21, 2022 10:10:07 AM

D07-12-22-0057

GENERAL CONSTRUCTION NOTES

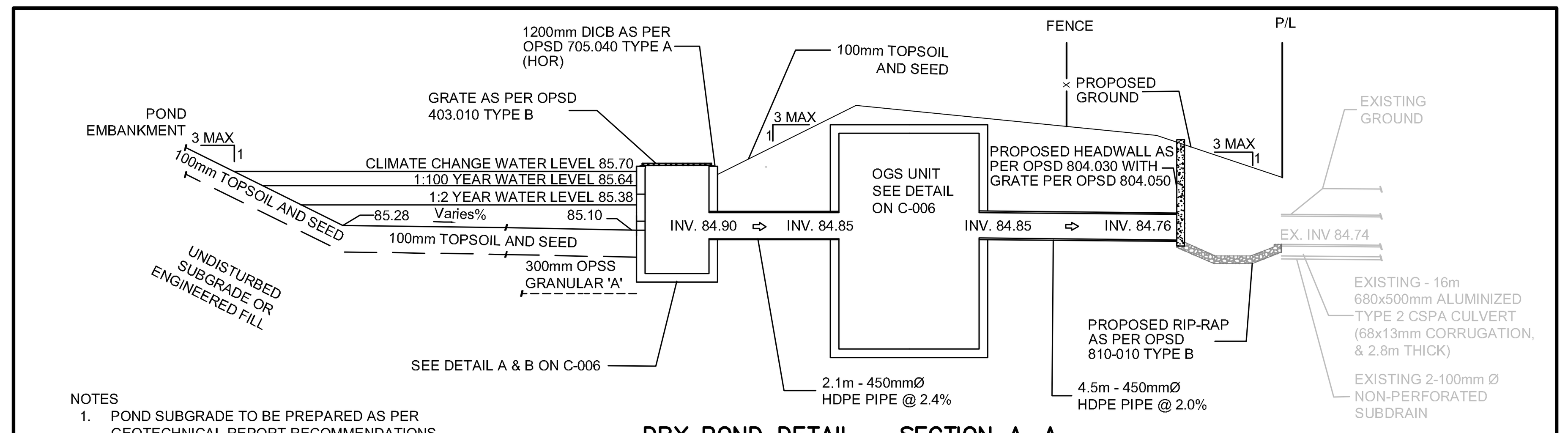
1. CONTRACTOR TO CARRY OUT WORKS PER THE CURRENT CITY OF OTTAWA STANDARD DRAWINGS AND SPECIFICATIONS AND PER THE ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS.
2. CONTRACTOR TO READ THE SITE'S SERVICING DESIGN PLAN IN CONJUNCTION WITH THE LATEST SITE SERVICING REPORT, PREPARED BY J.L. RICHARDS & ASSOCIATES LIMITED, FOR THE PROPOSED CONSTRUCTION WORKS.
3. ALL SOIL DISPOSAL FROM SITE TO BE COORDINATED WITH THE HYDRO ONE ENVIRONMENTAL TEAM.
4. THE NOMINAL DIAMETER OF PIPES ARE REFERRED TO IN PLAN VIEW.
5. CONTRACTOR RESPONSIBLE FOR OBTAINING ALL SITE UTILITY LOCATES BEFORE CONSTRUCTION.
6. CONTRACTOR RESPONSIBLE FOR ALL EXCAVATION, BACKFILL AND REINSTATEMENT OF ALL AREAS DISTURBED DURING CONSTRUCTION AND ANY ASSOCIATED WORKS TO THE SATISFACTION OF THE ENGINEER AND CITY OF OTTAWA.
7. SEPTIC SYSTEM (TREATMENT TANKS & LEACHING BED) PER WSP GOLDER'S - NEW SEPTIC DESIGN - TECHNICAL MEMORANDUM (SEPT. 2022).
8. ALL CONNECTIONS TO EXISTING WELL TO BE IN ACCORDANCE WITH THE CITY OF OTTAWA DESIGN GUIDELINES. CONTRACTOR TO PROVIDE EXCAVATION BACKFILLING, COMPACTION AND REINSTATEMENTS, IN ACCORDANCE WITH THE LATEST GEOTECHNICAL INVESTIGATION PREPARED BY GOLDER ASSOCIATES FOR THE SITE.
9. CONTRACTOR RESPONSIBLE FOR DETERMINING, VIA EXCAVATION, THE EXACT LOCATION AND ELEVATION OF THE EXISTING UNDERGROUND UTILITIES AND STRUCTURES AS REQUIRED FOR ALL PROPOSED CONNECTIONS, RELOCATIONS, AND BLANKINGS.
10. FOR ALL PROPOSED CONNECTION POINTS (IF ANY), THE CONTRACTOR IS RESPONSIBLE FOR THE REINSTATEMENT OF ALL SURFACES TO EXISTING CONDITIONS OR BETTER. PAVEMENT STRUCTURE RESTORATION (FRANK KENNEY ROAD) SHALL BE PER CITY OF OTTAWA STANDARDS. THE THICKNESS OF GRANULAR AND ASPHALT LAYERS SHALL MATCH EXISTING.
11. CONTRACTOR RESPONSIBLE FOR VERIFYING THAT THE SITE BENCHMARK(S) HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THEIR RELATIVE ELEVATION(S) AND DESCRIPTION(S) AGREE WITH THE INFORMATION DEPICTED ON THE PLAN.
12. CONTRACTOR TO MATCH EXISTING ELEVATIONS AT PROPERTY LIMITS AND ENSURE POSITIVE DRAINAGE TOWARDS A SUITABLE OUTLET, WHETHER INDICATED OR NOT ON THE PLANS.
13. CONTRACTOR TO PROVIDE ALL PAVEMENT MARKINGS AS SHOWN, INCLUDING HANDICAPPED PARKING SYMBOLS.
14. ALL GROUNDWATER PUMPED FROM THE SITE TO BE METERED AND A PERMIT TO TAKE WATER OBTAINED AS APPLICABLE.
15. PAVEMENT DESIGN TO BE PER THE SITE'S GEOTECHNICAL INVESTIGATION REPORT (SEPT. 2022), PREPARED BY GOLDER ASSOCIATES LDT. (21493887):

LIGHT-DUTY PAVEMENT STRUCTURE (CAR PARKING AREAS):
50 MM - H.L. 3 SURFACE COURSE OR 12.5 SUPERPAVE
150 MM - BASE - OPSS GRANULAR A
450 MM - SUBBASE - OPSS GRANULAR B TYPE II

HEAVY-DUTY PAVEMENT STRUCTURE (ACCESS LANES AND PAVED TRUCK TRAFFIC AREAS):
40 MM - H.L. 3 SURFACE COURSE OR 12.5 SUPERPAVE
50 MM - H.L. 8 BINDER COURSE OR 19.0 SUPERPAVE
150 MM BASE - OPSS GRANULAR A
450 MM SUBBASE - OPSS GRANULAR B TYPE II

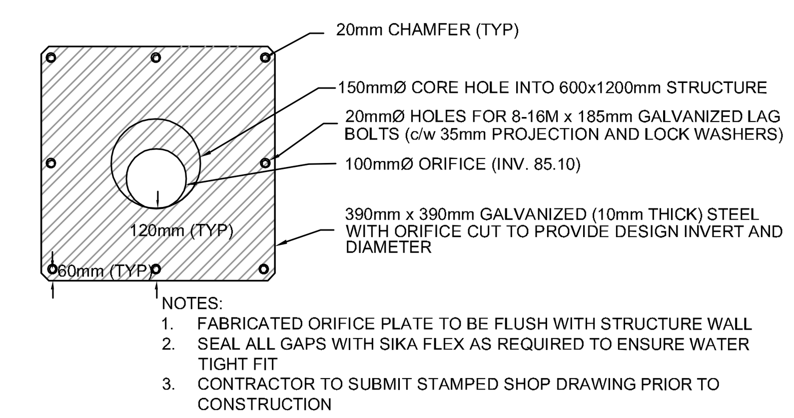
GRANULAR TRAFFIC AREAS (UNPAVED ACCESS LANES AND TRUCK TRAFFIC AREAS):
250 MM BASE - OPSS GRANULAR A
450 MM SUBBASE - OPSS GRANULAR B TYPE II

16. CONTRACTOR TO ENSURE ALL PROPOSED PAVEMENT AREAS ARE PREPARED PER THE SITE'S GEOTECHNICAL INVESTIGATION RECOMMENDATIONS AND ALL TOPSOIL AND OTHER UNSUITABLE FILL (FILLS CONTAINING ORGANIC MATTER) ARE EXCAVATED FROM THESE SURFACES.
17. CONTRACTOR TO ENSURE PROPOSED PAVEMENT AREAS SUBGRADE HAS BEEN ACCEPTABLY PREPARED, WHERE THE TRENCH BACKFILL AND GRADE RAISE FILL HAVE BEEN ADEQUATELY COMPACTED TO THE REQUIRED DENSITY AND THE SUBGRADE SURFACE NOT DISTURBED BY CONSTRUCTION OPERATIONS OR PRECIPITATION. DEPENDING ON THE ACTUAL CONDITIONS OF THE PAVEMENT SUBGRADE AT THE TIME OF CONSTRUCTION, IT MAY BE NECESSARY TO INCREASE THE THICKNESS OF THE SUBBASE AND/OR TO PLACE A WOVEN GEOTEXTILE BENEATH THE GRANULAR MATERIALS.
18. CONTRACTOR TO ENSURE GRANULAR BASE AND SUBBASE MATERIALS ARE UNIFORMLY COMPACTED TO AT LEAST 100% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY USING SUITABLE VIBRATORY COMPACTION EQUIPMENT. THE ASPHALTIC CONCRETE IS TO BE COMPACTED PER TABLE 9 OF OPSS 310.
19. REQUIREMENT FOR ADDITIONAL GRANULAR 'B' AND/OR GEOTEXTILE TO BE CONFIRMED ON-SITE BY GEOTECHNICAL ENGINEER
20. CURBS TO BE BARRIER TYPE PER CITY OF OTTAWA STANDARD SC1.1.
21. THE EXISTING ON-SITE MODULAR OFFICE AND ASSOCIATED SERVICES (WELL, SEPTIC TANK, ETC.) TO REMAIN IN SERVICE UNTIL THE PROPOSED OFFICE IS COMPLETED. ONCE THE NEW OFFICE IS OPERATIONAL, THE CONTRACTOR SHALL COORDINATE THE MODULAR REMOVAL AND COMPLETE THE REMAINING PROPOSED WORKS (FENCE, LANDSCAPE, ETC.).
22. CONTRACTOR RESPONSIBLE TO DEVELOP DEMOLITION AND TEMPORARY SERVICING STAGING PLAN FOR APPROVAL BY HONI PRIOR TO CONTRUCTION
23. LINE PAINTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 710.
24. ASPHALT LINE PAINTING FOR THE PARKING STALLS AS PER OPSS 1716.
25. FENCE TO BE IN ACCORDANCE WITH SPECIFICATION, SEE SPECIFICATIONS UNDER SEPARATE COVER FOR DETAILS.
26. WHERE POSSIBLE CONTRACTOR TO RE-USE EXISTING ON SITE JERSEY BARRIER
27. PROPOSE CONCRETE BARRIERS PER OPSD 911.14
28. CONCRETE WALKWAY TO BE INSTALLED IN ACCORDANCE WITH OPSS 351.
29. CONCRETE CURB SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 353.
30. SUBDRAINS SHALL BE COMPLETE WITH FILTER SOCK AND INSTALLED AS PER OPSS 405.
31. CULVERTS SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 421.



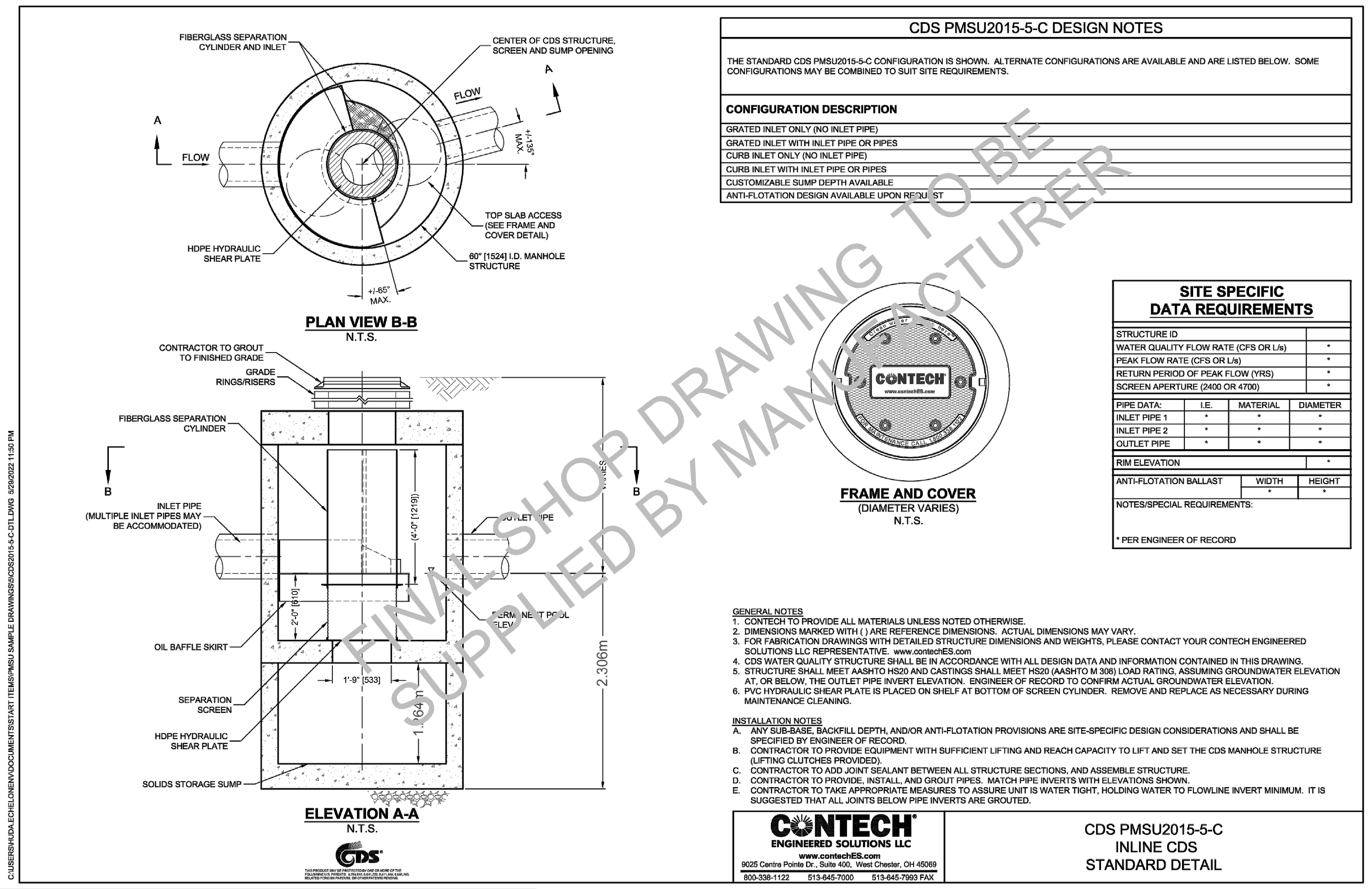
DRY POND DETAIL – SECTION A-A

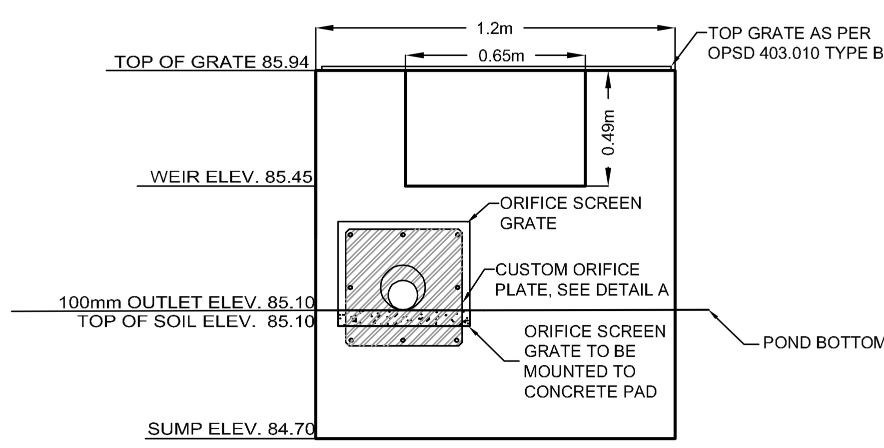
NOT TO SCALE



DETAIL A – DRY POND OUTLET STRUCTURE 100mmø ORIFICE PLATE DETAIL

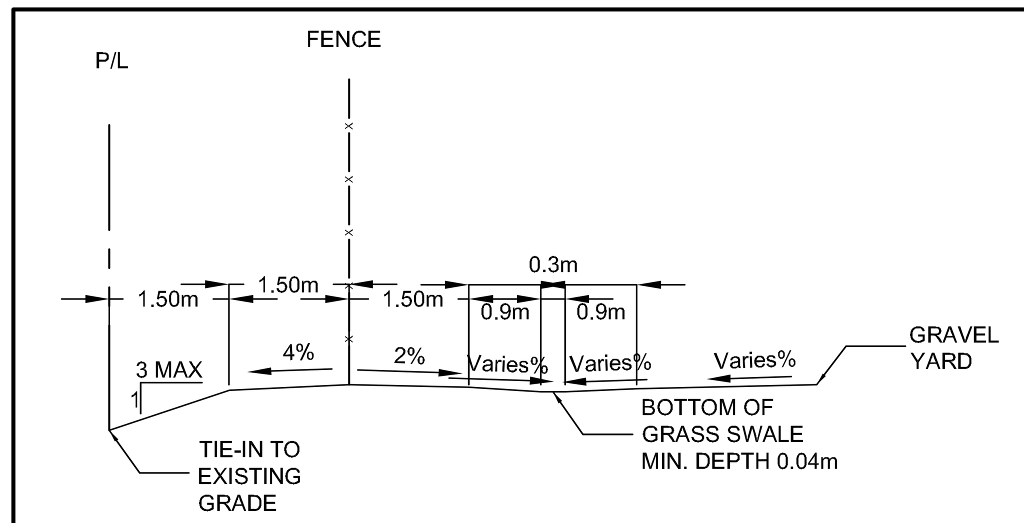
NOT TO SCALE





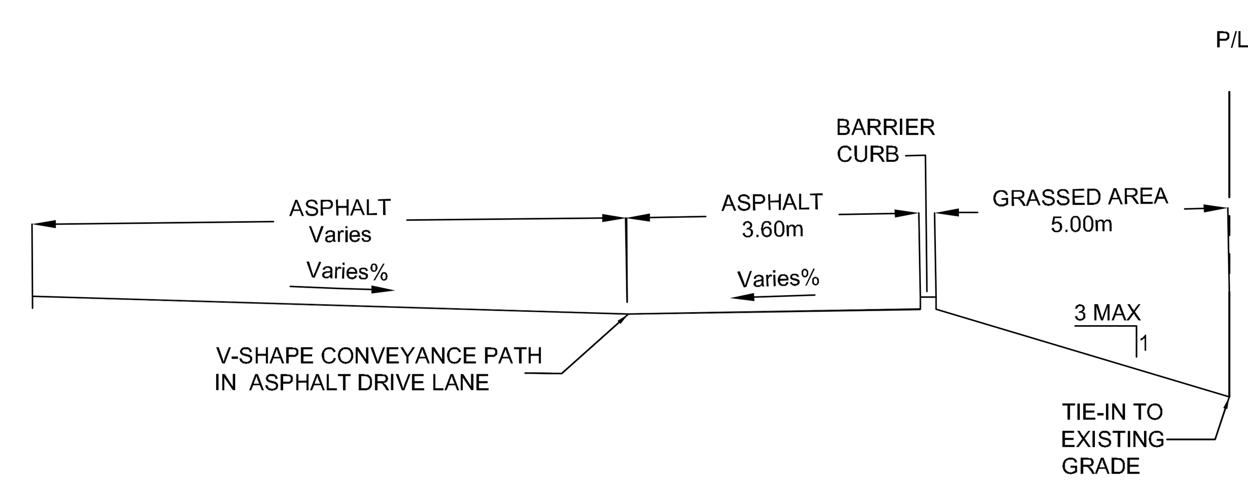
DETAIL B – DRY POND OUTLET STRUCTURE DITCH INLET CATCH BASIN (600mmx1200mm) DETAIL – FRONT VIEW

NOT TO SCALE



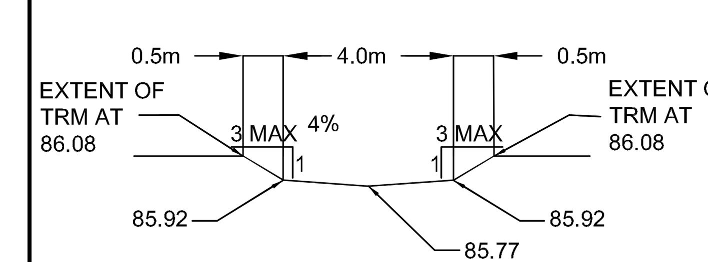
SECTION C–C

NOT TO SCALE



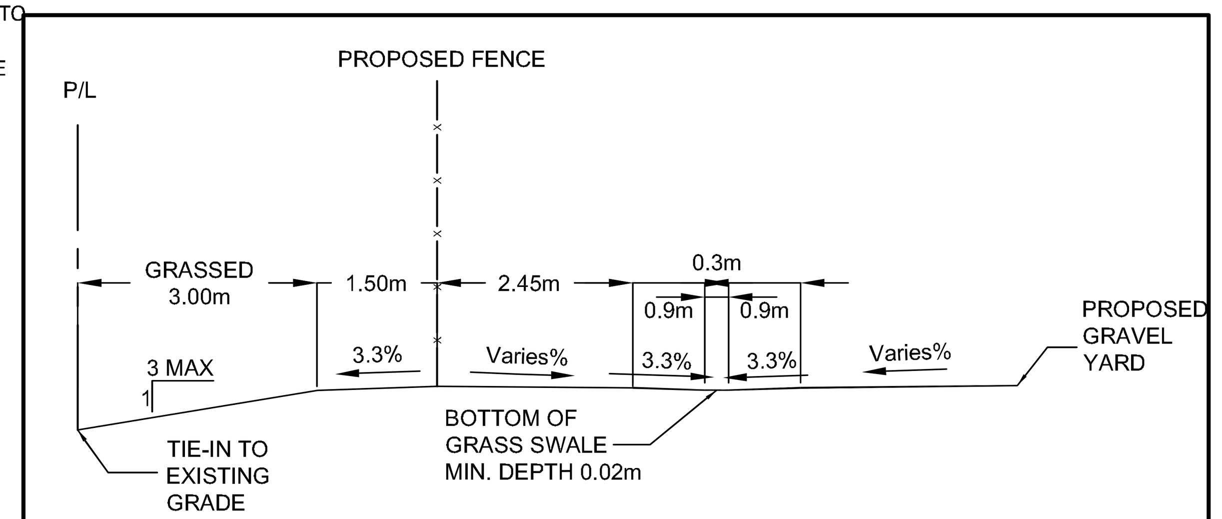
SECTION D–D

NOT TO SCALE



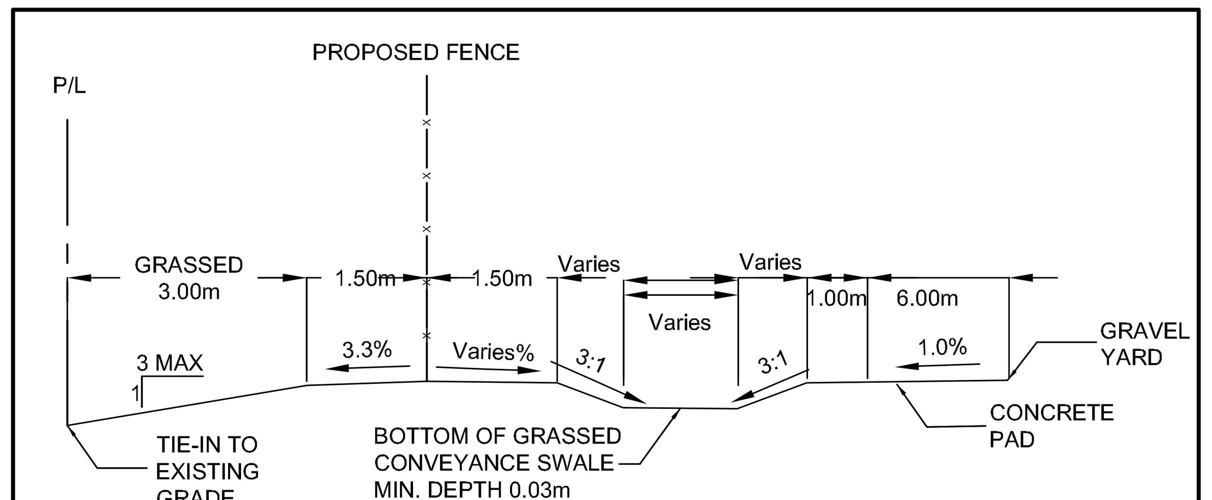
SECTION F–F

NOT TO SCALE



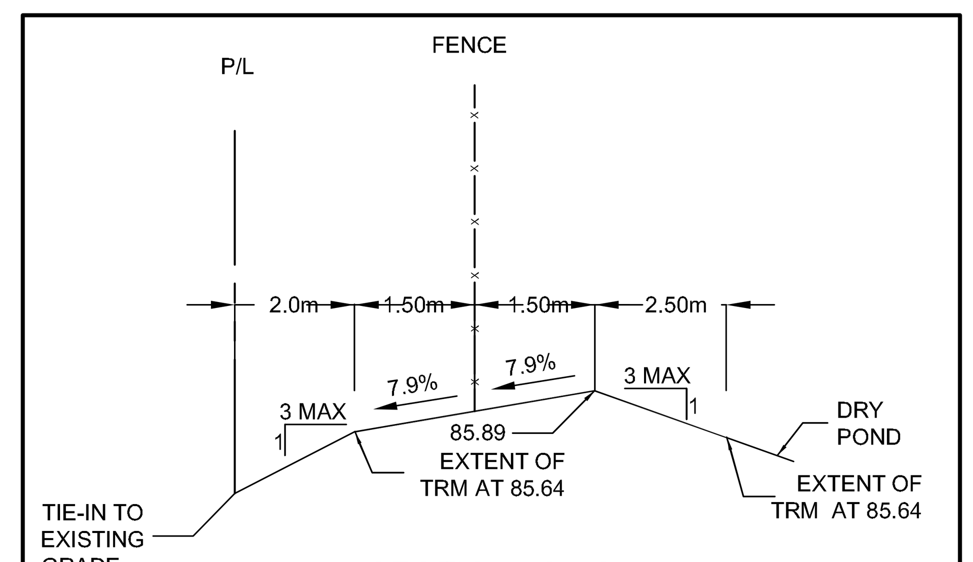
SECTION B–B

NOT TO SCALE



SECTION E–E

NOT TO SCALE



SECTION G–G

NOT TO SCALE

No.	ISSUE / REVISION	DD/MM/YY
03	ISSUED FOR CITY SITE PLAN APPROVAL	21/12/22
02	RE-ISSUED FOR CITY SITE PLAN APPROVAL	12/09/22
01	ISSUED FOR CITY SITE PLAN APPROVAL	06/04/22
00	ISSUED FOR CLIENT REVIEW	04/04/22

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE:

CLIENT: hydro one BGIS

CONSULTANT: J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS www.jlrichards.ca

CONSULTANT:

ISSUED FOR CITY REVIEW

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER M. DUTHILLEUL 100205184 PROVINCE OF ONTARIO 2022-12-21

PROJECT:

HYDRO ONE OPERATIONS CENTRE, ORLEANS

3440 FRANK KENNY ROAD

DRAWING:

DETAILS 1

DESIGN: M.D.
DRAWN: G.C.
CHECKED: D.U.
JLR #: 31500-000

DRAWING #: C-006

PLOT DATE: December 21, 2022 10:17:00 AM

File Location: P:\31000\31500-000 - HONI Orleans OPC\3-Production\1-Civil\31500-000 C DETAILS.dwg

D07-12-22-0057

Appendix C

Environmental
Compliance Approval
(Phase 1)

Ontario

Ministry of the Environment
Ministère de l'Environnement

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 3750-92FKEH
Issue Date: December 6, 2012

743120 Ontario Inc.
3450 Frank Kenny Road
Post Office Box No. 70
Ottawa, Ontario
K4B 1J3

Site Location: Orleans Operations Centre
3450 Frank Kenny Road
City of Ottawa

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, *R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:*

the establishment of stormwater management works to serve the Hydro One Networks Inc. Operations Service Centre, in the City of Ottawa, for the treatment and disposal of stormwater runoff from a total catchment area of 1.02 hectares, to provide Normal Level water quality protection and erosion control and to attenuate post-development peak flows to pre-development release rates, discharging to an outlet ditch located along the western property boundary and ultimately to Bearbrook Creek, for all storm events up to and including the 100-year return storm, comprising;

- ***grassed swale,*** located along the eastern boundary of the gravel surface area, designed to accommodate up to and including the 100-year return storm runoff from a catchment area of 0.18 hectare, having a length of approximately 55 m, a maximum flow depth of 250 mm, a longitudinal slope of 0.44%, a "V" shaped bottom, and side slopes of 3:1, discharging to a swale located along the southern boundary of the gravel surface area;

- ***grassed swale,*** located along the southern boundary of the gravel surface area, designed to accommodate up to and including the 100-year return storm runoff from a catchment area of 0.62 hectare, having a length of approximately 88.3 m, a maximum flow depth of 300 mm, a longitudinal slope of 0.49%, a bottom width of 1 m, and side slopes of 3:1, discharging a dry pond facility;

- ***grassed swale,*** located along the western boundary of the gravel surface area, designed to accommodate up to and including the 100-year return storm runoff from a catchment area of 0.22 hectare, having a length of approximately 63 m, a maximum flow depth of 150 mm, a bottom grade of 0.56%, a bottom width of 1 m, and side slopes of 3:1, discharging to a dry pond facility; and

- ***one (1) dry pond facility*** located at the south-west corner of the site, having an available storage volume of approximately 634 cubic metres and a maximum depth of approximately 850 mm, complete with ***one (1) sand filter*** located at the base of the facility -having an available active treatment storage volume of approximately 39.4 cubic metres, a surface area of approximately 33 square metres, a width of approximately 1.5 m, a length of approximately 22 m, and a maximum depth of approximately 700 mm, consisting of an approximately 150 mm thick layer of top soil, an approximately 400 mm thick layer of sand wrapped in non-woven geotextile and an approximately 150 mm thick layer of clear stone, complete with two (2) 100 mm diameter perforated subdrains wrapped in non-woven geotextile -one (1) 750 mm diameter wide weir and emergency spillway and one (1) outlet structure consisting of a 525 mm diameter storm outlet pipe equipped with two (2) 150 mm diameter orifices allowing a maximum discharge of 58 L/s (the 100-year storm event), discharging via an outlet ditch complete with two (2) 100 mm diameter non-perforated subdrains, a 680 mm by 500 mm culvert and riprap to the existing drainage ditch located south of the site, and ultimately to Bearbrook Creek;

all in accordance with the application dated June 25, 2012, including final plans and specifications prepared by J.L. Richards & Associates Limited.

For the purpose of this environmental compliance approval, the following definitions apply:

1. "Approval" means this Environmental Compliance Approval and any Schedules to it, including the application and supporting documentation.

2. "Director" means any Ministry employee appointed by the Minister pursuant to section 5 of the Part II.1 of the Environmental Protection Act;

3. "District Manager" means the District Manager of the Ottawa District Office of the Ministry;

4. "Ministry" means the Ontario Ministry of the Environment;

5. "Owner" means 743120 Ontario Inc., and includes its successors and assignees;

6. "Works" means the sewage works described in the Owner's application, this Approval and in the supporting documentation referred to herein, to the extent approved by this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

1.1 The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

1.2 Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, the application for approval of the Works and the submitted supporting documents and plans and specifications as listed in this Approval.

1.3 Where there is a conflict between a provision of any submitted document referred to in this Approval and the Conditions of this Approval, the Conditions in this Approval shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

1.4 Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

1.5 The requirements of this Approval are severable. If any requirement of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this Approval shall not be affected thereby.

2. EXPIRY OF APPROVAL

The approval issued by this Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.

3. CHANGE OF OWNER

The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; and

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

4. OPERATION AND MAINTENANCE

4.1 The Owner shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the stormwater management Works do not constitute a safety or health hazard to the general public.

4.2 The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the Owner's corporate office for inspection by the Ministry. The logbook shall include the following:

(a) the name of the Works; and

(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed and method of clean-out of the stormwater management Works.

4.3 The Owner shall undertake an inspection of the condition of the stormwater management Works, at least once a year, and undertake any necessary cleaning and maintenance to ensure that sediment, debris and excessive decaying vegetation are removed from the above noted stormwater management Works to prevent the excessive build-up of sediment, debris and/or decaying vegetation to avoid reduction of capacity of the stormwater management Works and any reduction of filters permeability. The Owner shall also regularly inspect and clean out the inlet to and outlet from the Works to ensure that these are not obstructed.

5. RECORD KEEPING

The Owner shall retain for a minimum of five (5) years from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Approval.

6. SPILL CONTINGENCY PLAN

6.1 Within six (6) months from the issuance of this Approval, the Owner shall implement a spill contingency plan - that is a set of procedures describing how to mitigate the impacts of a spill within the area serviced by the Works. This plan shall include as a minimum:

(i) the name, job title and location (address) of the Owner, person in charge, management or person(s) in control of the facility;

(ii) the name, job title and 24-hour telephone number of the person(s) responsible for activating the spill contingency plan;

(iii) a site plan drawn to scale showing the facility, nearby buildings, streets, catchbasins & manholes, drainage patterns (including direction(s) of flow in storm sewers), any receiving body(ies) of water that could potentially be significantly impacted by a spill and any features which need to be taken into account in terms of potential impacts on access and response (including physical obstructions and location of response and clean-up equipment);

(iv) steps to be taken to report, contain, clean up and dispose of contaminants following a spill;

(v) a listing of telephone numbers for: local clean-up company(ies) who may be called upon to assist in responding to spills; local emergency responders including health institution(s); and MOE Spills Action Centre 1-800-268-6060;

(vi) Materials Safety Data Sheets (MSDS) for each hazardous material which may be transported or stored within the area serviced by the Works;

(vii) the means (internal corporate procedures) by which the spill contingency plan is activated;

(viii) a description of the spill response training provided to employees assigned to work in the area serviced by the Works, the date(s) on which the training was provided and by whom;

(ix) an inventory of response and clean-up equipment available to implement the spill contingency plan, location and, date of maintenance/replacement if warranted; and

(x) the date on which the contingency plan was prepared and subsequently, amended.

6.2 The spill contingency plan shall be kept in a conspicuous, readily accessible location on-site.

6.3 The spill contingency plan shall be amended from time to time as required by changes in the operation of the facility.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which Approval was granted. This Condition is also included to emphasize the precedence of Conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The Condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this Approval of the existence of this Approval.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved Works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included as regular inspection and necessary removal of sediment and excessive decaying vegetation from this approved stormwater management Works are required to mitigate the impact of sediment, debris and/or decaying vegetation on the treatment capacity of the Works. It is also required to ensure that adequate storage is maintained in the stormwater management facilities at all times as required by the design, and to prevent stormwater impounded in the works from becoming stagnant. Furthermore, Condition 4 is included to ensure that the stormwater management Works are operated and maintained to function as designed.

5. Condition 5 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

6. Condition 6 is included to ensure that the Owner will implement the Spill Contingency Plan, such that the environment is protected and deterioration, loss, injury or damage to any person(s) or property is prevented.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary* Environmental Review Tribunal 655 Bay Street, Suite 1500 Toronto, Ontario M5G 1E5	AND	The Director appointed for the purposes of Part II.1 of the Environmental Protection Act Ministry of the Environment 2 St. Clair Avenue West, Floor 12A Toronto, Ontario M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 6th day of December, 2012

THIS APPROVAL WAS MAILED
ON Dec. 12, 2012
9 C
(Signed)

Sherif Hegazy, P.Eng.
Director
appointed for the purposes of Part II.1 of the *Environmental Protection Act*

JO/

c: District Manager, MOE Ottawa District Office.
Derrick Upton, J.L. Richards & Associates Limited.

RECEIVED
DEC 17 2012
J.L. Richards & Associates Limited
OTTAWA OFFICE

Appendix D

Geotechnical Investigation Report & Hydrogeological Assessment

UPDATED REPORT

Geotechnical Investigation
Proposed Hydro One Operations Facility

3440 Frank Kenny Road, Ottawa, Ontario

Submitted to:

J.L. Richards & Associates Limited

343 Preston Street, Suite 1000
Ottawa, Ontario K1S 1N4

Submitted by:

Golder Associates Ltd.

1931 Robertson Road,
Ottawa, Ontario, K2H 5B7

+1 613 592 9600

21493887

December 12, 2022

Distribution List

1 e-copy - J.L. Richards & Associates Limited

1 e-copy - Golder Associates Ltd

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out at the site of a proposed Hydro One operations facility to be located at 3440 Frank Kenny Road in Ottawa, Ontario.

This report was previously issued under report number 11-1122-0129-2000 in January 2012. This report provides updated geotechnical guidance for Phase 2 of the proposed facility and supersedes the previously issued report. Further, this report is based solely on the results of the previous geotechnical investigations, with the exception of updated water levels, and the site conditions may have changed due to construction or other activities on the site since those investigations were completed.

The purpose of the geotechnical investigation was to assess the subsurface conditions at the site by means of a limited number of test pits and boreholes.

Based on an interpretation of the factual information available for this site, a general description of the subsurface conditions across the site is presented. These interpreted subsurface conditions and available project details were used to prepare engineering guidelines on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

The reader is referred to the "Important Information and Limitations of This Report" which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared for the construction of a Hydro One operations facility to be located at 3440 Frank Kenny Road in Ottawa, Ontario (see Key Plan, Figure 1).

The following is known about the existing property:

- The overall site measures approximately 145 metres by 360 metres in plan area.
- The northern part of the site (3406 Frank Kenny Road) is occupied by M. L. Bradley Bus Lines (Bradley) and contains several buildings.
- The southern part of the site (3440 Frank Kenny Road) is occupied by a residential dwelling and is agricultural land.
- The overall site topography is relatively flat.

It is understood that the proposed operations facility is to be constructed in two phases. The first phase will include:

- A temporary office building located on the western portion of the 3440 Frank Kenny Road property. The temporary office building will measure about 15 metres by 20 metres in plan area, will be one storey in height, and will be of slab-on-grade construction (i.e., no basement level).
- A general storage building to be located on the north side of the 3440 Frank Kenny Road property. The general storage building will measure about 14 metres by 22 metres in plan area, will be one storey in height, and will be of slab-on-grade construction (i.e., no basement level).
- Gravel surfaced roadways and parking areas.

It is also understood that the grades will not be raised within the phase 1 area.

The second phase will include:

- A permanent office/storage building located on the south side of the 3440 Frank Kenny Road property. The office building will measure about 32 metres by 66 metres in plan area (including the covered vehicle storage area), will be one storey in height, and will be of slab-on-grade construction (i.e., no basement level).
- The office/storage building will be provided with a storage ramp on the north side.
- A concrete pad for placement of two fire water storage tanks.
- A storm water management pond in the southern corner of the site.
- Asphalt and gravel surfaced roadways and parking areas. The asphalt parking area includes lanes for heavy vehicle (truck) traffic.

It is also understood that the grades will be raised by up to about 1.5 metres within the phase 2 area.

Published geological mapping indicates that the subsurface conditions at the site consist of silty clay. The bedrock surface is expected to be at a depth of 5 to 10 metres below ground surface at the northern portion of the site and 3 to 5 metres below ground surface at the southern portion of the site.

Geological bedrock mapping indicates that the site is located near the contact between two bedrock formations. At the northern portion of the site, the bedrock is indicated to consist of interbedded limestone and shale of the Lindsay Formation while, at the southern portion of the site, the bedrock is indicated to consist of shale of the Billings Formation.

3.0 PROCEDURE

The field work for this investigation was carried out between October 31 and November 1, 2011. During this period, a total of seven boreholes (numbered BH 11-1 to BH 11-7) and five test pits (numbered TP 11-1 to TP 11-4) were put down at the approximate locations shown on Figure 2.

The boreholes were advanced using a track-mounted hollow-stem auger drill rig supplied and operated by Marathon Drilling Company Ltd. of Ottawa, Ontario. The boreholes were advanced to depths which vary from 2.0 to 7.0 metres below existing ground surface.

Within the boreholes, standard penetration tests were carried out at regular intervals of depth and samples of the soils encountered were recovered using drive open sampling equipment. In situ vane testing was carried out where possible in the silty clay to determine the undrained shear strength of this soil unit. In addition, two relatively undisturbed, 73-millimetre diameter thin-walled Shelby tube samples of the silty clay were obtained using a fixed piston sampler.

Standpipes were sealed into boreholes 11-3 and 11-5 to allow subsequent measurement of the stabilized groundwater level at the site.

The test pits were excavated using a rubber-tired backhoe supplied and operated by Glenn Wright Excavating of Ottawa, Ontario. The test pits were advanced to depths ranging from approximately 1.6 to 2.4 metres below the existing ground surface.

The soils exposed on the sides of the test pits were classified by visual and tactile examination. The groundwater seepage conditions were observed in the open test pits and the test pits were loosely backfilled upon completion of excavating and sampling.

The subsurface conditions encountered in the test pits are shown on Table 1 - Record of Test Pits.

The field work was supervised by an experienced technician from our staff who located the boreholes and test pits, directed the drilling and excavating operations, logged the boreholes and test pits, took custody of the samples, and carried out the in situ testing. The soil samples obtained during the field work were brought to our laboratory for further examination by the project engineer and for laboratory testing. Geotechnical laboratory testing included determination of water content (D-2216; LS-701) and Atterberg limits (D-4318; LS703/704).

One sample of soil from borehole 11-5 was submitted to Exova Accutest Laboratories Ltd. for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements.

The boreholes and test pits were selected, staked in the field, and subsequently surveyed by Golder Associates personnel. The positions and ground surface elevations at the borehole and test locations were determined using a Trimble R8 GPS survey unit. The elevations are referenced to Geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

The subsurface conditions encountered in the boreholes during the current investigation are shown on the Record of Borehole Sheets in Appendix A. The subsurface conditions encountered in the test pits are shown on Table 1 – Record of Test Pits. The results of the laboratory water content and Atterberg limit testing on the selected soil samples are given on the Record of Borehole Sheets. The results of the basic chemical analyses are provided in Appendix B.

In general, the subsurface conditions at this site consist of surficial topsoil or fill (where present) overlying sensitive silty clay and glacial till, with the underlying shale bedrock surface varying from about 3 to 4 metres depth at the south portion of the site and greater than 7 metres depth at the north portion of the site.

The following sections present a more detailed overview of the subsurface conditions encountered in the boreholes and test pits advanced during the present investigation. The subsurface conditions encountered in the monitoring well (MW 11-1) are provided on the Record of Borehole Sheet in Appendix A, but are not discussed in the following sections.

GHD carried out a separate hydrogeological investigation which included the installation of four monitoring wells in the Phase 2 area. The results of this investigation are contained in the following reports:

Hydrogeological Assessment, Proposed Development, Orleans Station Yard, 3440 Frank Kenny Road, Navan Ontario, GHD Report Number 12575389(1), dated June 24, 2022; and,

Hydrogeological Assessment - Amendment, Groundwater Level Monitoring, Proposed Development, Orleans Operations Centre (OC), 3440 Frank Kenny Road, Navan Ontario, GHD Reference Number 12575389-Let-3-Spence, dated August 5, 2022.

The GHD monitoring well locations are shown on Figure1 and the stratigraphic and instrumentation logs are provided in Appendix C. The water level information from the GHD records is included below in Section 4.6.

4.2 Topsoil and Fill

A surficial topsoil layer exists at all of the test pit and borehole locations, with the exception of boreholes 11-1 and 11-4. The topsoil varies from about 80 to 150 millimetres in thickness.

Fill materials exist at the ground surface in boreholes 11-1 and 11-4. At these locations, the fill materials are about 310 and 150 millimetres in thickness, respectively. The fill materials consist of clayey topsoil, sand, organic matter, and crushed stone.

4.3 Silty Clay

The topsoil and fill materials are underlain by a deposit of sensitive silty clay. The upper portion of the deposit has been weathered to a stiff grey brown crust. Towards the south (i.e., Phase 2), the entire deposit has been weathered and extends to about 2.0 to 2.7 metres below the existing ground surface. Towards the north (i.e., Phase 1), the weathered zone extends to about 2.7 to 3.1 metres below the existing ground surface.

The results of in-situ vane testing carried out in the lower portions of the weathered crust gave undrained shear strengths ranging from 44 to 69 kilopascals. Standard penetration tests carried out within the weathered crust gave 'N' values ranging from 1 to 12 blows per 305 millimetres of penetration. The results of this in situ testing indicate a firm to very stiff (but generally stiff) consistency. The measured water content of the weathered crust ranges from approximately 30 to 82 percent.

In boreholes 11-1 and 11-3 (i.e., Phase 1), the silty clay below the depth of weathering is grey in colour (borehole 11-2 did not fully penetrate the weathered crust). The unweathered silty clay was fully penetrated in borehole 11-3 and was about 1.2 metres in thickness (i.e., extending down to a depth of about 4.1 metres). The unweathered silty clay was not fully penetrated in borehole 11-1 but was proven to a depth of about 7.0 metres.

The results of in-situ vane testing in the unweathered silty clay gave undrained shear strengths ranging from 25 to 44 kilopascals, indicating a firm consistency.

The results of Atterberg limit testing carried out on two samples of the grey silty clay gave plasticity index values of 58 and 63 percent and liquid limit values of 89 and 93 percent, indicating high plasticity soil. The measured water content of the two grey silty clay samples were 83 and 88 percent, which are slightly below the measured liquid limits.

4.4 Glacial Till

Glacial till was encountered underlying the silty clay (where fully penetrated) in all borehole locations. The glacial till consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand and shale fragments. The glacial till was fully penetrated in four of the boreholes and varied in thickness from about 0.3 to 1.7 metres. In borehole 11-3, the glacial till was not fully penetrated, but was proven to a depth of about 5.6 metres prior to the borehole being terminated.

Standard penetration test 'N' values for this material ranged from 11 to 38 blows per 305 millimetres of penetration, which indicates a compact to dense state of packing for this deposit. However, the higher 'N' values likely reflect the presence of cobbles and boulders, rather than the actual state of packing of the soil matrix.

4.5 Bedrock

Bedrock was encountered underlying the glacial till on the south of the site (i.e., Phase 2) in boreholes 11-4 to 11-7 (inclusive). The depth to bedrock ranges from about 3.1 to 4.3 metres below the existing ground surface.

In these boreholes, the upper portion of the bedrock is highly weathered and the boreholes were advanced into the bedrock by up to an additional 0.5 to 2.4 metres prior to the boreholes being terminated.

The bedrock consists of black shale. Published geological mapping indicates that this shale bedrock is of the Billings Formation.

4.6 Groundwater

The groundwater levels (GWL's) recorded in the piezometers and monitoring wells installed at the site are summarized in the following table:

Hole Designation	Approximate Screen Depth Interval (m)	Screen Strata	Date	GWL Depth below Ground Surface (m)	GWL Elev (m)*
11-3	4.2 – 4.9	Glacial Till	Nov. 14, 2011	1.1	84.4
11-5	3.4 – 4.0	Glacial Till/Bedrock	Nov. 1, 2011	1.3	84.4
DBW001	1.5 – 4.0	Clay/Clayey Gravel	Apr. 19, 2022	1.0	85.6
DBW002	0.9 – 3.1	Clay/Gravelly Clay	Apr. 19, 2022	0.1	85.5
DBW003	1.5 – 3.1	Clay/Clayey Gravel	Apr. 19, 2022	0.2	85.4
DBW004	1.2 – 3.7	Clay	Apr. 19, 2022	0.4	84.7

* The water levels shown for the GHD monitoring wells are the maximum recorded during the monitoring period from April 19, 2022 to July 7, 2022.

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

5.0 DISCUSSION

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the available information described herein and project requirements and is subject to the limitations in the "Important Information and Limitations of this Report" attachment which follows the text of this report.

The foundation engineering guidelines presented in this section have been developed in a manner consistent with the procedures outlined in Part 4 of the Ontario Building Code (OBC) for Limit States Design.

5.2 Foundations

The subsurface conditions vary across the overall site.

Within the Phase 1 area, the subsurface conditions generally consist of fill material over 3 metres of weathered silty clay, overlying unweathered silty clay, which are underlain by glacial till.

Within the Phase 2 area, the subsurface conditions generally consist of 2 to 2.5 metres of weathered silty clay, overlying glacial till, with the surface of the shale bedrock at about 3 to 4 metres depth.

5.2.1 Phase 1 Area

The existing surficial fill materials present on this site are not suitable for the support of the footings, or the slab, and should be removed from within the building footprint. The footings should then be founded on/within the weathered silty clay crust or on engineered fill placed on that bearing surface.

The foundation design parameter values (Serviceability Limit States (SLS) and Ultimate Limit States (ULS) resistances) for spread footing foundations at this phase of the site are based on limiting the stress increases on the grey silty clay at depth to an acceptable level so that foundation settlements do not become excessive. Four important parameters in calculating the stress increase on the grey silty clay under the weathered crust are:

- The thickness of the weathered crust below the underside of the footings;
- The size (dimensions) of the footings;
- The amount of surcharge in the vicinity of the foundation due to landscape fill, underslab fill, floor loads, etc; and,
- The effects of groundwater lowering caused by this or other construction.

It is understood that the proposed finished floor slab levels of the Phase 1 buildings will be at about the existing grade.

For frost protection purposes, the exterior footings should be founded at least 1.5 metres below the finished exterior grade, placing the exterior footings for the structures no deeper than about elevation 84.3 metres. The floor loading for the structures is understood not to exceed 5 kilopascals.

Based on the above elevations and floor loadings, the SLS net bearing resistance and the factored ULS bearing resistance values for spread footing foundations (for buildings and retaining walls) may be taken as follows:

Building Footing Type	Minimum Founding Elevation (metres)	Footing Width or Size (metres)	Net Bearing Resistance at SLS (kPa)	Factored Bearing Resistance at ULS (kPa)
Temporary Office Building Strip Footing	84.3	< 1.0	125	165
Temporary Office Building Pad Footing	84.3	< 1.0	150	165
General Storage Building Strip Footing	84.3	< 1.0	95	165

Building Footing Type	Minimum Founding Elevation (metres)	Footing Width or Size (metres)	Net Bearing Resistance at SLS (kPa)	Factored Bearing Resistance at ULS (kPa)
General Storage Building Pad Footing	84.3	< 1.0	150	165

For larger footings, footings placed at greater depth, increases in floor loading or increases in exterior grade levels, the above design parameters will change and new values must be calculated taking any such changes into account.

The post construction total and differential settlements of footings sized using the above SLS net bearing resistance values should be less than about 25 and 15 millimetres, respectively, provided that the soil at or below founding level is not disturbed during construction. These bearing resistances correspond to a settlement resulting from consolidation of the silty clay and are based on the thickness of the weathered crust, empirical correlation between undrained shear strength and pre-consolidation pressure and experience with similar soils.

Consolidation of the silty clay is a process which takes months or longer and, as such, results from sustained loading. Therefore, the foundation loads to be used in conjunction with the SLS resistance values given above should be the full dead load plus sustained live load. The factored dead plus full factored live load should be used in conjunction with the ULS factored bearing resistance.

5.2.2 Phase 2 Area

Grade raises of up to 3 m are acceptable on the Phase 2 area of the site and the foundations guidance below has been developed on that basis.

The existing surficial fill materials and the disturbed silty clay (at borehole 11-4) present on this site are not suitable for the support of the footings, or the slab, and should be removed from within the building footprint.

It is considered that the footings could be founded on/within the weathered silty clay crust or on engineered fill placed on that bearing surface.

The net bearing resistance at Serviceability Limit States (SLS) for pad footings up to 3.0 metres square and for strip footings up to 3.0 metres in width, may be taken as 125 kilopascals. The factored bearing resistance at Ultimate Limit States (ULS) may be taken as 165 kilopascals.

The post construction total and differential settlements of footings sized using the above SLS net bearing resistance values should be less than about 25 and 15 millimetres, respectively, provided that the soil at or below founding level is not disturbed during construction. Further, these bearing resistances correspond to a settlement resulting from consolidation of the silty clay and are based on the thickness of the weathered crust, empirical correlation between undrained shear strength and pre-consolidation pressure and experience with similar soils.

Consolidation of the silty clay is a process which takes months or longer and, as such, results from sustained loading. Therefore, the foundation loads to be used in conjunction with the SLS resistance values given above should be the full dead load plus sustained live load. The factored dead plus full factored live load should be used in conjunction with the ULS factored bearing resistance.

The underside of both the perimeter and interior footings for the building and canopy may be above the surface of the native soils. In addition, when the existing buildings (house, garage, etc) are demolished, the existing foundations and backfill must be removed from within the zone of influence of the new foundations and floor slabs. The zone of influence is considered to extend out and down from the edge of the new footings and edge of slabs at a slope of 1 horizontal to 1 vertical. Where the site preparation leaves the native subgrade level below the proposed underside of footing level, the grade should be raised, within the zone of influence, with Ontario Provincial Standard Specification (OPSS) Granular B Type II placed in maximum 300 millimetre thick lifts and compacted to at least 98 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The same foundation design parameters can be used for this design option, as given above.

At locations where the footings are founded on the weathered silty clay, the short-term shear resistance within the silty clay should be checked using a factored shear strength (Su) value of 40 kPa. The lateral resistance to long term loading of footings on weathered silty clay may be evaluated using a factored tan δ^* lateral sliding resistance value of 0.34.

Where foundations will be supported on engineered fill, a factored tan δ^* lateral sliding resistance value of 0.40 may be used at the base of footing – engineered fill interface.

5.3 Groundwater Management

Based on the design details provided, it is anticipated the underside of foundations will be at about elevation 85.6. The groundwater levels at the site were indicated to be at about elevations ranging from 84.4 to 85.6 m. Based on the underside of footing elevations and the measured groundwater levels, the building excavation inverts may extend to the maximum measured groundwater levels, depending on the time of year, and any dewatering required should be manageable by pumping from sumps within the excavations.

The base of the stormwater management pond (dry retention area) is indicated to be at about 85.1 m (i.e., about 0.5 m below the highest measured groundwater level). Pumping from sumps should also be feasible for groundwater management but higher inflows may be expected depending on the groundwater level at the time of construction. Surface water inflows from precipitation events will also add to the pumping requirements. Ideally excavations would be planned for drier periods, such as summer.

Consideration should be given to carrying out further hydrogeolological assessments to assess the potential risks associated with construction when the facility design is finalized.

Construction Water takings in excess of 50 m^3/day are regulated by the Ministry of the Environment, Conservation and Parks (MECP). Certain takings of groundwater and stormwater for construction dewatering purposes with a combined total less than 400 m^3/day qualify for self-registration on the MECP's Environmental Activity and Sector Registry (EASR). Registry on the EASR replaces the need to obtain a PTTW for water taking less than 400 m^3/day and a Section 53 approval for discharge of water to the environment. A "Water Taking Plan" and a "Discharge Plan" are required by the MECP if water is taken in accordance with an EASR. In all cases, discharge under the EASR must be in accordance with a Discharge Plan. A Category 3 PTTW would be required for water takings in excess of 400 m^3/day. The construction water taking permit and registration should be prepared adequately in advance of site excavation works so as not to unduly affect the construction schedule.

5.4 Seismic Site Response Classification

The seismic design provisions of the Ontario Building Code depend, in part, on the shear wave velocity, undrained shear strength or SPT N values of the upper 30 metres of soil and/or rock below founding level. Due to the differing soil conditions across the site, the site class has been evaluated for each of the three proposed buildings.

For design purposes, the proposed Phase 1 temporary office building and general storage building can be assigned a Site Class D.

The Phase 2 permanent office building can be assigned a Site Class C for design.

The glacial till soils and the native silty clay at this site are not considered to be susceptible to liquefaction or cyclic softening in response to the design seismic event.

5.5 Slab on Grade

Conventional slab on grade construction can be used for the structures on this site.

However, for predictable performance of the floor slabs, the existing topsoil, fill materials, and disturbed clay should be removed from within the proposed building areas. Provision should be made for at least 150 millimetres of Ontario Provincial Standard Specification (OPSS) Granular A to form the base for the floor slabs. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II. The underslab fill should be placed in maximum 300-millimetre thick lifts and should be compacted to at least 98 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

It is understood that the slabs for the building and for support of the fire water tanks will be point loaded and for structural analysis of the slab deflections a modulus of subgrade reaction, ks, is required. It should be noted however that the modulus of subgrade reaction is not a fundamental soil property and its value depends, in part, on the size and shape of the loaded area. For the analysis of the contact stress distribution beneath a raft foundation, its value would depend on the size of the areas over which increased/concentrated contact stresses are anticipated (analogous to equivalent footings beneath the walls and columns) and the size of these areas is in turn related to the value the modulus of subgrade reaction, i.e., they are inter-related. Accordingly, the analysis of the raft slabs should ideally involve an iterative analysis between the determination of the contact stress distribution by the structural engineer and the geotechnical determination of the modulus of subgrade reaction value, until the two are consistent with each other.

For a 0.3 metre by 0.3 metre section of the slab supported on the native weathered silty clay, the modulus of subgrade reaction may be assumed to be in the range of 10 to 30 megapascals per metre. The structural design of the slab at any location should be determined based on whichever value causes the larger effect, since the maximum and minimum values may govern for different locations and load effects.

5.6 Frost Protection

The soils at this site are considered to be frost susceptible. Therefore, all exterior foundation elements should be provided with a minimum of 1.5 metres of earth cover for frost protection purposes. Isolated, unheated footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 metres of earth cover.

Insulation of the bearing surface with high density polystyrene rigid foam insulation could be considered as an alternative to earth cover for frost protection. The details for footing insulation could be provided if and when required.

Insulation will likely be required at the loading dock, unless the retaining wall footings can be founded at least 1.8 m below the ramp surface (i.e., below the underside of the building foundations). The footings for the retaining walls at the ramp should be provided with insulation, at least 50 mm in thickness, at the underside extending a distance of 1.8 m, less the depth of earth cover, beyond the edge of the footings.

In preparation for the insulation, a levelling mat consisting of 25 millimetres of concrete/mortar sand or 50 millimetres of lean concrete should be placed on the approved bearing surface. Care must be taken to ensure that the insulation is not damaged during construction. Joints should be carefully lap jointed and glued where and if possible. Footings may then be constructed on the surface of the insulation. The type of insulations should be selected such that the bearing pressure on the insulation placed under the footings does not exceed about 35 percent of the insulation's quoted compressive strength. This is due to the time dependant creep characteristics of this material. For example, the allowable bearing pressures for several strengths of insulation are:

Insulation Type	SLS Resistance (kilopascals)	ULS Factored Resistance (kilopascals)
Dow SM	65	100
Dow Highload 40	90	135
Dow Highload 60	145	205
Dow Highload 100	240	340

To reduce the potential for differential frost heaving across the loading dock ramp, the insulation below the ramp should extend from retaining wall to retaining wall (i.e., across the full width of the ramp).

The insulation which projects beyond the edge of the footings can consist of Dow SM or equivalent, except beneath pavements where HI 60 should be used beyond the footing.

In addition, the building foundations should also be insulated at the loading dock (unless founded 1.8 m below the ramp pavement surface).

A transition detail may be required at the top of the loading dock ramp, where the insulation ends, depending if the footings are maintained at the same elevation or steeped as the ramp grade rises. Further details can be provided as the design progresses.

5.7 Foundation Wall Backfill

The soils at this site are frost susceptible and should not be used as backfill against exterior or unheated foundation elements. To avoid problems with frost adhesion and heaving, these foundation elements should be backfilled with non-frost susceptible sand, or sand and gravel conforming to the requirements for OPSS Granular B Type I.

In areas where pavement or other hard surfacing will abut the building, differential frost heaving could occur between the granular fill and other areas, particularly where clay is present. To control this differential heaving, the backfill adjacent to the foundation wall should be placed to form a frost taper. The frost taper should be brought up to pavement subgrade level from 1.5 metres below finished exterior grade at a slope of 3 horizontal to 1 vertical, or flatter, away from the wall. The granular fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

It is understood that the native subgrade at or below foundation depth will be sloped away from the foundations at a grade of at least 1% and that the backfill within the building and covered vehicle storage area will consist of free draining OPSS Granular A or Granular B Type II. Considering the planned filling on site and the maximum groundwater levels recorded, foundation drainage is not considered to be required.

5.8 Site Servicing

Excavation for the installation of the site services will generally be through topsoil, fill, weathered silty clay, and possibly into the glacial till.

No unusual problems are anticipated in excavating in the overburden materials using conventional hydraulic excavating equipment, recognizing that boulders may be encountered within the glacial till. Boulders larger than 0.3 metres in size should be removed from the excavation side slopes for worker safety.

The Occupational Health and Safety Act (OHSA) of Ontario indicates that side slopes could be sloped at a minimum of 1 horizontal to 1 vertical (i.e., Type 3 soils).

Some groundwater inflow into the excavations should be expected. However, it should be possible to handle the groundwater inflow by pumping from well filtered sumps established in the floor of the excavations.

At least 150 millimetres of OPSS Granular A should be used as pipe bedding for sewer and water pipes. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to place a sub-bedding layer consisting of 300 millimetres of compacted OPSS Granular B Type II beneath the Granular A or to thicken the Granular A bedding. The bedding material should in all cases extend to the spring line of the pipe and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density. The use of clear crushed stone as a bedding layer should not be permitted anywhere on this project since fine particles from the sandy backfill materials could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from the spring line of the pipe to at least 300 millimetres above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 millimetres. The cover material should be compacted to at least 95 percent of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the grey brown silty clay and glacial till as trench backfill. Where the trench will be covered with hard surfaced areas, the type of native material placed in the frost zone (between subgrade level and 1.8 metres depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.9 Slope Stability

It is understood that retaining walls, potentially up to about 1.2 m in exposed height, will be required at the loading dock. The retaining walls were evaluated using the GeoStudio 2021 Slope/W software for limit equilibrium analysis.

The subsurface stratigraphy used in the analyses was based on the subsurface conditions encountered in Borehole 11-4, which was advanced in relatively close proximity to the proposed loading dock. Input parameters for the analysis are provided in Table 1.

The interpreted subsurface conditions consist of general earth fill, engineered fill (anticipated to replace a surficial layer of topsoil and to raise the founding surface to the underside of footings, if required), overlying a deposit of stiff to very stiff silty clay weathered crust, over glacial till and bedrock.

Table 1: Geotechnical Design Parameters for Stability Analysis

Soil Type	Bulk Unit Weight, γ (kN/m^3)	Shear Strength Parameters		
		Undrained Shear Strength, Su (kPa)	Effective Angle of Internal Friction, ϕ' (°)	Effective Cohesion, c' (kPa)
Earth (Grade Raise) Fill	20	N/A	30	0
Engineered Fill	21.5	N/A	34	0
Weathered Silty Clay	17.5	60	35	5
Glacial Till	21	0	34	0
Bedrock	Impenetrable			

The following conditions were also assumed in the analysis:

- The ground behind the wall will be level.
- Site Class C Seismic site classification, (2022 Geotechnical Investigation report).
- A seismic horizontal loading of 0.201, equal to ½ of the site adjusted PGA value (0.402g for Site Class C).
- A static long term groundwater level of 85.0 m.

With appropriate subgrade preparation and proper placement of earth or granular soils, the up to 1.2 m high cast in place concrete retaining wall, will have a factor of safety greater than 1.5 against deep seated slope instability and a factor of safety greater than 1.1 against seismic global instability for both the existing conditions as well as an assumed condition with a higher groundwater level (at the ground surface). The results of the slope stability analysis are shown on Figures 1 through 4 in Appendix D.

It also understood that the storm water management pond will have side slopes less than 1 m in height with side slopes no steeper than 3 horizontal to 1 vertical. The pond side slopes will have factors of safety of greater than 1.5 or 1.1 against static and seismic instability. The pond side slopes should be provided with erosion control measures (e.g., rip rap) to reduce the potential for sloughing and ravelling of the sideslopes.

5.10 Pavement

In preparation for pavement construction, all topsoil and other unsuitable fill (i.e., fills containing organic matter) should be excavated from the pavement areas.

Those portions of the fill material not containing organic matter may be left in place provided that some long term settlement of the pavement surface can be tolerated. However, the surface of the fill material at subgrade level should be proof rolled with a heavy smooth drum roller under the supervision of qualified geotechnical personnel to compact the surface of the existing fill and to identify soft areas requiring sub-excavation and replacement with more suitable fill.

Sections requiring grade raising to proposed subgrade level should be filled using acceptable (compactable and inorganic) earth borrow or OPSS Select Subgrade Material. These materials should be placed in maximum 300-millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

The surface of the subgrade or fill should be crowned to promote drainage of the pavement granular structure. Perforated pipe subdrains should be provided at subgrade level extending from the catch basins for a distance of at least 3 metres in four orthogonal directions, or longitudinally where parallel to a curb.

The pavement structure for car parking areas should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	50
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

The pavement structure for access roadways and truck traffic areas should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

The pavement structure for unpaved access roadways and truck traffic areas should consist of:

Pavement Component	Thickness (millimetres)
OPSS Granular A Base	250
OPSS Granular B Type II Subbase	450

The granular base and subbase materials should be uniformly compacted to at least 100 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The asphaltic concrete should be compacted in accordance with Table 9 of OPSS 310.

The composition of the asphaltic concrete pavement in car parking areas should be as follows:

Superpave 12.5 or HL 3 Surface Course – 50 millimetres

The composition of the asphaltic concrete pavement in access roadways and truck traffic areas should be as follows:

Superpave 12.5 or HL 3 Surface Course – 40 millimetres

Superpave 19.0 or HL 8 Binder Course – 50 millimetres

The above pavement designs are based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required density and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

5.11 Corrosion and Cement Type

One sample of soil from borehole 11-5 was submitted to EXOVA Accutest Laboratories Ltd. for chemical analysis related to potential corrosion of exposed buried steel and concrete elements (corrosion and sulphate attack). The results of this testing are provided in Appendix B.

The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate a high potential for corrosion of exposed ferrous metal.

5.12 Material Reuse

It is understood that excavated materials from the site are to be re-used on site as much as possible. In general, the excavated weathered silty clay and glacial till may be re-used in pavement and landscaped areas. Re-use of the material will depend on the water content of the excavated material. Material that is wetter than optimum will need to be stockpiled and possibly spread to dry prior to re-use. Excavation during wetter times of year should be avoided. Any organics, such as topsoil, should be stripped and saved for re-use in landscaped areas.

The glacial till will likely be wetter than optimum and it should be planned to place the glacial till in landscaped areas. The glacial till should be placed in maximum 0.3 m thick lifts and compacted using a 15 tonne roller compactor in non-vibratory mode to 95% of the materials maximum standard Proctor dry density, if achievable.

The weathered silty clay should placed in maximum 0.3 m thick lifts and compacted using a 15 tonne sheepsfoot compactor in non-vibratory mode to 95% or 98% of the materials maximum standard Proctor dry density in landscaped areas or beneath paved areas, respectively. The surface of the clay should be compacted using a 15 tonne smooth drum roller compactor in non-vibratory mode prior to placement of granular materials.

Ideally, the clay fill should be allowed to sit for 2 to 4 weeks and should be proofrolled after that period prior to the placement of granulars for pavements. Consideration should be given to using a geogrid within the pavement subbase granulars in the pavement structure in areas constructed on clay fill. Delaying final paving of the parking area, for as long as feasible, should be considered as well.

Site excavated materials should be approved by a geotechnical professional prior to placement and prior to placement of pavement granulars.

5.13 Trees

The silty clay deposit that is present at the site is highly sensitive to water depletion by trees of high-water demand during periods of dry weather. When trees draw water from clayey soils, the clay undergoes shrinkage which can result in settlement of adjacent structures. The zone of influence of a tree is considered to be approximately equal to the full mature height of the tree. Therefore, in this area, trees which have a high-water demand should not be planted closer to structures than the ultimate height of the trees. Table 2 provides a list of the common trees in decreasing order of water demand and, accordingly, decreasing risk of potential effects on structures.

It is understood that no trees will be planted in the Phase 1 area of the development. In Phase 2, trees will be planted in front of the building (i.e., on the street side of the building). Based on the current landscaping plan, the trees will be at least 12 m from the foundations walls, and this set back distance will meet the current City guidelines for trees on sensitive marine soils (i.e., reduced set backs from the guidelines will not be required).

It should also be noted that the foundation depths for the proposed building are less than the required 2.1 metres in the current City guidelines and reduced set back distances for tree planting will not be feasible, should the landscaping plan change.

6.0 CLOSURE

The soils at this site are sensitive to disturbance from ponded water, construction traffic and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling to establish that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill should be inspected to confirm that the materials used conform to the specifications from both a grading and compaction view point.

Golder Associates should be retained to review the final drawings and specifications for this project prior to tendering to ensure that the guidelines in this report have been adequately interpreted.

Signature Page

Golder Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
C. G. HENDRY
100011328
Dec 12, 2022
PROVINCE OF ONTARIO

Chris Hendry, M.Eng., P.Eng.
Senior Geotechnical Engineer

CH/WC/hdw/ml

https://golderassociates.sharepoint.com/sites/152302/project files/6 deliverables/updated geotechnical report/revised final report 12-12-2022/21493887 rpt-001 updated proposed hydro one facility 2022_09_09_r1.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client **J.L. Richards & Associates Ltd.** The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then the client may authorize the use of this report for such purpose by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process, provided this report is not noted to be a draft or preliminary report, and is specifically relevant to the project for which the application is being made. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

TABLE 1
RECORD OF TEST PITS

Test Pit Number (Elevation)	Depth (metres)	Description
11-1 (85.74 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 2.00	Grey brown SILTY CLAY (Weathered Crust)
	2.00	END OF TEST PIT
		Note: Groundwater seepage at 2.00 metres depth

Sample	Depth (m)
1	1.00

Test Pit Number (Elevation)	Depth (metres)	Description
11-2 (85.72 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 1.00	Grey brown SILTY CLAY (Weathered Crust)
	1.00 – 2.40	Grey brown SILTY SAND, some gravel and clay, with cobbles and boulders (GLACIAL TILL)
	2.40	END OF TEST PIT
		Note: Groundwater seepage at 2.00 metres depth

Sample	Depth (m)
1	2.00

Test Pit Number (Elevation)	Depth (metres)	Description
11-3 (85.90 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 2.00	Grey brown SILTY CLAY (Weathered Crust)
	2.00	END OF TEST PIT
		Note: Groundwater seepage at 2.00 metres depth
11-4 (85.08 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 1.60	Grey brown SILTY CLAY (Weathered Crust)
	1.60	END OF TEST PIT
		Note: Groundwater seepage at 1.50 metres depth

Sample	Depth (m)
1	0.50
2	1.00

RECORD OF TEST PIT 11-5

Test Pit Number (Elevation)	Depth (metres)	Description
11-5 (±85.9 metres)	0.00 – 0.27	TOPSOIL
	0.27 – 2.00	Very stiff grey brown SILTY CLAY (Weathered Crust)
		- Field vane test at 0.9 metres > 100 kilopascals
	2.00 – 2.45	Very stiff grey SILTY CLAY
		- Field vane test at 2.1 metres > 100 kilopascals
	2.45 – 2.60	Grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)
	2.60	END OF TEST PIT
		Note: Groundwater seepage at 0.9 metres depth

Sample	Depth (m)
1	0.9
2	2.3
3	2.5

TABLE 2

SOME COMMON TREES
IN DECREASING ORDER OF WATER DEMAND

Broad Leaved Deciduous

Poplar

Alder

Aspen

Willow

Elm

Maple

Birch

Ash

Beech

Oak

Deciduous Conifer

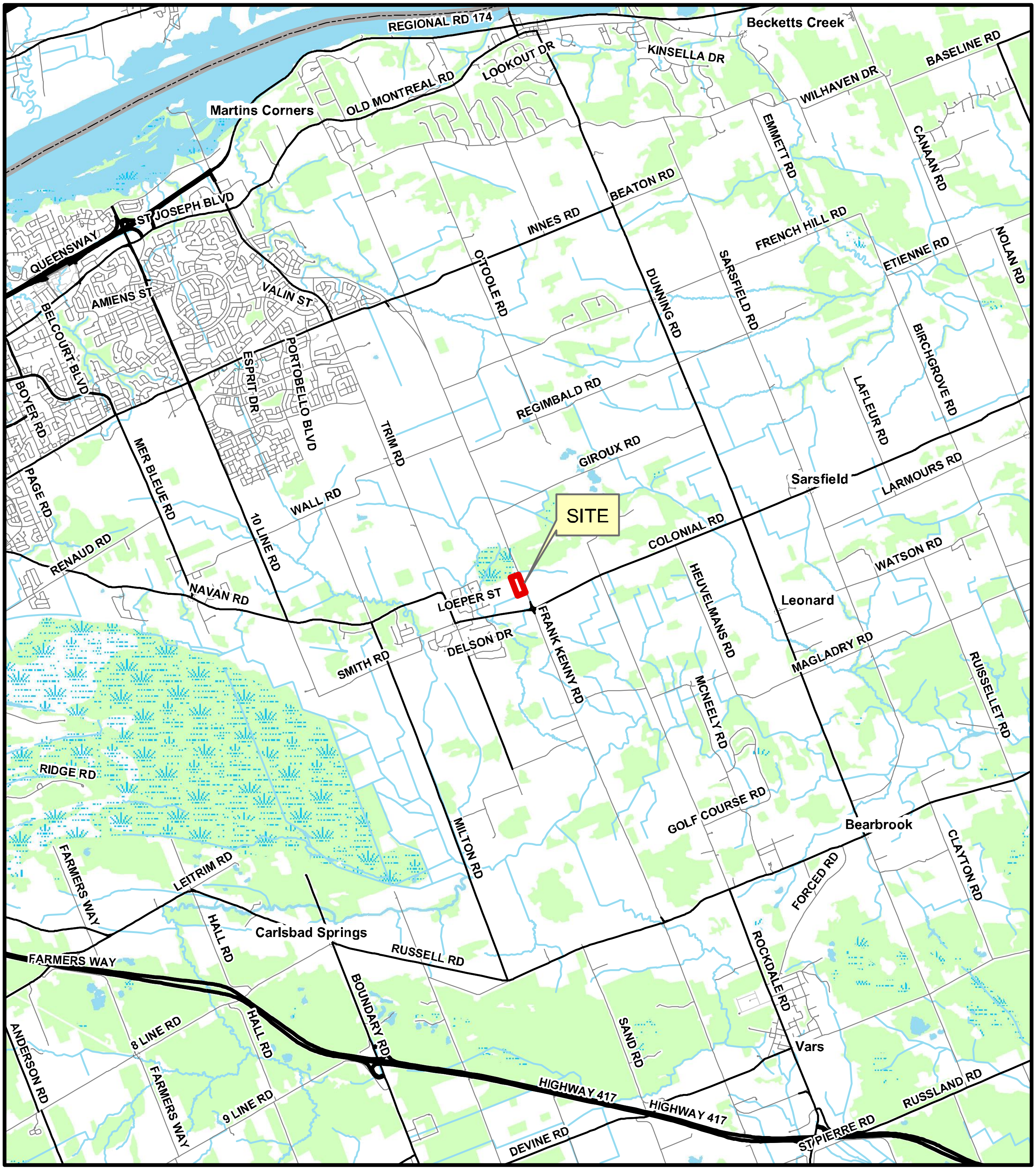
Larch

Evergreen Conifers

Spruce

Fir

Pine



NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 11-1122-0129-2000

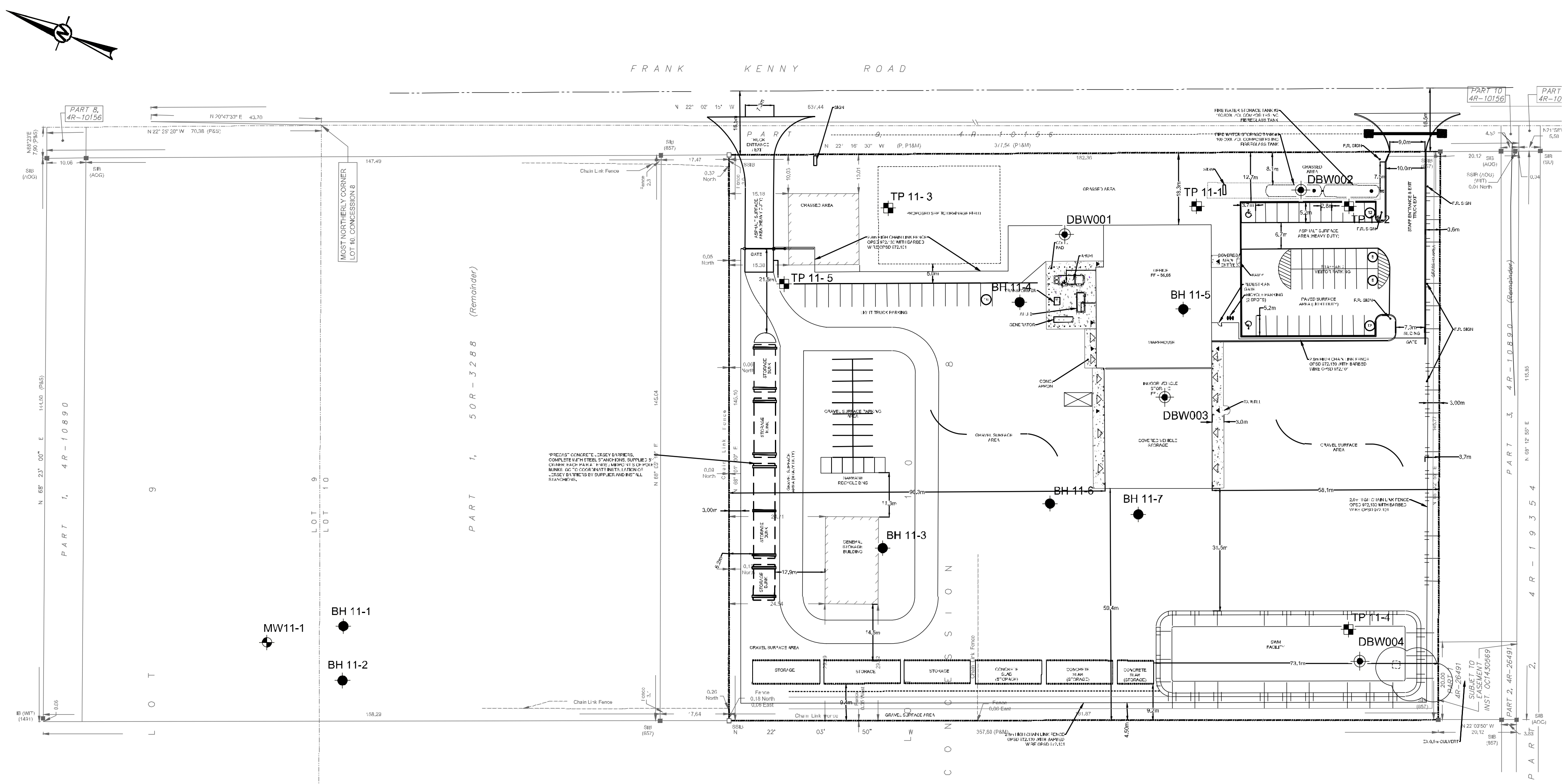
REFERENCE

DIGITAL BASE MAP DATA SUPPLIED BY DMTI SPATIAL INC. CANMAP, 2008
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9

2,500 0 2,500
SCALE 1:100,000 METRES

Golder Associates
Ottawa, Ontario

DATE	Nov. 2011	TITLE	KEY PLAN
DESIGN	BGS		
GIS	BJ		
PROJECT No. 11-1122-0129-2000	CHECK BGS	PROJECT	PROPOSED HYDRO ONE OPERATIONS FACILITY 3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO
SCALE AS SHOWN REV. 0	REVIEW DHP		FIGURE 1



LEGEND

- APPROXIMATE MONITORING WELL LOCATION, GHD INVESTIGATION
- APPROXIMATE TEST PIT LOCATION, PREVIOUS INVESTIGATION
- APPROXIMATE BOREHOLE LOCATION, PREVIOUS INVESTIGATION
- APPROXIMATE MONITORING WELL LOCATION, PREVIOUS INVESTIGATION

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY J.L. RICHARDS AND ASSOCIATES, DATED MARCH 23, 2022.

DRAFT

0 25 50
1:1,000 METRES

CLIENT
HYDRO ONE

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-06-20
DESIGNED	---
PREPARED	ZS/JEM
REVIEWED	---
APPROVED	---

PROJECT
GEOTECHNICAL INVESTIGATION PROPOSED HYDRO ONE OPERATIONS FACILITY 3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO

TITLE
SITE PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
21493887	0001	A	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

List of Abbreviations and Symbols
Record of Borehole Sheets

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample
DT	Dual Tube sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open Sampler for a distance of 300 mm (12 in.)
DD- Diamond Drilling

Dynamic Penetration Resistance; N_d:
The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive Uncased a 50 mm (2 in.) diameter, 60^0 cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH:	Sampler advanced by hydraulic pressure
PM:	Sampler advanced by manual pressure
WH:	Sampler advanced by static weight of hammer
WR:	Sampler advanced by weight of sampler and rod

Peizo-Cone Penetration Test (CPT):
An electronic cone penetrometer with a 60^0 conical tip and a projected end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded Electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	**N** Blows/300 mm Or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	**C_u or S_u** Kpa	Psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	Over 200	Over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limited
w_l	liquid limit
C	consolidaiton (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	modified Proctor compaction test
SPC	standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane test (LV-laboratory vane test)
γ	unit weight

Note:
1. Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	= 3.1416
ln x, natural logarithm of x	
$\log_{10}$ x or log x, logarithm of x to base 10	
g	Acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma'$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma''$-u)
σ'_{vo}	initial effective overburden stress
$\sigma_1\sigma_2\sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1+\sigma_2+\sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma'=\gamma-\gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R= p_s/p_w$) formerly (G_s)
e	void ratio
n	porosity
S	degree of saturation
*	Density symbol is p. Unit weight symbol is γ where γ=pg(i.e. mass density x acceleration due to gravity)

(a) Index Properties (cont'd.)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity Index=(w_l-w_p)
w_s	shrinkage limit
I_L	liquidity index=(w-w_p)/I_p
I_c	consistency index=(w_l-w)/I_p
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index-(e_{max}-e)/(e_{max}-e_{min}) (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	Overconsolidation ratio=σ'_p/σ'_{vo}

(d) Shear Strength

$\tau_p\tau_r$	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction=tan δ
c'	effective cohesion
c_u,s_u	undrained shear strength (ϕ=0 analysis)
p	mean total stress $(\sigma_1+\sigma_3)/2$
p'	mean effective stress $(\sigma'_1+\sigma'_3)/2$
q	$(\sigma_1-\sigma_3)/2$ or $(\sigma'_1-\sigma_3)/2$
q_u	compressive strength $(\sigma_1-\sigma_3)$
S_t	sensitivity

Notes: 1. τ=c'σ' tan| '
2. Shear strength=(Compressive strength)/2

RECORD OF BOREHOLE: 11-1

PROJECT: 11-1122-0129-2000
LOCATION: See Site Plan
BORING DATE: October 31, 2011
SHEET 1 OF 1
DATUM: Geodetic
SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
0	GROUND SURFACE	86.36			
	Dark brown silty fine sand, trace organic matter (FILL)	0.00			
	Loose brown fine sand (FILL)	86.05 / 0.31	1	50 DO	6
	Very stiff to stiff brown to grey brown SILTY CLAY (Weathered Crust)	0.31			
1			2	50 DO	12
2			3	50 DO	5
			4	50 DO	3
3	Firm grey SILTY CLAY	83.31 / 3.05	5	50 DO	1
5			6	50 DO	WH
6			7	50 DO	WH
7	End of Borehole	79.40 / 6.96			

Chart headings: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa — nat V. + Q - ● ; rem V. ⊕ U - ○ (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp — W — Wl (20, 40, 60, 80); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: HEC
CHECKED: SD

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 31, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ├─○W─┤ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.78							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.08	1	50 DO	12				
1					2	50 DO	7				
					3	50 DO	4				
2		End of Borehole		83.80 1.98							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-3

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200 mm Diam. (Hollow Stem)

DEPTH (m)	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
	GROUND SURFACE	85.48			
0	TOPSOIL	0.00			
	Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)	0.15	1	50 DO	5
			2	50 DO	2
			3	50 DO	1
	Firm grey SILTY CLAY	82.58 / 2.90	4	50 DO	WH
	Compact to dense dark grey to black SILTY SAND, some gravel, with shale fragments, cobbles, and boulders (GLACIAL TILL)	81.42 / 4.06	5	50 DO	17
			6	50 DO	38
	End of Borehole	79.84 / 5.64			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION:

Native Backfill

Bentonite Seal

Silica Sand

Standpipe

W.L. in Standpipe at Elev. 84.38 m on Nov. 14, 2011

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-3A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 2, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.48							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.15							
		Firm grey SILTY CLAY		82.74 2.74	1	73 TP	PH				
					2	73 TP	PH				
					3	50 DO	WH				
		Compact dark grey to black SILTY SAND, with shale fragments (GLACIAL TILL)		80.73 4.75	4	50 DO	6				
5		End of Borehole Note: Shallow portion of stratigraphy inferred from BH 11-3		80.43 5.05							

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-4

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 2, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200 mm Diam. (Hollow Stem)

Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m
GROUND SURFACE	85.90			
Dark brown clayey topsoil (FILL)	0.00			
Grey crushed stone (FILL)	0.15			
Grey brown SILTY CLAY (Disturbed)		1	50 DO	6
Stiff grey brown SILTY CLAY (Weathered Crust)	84.68 / 1.22	2	50 DO	3
		3	50 DO	16
Compact dark grey to black SILTY SAND, with shale fragments, cobbles, and boulders (GLACIAL TILL)	83.36 / 2.54	4	50 DO	12
		5	50 DO	16
Highly weathered black SHALE BEDROCK	81.63 / 4.27	6	50 DO	>50
End of Borehole Sampler Refusal	81.38 / 4.52			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ●; rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp W Wl : 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

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PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
	GROUND SURFACE	85.64				
0	TOPSOIL	0.00				
	Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)	0.15	1	50 DO	9	
1			2	50 DO	7	Native Backfill
2			3	50 DO	2	
	Compact dark grey to black SILTY SAND, some gravel, with cobbles, boulders, and shale fragments (GLACIAL TILL)	83.51 / 2.13	4	50 DO	11	
3			5	50 DO	16	Bentonite Seal; Silica Sand; Standpipe
	Highly weathered black SHALE BEDROCK	81.83 / 3.81	6	50 DO	>50	
4	End of Borehole	81.58 / 4.06				

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 20 40 60 80

ADDITIONAL LAB. TESTING

W.L. in Standpipe at Elev. 84.37 m on Nov. 14, 2011

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

RECORD OF BOREHOLE: 11-6

PROJECT: 11-1122-0129-2000

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.44							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff brown SILTY CLAY (Weathered Crust)		0.15							
1					1	50 DO	4				
2					2	50 DO	2				
					3	50 DO	7				
				82.70							
		Compact dark grey to black SILTY SAND, with shale fragments (GLACIAL TILL)		2.74							
3				82.39							
		Highly weathered black SHALE BEDROCK		3.05	4	50 DO	21				
				81.78							
		End of Borehole		3.66							
4											
5											
6											
7											
8											
9											
10											

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-7

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp — W — Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.42							
0	Power Auger, 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.15							
1					1	50 DO	5				
					2	50 DO	2				
2		Compact dark grey to black SILTY SAND, with shale fragments, cobbles, and boulders (GLACIAL TILL)		83.44 / 1.98							
					3	50 DO	16				
3					4	50 DO	17				
		Highly weathered SHALE BEDROCK		81.91 / 3.51							
4					5	50 DO	20				
					6	50 DO	>50				
		End of Borehole		80.70 / 4.72							
5											
6											
7											
8											
9											
10											

Graph scales: Dynamic penetration 20, 40, 60, 80; Hydraulic conductivity 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}; Shear strength 20, 40, 60, 80; Water content 20, 40, 60, 80.

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: MW11-1

LOCATION: See Site Plan

BORING DATE: October 31, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	85.96				
Grey crushed stone (FILL)	0.00	1	50 DO	22	Gravel
	85.35				
Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)	0.61	2	50 DO	8	Bentonite Seal
		3	50 DO	5	Silica Sand
		4	50 DO	4	
	83.52				
Firm grey SILTY CLAY	2.44	5	50 DO	1	51 mm Diam. PVC #10 Slot Screen
		6	50 DO	1	
	82.30				
End of Borehole	3.66				W.L. in Screen at Elev. 84.77 m on November 4, 2011

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

APPENDIX B

Results of Basic Chemical Analysis Exova Accutest Report No. 1126218

EXOVA ACCUTEST

REPORT OF ANALYSIS

Client: **Golder Associates Ltd. (Ottawa)**
32 Steacie Drive

Kanata, ON
K2K 2A9

Attention: **Mr. Stephen Dunlop**

Report Number: 1126218
Date: 2011-11-15
Date Submitted: 2011-11-08
Project: 11-1122-0129
P.O. Number:
Matrix: Soil

Chain of Custody Number: **127521**

		LAB ID:	923658					GUIDELINE		
		Sample Date:	2011-11-01							
		Sample ID:	11-5 Sa2							
PARAMETER	**UNITS**	**MRL**						**TYPE**	**LIMIT**	**UNITS**
Chloride	%	0.002	0.004							
Electrical Conductivity	mS/cm	0.05	0.27							
pH			7.5							
Resistivity	ohm-cm	1	3700							
Sulphate	%	0.01	0.01							

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL: ____________________

Lorna Wilson
Inorganic Lab Supervisor

Methods references and/or additional QA/QC information available on request.

APPENDIX C

Stratigraphic and Instrumentation Logs (DBW001 to DBW004) GHD Project Number 12575389

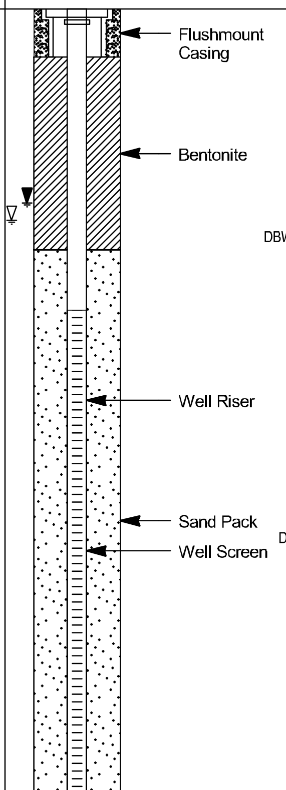
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Hydrogeological Assessment and Soil Quality Investigation - New Orleans OC
PROJECT NUMBER: 12575389
CLIENT: Hydro One Networks Inc.
LOCATION: 3440 Frank Kenny Road, Navan, Ontario

HOLE DESIGNATION: DBW001
DATE COMPLETED: 7 April 2022
DRILLING METHOD: 205mm O.D HSA + Split Spoon
FIELD PERSONNEL: L. McCann

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
	GROUND SURFACE	86.60
	TOP OF RISER	86.47
0.00–0.61	FILL-SAND and GRAVEL; dense; coarse grained; poorly graded; brown to grey; moist	
0.61–1.07	FILL-SANDY SILT; very stiff; low plasticity; brown; dry	85.99
1.07–2.87	CL-CLAY (NATIVE); firm; low plasticity; brown; dry to moist - becomes soft, brown to grey, moist at 2.49m BGS	85.53
2.87–3.96	GP-GC-CLAYEY GRAVEL; compact; medium grained; poorly graded; grey; very wet	83.73
3.96	END OF BOREHOLE @ 3.96m BGS Refusal at 3.96 mBGS	82.64

Monitoring Well



SAMPLE NUMBER	REC (%)	'N' Value	PID (ppm)
1 (DBW001-1-2)	70	35	0.1
2 (DBW001-3-4/DUP003)	80	17	0.0
3	80	9	0.0
4 (DBW001-7.5-9.5)	60	2	0.1
5	25	27	0.0
6	20	<50	0.0

WELL DETAILS
Screened interval:
85.08 to 82.64m AMSL
1.52 to 3.96m BGS
Length: 2.44m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
86.45 to 82.64m AMSL
0.15 to 3.96m BGS
Material: Bentonite
Sand Pack:
85.38 to 82.64m AMSL
1.22 to 3.96m BGS
Material: #2 Silica Sand

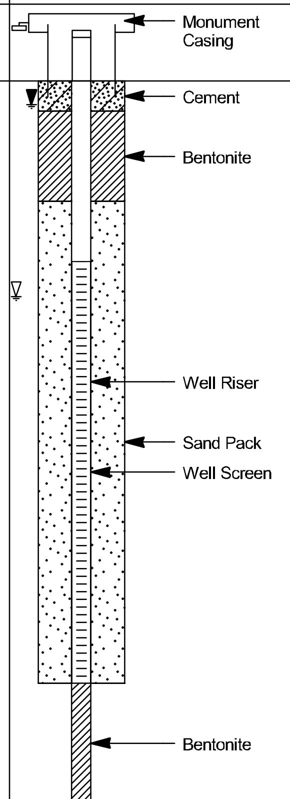
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND 4/13/2022 STATIC WATER LEVEL 4/19/2022
CHEMICAL ANALYSIS GRAIN SIZE ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: Hydrogeological Assessment and Soil Quality Investigation - New Orleans OC
HOLE DESIGNATION: DBW002
DATE COMPLETED: 6 April 2022
PROJECT NUMBER: 12575389
DRILLING METHOD: 205mm O.D HSA + Split Spoon
CLIENT: Hydro One Networks Inc.
FIELD PERSONNEL: L. McCann
LOCATION: 3440 Frank Kenny Road, Navan, Ontario

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
	TOP OF RISER	86.51
	GROUND SURFACE	85.58
	TOPSOIL-CLAYEY SILT; firm; low plasticity; brown; dry to moist	85.27
0.5	CL-CLAY (NATIVE); firm; low plasticity; brown; dry	
1.0	- becomes grey, very stiff, dry to moist from 0.97 to 1.22m BGS	84.36
1.5	CLG-GRAVELLY CLAY; hard; low plasticity; dark brown; wet	
2.0		
2.5	- sand lense from 2.59 to 2.64m BGS	
3.0		
3.5		81.92
	END OF BOREHOLE @ 3.66m BGS	
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		

Monitoring Well



WELL DETAILS
Screened interval:
84.66 to 82.53m AMSL
0.91 to 3.05m BGS
Length: 2.13m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
85.43 to 84.97m AMSL
0.15 to 0.61m BGS
Material: Bentonite
Sand Pack:
84.97 to 82.53m AMSL
0.61 to 3.05m BGS
Material: #2 Silica Sand

SAMPLE

NUMBER	INTERVAL	REC (%)	'N' Value	PID (ppm)
1 (DBW002-0-1)		80	33	0.1
2 (DBW002-2-3)		90	9	0.1
3 (DBW002-5-7)		60	41	0.1
4		30	40	0.0
5		85	35	0.1

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇ 4/13/2022 STATIC WATER LEVEL ▼ 4/19/2022
CHEMICAL ANALYSIS ◯ GRAIN SIZE ANALYSIS ▢

File: \\GHDNET\GHD\CA\OTTAWA\PROJECTS\662\12575389\TECH\GINT\12575389 ORLEANS H1.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 13/6/22

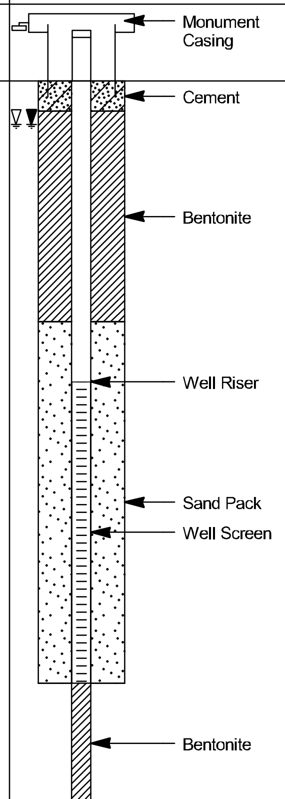
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Hydrogeological Assessment and Soil Quality Investigation - New Orleans OC
PROJECT NUMBER: 12575389
CLIENT: Hydro One Networks Inc.
LOCATION: 3440 Frank Kenny Road, Navan, Ontario

HOLE DESIGNATION: DBW003
DATE COMPLETED: 6 April 2022
DRILLING METHOD: 205mm O.D HSA + Split Spoon
FIELD PERSONNEL: L. McCann

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	SAMPLE NUMBER	INTERVAL	REC (%)	'N' Value	PID (ppm)
	TOP OF RISER	86.54					
	GROUND SURFACE	85.64					
	TOPSOIL-CLAYEY SILT; firm; low plasticity; brown; dry; rootlets	85.44	DBW003-0-1				
0.5	CL-CLAY (NATIVE); firm; low plasticity; brown; dry to moist		1	X	90	6	0.1
			DBW003-2-3				
1.0			2	X	80	5	0.0
1.5	- becomes very soft, brown to grey, moist from 1.52 to 2.13m BGS						
2.0			3	X	100	0	0.1
	GP-GC-CLAYEY GRAVEL; compact; medium grained; poorly graded; dark brown; very wet	83.35					
2.5			4	X	50	27	0.0
3.0							
3.5			5	X	25	21	0.0
	END OF BOREHOLE @ 3.66m BGS	81.98					
4.0							
4.5							
5.0							
5.5							
6.0							
6.5							

Monitoring Well



WELL DETAILS
Screened interval:
84.12 to 82.59m AMSL
1.52 to 3.05m BGS
Length: 1.52m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
85.49 to 84.42m AMSL
0.15 to 1.22m BGS
Material: Bentonite
Sand Pack:
84.42 to 82.59m AMSL
1.22 to 3.05m BGS
Material: #2 Silica Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ∇ 4/13/2022 STATIC WATER LEVEL ▼ 4/19/2022
CHEMICAL ANALYSIS

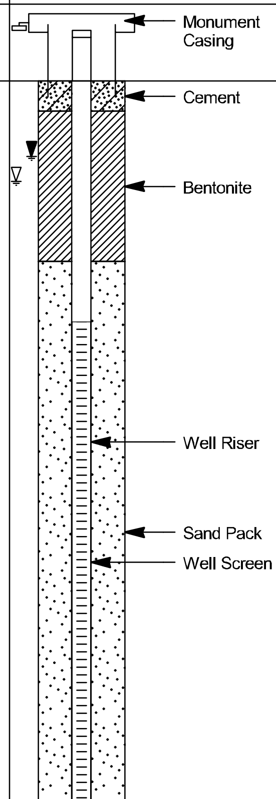
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Hydrogeological Assessment and Soil Quality Investigation - New Orleans OC
HOLE DESIGNATION: DBW004
DATE COMPLETED: 6 April 2022
PROJECT NUMBER: 12575389
DRILLING METHOD: 205mm O.D HSA + Split Spoon
CLIENT: Hydro One Networks Inc.
FIELD PERSONNEL: L. McCann
LOCATION: 3440 Frank Kenny Road, Navan, Ontario

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
	TOP OF RISER	86.10
	GROUND SURFACE	85.11
	TOPSOIL-CLAYEY SILT; firm; low plasticity; brown; dry; rootlets	84.91
	CL-CLAY (NATIVE); firm; low plasticity; brown; dry	
	- becomes softer, moist from 1.07 to 1.37m BGS	
	- very soft, wet from 1.60 to 3.66m BGS	
	END OF BOREHOLE @ 3.66m BGS	81.45

Depth scale (m BGS): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5

Monitoring Well



WELL DETAILS
Screened interval:
83.89 to 81.45m AMSL
1.22 to 3.66m BGS
Length: 2.44m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
84.96 to 84.19m AMSL
0.15 to 0.91m BGS
Material: Bentonite
Sand Pack:
84.19 to 81.45m AMSL
0.91 to 3.66m BGS
Material: #2 Silica Sand

SAMPLE

NUMBER	INTERVAL	REC (%)	'N' Value	PID (ppm)
DBW004-0-1				
1		100	4	0.2
DBW004-2-3				
2		100	5	0.0
3		100	0	0.1
4		100	0	0.1
5 DBW004-10-12		100	0	0.1

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
WATER FOUND ⊻ 4/13/2022 STATIC WATER LEVEL ▼ 4/19/2022
CHEMICAL ANALYSIS ◯ GRAIN SIZE ANALYSIS ▭

File: \\GHDNET\GHD\CA\OTTAWA\PROJECTS\662\12575389\TECH\GINT\12575389 ORLEANS H1.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 13/6/22

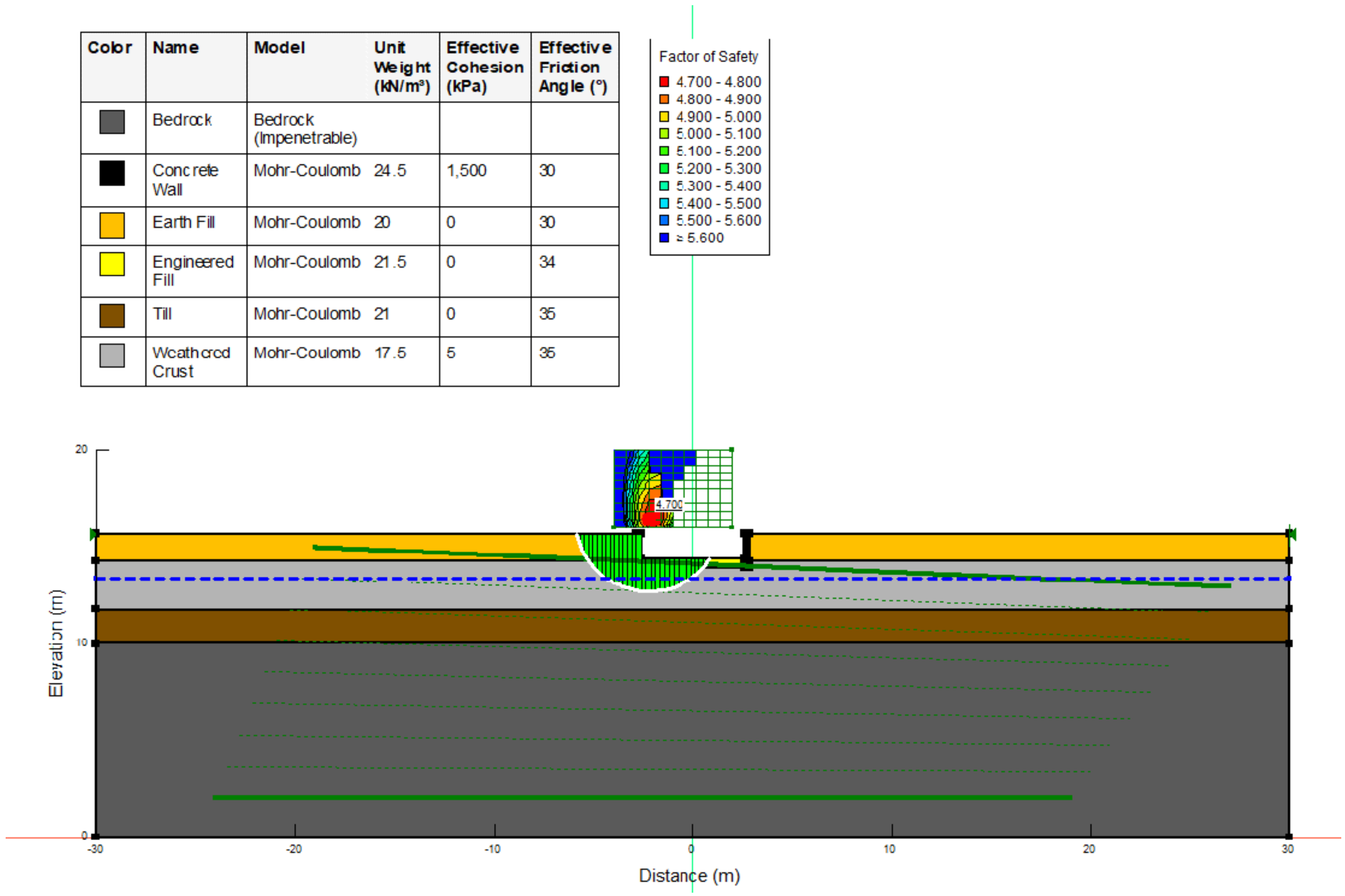
APPENDIX D

Slope Stability Figures

Section AA'

Case 1 – Static Analysis

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Bedrock	Bedrock (Impenetrable)			
	Concrete Wall	Mohr-Coulomb	24.5	1,500	30
	Earth Fill	Mohr-Coulomb	20	0	30
	Engineered Fill	Mohr-Coulomb	21.5	0	34
	Till	Mohr-Coulomb	21	0	35
	Weathered Crust	Mohr-Coulomb	17.5	5	35



Slope Stability Analysis	
D07-12-22-0057-3440 Frank Kenny Road	
Project No:	21490288
Drawn:	KG
Date:	May 20, 2022
Checked:	WC
Review:	WC

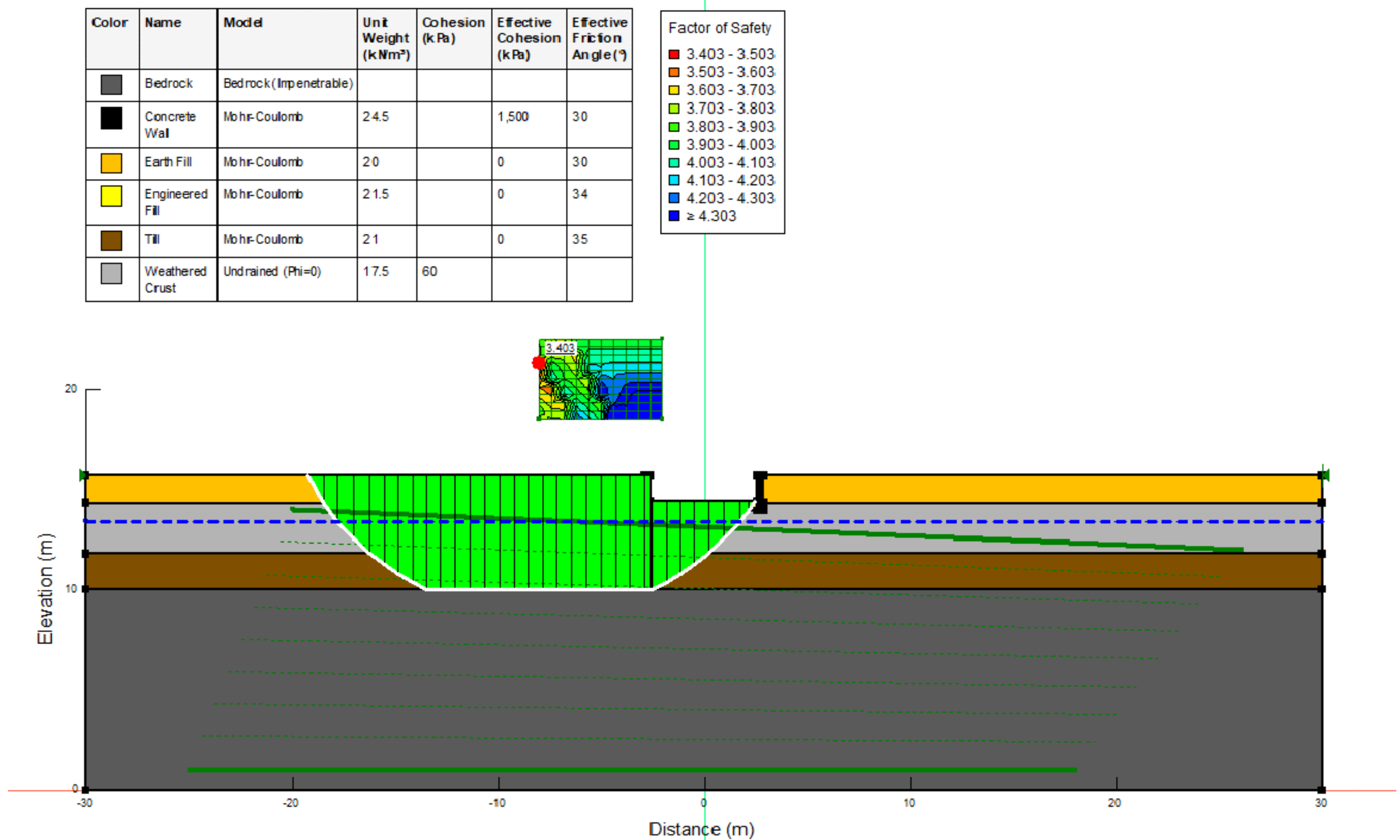
FIGURE 1

Section AA'

Case 2 – Seismic Analysis

Horz Seismic Coef.: 0.201 g
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Cohesion (kPa)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Bedrock	Bedrock (Impenetrable)				
	Concrete Wall	Mohr-Coulomb	24.5		1,500	30
	Earth Fill	Mohr-Coulomb	20		0	30
	Engineered Fill	Mohr-Coulomb	21.5		0	34
	Till	Mohr-Coulomb	21		0	35
	Weathered Crust	Undrained (Phi=0)	17.5	60		



Slope Stability Analysis

D07-12-22-0057-3440 Frank Kenny Road

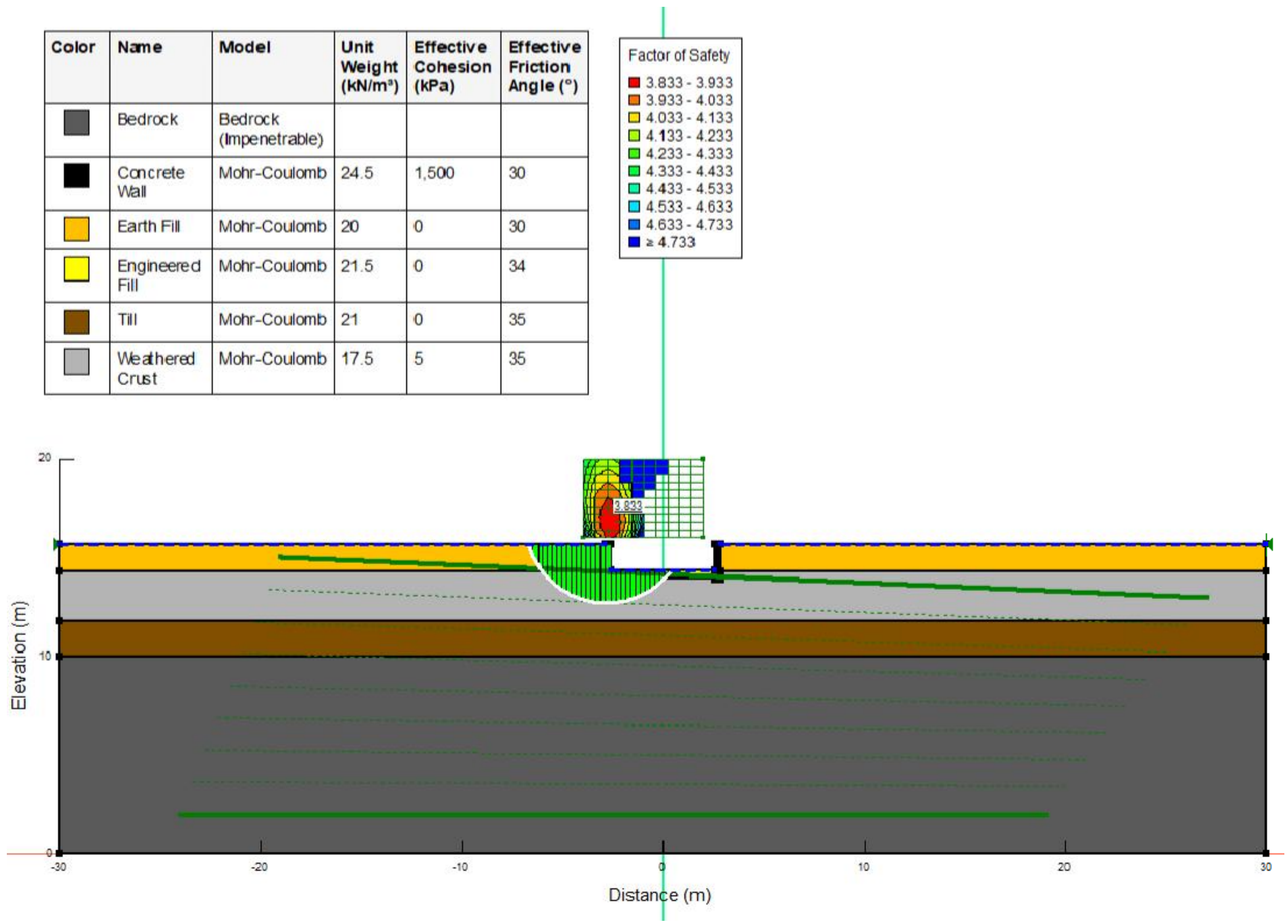
Project No:	21490288
Drawn:	KG
Date:	May 20, 2022
Checked:	WC
Review:	WC

FIGURE 2

Section AA'

Case 1 – Static Analysis

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Bedrock	Bedrock (Impenetrable)			
	Concrete Wall	Mohr-Coulomb	24.5	1,500	30
	Earth Fill	Mohr-Coulomb	20	0	30
	Engineered Fill	Mohr-Coulomb	21.5	0	34
	Till	Mohr-Coulomb	21	0	35
	Weathered Crust	Mohr-Coulomb	17.5	5	35



Slope Stability Analysis

D07-12-22-0057-3440 Frank Kenny Road

Project No:	21490288
Drawn:	KG
Date:	December 12, 2022
Checked:	CH
Reviewed:	CH

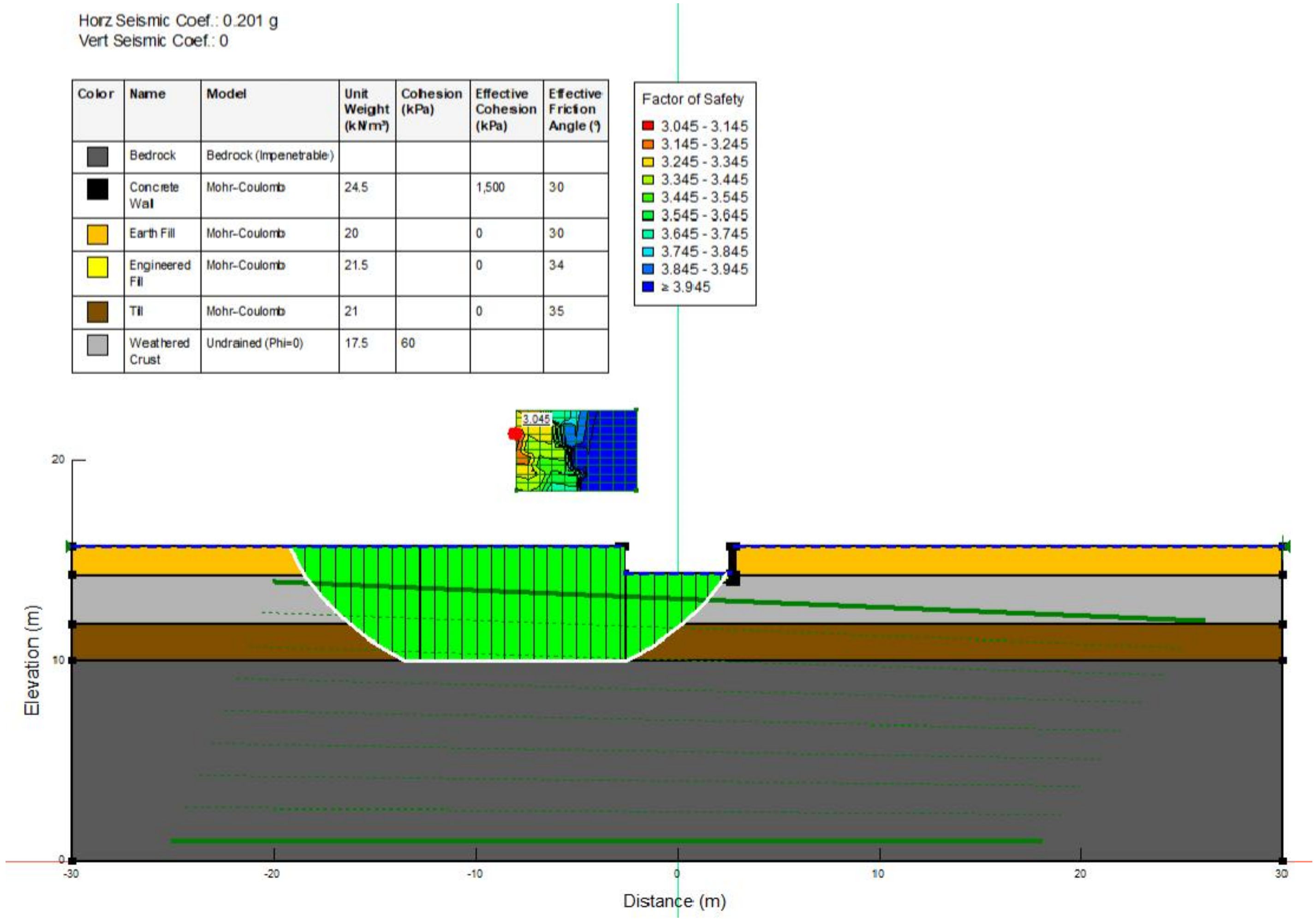
FIGURE 3

Section AA'

Case 2 – Seismic Analysis

Horz Seismic Coef.: 0.201 g
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Cohesion (kPa)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Bedrock	Bedrock (Impenetrable)				
	Concrete Wall	Mohr-Coulomb	24.5		1,500	30
	Earth Fill	Mohr-Coulomb	20		0	30
	Engineered Fill	Mohr-Coulomb	21.5		0	34
	Till	Mohr-Coulomb	21		0	35
	Weathered Crust	Undrained (Phi=0)	17.5	60		



GOLDER

Slope Stability Analysis
D07-12-22-0057-3440 Frank Kenny Road

Project No:	21490288
Drawn:	KG
Date:	December 12, 2022
Checked:	CH
Reviewed:	CH

FIGURE 4

455 Phillip Street, Unit 100A
Waterloo, Ontario N2L 3X2
Canada
www.ghd.com

GHD Reference No: 12575389-LTR-4-Spence

16 November 2022

Mr. David Spence
Hydro One Networks Inc.
230 Bayview Drive
Barrie, Ontario
L4N 4Y8

Hydrogeological Assessment – Amendment
Final Groundwater Level Monitoring
Orleans Operations Centre (OC)
3440 Frank Kenny Road, Navan, Ontario

Dear Mr. Spence,

1. Introduction

GHD Limited (GHD) provide the following long term groundwater level monitoring data and assessment as part of the Hydrogeological Assessment for the proposed construction of the Orleans Operations Centre (OC) located at 3440 Frank Kenny Road in Navan, Ontario (Site or Property) (GHD June 24, 2022)[1]. GHD presented the initial groundwater level monitoring data collected on April 19th, 2022 in the Hydrogeological Assessment and groundwater monitoring letter[2]. This letter presents completion of the groundwater level monitoring over the spring freshet into the fall months from April 2022 to November 2022 for the Site.

This Hydrogeological Assessment Letter presents the completed long term groundwater level monitoring performed on the Site and contains all previous groundwater monitoring data. The hydrogeological interpretations and conclusions presented in this letter supersede and override the understanding of the Site stated in previous reports. It is noted that the updated data does not significantly alter the previous interpretation of the Site.

1.1 Groundwater Level Monitoring

Groundwater level monitoring was undertaken on a seasonal basis to assess the “high” groundwater levels through a wet season (spring) and to determine stable levels and seasonal fluctuations. Groundwater monitoring was observed between April 2022 and November 2022. Manual groundwater level measurements were collected using a water level meter (Solinst Model 101) and DBW003 was equipped with a water level data logger (Solinst Model 3001 – Levelogger Edge). The data logger continuously recorded water levels and

[1] Hydrogeological Assessment – Proposed Development – Orleans Station Yard 3440 Frank Kenny Road, Navan, Ontario. Prepared for Hydro One Networks Inc. Dated June 24,2022.
[2] Hydrogeological Assessment – Amendment, Groundwater Level Monitoring Orleans OC 3440 Frank Kenny Road, Navan, Ontario. Prepared for Hydro One Networks Inc. Dated August 5, 2022.

provide a detailed record of the response of groundwater to climatic conditions throughout the monitoring period.

2. Monitoring Results

2.1 Groundwater Level Monitoring

The high seasonal groundwater levels were observed in April 2022, based on the seasonal groundwater monitoring. The groundwater level contours from the April monitoring event are presented on **Figure 1.0**. The most recent round of groundwater level contours are presented on **Figure 2.0**. Groundwater levels collected from the monitoring wells are presented in **Tables 1 and 2,** and a hydrograph of the groundwater levels alongside precipitation data is presented in **Attachment A1**. The highest and lowest observed groundwater levels recorded by the data logger are presented in **Table 3**.

Groundwater levels measured in metres below ground surface (mBGS) are presented in **Table 1**. Review of the groundwater monitoring data indicates that the groundwater table fluctuated during the monitoring period with seasonal highs occurring during the month of April. The groundwater table was on average 0.85 mBGS at all monitoring wells, ranging from 0.12 mBGS at DBW002 to 1.86 mBGS at DBW001.

Groundwater levels measured in metres above mean sea level (mAMSL) are presented in **Table 2**. Based on review of the groundwater levels collected, the groundwater levels ranged from 84.22 mAMSL at DBW004 to 85.62 mAMSL at DBW001. Based on **Figure 1**, the groundwater flow direction on Site is south to southwest.

Precipitation data collected from the nearby Environment Canada weather station (Ottawa CDA RCS Climate ID: 6105978) was plotted alongside the manual groundwater level measurements and long-term data logger data for the Site (**Attachment A1**). The hydrograph data logger groundwater elevation fluctuations show some correlation with the precipitation data illustrating that the groundwater table on Site is sensitive to and responses to precipitation events.

The seasonal high-water table occurred during the spring period of April 2022, with a high of 85.64 mAMSL at DBW003 based on the data logger data (**Table 3**). The seasonal low occurred during November 2022 with a groundwater level of 84.22 mAMSL at DBW004, according to data logger data and manual measurements.

2.2 Groundwater Elevations – Detailed Design

The manual and electronic (data logger) data was reviewed to determine the high groundwater levels measured over the monitoring period. Based on review of the data, the groundwater table was observed to be very close to ground surface during the spring freshet. Groundwater elevations in April were observed to be within 0.1 m to 0.4 m of the ground surface.

The spring freshet typically begins in late February to early March and the manual and electronic (data logger) data for this Site were not initiated until April, not capturing the full extent of the spring thaw and snowpack melt. A hydrograph of the projected groundwater levels to the early spring period based on the groundwater monitoring trend lines is presented in **Attachment A2**. Based on the 'trend' of the measured groundwater levels, the projected early spring groundwater levels on the site would range from approximately 85 to 86 mAMSL.

To be conservative, a groundwater elevation at ground surface should be considered during detailed design to account for the potential high groundwater elevations during the early part of the spring freshet for each structure. For reference, the table below outlines the surveyed ground elevations at each of the monitoring wells installed in proximity to the proposed Orleans Operations Centre structures.

Structure	Monitoring Well	Ground Surface (mAMSL)
Septic tank	DBW001	85.53*
Fire storage tanks	DBW002	85.58
Building foundation	DBW003	85.64
Stormwater Management facility	DBW004	85.11

*Note – Due to DBW001 being located in a built-up area of fill material, the elevation of the native material is utilized as ground surface

The highest design groundwater level would be 86 mAMSL over the majority of the Site based on the projected groundwater level monitoring (see **Attachment A2**). The stormwater management pond ground surface is at a lower elevation. Based on review of the topography, borehole logs, and measured and projected groundwater levels, a high groundwater level of 85.1 mAMSL in the area of the stormwater management pond is appropriate for design.

Based on our completed monitoring through the spring freshet into the fall months of 2022, the updated monitoring does not significantly alter the previous hydrogeological interpretations for the Site. The highest groundwater elevations occurred during the spring freshet and the detailed design groundwater elevations are considered to be reasonable extrapolated elevations based on the long-term monitoring completed for the Site.

Please do not hesitate to contact us, should you have any question or require clarification.

Regards,

GHD

PROFESSIONAL GEOSCIENTIST
MICHAEL MCKERRALL
PRACTISING MEMBER
3644
11/16/2022
ONTARIO

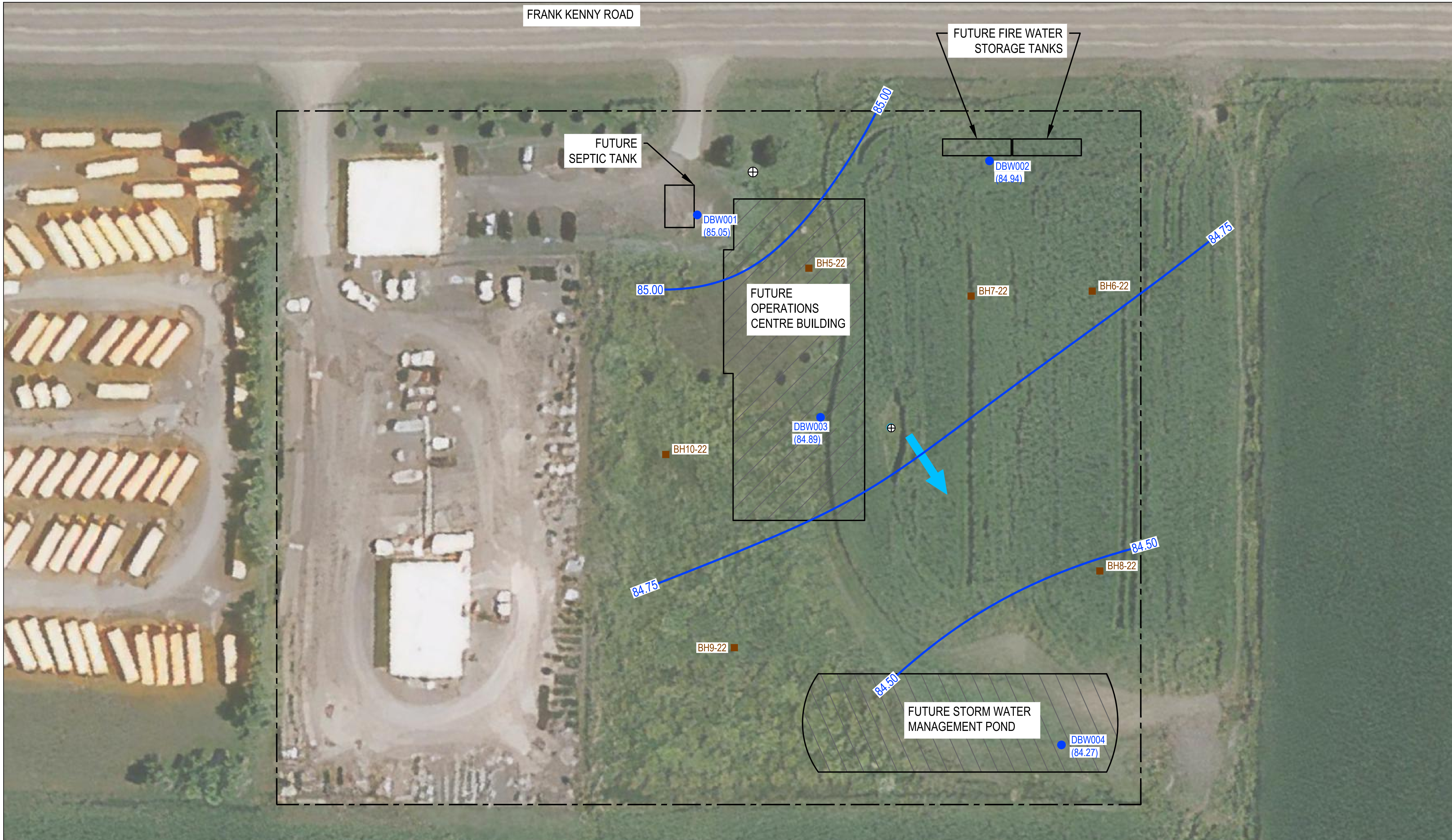
PROFESSIONAL GEOSCIENTIST
PHILIP J. SMART
PRACTISING MEMBER
0286
11/16/2022
ONTARIO

Michael McKerrall, P. Geo.

Philip Smart, MSc., P. Geo.

Encl.

Figures



LEGEND

- MONITORING WELL
- BOREHOLE LOCATIONS
- POTABLE/SUPPLY WELL

(85.22) GROUNDWATER ELEVATION (mAMSL)
85.25 GROUNDWATER ELEVATION CONTOUR (mAMSL)
GROUNDWATER FLOW DIRECTION
mAMSL METRES ABOVE MEAN SEA LEVEL

0 7.5 15 22.5m
1:750
Coordinate System: UTM83-18

HYDRO ONE NETWORKS INC.
3440 FRANK KENNY DR, NAVAN, ONTARIO
HYDROGEOLOGICAL ASSESSMENT

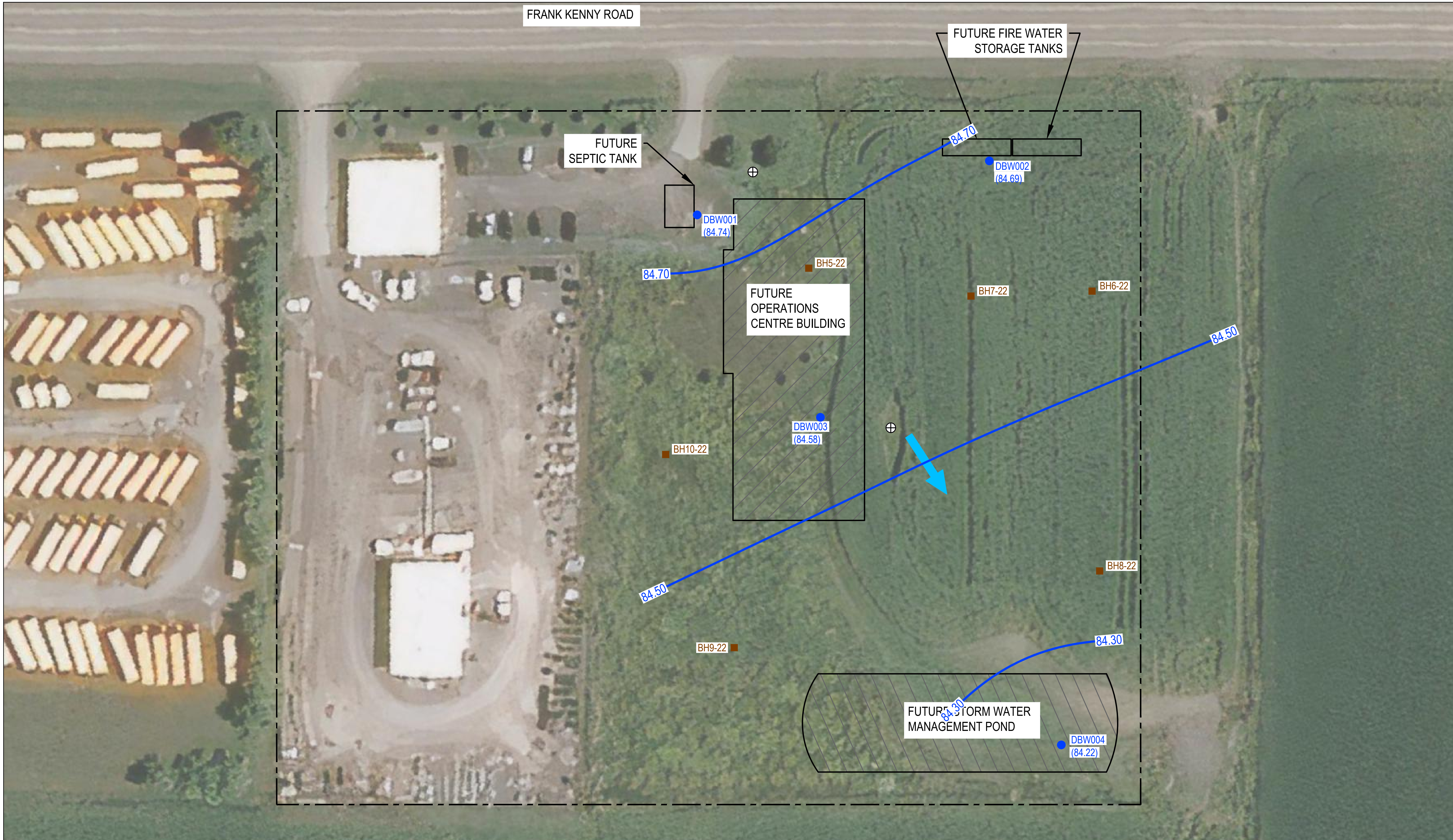
GHD

GROUNDWATER ELEVATION CONTOURS
JULY 7, 2022

Project No. 12575389
Date July 2022

FIGURE 1.0

Filename: \\ghdnet\ghd\CA\Ottawa\Projects\662\12575389\Digital_Design\ACAD\Figures\PRE002\12575389-GHD-00-00-PRE-EN-D101_WA-002.dwg
Plot Date: 22 July 2022 12:58 PM



LEGEND

- MONITORING WELL
- BOREHOLE LOCATIONS
- POTABLE/SUPPLY WELL

(84.74)	GROUNDWATER ELEVATION (mAMSL)
84.50	GROUNDWATER ELEVATION CONTOUR (mAMSL)
	GROUNDWATER FLOW DIRECTION
mAMSL	METRES ABOVE MEAN SEA LEVEL

0 7.5 15 22.5m
1:750
Coordinate System: UTM83-18

GHD

HYDRO ONE NETWORKS INC.
3440 FRANK KENNY DR, NAVAN, ONTARIO
HYDROGEOLOGICAL ASSESSMENT

GROUNDWATER ELEVATION CONTOURS
NOVEMBER 1, 2022

Project No. 12575389
Date November 2022

FIGURE 2.0

Filename: N:\CA\Ottawa\Projects\662\12575389\Digital_Design\ACAD\Figures\LTR004-ORLEANS\12575389-GHD-00-00-LTR-EN-D101_WA-ORLEANS004.dwg
Plot Date: 09 November 2022 3:34 PM

Tables

Table 1

Groundwater Elevations (mBGS)
Hydrogeological Assessment
3440 Frank Kenny Road, Navan, Ontario
Hydro One Networks Inc.

	DBW001	**DBW002**	**DBW003**	**DBW004**
Top of Riser (mAMSL)	86.47	86.51	86.54	86.10
Ground Surface (mAMSL)	86.60	85.58	85.64	85.11
19-Apr-22	0.98	0.12	0.22	0.38
7-Jul-22	1.55	0.64	0.75	0.84
1-Nov-22	1.86	0.89	1.06	0.89

Notes:

-	No data available
mBGS	metres below ground surface
mAMSL	metres above mean sea level

Table 2

Groundwater Elevations (mAMSL)
Hydrogeological Assessment
3440 Frank Kenny Road, Navan, Ontario
Hydro One Networks Inc.

	DBW001	DBW002	DBW003	DBW004
Top of Riser (mAMSL)	86.47	86.51	86.54	86.10
Ground Surface (mAMSL)	86.60	85.58	85.64	85.11
19-Apr-22	85.62	85.46	85.42	84.73
7-Jul-22	85.05	84.94	84.89	84.27
1-Nov-22	84.74	84.69	84.58	84.22

Notes:

-	No data available
mBGS	metres below ground surface
mAMSL	metres above mean sea level

Table 3

Logger Elevations (mAMSL)
Hydrogeological Assessment
3440 Frank Kenny Road, Navan, Ontario
Hydro One Networks Inc.

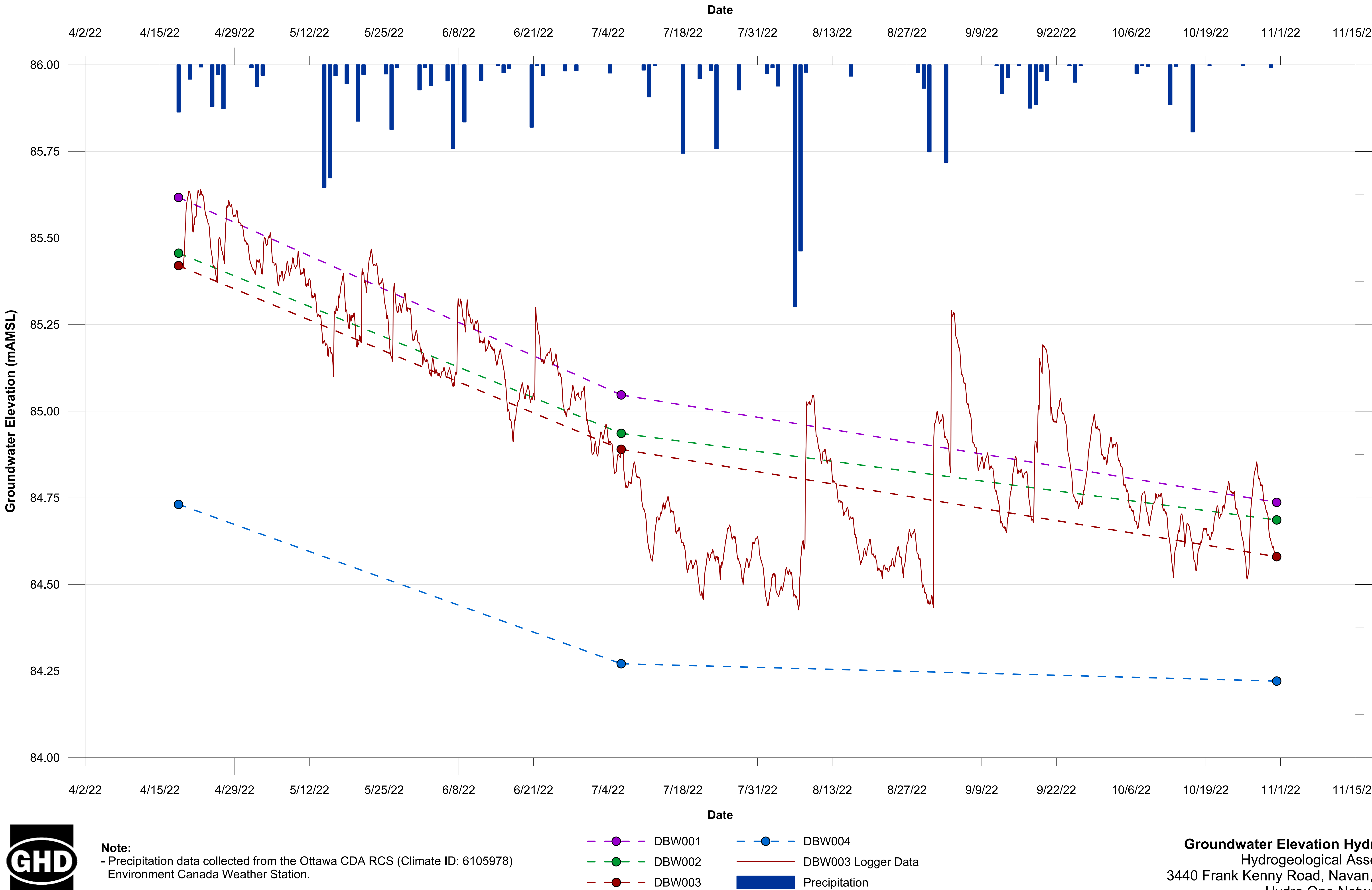
Highest / Lowest	Monitoring Well ID	Date	Groundwater Elevation (mAMSL)
Highest recorded logger groundwater elevation during the monitoring period (April 19th to November 1st, 2022)	**DBW003**	Friday, April 22, 2022	85.64
Lowest recorded logger groundwater elevation during the monitoring period (April 19th to November 1st, 2022)	**DBW003**	Wednesday, August 31, 2022	84.43

Notes:
mAMSL meters above mean sea level

Attachments

Attachment A1

Hydrograph

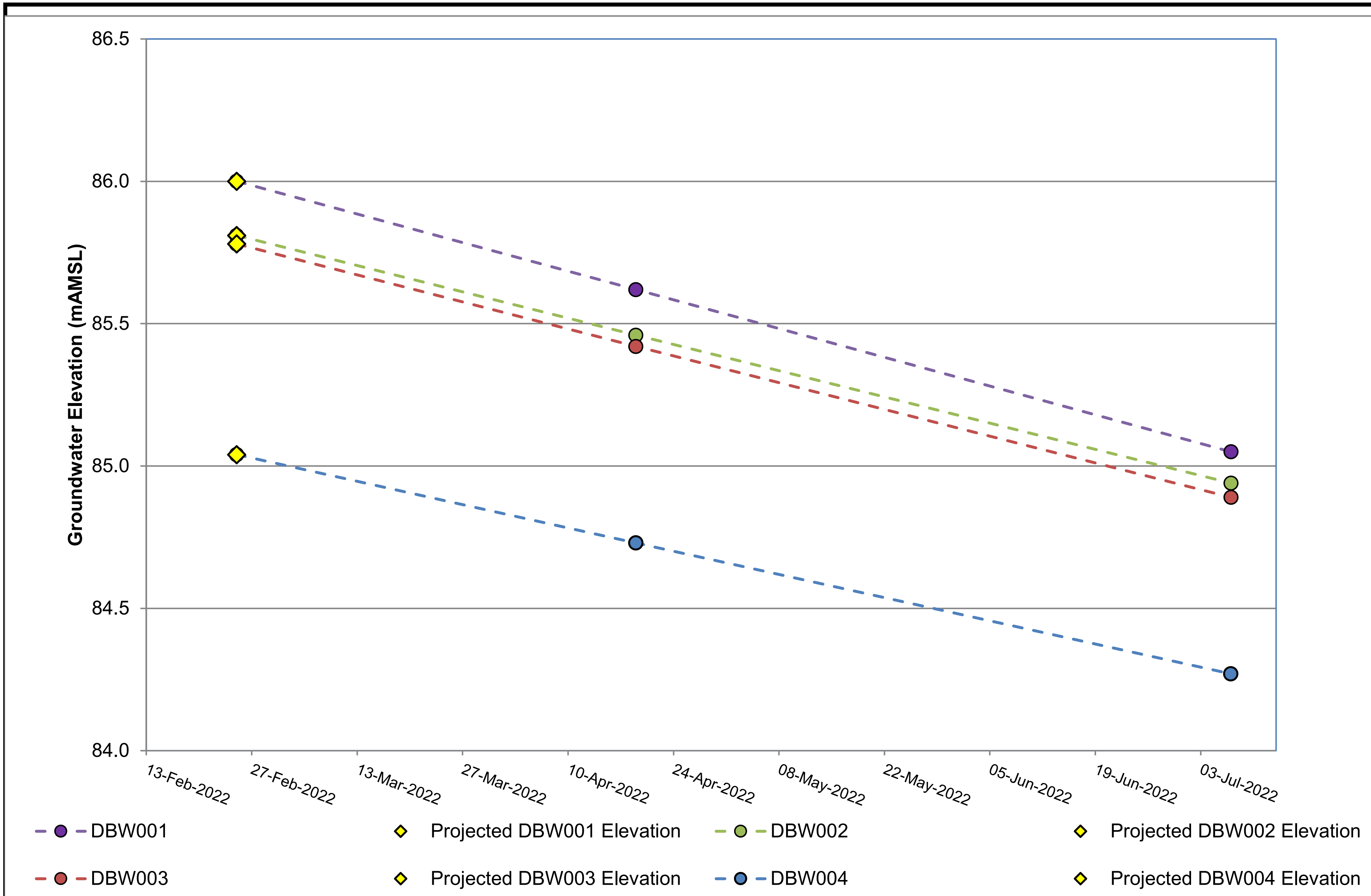


Note:
- Precipitation data collected from the Ottawa CDA RCS (Climate ID: 6105978) Environment Canada Weather Station.

Groundwater Elevation Hydrograph
Hydrogeological Assessment
3440 Frank Kenny Road, Navan, Ontario
Hydro One Networks Inc.

Attachment A2

Projected Early Spring Freshet Groundwater Elevations



Projected Early Spring Freshet Groundwater Elevations

Hydrogeological Assessment
3440 Frank Kenny Road, Navan, Ontario
Hydro One Networks Inc.

Appendix E

Storm Management
Facility Design
Information

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2000
START_TIME           00:00:00
REPORT_START_DATE    01/01/2000
REPORT_START_TIME    00:00:00
END_DATE             01/02/2000
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     NONE
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
Rainfall         INTENSITY 0:10     1.0      TIMESERIES 3CHI100

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- ---
----- -------- ----------------
S1               Rainfall         OF1              2.0128   0        231.963  
0.707    0
S2               Rainfall         OF2              0.5001   0        151.84   
2.06     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo   
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------
- ----------
S1               0.013      0.25       1.57       4.67       0          OUTLET
S2               0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
S1               82         12.7       7          0          0
S2               82         12.7       7          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OF1              84.3       NORMAL                      NO
OF2              85.41      NORMAL                      NO

[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.025    0.035    0.035
X1 Ditch-1           24       8        16       0.0      0.0      0.0      0.0
0.0
GR 86.917   0        86.882   1        86.858   2        86.805   3        86.716
4
GR 86.682   5        86.569   6        86.361   7        86.102   8        85.757
9
GR 85.502   10       85.449   11       85.551   12       85.706   13       85.759
14
GR 85.792   15       85.902   16       86.026   17       86.115   18       86.179
19
GR 86.235   20       86.253   21       86.251   22       86.24    23.52895103
;
NC 0.025    0.035    0.035
X1 Ditch-2           22       9        13       0.0      0.0      0.0      0.0
0.0
GR 86.731   0        86.719   1        86.68    2        86.594   3        86.588
4
GR 86.552   5        86.475   6        86.273   7        85.934   8        85.596
9
GR 85.29    10       85.183   11       85.307   12       85.423   13       85.433
14
GR 85.454   15       85.502   16       85.535   17       85.548   18       85.552
19
GR 85.544   20       85.536   21.97530921
;
NC 0.045    0.045    0.035
X1 Ditch-3           13       4        9        0.0      0.0      0.0      0.0
0.0
GR 84.969   0        84.961   1        84.979   2        84.985   3        84.912
4
GR 84.708   5        84.554   6        84.63    7        84.816   8        84.926
9
GR 84.953   10       84.961   11       84.976   12.4337141

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Rainfall (mm/hr)
3CHI10           01/01/2000 00:00:00   3.755
3CHI10           01/01/2000 00:10:00   4.478
3CHI10           01/01/2000 00:20:00   5.593
3CHI10           01/01/2000 00:30:00   7.551
3CHI10           01/01/2000 00:40:00   11.936
3CHI10           01/01/2000 00:50:00   30.856
3CHI10           01/01/2000 01:00:00   122.142
3CHI10           01/01/2000 01:10:00   35.237
3CHI10           01/01/2000 01:20:00   18.159
3CHI10           01/01/2000 01:30:00   12.238
3CHI10           01/01/2000 01:40:00   9.269
3CHI10           01/01/2000 01:50:00   7.492
3CHI10           01/01/2000 02:00:00   6.309
3CHI10           01/01/2000 02:10:00   5.465
3CHI10           01/01/2000 02:20:00   4.831
3CHI10           01/01/2000 02:30:00   4.338
3CHI10           01/01/2000 02:40:00   3.942
3CHI10           01/01/2000 02:50:00   3.617
3CHI10           01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI100          01/01/2000 00:00:00   5.339
3CHI100          01/01/2000 00:10:00   6.376
3CHI100          01/01/2000 00:20:00   7.977
3CHI100          01/01/2000 00:30:00   10.797
3CHI100          01/01/2000 00:40:00   17.136
3CHI100          01/01/2000 00:50:00   45.128
3CHI100          01/01/2000 01:00:00   178.107
3CHI100          01/01/2000 01:10:00   51.056
3CHI100          01/01/2000 01:20:00   26.163
3CHI100          01/01/2000 01:30:00   17.571
3CHI100          01/01/2000 01:40:00   13.277
3CHI100          01/01/2000 01:50:00   10.712
3CHI100          01/01/2000 02:00:00   9.008
3CHI100          01/01/2000 02:10:00   7.793
3CHI100          01/01/2000 02:20:00   6.883
3CHI100          01/01/2000 02:30:00   6.174
3CHI100          01/01/2000 02:40:00   5.607
3CHI100          01/01/2000 02:50:00   5.142
3CHI100          01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI120          01/01/2000 00:00:00   6.406801
3CHI120          01/01/2000 00:10:00   7.6512
3CHI120          01/01/2000 00:20:00   9.572401
3CHI120          01/01/2000 00:30:00   12.9564
3CHI120          01/01/2000 00:40:00   20.5632
3CHI120          01/01/2000 00:50:00   54.1536
3CHI120          01/01/2000 01:00:00   213.7284
3CHI120          01/01/2000 01:10:00   61.2672
3CHI120          01/01/2000 01:20:00   31.3956
3CHI120          01/01/2000 01:30:00   21.0852
3CHI120          01/01/2000 01:40:00   15.9324
3CHI120          01/01/2000 01:50:00   12.8544
3CHI120          01/01/2000 02:00:00   10.8096
3CHI120          01/01/2000 02:10:00   9.351601
3CHI120          01/01/2000 02:20:00   8.259601
3CHI120          01/01/2000 02:30:00   7.4088
3CHI120          01/01/2000 02:40:00   6.7284
3CHI120          01/01/2000 02:50:00   6.170401
3CHI120          01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI2            01/01/2000 00:00:00   2.491
3CHI2            01/01/2000 00:10:00   2.966
3CHI2            01/01/2000 00:20:00   3.696
3CHI2            01/01/2000 00:30:00   4.976
3CHI2            01/01/2000 00:40:00   7.828
3CHI2            01/01/2000 00:50:00   19.966
3CHI2            01/01/2000 01:00:00   76.805
3CHI2            01/01/2000 01:10:00   22.777
3CHI2            01/01/2000 01:20:00   11.852
3CHI2            01/01/2000 01:30:00   8.025
3CHI2            01/01/2000 01:40:00   6.096
3CHI2            01/01/2000 01:50:00   4.938
3CHI2            01/01/2000 02:00:00   4.165
3CHI2            01/01/2000 02:10:00   3.613
3CHI2            01/01/2000 02:20:00   3.197
3CHI2            01/01/2000 02:30:00   2.873
3CHI2            01/01/2000 02:40:00   2.613
3CHI2            01/01/2000 02:50:00   2.4
3CHI2            01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI25           01/01/2000 00:00:00   4.358
3CHI25           01/01/2000 00:10:00   5.202
3CHI25           01/01/2000 00:20:00   6.506
3CHI25           01/01/2000 00:30:00   8.801
3CHI25           01/01/2000 00:40:00   13.954
3CHI25           01/01/2000 00:50:00   36.302
3CHI25           01/01/2000 01:00:00   144.693
3CHI25           01/01/2000 01:10:00   41.479
3CHI25           01/01/2000 01:20:00   21.286
3CHI25           01/01/2000 01:30:00   14.308
3CHI25           01/01/2000 01:40:00   10.818
3CHI25           01/01/2000 01:50:00   8.732
3CHI25           01/01/2000 02:00:00   7.345
3CHI25           01/01/2000 02:10:00   6.356
3CHI25           01/01/2000 02:20:00   5.615
3CHI25           01/01/2000 02:30:00   5.038
3CHI25           01/01/2000 02:40:00   4.576
3CHI25           01/01/2000 02:50:00   4.197
3CHI25           01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI5            01/01/2000 00:00:00   3.256
3CHI5            01/01/2000 00:10:00   3.881
3CHI5            01/01/2000 00:20:00   4.844
3CHI5            01/01/2000 00:30:00   6.532
3CHI5            01/01/2000 00:40:00   10.308
3CHI5            01/01/2000 00:50:00   26.792
3CHI5            01/01/2000 01:00:00   103.93
3CHI5            01/01/2000 01:10:00   30.286
3CHI5            01/01/2000 01:20:00   15.655
3CHI5            01/01/2000 01:30:00   10.568
3CHI5            01/01/2000 01:40:00   8.013
3CHI5            01/01/2000 01:50:00   6.482
3CHI5            01/01/2000 02:00:00   5.462
3CHI5            01/01/2000 02:10:00   4.733
3CHI5            01/01/2000 02:20:00   4.186
3CHI5            01/01/2000 02:30:00   3.76
3CHI5            01/01/2000 02:40:00   3.418
3CHI5            01/01/2000 02:50:00   3.137
3CHI5            01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI50           01/01/2000 00:00:00   4.828
3CHI50           01/01/2000 00:10:00   5.766
3CHI50           01/01/2000 00:20:00   7.214
3CHI50           01/01/2000 00:30:00   9.763
3CHI50           01/01/2000 00:40:00   15.496
3CHI50           01/01/2000 00:50:00   40.401
3CHI50           01/01/2000 01:00:00   161.471
3CHI50           01/01/2000 01:10:00   46.17
3CHI50           01/01/2000 01:20:00   23.66
3CHI50           01/01/2000 01:30:00   15.89
3CHI50           01/01/2000 01:40:00   12.006
3CHI50           01/01/2000 01:50:00   9.687
3CHI50           01/01/2000 02:00:00   8.146
3CHI50           01/01/2000 02:10:00   7.047
3CHI50           01/01/2000 02:20:00   6.224
3CHI50           01/01/2000 02:30:00   5.583
3CHI50           01/01/2000 02:40:00   5.07
3CHI50           01/01/2000 02:50:00   4.649
3CHI50           01/01/2000 03:00:00   0

;Rainfall (mm/hr)
4hr-25mm         01/01/2000 00:00:00   1.777
4hr-25mm         01/01/2000 00:15:00   2.357
4hr-25mm         01/01/2000 00:30:00   3.618
4hr-25mm         01/01/2000 00:45:00   8.975
4hr-25mm         01/01/2000 01:00:00   45.631
4hr-25mm         01/01/2000 01:15:00   11.911
4hr-25mm         01/01/2000 01:30:00   6.051
4hr-25mm         01/01/2000 01:45:00   4.108
4hr-25mm         01/01/2000 02:00:00   3.138
4hr-25mm         01/01/2000 02:15:00   2.555
4hr-25mm         01/01/2000 02:30:00   2.165
4hr-25mm         01/01/2000 02:45:00   1.885
4hr-25mm         01/01/2000 03:00:00   1.675
4hr-25mm         01/01/2000 03:15:00   1.509
4hr-25mm         01/01/2000 03:30:00   1.376
4hr-25mm         01/01/2000 03:45:00   1.266

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
```

```
[MAP]
DIMENSIONS       467683.7855      5030267.4602     467898.8685      5030526.6598
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OF1              467770.833         5030279.242
OF2              467862.637         5030430.33

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
S1               467880.085         5030372.188
S1               467889.092         5030349.635
S1               467841.611         5030331.394
S1               467839.414         5030329.19
S1               467757.573         5030298.19
S1               467693.562         5030464.924
S1               467800.598         5030506.231
S1               467805.604         5030490.787
S1               467809.594         5030467.675
S1               467819.441         5030443.138
S1               467823.556         5030439.654
S1               467825.307         5030437.242
S1               467817.071         5030434.168
S1               467820.274         5030426.487
S1               467827.355         5030428.933
S1               467827.837         5030427.572
S1               467835.566         5030406.949
S1               467833.049         5030402.369
S1               467816.278         5030386.339
S1               467825.652         5030371.224
S1               467880.085         5030372.188
S2               467827.355         5030428.933
S2               467820.274         5030426.487
S2               467817.071         5030434.169
S2               467825.307         5030437.242
S2               467823.556         5030439.654
S2               467819.441         5030443.138
S2               467809.594         5030467.675
S2               467805.604         5030490.787
S2               467800.598         5030506.231
S2               467824.746         5030514.878
S2               467856.724         5030432.479
S2               467880.085         5030372.188
S2               467825.652         5030371.224
S2               467816.278         5030386.339
S2               467833.049         5030402.369
S2               467835.566         5030406.949
S2               467827.837         5030427.572
S2               467827.355         5030428.933

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 2
  Number of nodes ........... 2
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ------------------------------------------------------------------------
  Rainfall             3CHI100                        INTENSITY    10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                       Area     Width   %Imperv    %Slope Rain Gage
Outlet
  -----------------------------------------------------------------------------
----------------------------
  S1                         2.01    231.96      0.00    0.7070 Rainfall
OF1
  S2                         0.50    151.84      0.00    2.0600 Rainfall
OF2


  ************
  Node Summary
  ************
                                           Invert      Max.    Ponded    External
  Name                 Type                 Elev.     Depth      Area    Inflow
  -------------------------------------------------------------------------------
  OF1                  OUTFALL              84.30      0.00       0.0
  OF2                  OUTFALL              85.41      0.00       0.0


  ****************
  Transect Summary
  ****************

  Transect Ditch-1
  Area:
            0.0007     0.0028     0.0059     0.0095     0.0138
            0.0185     0.0238     0.0295     0.0358     0.0431
            0.0515     0.0614     0.0722     0.0836     0.0955
            0.1081     0.1211     0.1348     0.1490     0.1637
            0.1791     0.1952     0.2120     0.2297     0.2484
            0.2681     0.2890     0.3151     0.3424     0.3700
            0.3978     0.4257     0.4539     0.4824     0.5111
            0.5400     0.5691     0.5985     0.6282     0.6584
            0.6890     0.7200     0.7520     0.7851     0.8187
            0.8530     0.8879     0.9237     0.9610     1.0000
  Hrad:
            0.0160     0.0336     0.0555     0.0769     0.0980
            0.1181     0.1373     0.1559     0.1703     0.1753
            0.1788     0.1867     0.2076     0.2279     0.2478
            0.2679     0.2881     0.3079     0.3274     0.3454
            0.3610     0.3767     0.3933     0.4070     0.4204
            0.4318     0.4346     0.3771     0.4082     0.4393
            0.4703     0.5011     0.5318     0.5624     0.5930
            0.6235     0.6540     0.6844     0.7138     0.7429
            0.7719     0.8008     0.8243     0.8515     0.8792
            0.9069     0.9327     0.9578     0.9777     1.0000
  Width:
            0.0358     0.0679     0.0850     0.1000     0.1129
            0.1259     0.1388     0.1518     0.1685     0.1970
            0.2310     0.2641     0.2790     0.2940     0.3089
            0.3232     0.3369     0.3505     0.3642     0.3793
            0.3969     0.4145     0.4348     0.4591     0.4838
            0.5109     0.5590     0.6877     0.6926     0.6974
            0.7022     0.7081     0.7141     0.7201     0.7261
            0.7321     0.7381     0.7441     0.7544     0.7655
            0.7765     0.7876     0.8243     0.8419     0.8559
            0.8699     0.8917     0.9155     0.9643     1.0000

  Transect Ditch-2
  Area:
            0.0004     0.0017     0.0039     0.0069     0.0105
            0.0147     0.0195     0.0250     0.0333     0.0431
            0.0543     0.0695     0.0903     0.1112     0.1323
            0.1536     0.1750     0.1965     0.2182     0.2400
            0.2620     0.2842     0.3064     0.3289     0.3514
            0.3742     0.3970     0.4200     0.4432     0.4665
            0.4900     0.5136     0.5373     0.5612     0.5853
            0.6095     0.6340     0.6587     0.6837     0.7089
            0.7343     0.7601     0.7863     0.8132     0.8410
            0.8708     0.9019     0.9337     0.9661     1.0000
  Hrad:
            0.0134     0.0268     0.0401     0.0558     0.0719
            0.0872     0.1021     0.0980     0.0964     0.1105
            0.1213     0.0900     0.1159     0.1424     0.1690
            0.1954     0.2218     0.2482     0.2745     0.3007
            0.3269     0.3531     0.3792     0.4052     0.4312
            0.4572     0.4832     0.5091     0.5350     0.5608
            0.5867     0.6124     0.6382     0.6639     0.6896
            0.7145     0.7392     0.7639     0.7886     0.8131
            0.8377     0.8611     0.8818     0.9026     0.9191
            0.9294     0.9504     0.9714     0.9896     1.0000
  Width:
            0.0245     0.0491     0.0736     0.0935     0.1102
            0.1270     0.1437     0.1924     0.2603     0.2943
            0.3375     0.5843     0.5889     0.5932     0.5974
            0.6015     0.6057     0.6099     0.6140     0.6182
            0.6224     0.6265     0.6307     0.6349     0.6390
            0.6432     0.6474     0.6515     0.6557     0.6598
            0.6640     0.6681     0.6723     0.6764     0.6806
            0.6870     0.6940     0.7009     0.7079     0.7149
            0.7219     0.7319     0.7502     0.7685     0.8031
            0.8704     0.8868     0.9032     0.9324     1.0000

  Transect Ditch-3
  Area:
            0.0005     0.0020     0.0045     0.0079     0.0124
            0.0179     0.0243     0.0318     0.0402     0.0494
            0.0592     0.0695     0.0805     0.0921     0.1043
            0.1170     0.1304     0.1444     0.1589     0.1739
            0.1895     0.2056     0.2222     0.2393     0.2569
            0.2751     0.2938     0.3130     0.3327     0.3529
            0.3737     0.3952     0.4174     0.4403     0.4639
            0.4882     0.5132     0.5389     0.5654     0.5925
            0.6204     0.6490     0.6787     0.7100     0.7439
            0.7804     0.8205     0.8699     0.9314     1.0000
  Hrad:
            0.0195     0.0389     0.0584     0.0778     0.0973
            0.1168     0.1362     0.1557     0.1765     0.2029
            0.2285     0.2533     0.2775     0.3013     0.3246
            0.3475     0.3702     0.3928     0.4169     0.4408
            0.4643     0.4875     0.5105     0.5333     0.5558
            0.5782     0.6004     0.6224     0.6443     0.6661
            0.6841     0.7001     0.7162     0.7325     0.7490
            0.7657     0.7825     0.7995     0.8165     0.8337
            0.8511     0.8718     0.8954     0.9283     0.9592
            0.9863     1.0076     1.0157     1.0092     1.0000
  Width:
            0.0136     0.0272     0.0409     0.0545     0.0681
            0.0817     0.0954     0.1090     0.1216     0.1299
            0.1381     0.1463     0.1545     0.1628     0.1710
            0.1792     0.1875     0.1955     0.2027     0.2098
            0.2169     0.2240     0.2312     0.2383     0.2454
            0.2525     0.2597     0.2668     0.2739     0.2810
            0.2897     0.2994     0.3091     0.3188     0.3285
            0.3382     0.3479     0.3576     0.3673     0.3770
            0.3867     0.3993     0.4151     0.4473     0.4824
            0.5176     0.5962     0.7745     0.8984     1.0000


  *********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  *********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... CURVE_NUMBER
  Surcharge Method ......... EXTRAN
  Starting Date ............ 01/01/2000 00:00:00
  Ending Date .............. 01/02/2000 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.180        71.708
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.097        38.576
  Surface Runoff ...........         0.080        32.015
  Final Storage ............         0.003         1.254
  Continuity Error (%) .....        -0.191


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.080         0.805
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........         0.080         0.805
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....         0.000


  ***************************
  Subcatchment Runoff Summary
  ***************************

  -----------------------------------------------------------------------------
---------------------------------------------
                             Total      Total      Total      Total     Imperv
Perv      Total         Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff        Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm
mm         mm    10^6 ltr       LPS
  -----------------------------------------------------------------------------
---------------------------------------------
  S1                         71.71       0.00       0.00      39.10       0.00
31.43      31.43         0.63   102.72   0.438
  S2                         71.71       0.00       0.00      36.47       0.00
34.36      34.36         0.17    62.14   0.479


  Analysis begun on:  Thu Dec  8 14:06:27 2022
  Analysis ended on:  Thu Dec  8 14:06:27 2022
  Total elapsed time: < 1 sec
```

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2000
START_TIME           00:00:00
REPORT_START_DATE    01/01/2000
REPORT_START_TIME    00:00:00
END_DATE             01/02/2000
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     NONE
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
Rainfall         INTENSITY 0:10     1.0      TIMESERIES 3CHI100

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- ---
----- -------- ----------------
S1               Rainfall         J3               1.0934   0.203    107.73
0.732    0
S2               Rainfall         OF2              0.3791   13.809   151      2
0
S4               Rainfall         Pond             0.9001   60.917   57.019   1
0
S5               Rainfall         Pond             0.1409   45.676   125.44
33.33    0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------
- ----------
S1               0.013      0.25       1.57       4.67       0          OUTLET
S2               0.013      0.25       1.57       4.67       0          OUTLET
S4               0.013      0.25       1.57       4.67       0          OUTLET
S5               0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
S1               85.941     12.7       7          0          0
S2               85.603     12.7       7          0          0
S4               81.996     12.7       7          0          0
S5               83.693     12.7       7          0          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
Ditch            84.3       1          0.88       0          0
J1               85.5       0.7        0          0          0
J2               85.3       0.9        0          0          0
J3               84.74      1.26       0.44       0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OF1              84.28      FIXED      85.18            NO
OF2              85.41      FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ----------------------
------ -------- --------          -------- --------
Pond             85.5     0.7        0          TABULAR    EX_Pond
0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- --------
-- ---------- ---------- ----------
C1               J1               J2               4.651      0.013      85.5
85.3       0          0
C3               Ditch            OF1              6.69       0.013      84.3
84.28      0          0
CULV-1           J3               Ditch            16         0.024      84.74
84.68      0          0
Interim_Ditch    J2               J3               57.531     0.013      85.3
84.74      0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ------
---- -------- ----------
OR1              Pond             J1               SIDE         85.5       0.65
NO       0
OR2              Pond             J1               SIDE         85.75      0.65
NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ------
---- -------- -------- ---------- ---------- ---------- ---------- -------------
--
1                Pond             J1               TRAPEZOIDAL  85.9       1.87
NO       0        0          NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- -
--------- ----------
C1               CIRCULAR     0.525            0          0          0          1
C3               IRREGULAR    Ditch            0          0          0          1
CULV-1           ARCH         0.5              0.68       0          0          1
47
Interim_Ditch    IRREGULAR    Interim_Ditch    0          0          0          1
OR1              CIRCULAR     0.15             0          0          0
OR2              CIRCULAR     0.15             0          0          0
1                TRAPEZOIDAL  0.3              0.75       3          3

[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.035    0.035    0.025
X1 Ditch             8        0.0      6        0.0      0.0      0.0      0.0
0.0
GR 84.64    0        84.582   1        84.43    2        84.317   3        84.331
4
GR 84.521   5        84.719   6        84.801   7.55792774357109
;
NC 0.045    0.045    0.035
X1 Interim_Ditch     8        3.6      6.5      0.0      0.0      0.0      0.0
0.0
GR 0.5      0        0.3      0.6      0.2      3.6      0        4.2      0
5.9
GR 0.2      6.5      0.3      9.5      0.5      10.1

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
C1               0          0.045      0          NO         0
CULV-1           0.9        0.5        0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
;From Phase 1 Report - SWMHYMO model Curve
EX_Pond          Storage    0          0
EX_Pond                     0.15       575
EX_Pond                     0.2        983
EX_Pond                     0.25       1013
EX_Pond                     0.3        1043
EX_Pond                     0.35       1073
EX_Pond                     0.4        1103
EX_Pond                     0.41       1109
EX_Pond                     0.42       1115
EX_Pond                     0.43       1121
EX_Pond                     0.44       1127
EX_Pond                     0.442      1129
EX_Pond                     0.444      1130
EX_Pond                     0.45       1134
EX_Pond                     0.5        1164
EX_Pond                     0.55       1194
EX_Pond                     0.6        1224
EX_Pond                     0.65       1254
EX_Pond                     0.7        1284

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Rainfall (mm/hr)
3CHI10           01/01/2000 00:00:00   3.755
3CHI10           01/01/2000 00:10:00   4.478
3CHI10           01/01/2000 00:20:00   5.593
3CHI10           01/01/2000 00:30:00   7.551
3CHI10           01/01/2000 00:40:00   11.936
3CHI10           01/01/2000 00:50:00   30.856
3CHI10           01/01/2000 01:00:00   122.142
3CHI10           01/01/2000 01:10:00   35.237
3CHI10           01/01/2000 01:20:00   18.159
3CHI10           01/01/2000 01:30:00   12.238
3CHI10           01/01/2000 01:40:00   9.269
3CHI10           01/01/2000 01:50:00   7.492
3CHI10           01/01/2000 02:00:00   6.309
3CHI10           01/01/2000 02:10:00   5.465
3CHI10           01/01/2000 02:20:00   4.831
3CHI10           01/01/2000 02:30:00   4.338
3CHI10           01/01/2000 02:40:00   3.942
3CHI10           01/01/2000 02:50:00   3.617
3CHI10           01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI100          01/01/2000 00:00:00   5.339
3CHI100          01/01/2000 00:10:00   6.376
3CHI100          01/01/2000 00:20:00   7.977
3CHI100          01/01/2000 00:30:00   10.797
3CHI100          01/01/2000 00:40:00   17.136
3CHI100          01/01/2000 00:50:00   45.128
3CHI100          01/01/2000 01:00:00   178.107
3CHI100          01/01/2000 01:10:00   51.056
3CHI100          01/01/2000 01:20:00   26.163
3CHI100          01/01/2000 01:30:00   17.571
3CHI100          01/01/2000 01:40:00   13.277
3CHI100          01/01/2000 01:50:00   10.712
3CHI100          01/01/2000 02:00:00   9.008
3CHI100          01/01/2000 02:10:00   7.793
3CHI100          01/01/2000 02:20:00   6.883
3CHI100          01/01/2000 02:30:00   6.174
3CHI100          01/01/2000 02:40:00   5.607
3CHI100          01/01/2000 02:50:00   5.142
3CHI100          01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI120          01/01/2000 00:00:00   6.406801
3CHI120          01/01/2000 00:10:00   7.6512
3CHI120          01/01/2000 00:20:00   9.572401
3CHI120          01/01/2000 00:30:00   12.9564
3CHI120          01/01/2000 00:40:00   20.5632
3CHI120          01/01/2000 00:50:00   54.1536
3CHI120          01/01/2000 01:00:00   213.7284
3CHI120          01/01/2000 01:10:00   61.2672
3CHI120          01/01/2000 01:20:00   31.3956
3CHI120          01/01/2000 01:30:00   21.0852
3CHI120          01/01/2000 01:40:00   15.9324
3CHI120          01/01/2000 01:50:00   12.8544
3CHI120          01/01/2000 02:00:00   10.8096
3CHI120          01/01/2000 02:10:00   9.351601
3CHI120          01/01/2000 02:20:00   8.259601
3CHI120          01/01/2000 02:30:00   7.4088
3CHI120          01/01/2000 02:40:00   6.7284
3CHI120          01/01/2000 02:50:00   6.170401
3CHI120          01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI2            01/01/2000 00:00:00   2.491
3CHI2            01/01/2000 00:10:00   2.966
3CHI2            01/01/2000 00:20:00   3.696
3CHI2            01/01/2000 00:30:00   4.976
3CHI2            01/01/2000 00:40:00   7.828
3CHI2            01/01/2000 00:50:00   19.966
3CHI2            01/01/2000 01:00:00   76.805
3CHI2            01/01/2000 01:10:00   22.777
3CHI2            01/01/2000 01:20:00   11.852
3CHI2            01/01/2000 01:30:00   8.025
3CHI2            01/01/2000 01:40:00   6.096
3CHI2            01/01/2000 01:50:00   4.938
3CHI2            01/01/2000 02:00:00   4.165
3CHI2            01/01/2000 02:10:00   3.613
3CHI2            01/01/2000 02:20:00   3.197
3CHI2            01/01/2000 02:30:00   2.873
3CHI2            01/01/2000 02:40:00   2.613
3CHI2            01/01/2000 02:50:00   2.4
3CHI2            01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI25           01/01/2000 00:00:00   4.358
3CHI25           01/01/2000 00:10:00   5.202
3CHI25           01/01/2000 00:20:00   6.506
3CHI25           01/01/2000 00:30:00   8.801
3CHI25           01/01/2000 00:40:00   13.954
3CHI25           01/01/2000 00:50:00   36.302
3CHI25           01/01/2000 01:00:00   144.693
3CHI25           01/01/2000 01:10:00   41.479
3CHI25           01/01/2000 01:20:00   21.286
3CHI25           01/01/2000 01:30:00   14.308
```

```
3CHI25           01/01/2000 01:40:00   10.818
3CHI25           01/01/2000 01:50:00   8.732
3CHI25           01/01/2000 02:00:00   7.345
3CHI25           01/01/2000 02:10:00   6.356
3CHI25           01/01/2000 02:20:00   5.615
3CHI25           01/01/2000 02:30:00   5.038
3CHI25           01/01/2000 02:40:00   4.576
3CHI25           01/01/2000 02:50:00   4.197
3CHI25           01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI5            01/01/2000 00:00:00   3.256
3CHI5            01/01/2000 00:10:00   3.881
3CHI5            01/01/2000 00:20:00   4.844
3CHI5            01/01/2000 00:30:00   6.532
3CHI5            01/01/2000 00:40:00   10.308
3CHI5            01/01/2000 00:50:00   26.792
3CHI5            01/01/2000 01:00:00   103.93
3CHI5            01/01/2000 01:10:00   30.286
3CHI5            01/01/2000 01:20:00   15.655
3CHI5            01/01/2000 01:30:00   10.568
3CHI5            01/01/2000 01:40:00   8.013
3CHI5            01/01/2000 01:50:00   6.482
3CHI5            01/01/2000 02:00:00   5.462
3CHI5            01/01/2000 02:10:00   4.733
3CHI5            01/01/2000 02:20:00   4.186
3CHI5            01/01/2000 02:30:00   3.76
3CHI5            01/01/2000 02:40:00   3.418
3CHI5            01/01/2000 02:50:00   3.137
3CHI5            01/01/2000 03:00:00   0

;Rainfall (mm/hr)
3CHI50           01/01/2000 00:00:00   4.828
3CHI50           01/01/2000 00:10:00   5.766
3CHI50           01/01/2000 00:20:00   7.214
3CHI50           01/01/2000 00:30:00   9.763
3CHI50           01/01/2000 00:40:00   15.496
3CHI50           01/01/2000 00:50:00   40.401
3CHI50           01/01/2000 01:00:00   161.471
3CHI50           01/01/2000 01:10:00   46.17
3CHI50           01/01/2000 01:20:00   23.66
3CHI50           01/01/2000 01:30:00   15.89
3CHI50           01/01/2000 01:40:00   12.006
3CHI50           01/01/2000 01:50:00   9.687
3CHI50           01/01/2000 02:00:00   8.146
3CHI50           01/01/2000 02:10:00   7.047
3CHI50           01/01/2000 02:20:00   6.224
3CHI50           01/01/2000 02:30:00   5.583
3CHI50           01/01/2000 02:40:00   5.07
3CHI50           01/01/2000 02:50:00   4.649
3CHI50           01/01/2000 03:00:00   0

;Rainfall (mm/hr)
4hr-25mm         01/01/2000 00:00:00   1.777
4hr-25mm         01/01/2000 00:15:00   2.357
4hr-25mm         01/01/2000 00:30:00   3.618
4hr-25mm         01/01/2000 00:45:00   8.975
4hr-25mm         01/01/2000 01:00:00   45.631
4hr-25mm         01/01/2000 01:15:00   11.911
4hr-25mm         01/01/2000 01:30:00   6.051
4hr-25mm         01/01/2000 01:45:00   4.108
4hr-25mm         01/01/2000 02:00:00   3.138
4hr-25mm         01/01/2000 02:15:00   2.555
4hr-25mm         01/01/2000 02:30:00   2.165
4hr-25mm         01/01/2000 02:45:00   1.885
4hr-25mm         01/01/2000 03:00:00   1.675
4hr-25mm         01/01/2000 03:15:00   1.509
4hr-25mm         01/01/2000 03:30:00   1.376
4hr-25mm         01/01/2000 03:45:00   1.266

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Subcatch   S5                Dry_Pond
Node       Pond              Pond
Link       CULV-1            Culvert
Link       Interim_Ditch     Ditch

[MAP]
DIMENSIONS       467683.7855      5030264.67035    467898.8685      5030526.79265
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Ditch            467770.833         5030279.242
J1               467743.528         5030355.828
J2               467745.142         5030351.468
J3               467763.915         5030297.109
OF1              467764.696         5030276.585
OF2              467862.637         5030430.33
Pond             467742.802         5030357.725

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OR2              467744.066         5030358.304
OR2              467744.981         5030356.151
1                467741.829         5030357.421
1                467742.695         5030355.393

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
S1               467880.085         5030372.188
S1               467889.092         5030349.635
S1               467841.611         5030331.394
S1               467839.414         5030329.19
S1               467804.973         5030316.097
S1               467757.573         5030298.19
S1               467738.01          5030349.083
S1               467758.885         5030357.883
S1               467741.424         5030405.936
S1               467817.071         5030434.169
S1               467820.827         5030435.827
S1               467825.307         5030437.242
S1               467834             5030438
S1               467826.751         5030431.616
S1               467827.355         5030428.933
S1               467827.837         5030427.572
S1               467835.566         5030406.949
S1               467833.049         5030402.369
S1               467816.278         5030386.339
S1               467825.652         5030371.224
S1               467880.085         5030372.188
S2               467827.355         5030428.933
S2               467826.751         5030431.616
S2               467834             5030438
S2               467831.229         5030441.227
S2               467832.396         5030447.741
S2               467829.193         5030456.172
S2               467829.656         5030460
S2               467828.568         5030464.568
S2               467824.215         5030468.193
S2               467819.504         5030469.506
S2               467817.442         5030472.421
S2               467817.365         5030476.245
S2               467829.1           5030480.65
S2               467831.147         5030481.189
S2               467829.003         5030485.982
S2               467828.246         5030485.561
S2               467827.868         5030484.594
S2               467822.529         5030497.878
S2               467819.318         5030496.605
S2               467819.546         5030497.001
S2               467818.228         5030499.226
S2               467818.229         5030501.773
S2               467814.196         5030511.1
S2               467824.746         5030514.878
S2               467880.085         5030372.188
S2               467825.652         5030371.224
S2               467816.278         5030386.339
S2               467833.049         5030402.369
S2               467835.566         5030406.949
S2               467827.837         5030427.572
S2               467827.355         5030428.933
S4               467741.401         5030405.927
S4               467738.253         5030414.576
S4               467716.066         5030406.169
S4               467699.987         5030447.997
S4               467693.562         5030464.924
S4               467800.598         5030506.231
S4               467814.196         5030511.1
S4               467818.229         5030501.773
S4               467818.228         5030499.226
S4               467819.546         5030497.001
S4               467819.318         5030496.605
S4               467822.529         5030497.878
S4               467827.868         5030484.594
S4               467828.246         5030485.561
S4               467829.003         5030485.982
S4               467831.147         5030481.189
S4               467829.1           5030480.65
S4               467817.365         5030476.245
S4               467817.442         5030472.421
S4               467819.504         5030469.506
S4               467824.215         5030468.193
S4               467828.568         5030464.568
S4               467829.656         5030460
S4               467829.193         5030456.172
S4               467832.396         5030447.741
S4               467831.229         5030441.227
S4               467834             5030438
S4               467825.307         5030437.242
S4               467820.827         5030435.827
S4               467817.071         5030434.169
S4               467741.424         5030405.936
S4               467741.401         5030405.927
S5               467716.066         5030406.169
S5               467738.253         5030414.576
S5               467741.401         5030405.927
S5               467758.885         5030357.883
S5               467738.01          5030349.083
S5               467716.066         5030406.169

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 4
  Number of nodes ........... 7
  Number of links ........... 7
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                             Data      Recording
  Name                 Data Source                           Type      Interval
  ------------------------------------------------------------------------------
  Rainfall             3CHI100                               INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                       Area     Width   %Imperv    %Slope Rain Gage
Outlet
  -----------------------------------------------------------------------------------------------
----------------------------
  S1                         1.09    107.73      0.20    0.7320 Rainfall
J3
  S2                         0.38    151.00     13.81    2.0000 Rainfall
OF2
  S4                         0.90     57.02     60.92    1.0000 Rainfall
Pond
  S5                         0.14    125.44     45.68   33.3300 Rainfall
Pond


  ************
  Node Summary
  ************
                                           Invert      Max.    Ponded    External
  Name                 Type                 Elev.     Depth      Area    Inflow
  -------------------------------------------------------------------------------
  Ditch                JUNCTION             84.30      1.00       0.0
  J1                   JUNCTION             85.50      0.70       0.0
  J2                   JUNCTION             85.30      0.90       0.0
  J3                   JUNCTION             84.74      1.26       0.0
  OF1                  OUTFALL              84.28      0.48       0.0
  OF2                  OUTFALL              85.41      0.00       0.0
  Pond                 STORAGE              85.50      0.70       0.0


  ************
  Link Summary
  ************
  Name             From Node        To Node          Type            Length
%Slope Roughness
  -----------------------------------------------------------------------------------------------
--------------
  C1               J1               J2               CONDUIT            4.7
4.3041    0.0130
  C3               Ditch            OF1              CONDUIT            6.7
0.2990    0.0250
  CULV-1           J3               Ditch            CONDUIT           16.0
0.3750    0.0240
  Interim_Ditch    J2               J3               CONDUIT           57.5
0.9734    0.0350
  OR1              Pond             J1               ORIFICE
  OR2              Pond             J1               ORIFICE
  1                Pond             J1               WEIR


  *********************
  Cross Section Summary
  *********************
                                        Full     Full     Hyd.     Max.   No. of
Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
Flow
  -----------------------------------------------------------------------------------------------
--------
  C1               CIRCULAR             0.53     0.22     0.13     0.53        1
892.28
  C3               Ditch                0.48     2.01     0.30     7.56        1
1967.71
  CULV-1           ARCH                 0.50     0.27     0.15     0.68        1
192.59
```

```
  Interim_Ditch    Interim_Ditch        0.50     2.95     0.27    10.10        1
3493.52


  ****************
  Transect Summary
  ****************

  Transect Ditch
  Area:
           0.0019      0.0070      0.0131      0.0199      0.0273
           0.0354      0.0441      0.0535      0.0636      0.0743
           0.0857      0.0977      0.1103      0.1235      0.1372
           0.1514      0.1662      0.1816      0.1975      0.2140
           0.2310      0.2486      0.2667      0.2853      0.3045
           0.3243      0.3445      0.3654      0.3874      0.4103
           0.4343      0.4594      0.4855      0.5124      0.5397
           0.5671      0.5949      0.6228      0.6510      0.6794
           0.7081      0.7371      0.7668      0.7975      0.8290
           0.8614      0.8948      0.9290      0.9640      1.0000
  Hrad:
           0.0161      0.0390      0.0655      0.0899      0.1129
           0.1348      0.1559      0.1762      0.1960      0.2153
           0.2342      0.2535      0.2738      0.2938      0.3134
           0.3328      0.3518      0.3707      0.3894      0.4078
           0.4261      0.4445      0.4627      0.4808      0.4988
           0.5166      0.5344      0.5443      0.5503      0.5572
           0.5649      0.5732      0.5822      0.6018      0.6273
           0.6525      0.6774      0.7021      0.7266      0.7509
           0.7749      0.8016      0.8304      0.8580      0.8842
           0.9094      0.9335      0.9566      0.9787      1.0000
  Width:
           0.1028      0.1587      0.1768      0.1949      0.2129
           0.2310      0.2491      0.2672      0.2852      0.3033
           0.3214      0.3385      0.3537      0.3688      0.3840
           0.3992      0.4144      0.4295      0.4447      0.4599
           0.4750      0.4899      0.5048      0.5197      0.5346
           0.5495      0.5644      0.5878      0.6164      0.6449
           0.6735      0.7020      0.7306      0.7452      0.7516
           0.7581      0.7646      0.7710      0.7775      0.7840
           0.7904      0.8053      0.8297      0.8540      0.8783
           0.9027      0.9270      0.9513      0.9757      1.0000

  Transect Interim_Ditch
  Area:
           0.0059      0.0119      0.0182      0.0247      0.0314
           0.0382      0.0453      0.0526      0.0601      0.0678
           0.0757      0.0838      0.0921      0.1006      0.1093
           0.1182      0.1274      0.1367      0.1462      0.1559
           0.1668      0.1797      0.1946      0.2115      0.2305
           0.2515      0.2746      0.2997      0.3268      0.3559
           0.3862      0.4167      0.4474      0.4782      0.5093
           0.5406      0.5721      0.6038      0.6357      0.6678
           0.7001      0.7326      0.7653      0.7982      0.8314
           0.8647      0.8982      0.9319      0.9659      1.0000
  Hrad:
           0.0359      0.0705      0.1040      0.1364      0.1678
           0.1984      0.2283      0.2574      0.2858      0.3137
           0.3410      0.3678      0.3941      0.4199      0.4454
           0.4705      0.4952      0.5196      0.5437      0.5675
           0.5982      0.6200      0.6346      0.6438      0.6489
           0.6513      0.6518      0.6513      0.6504      0.6493
           0.6558      0.6653      0.6773      0.6910      0.7062
           0.7226      0.7399      0.7579      0.7765      0.7956
           0.8150      0.8349      0.8550      0.8753      0.8958
           0.9164      0.9372      0.9581      0.9790      1.0000
  Width:
           0.1743      0.1802      0.1861      0.1921      0.1980
           0.2040      0.2099      0.2158      0.2218      0.2277
           0.2337      0.2396      0.2455      0.2515      0.2574
           0.2634      0.2693      0.2752      0.2812      0.2871
           0.3465      0.4059      0.4653      0.5248      0.5842
           0.6436      0.7030      0.7624      0.8218      0.8812
           0.8871      0.8931      0.8990      0.9050      0.9109
           0.9168      0.9228      0.9287      0.9347      0.9406
           0.9465      0.9525      0.9584      0.9644      0.9703
           0.9762      0.9822      0.9881      0.9941      1.0000


  *********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  *********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Infiltration Method ...... CURVE_NUMBER
  Flow Routing Method ...... DYNWAVE
  Surcharge Method ......... EXTRAN
  Starting Date ............ 01/01/2000 00:00:00
  Ending Date .............. 01/02/2000 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00
  Routing Time Step ........ 1.00 sec
  Variable Time Step ....... YES
  Maximum Trials ........... 8
  Number of Threads ........ 1
  Head Tolerance ........... 0.001500 m


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.180        71.708
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.063        25.076
  Surface Runoff ...........         0.115        45.621
  Final Storage ............         0.003         1.323
  Continuity Error (%) .....        -0.434


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.115         1.147
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.001         0.010
  External Outflow .........         0.115         1.151
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.005         0.048
  Final Stored Volume ......         0.009         0.085
  Continuity Error (%) .....        -2.681


  ***************************
  Time-Step Critical Elements
  ***************************
  None


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link C3 (14)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :     1.00 sec
  Maximum Time Step           :     1.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.00
  Percent Not Converging      :     0.00
  Time Step Frequencies       :
     1.000 -  0.871 sec       :   100.00 %
     0.871 -  0.758 sec       :     0.00 %
     0.758 -  0.660 sec       :     0.00 %
     0.660 -  0.574 sec       :     0.00 %
     0.574 -  0.500 sec       :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ------------------------------------------------------------------------------
----------------------------------------------
                             Total      Total      Total      Total     Imperv
Perv      Total       Total     Peak  Runoff
                            Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff   Runoff   Coeff
  Subcatchment                  mm         mm         mm         mm         mm
mm         mm    10^6 ltr      LPS
  ------------------------------------------------------------------------------
----------------------------------------------
  S1                         71.71       0.00       0.00      33.76       0.14
36.65      36.80        0.40    63.22   0.513
  S2                         71.71       0.00       0.00      27.00       9.71
34.17      43.87        0.17    92.21   0.612
  S4                         71.71       0.00       0.00      14.83      43.10
12.78      55.88        0.50   285.77   0.779
  S5                         71.71       0.00       0.00      17.89      32.11
21.17      53.28        0.08    57.32   0.743


  ******************
  Node Depth Summary
  ******************

  ---------------------------------------------------------------------------------
--
                                 Average  Maximum  Maximum  Time of Max
Reported
                                   Depth    Depth      HGL   Occurrence    Max
Depth
  Node                 Type       Meters   Meters   Meters  days hr:min
Meters
  ---------------------------------------------------------------------------------
--
  Ditch                JUNCTION     0.88     0.88    85.18     1  00:00
0.88
  J1                   JUNCTION     0.02     0.13    85.63     0  01:42
0.13
  J2                   JUNCTION     0.01     0.06    85.36     0  01:45
0.06
  J3                   JUNCTION     0.44     0.47    85.21     0  01:37
0.47
  OF1                  OUTFALL      0.90     0.90    85.18     0  00:00
0.90
  OF2                  OUTFALL      0.00     0.00    85.41     0  00:00
0.00
  Pond                 STORAGE      0.07     0.43    85.93     0  01:43
0.43


  *******************
  Node Inflow Summary
  *******************

  ---------------------------------------------------------------------------------
-------------------
                                 Maximum  Maximum                  Lateral
Total        Flow
                                 Lateral    Total  Time of Max      Inflow
Inflow     Balance
                                  Inflow   Inflow   Occurrence      Volume
Volume       Error
  Node                 Type          LPS      LPS  days hr:min    10^6 ltr
10^6 ltr     Percent
  ---------------------------------------------------------------------------------
-------------------
  Ditch                JUNCTION     0.00   108.55     0  01:37           0
0.993       0.496
  J1                   JUNCTION     0.00    49.81     0  01:43           0
0.578       0.002
  J2                   JUNCTION     0.00    49.81     0  01:43           0
0.578       0.020
  J3                   JUNCTION    63.22   108.68     0  01:34       0.402
0.984      -0.011
  OF1                  OUTFALL      0.00   108.55     0  01:37           0
0.995       0.000
  OF2                  OUTFALL     92.21    92.21     0  01:10       0.166
0.166       0.000
  Pond                 STORAGE    343.09   343.09     0  01:10       0.578
0.578       0.000


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  ---------------------------------------------------------------------
                                               Max. Height   Min. Depth
                                   Hours       Above Crown    Below Rim
  Node                 Type      Surcharged        Meters       Meters
  ---------------------------------------------------------------------
  Ditch                JUNCTION       17.51         0.000        0.120


  *********************
  Node Flooding Summary
  *********************

  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************

  ---------------------------------------------------------------------------------
--------------------
                          Average     Avg  Evap Exfil       Maximum     Max
Time of Max    Maximum
                           Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit            1000 m3    Full  Loss  Loss       1000 m3    Full
days hr:min        LPS
  ---------------------------------------------------------------------------------
--------------------
  Pond                      0.041       6     0     0         0.320      49
0  01:43      49.81


  ***********************
  Outfall Loading Summary
  ***********************
```

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	95.81	12.02	108.55	0.995
OF2	17.25	11.16	92.21	0.166
System	56.53	23.18	153.42	1.161

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	49.81	0 01:43	1.78	0.06	0.19
C3	CHANNEL	108.55	0 01:37	0.05	0.06	1.00
CULV-1	CONDUIT	108.55	0 01:37	0.41	0.56	0.97
Interim_Ditch	CHANNEL	49.76	0 01:45	0.06	0.01	0.53
OR1	ORIFICE	27.57	0 01:45			1.00
OR2	ORIFICE	16.21	0 01:43			1.00
1	WEIR	6.03	0 01:43			0.09

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C1	1.00	0.01	0.00	0.00	0.32	0.67	0.00	0.00	0.24	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
CULV-1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
Interim_Ditch	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.99	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C3	24.00	24.00	24.00	0.01	0.01
CULV-1	0.01	0.01	14.93	0.01	0.01

Analysis begun on: Thu Dec 8 14:06:14 2022
Analysis ended on: Thu Dec 8 14:06:16 2022
Total elapsed time: 00:00:02

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2000
START_TIME           00:00:00
REPORT_START_DATE    01/01/2000
REPORT_START_TIME    00:00:00
END_DATE             01/02/2000
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         1.167
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
Rainfall         INTENSITY 0:10     1.0      TIMESERIES 3CHI100

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width
%Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- ---
----- -------- ----------------
B1               Rainfall         OF2              0.3679   3.246    111.909  2
0
B2               Rainfall         POND             1.8387   25.758   180.23   2
0
SWM_Block        Rainfall         POND             0.3089   39.922   211.33   3
0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------
- ----------
B1               0.013      0.25       1.57       4.67       0          PERVIOUS
100
B2               0.013      0.25       1.57       4.67       0          PERVIOUS
100
SWM_Block        0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
B1               84.004     12.7       7          0          0
B2               90.469     12.7       7          0          0
SWM_Block        84         12.7       7          0          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
Ditch            84.3       1          0.88       0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OF1              84.28      FIXED      85.18            NO
OF2              85.41      FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params
N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ----------------------
------ -------- --------          -------- --------
J3               84.74    1.19       0.44       FUNCTIONAL 0.5        0.5        2
0        0
OGS              84.61    1.32       0.57       FUNCTIONAL 0          0
1.13     0        0
POND             85.1     0.84       0.08       TABULAR    Pond
0        0
SU1              84.61    1.32       0.57       FUNCTIONAL 0          0
0.72     0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset
OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- --------
-- ---------- ---------- ----------
C1               SU1              OGS              2.1        0.013      84.9
84.85      0          0
C2               OGS              J3               4.5        0.013      84.85
84.76      0          0
C3               Ditch            OF1              6.69       0.013      84.3
84.28      0          0
CULV-1           J3               Ditch            16         0.024      84.74
84.68      0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff
Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ------
---- -------- ----------
OR1              POND             SU1              SIDE         85.1       0.61
NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff
Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ------
---- -------- -------- ---------- ---------- ---------- ---------- --------------
--
W1               POND             SU1              TRAPEZOIDAL  85.45      1.84
NO       0        0          NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- -
--------- ----------
C1               CIRCULAR     0.45             0          0          0          1
C2               CIRCULAR     0.45             0          0          0          1
C3               IRREGULAR    Ditch            0          0          0          1
CULV-1           ARCH         0.5              0.68       0          0          1
47
OR1              CIRCULAR     0.1              0          0          0
W1               TRAPEZOIDAL  0.5              0.65       1          1

[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.035    0.035    0.025
X1 Ditch             8        0.0      6        0.0      0.0      0.0      0.0
0.0
GR 84.64    0        84.582   1        84.43    2        84.317   3        84.331
4
GR 84.521   5        84.719   6        84.801   7.55792774357109

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
C1               3          0.045      0          NO         0
C2               0          0.045      0          NO         0
CULV-1           0.9        0.5        0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
INFIL-1          Rating     0          0
INFIL-1                     0.01       0.0226
INFIL-1                     0.5        0.0226
INFIL-1                     0.91       0.0226

Pond             Storage    0          0
Pond                        0.1        421
Pond                        0.2        1496
Pond                        0.3        1890
Pond                        0.4        1981
Pond                        0.5        2091
Pond                        0.6        2222
Pond                        0.7        2373
Pond                        0.8        2545

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Rainfall (mm/hr)
12SCS10          01/01/2000 00:00:00   2.016
12SCS10          01/01/2000 00:15:00   2.016
12SCS10          01/01/2000 00:30:00   0.9408
12SCS10          01/01/2000 00:45:00   0.9408
12SCS10          01/01/2000 01:00:00   1.7472
12SCS10          01/01/2000 01:15:00   1.7472
12SCS10          01/01/2000 01:30:00   1.7472
12SCS10          01/01/2000 01:45:00   1.7472
12SCS10          01/01/2000 02:00:00   2.2848
12SCS10          01/01/2000 02:15:00   2.2848
12SCS10          01/01/2000 02:30:00   2.016
12SCS10          01/01/2000 02:45:00   2.016
12SCS10          01/01/2000 03:00:00   2.688
12SCS10          01/01/2000 03:15:00   2.688
12SCS10          01/01/2000 03:30:00   2.688
12SCS10          01/01/2000 03:45:00   2.688
12SCS10          01/01/2000 04:00:00   3.6288
12SCS10          01/01/2000 04:15:00   3.6288
12SCS10          01/01/2000 04:30:00   4.5696
12SCS10          01/01/2000 04:45:00   4.5696
12SCS10          01/01/2000 05:00:00   7.2576
12SCS10          01/01/2000 05:15:00   7.2576
12SCS10          01/01/2000 05:30:00   36.288
12SCS10          01/01/2000 05:45:00   78.7584
12SCS10          01/01/2000 06:00:00   14.6496
12SCS10          01/01/2000 06:15:00   14.6496
12SCS10          01/01/2000 06:30:00   6.4512
12SCS10          01/01/2000 06:45:00   6.4512
12SCS10          01/01/2000 07:00:00   4.3008
12SCS10          01/01/2000 07:15:00   4.3008
12SCS10          01/01/2000 07:30:00   3.7632
12SCS10          01/01/2000 07:45:00   3.7632
12SCS10          01/01/2000 08:00:00   2.9568
12SCS10          01/01/2000 08:15:00   2.9568
12SCS10          01/01/2000 08:30:00   3.0912
12SCS10          01/01/2000 08:45:00   3.0912
12SCS10          01/01/2000 09:00:00   2.016
12SCS10          01/01/2000 09:15:00   2.016
12SCS10          01/01/2000 09:30:00   1.6128
12SCS10          01/01/2000 09:45:00   1.6128
12SCS10          01/01/2000 10:00:00   2.2848
12SCS10          01/01/2000 10:15:00   2.2848
12SCS10          01/01/2000 10:30:00   1.4784
12SCS10          01/01/2000 10:45:00   1.4784
12SCS10          01/01/2000 11:00:00   1.344
12SCS10          01/01/2000 11:15:00   1.344
12SCS10          01/01/2000 11:30:00   1.344
12SCS10          01/01/2000 11:45:00   1.344
12SCS10          01/01/2000 12:00:00   0

;Rainfall (mm/hr)
12SCS100         01/01/2000 00:00:00   2.88
12SCS100         01/01/2000 00:15:00   2.88
12SCS100         01/01/2000 00:30:00   1.344
12SCS100         01/01/2000 00:45:00   1.344
12SCS100         01/01/2000 01:00:00   2.496
12SCS100         01/01/2000 01:15:00   2.496
12SCS100         01/01/2000 01:30:00   2.496
12SCS100         01/01/2000 01:45:00   2.496
12SCS100         01/01/2000 02:00:00   3.264
12SCS100         01/01/2000 02:15:00   3.264
12SCS100         01/01/2000 02:30:00   2.88
12SCS100         01/01/2000 02:45:00   2.88
12SCS100         01/01/2000 03:00:00   3.84
12SCS100         01/01/2000 03:15:00   3.84
12SCS100         01/01/2000 03:30:00   3.84
12SCS100         01/01/2000 03:45:00   3.84
12SCS100         01/01/2000 04:00:00   5.184
12SCS100         01/01/2000 04:15:00   5.184
12SCS100         01/01/2000 04:30:00   6.528
12SCS100         01/01/2000 04:45:00   6.528
12SCS100         01/01/2000 05:00:00   10.368
12SCS100         01/01/2000 05:15:00   10.368
12SCS100         01/01/2000 05:30:00   51.84
12SCS100         01/01/2000 05:45:00   112.512
12SCS100         01/01/2000 06:00:00   20.928
12SCS100         01/01/2000 06:15:00   20.928
12SCS100         01/01/2000 06:30:00   9.216
12SCS100         01/01/2000 06:45:00   9.216
12SCS100         01/01/2000 07:00:00   6.144
12SCS100         01/01/2000 07:15:00   6.144
12SCS100         01/01/2000 07:30:00   5.376
12SCS100         01/01/2000 07:45:00   5.376
12SCS100         01/01/2000 08:00:00   4.224
12SCS100         01/01/2000 08:15:00   4.224
12SCS100         01/01/2000 08:30:00   4.416
12SCS100         01/01/2000 08:45:00   4.416
12SCS100         01/01/2000 09:00:00   2.88
12SCS100         01/01/2000 09:15:00   2.88
12SCS100         01/01/2000 09:30:00   2.304
12SCS100         01/01/2000 09:45:00   2.304
12SCS100         01/01/2000 10:00:00   3.264
12SCS100         01/01/2000 10:15:00   3.264
12SCS100         01/01/2000 10:30:00   2.112
12SCS100         01/01/2000 10:45:00   2.112
12SCS100         01/01/2000 11:00:00   1.92
12SCS100         01/01/2000 11:15:00   1.92
12SCS100         01/01/2000 11:30:00   1.92
12SCS100         01/01/2000 11:45:00   1.92
12SCS100         01/01/2000 12:00:00   0

;Rainfall (mm/hr)
12SCS120         01/01/2000 00:00:00   3.456
12SCS120         01/01/2000 00:15:00   3.456
12SCS120         01/01/2000 00:30:00   1.6128
12SCS120         01/01/2000 00:45:00   1.6128
12SCS120         01/01/2000 01:00:00   2.9952
12SCS120         01/01/2000 01:15:00   2.9952
```

```
12SCS120         01/01/2000 01:30:00   2.9952
12SCS120         01/01/2000 01:45:00   2.9952
12SCS120         01/01/2000 02:00:00   3.9168
12SCS120         01/01/2000 02:15:00   3.9168
12SCS120         01/01/2000 02:30:00   3.456
12SCS120         01/01/2000 02:45:00   3.456
12SCS120         01/01/2000 03:00:00   4.608
12SCS120         01/01/2000 03:15:00   4.608
12SCS120         01/01/2000 03:30:00   4.608
12SCS120         01/01/2000 03:45:00   4.608
12SCS120         01/01/2000 04:00:00   6.2208
12SCS120         01/01/2000 04:15:00   6.2208
12SCS120         01/01/2000 04:30:00   7.8336
12SCS120         01/01/2000 04:45:00   7.8336
12SCS120         01/01/2000 05:00:00   12.4416
12SCS120         01/01/2000 05:15:00   12.4416
12SCS120         01/01/2000 05:30:00   62.208
12SCS120         01/01/2000 05:45:00   135.0144
12SCS120         01/01/2000 06:00:00   25.1136
12SCS120         01/01/2000 06:15:00   25.1136
12SCS120         01/01/2000 06:30:00   11.0592
12SCS120         01/01/2000 06:45:00   11.0592
12SCS120         01/01/2000 07:00:00   7.3728
12SCS120         01/01/2000 07:15:00   7.3728
12SCS120         01/01/2000 07:30:00   6.4512
12SCS120         01/01/2000 07:45:00   6.4512
12SCS120         01/01/2000 08:00:00   5.0688
12SCS120         01/01/2000 08:15:00   5.0688
12SCS120         01/01/2000 08:30:00   5.2992
12SCS120         01/01/2000 08:45:00   5.2992
12SCS120         01/01/2000 09:00:00   3.456
12SCS120         01/01/2000 09:15:00   3.456
12SCS120         01/01/2000 09:30:00   2.7648
12SCS120         01/01/2000 09:45:00   2.7648
12SCS120         01/01/2000 10:00:00   3.9168
12SCS120         01/01/2000 10:15:00   3.9168
12SCS120         01/01/2000 10:30:00   2.5344
12SCS120         01/01/2000 10:45:00   2.5344
12SCS120         01/01/2000 11:00:00   2.304
12SCS120         01/01/2000 11:15:00   2.304
12SCS120         01/01/2000 11:30:00   2.304
12SCS120         01/01/2000 11:45:00   2.304
12SCS120         01/01/2000 12:00:00   0

;Rainfall (mm/hr)
12SCS2           01/01/2000 00:00:00   1.296
12SCS2           01/01/2000 00:15:00   1.296
12SCS2           01/01/2000 00:30:00   0.6048
12SCS2           01/01/2000 00:45:00   0.6048
12SCS2           01/01/2000 01:00:00   1.1232
12SCS2           01/01/2000 01:15:00   1.1232
12SCS2           01/01/2000 01:30:00   1.1232
12SCS2           01/01/2000 01:45:00   1.1232
12SCS2           01/01/2000 02:00:00   1.4688
12SCS2           01/01/2000 02:15:00   1.4688
12SCS2           01/01/2000 02:30:00   1.296
12SCS2           01/01/2000 02:45:00   1.296
12SCS2           01/01/2000 03:00:00   1.728
12SCS2           01/01/2000 03:15:00   1.728
12SCS2           01/01/2000 03:30:00   1.728
12SCS2           01/01/2000 03:45:00   1.728
12SCS2           01/01/2000 04:00:00   2.3328
12SCS2           01/01/2000 04:15:00   2.3328
12SCS2           01/01/2000 04:30:00   2.9376
12SCS2           01/01/2000 04:45:00   2.9376
12SCS2           01/01/2000 05:00:00   4.6656
12SCS2           01/01/2000 05:15:00   4.6656
12SCS2           01/01/2000 05:30:00   23.328
12SCS2           01/01/2000 05:45:00   50.6304
12SCS2           01/01/2000 06:00:00   9.4176
12SCS2           01/01/2000 06:15:00   9.4176
12SCS2           01/01/2000 06:30:00   4.1472
12SCS2           01/01/2000 06:45:00   4.1472
12SCS2           01/01/2000 07:00:00   2.7648
12SCS2           01/01/2000 07:15:00   2.7648
12SCS2           01/01/2000 07:30:00   2.4192
12SCS2           01/01/2000 07:45:00   2.4192
12SCS2           01/01/2000 08:00:00   1.9008
12SCS2           01/01/2000 08:15:00   1.9008
12SCS2           01/01/2000 08:30:00   1.9872
12SCS2           01/01/2000 08:45:00   1.9872
12SCS2           01/01/2000 09:00:00   1.296
12SCS2           01/01/2000 09:15:00   1.296
12SCS2           01/01/2000 09:30:00   1.0368
12SCS2           01/01/2000 09:45:00   1.0368
12SCS2           01/01/2000 10:00:00   1.4688
12SCS2           01/01/2000 10:15:00   1.4688
12SCS2           01/01/2000 10:30:00   0.9504
12SCS2           01/01/2000 10:45:00   0.9504
12SCS2           01/01/2000 11:00:00   0.864
12SCS2           01/01/2000 11:15:00   0.864
12SCS2           01/01/2000 11:30:00   0.864
12SCS2           01/01/2000 11:45:00   0.864
12SCS2           01/01/2000 12:00:00   0

;Rainfall (mm/hr)
12SCS25          01/01/2000 00:00:00   2.376
12SCS25          01/01/2000 00:15:00   2.376
12SCS25          01/01/2000 00:30:00   1.1088
12SCS25          01/01/2000 00:45:00   1.1088
12SCS25          01/01/2000 01:00:00   2.0592
12SCS25          01/01/2000 01:15:00   2.0592
12SCS25          01/01/2000 01:30:00   2.0592
12SCS25          01/01/2000 01:45:00   2.0592
12SCS25          01/01/2000 02:00:00   2.6928
12SCS25          01/01/2000 02:15:00   2.6928
12SCS25          01/01/2000 02:30:00   2.376
12SCS25          01/01/2000 02:45:00   2.376
12SCS25          01/01/2000 03:00:00   3.168
12SCS25          01/01/2000 03:15:00   3.168
12SCS25          01/01/2000 03:30:00   3.168
12SCS25          01/01/2000 03:45:00   3.168
12SCS25          01/01/2000 04:00:00   4.2768
12SCS25          01/01/2000 04:15:00   4.2768
12SCS25          01/01/2000 04:30:00   5.3856
12SCS25          01/01/2000 04:45:00   5.3856
12SCS25          01/01/2000 05:00:00   8.5536
12SCS25          01/01/2000 05:15:00   8.5536
12SCS25          01/01/2000 05:30:00   42.768
12SCS25          01/01/2000 05:45:00   92.8224
12SCS25          01/01/2000 06:00:00   17.2656
12SCS25          01/01/2000 06:15:00   17.2656
12SCS25          01/01/2000 06:30:00   7.6032
12SCS25          01/01/2000 06:45:00   7.6032
12SCS25          01/01/2000 07:00:00   5.0688
12SCS25          01/01/2000 07:15:00   5.0688
12SCS25          01/01/2000 07:30:00   4.4352
12SCS25          01/01/2000 07:45:00   4.4352
12SCS25          01/01/2000 08:00:00   3.4848
12SCS25          01/01/2000 08:15:00   3.4848
12SCS25          01/01/2000 08:30:00   3.6432
12SCS25          01/01/2000 08:45:00   3.6432
12SCS25          01/01/2000 09:00:00   2.376
12SCS25          01/01/2000 09:15:00   2.376
12SCS25          01/01/2000 09:30:00   1.9008
12SCS25          01/01/2000 09:45:00   1.9008
12SCS25          01/01/2000 10:00:00   2.6928
12SCS25          01/01/2000 10:15:00   2.6928
12SCS25          01/01/2000 10:30:00   1.7424
12SCS25          01/01/2000 10:45:00   1.7424
12SCS25          01/01/2000 11:00:00   1.584
12SCS25          01/01/2000 11:15:00   1.584
12SCS25          01/01/2000 11:30:00   1.584
12SCS25          01/01/2000 11:45:00   1.584
12SCS25          01/01/2000 12:00:00   0

;Rainfall (mm/hr)
12SCS5           01/01/2000 00:00:00   1.728
12SCS5           01/01/2000 00:15:00   1.728
12SCS5           01/01/2000 00:30:00   0.8064
12SCS5           01/01/2000 00:45:00   0.8064
12SCS5           01/01/2000 01:00:00   1.4976
12SCS5           01/01/2000 01:15:00   1.4976
12SCS5           01/01/2000 01:30:00   1.4976
12SCS5           01/01/2000 01:45:00   1.4976
12SCS5           01/01/2000 02:00:00   1.9584
12SCS5           01/01/2000 02:15:00   1.9584
12SCS5           01/01/2000 02:30:00   1.728
12SCS5           01/01/2000 02:45:00   1.728
12SCS5           01/01/2000 03:00:00   2.304
12SCS5           01/01/2000 03:15:00   2.304
12SCS5           01/01/2000 03:30:00   2.304
12SCS5           01/01/2000 03:45:00   2.304
12SCS5           01/01/2000 04:00:00   3.1104
12SCS5           01/01/2000 04:15:00   3.1104
12SCS5           01/01/2000 04:30:00   3.9168
12SCS5           01/01/2000 04:45:00   3.9168
12SCS5           01/01/2000 05:00:00   6.2208
12SCS5           01/01/2000 05:15:00   6.2208
12SCS5           01/01/2000 05:30:00   31.104
12SCS5           01/01/2000 05:45:00   67.5072
12SCS5           01/01/2000 06:00:00   12.5568
12SCS5           01/01/2000 06:15:00   12.5568
12SCS5           01/01/2000 06:30:00   5.5296
12SCS5           01/01/2000 06:45:00   5.5296
12SCS5           01/01/2000 07:00:00   3.6864
12SCS5           01/01/2000 07:15:00   3.6864
12SCS5           01/01/2000 07:30:00   3.2256
12SCS5           01/01/2000 07:45:00   3.2256
12SCS5           01/01/2000 08:00:00   2.5344
12SCS5           01/01/2000 08:15:00   2.5344
12SCS5           01/01/2000 08:30:00   2.6496
12SCS5           01/01/2000 08:45:00   2.6496
12SCS5           01/01/2000 09:00:00   1.728
12SCS5           01/01/2000 09:15:00   1.728
12SCS5           01/01/2000 09:30:00   1.3824
12SCS5           01/01/2000 09:45:00   1.3824
12SCS5           01/01/2000 10:00:00   1.9584
12SCS5           01/01/2000 10:15:00   1.9584
12SCS5           01/01/2000 10:30:00   1.2672
12SCS5           01/01/2000 10:45:00   1.2672
12SCS5           01/01/2000 11:00:00   1.152
12SCS5           01/01/2000 11:15:00   1.152
12SCS5           01/01/2000 11:30:00   1.152
12SCS5           01/01/2000 11:45:00   1.152
12SCS5           01/01/2000 12:00:00   0

;Rainfall (mm/hr)
12SCS50          01/01/2000 00:00:00   2.628
12SCS50          01/01/2000 00:15:00   2.628
12SCS50          01/01/2000 00:30:00   1.2264
12SCS50          01/01/2000 00:45:00   1.2264
12SCS50          01/01/2000 01:00:00   2.2776
12SCS50          01/01/2000 01:15:00   2.2776
12SCS50          01/01/2000 01:30:00   2.2776
12SCS50          01/01/2000 01:45:00   2.2776
12SCS50          01/01/2000 02:00:00   2.9784
12SCS50          01/01/2000 02:15:00   2.9784
12SCS50          01/01/2000 02:30:00   2.628
12SCS50          01/01/2000 02:45:00   2.628
12SCS50          01/01/2000 03:00:00   3.504
12SCS50          01/01/2000 03:15:00   3.504
12SCS50          01/01/2000 03:30:00   3.504
12SCS50          01/01/2000 03:45:00   3.504
12SCS50          01/01/2000 04:00:00   4.7304
12SCS50          01/01/2000 04:15:00   4.7304
12SCS50          01/01/2000 04:30:00   5.9568
12SCS50          01/01/2000 04:45:00   5.9568
12SCS50          01/01/2000 05:00:00   9.4608
12SCS50          01/01/2000 05:15:00   9.4608
12SCS50          01/01/2000 05:30:00   47.304
12SCS50          01/01/2000 05:45:00   102.6672
12SCS50          01/01/2000 06:00:00   19.0968
12SCS50          01/01/2000 06:15:00   19.0968
12SCS50          01/01/2000 06:30:00   8.4096
12SCS50          01/01/2000 06:45:00   8.4096
12SCS50          01/01/2000 07:00:00   5.6064
12SCS50          01/01/2000 07:15:00   5.6064
12SCS50          01/01/2000 07:30:00   4.9056
12SCS50          01/01/2000 07:45:00   4.9056
12SCS50          01/01/2000 08:00:00   3.8544
12SCS50          01/01/2000 08:15:00   3.8544
12SCS50          01/01/2000 08:30:00   4.0296
12SCS50          01/01/2000 08:45:00   4.0296
12SCS50          01/01/2000 09:00:00   2.628
12SCS50          01/01/2000 09:15:00   2.628
12SCS50          01/01/2000 09:30:00   2.1024
12SCS50          01/01/2000 09:45:00   2.1024
12SCS50          01/01/2000 10:00:00   2.9784
12SCS50          01/01/2000 10:15:00   2.9784
12SCS50          01/01/2000 10:30:00   1.9272
12SCS50          01/01/2000 10:45:00   1.9272
12SCS50          01/01/2000 11:00:00   1.752
12SCS50          01/01/2000 11:15:00   1.752
12SCS50          01/01/2000 11:30:00   1.752
12SCS50          01/01/2000 11:45:00   1.752
12SCS50          01/01/2000 12:00:00   0

;Rainfall (mm/hr)
24SCS10          01/01/2000 00:00:00   1.08
24SCS10          01/01/2000 00:15:00   1.08
24SCS10          01/01/2000 00:30:00   1.08
24SCS10          01/01/2000 00:45:00   1.08
24SCS10          01/01/2000 01:00:00   0.504
24SCS10          01/01/2000 01:15:00   0.504
24SCS10          01/01/2000 01:30:00   0.504
24SCS10          01/01/2000 01:45:00   0.504
24SCS10          01/01/2000 02:00:00   0.936
24SCS10          01/01/2000 02:15:00   0.936
24SCS10          01/01/2000 02:30:00   0.936
24SCS10          01/01/2000 02:45:00   0.936
24SCS10          01/01/2000 03:00:00   0.936
24SCS10          01/01/2000 03:15:00   0.936
24SCS10          01/01/2000 03:30:00   0.936
24SCS10          01/01/2000 03:45:00   0.936
24SCS10          01/01/2000 04:00:00   1.224
24SCS10          01/01/2000 04:15:00   1.224
24SCS10          01/01/2000 04:30:00   1.224
24SCS10          01/01/2000 04:45:00   1.224
24SCS10          01/01/2000 05:00:00   1.08
24SCS10          01/01/2000 05:15:00   1.08
24SCS10          01/01/2000 05:30:00   1.08
24SCS10          01/01/2000 05:45:00   1.08
24SCS10          01/01/2000 06:00:00   1.44
24SCS10          01/01/2000 06:15:00   1.44
24SCS10          01/01/2000 06:30:00   1.44
24SCS10          01/01/2000 06:45:00   1.44
24SCS10          01/01/2000 07:00:00   1.44
24SCS10          01/01/2000 07:15:00   1.44
24SCS10          01/01/2000 07:30:00   1.44
24SCS10          01/01/2000 07:45:00   1.44
24SCS10          01/01/2000 08:00:00   1.944
24SCS10          01/01/2000 08:15:00   1.944
24SCS10          01/01/2000 08:30:00   1.944
24SCS10          01/01/2000 08:45:00   1.944
24SCS10          01/01/2000 09:00:00   2.304
24SCS10          01/01/2000 09:15:00   2.304
24SCS10          01/01/2000 09:30:00   2.592
24SCS10          01/01/2000 09:45:00   2.592
24SCS10          01/01/2000 10:00:00   3.312
24SCS10          01/01/2000 10:15:00   3.312
24SCS10          01/01/2000 10:30:00   4.464
24SCS10          01/01/2000 10:45:00   4.464
24SCS10          01/01/2000 11:00:00   6.912
24SCS10          01/01/2000 11:15:00   6.912
24SCS10          01/01/2000 11:30:00   29.952
24SCS10          01/01/2000 11:45:00   79.488
24SCS10          01/01/2000 12:00:00   10.368
```

24SCS10	01/01/2000 12:15:00	10.368
24SCS10	01/01/2000 12:30:00	5.328
24SCS10	01/01/2000 12:45:00	5.328
24SCS10	01/01/2000 13:00:00	3.888
24SCS10	01/01/2000 13:15:00	3.888
24SCS10	01/01/2000 13:30:00	3.024
24SCS10	01/01/2000 13:45:00	3.024
24SCS10	01/01/2000 14:00:00	2.304
24SCS10	01/01/2000 14:15:00	2.304
24SCS10	01/01/2000 14:30:00	2.304
24SCS10	01/01/2000 14:45:00	2.304
24SCS10	01/01/2000 15:00:00	2.016
24SCS10	01/01/2000 15:15:00	2.016
24SCS10	01/01/2000 15:30:00	2.016
24SCS10	01/01/2000 15:45:00	2.016
24SCS10	01/01/2000 16:00:00	1.584
24SCS10	01/01/2000 16:15:00	1.584
24SCS10	01/01/2000 16:30:00	1.584
24SCS10	01/01/2000 16:45:00	1.584
24SCS10	01/01/2000 17:00:00	1.656
24SCS10	01/01/2000 17:15:00	1.656
24SCS10	01/01/2000 17:30:00	1.656
24SCS10	01/01/2000 17:45:00	1.656
24SCS10	01/01/2000 18:00:00	1.08
24SCS10	01/01/2000 18:15:00	1.08
24SCS10	01/01/2000 18:30:00	1.08
24SCS10	01/01/2000 18:45:00	1.08
24SCS10	01/01/2000 19:00:00	0.864
24SCS10	01/01/2000 19:15:00	0.864
24SCS10	01/01/2000 19:30:00	0.864
24SCS10	01/01/2000 19:45:00	0.864
24SCS10	01/01/2000 20:00:00	1.224
24SCS10	01/01/2000 20:15:00	1.224
24SCS10	01/01/2000 20:30:00	1.224
24SCS10	01/01/2000 20:45:00	1.224
24SCS10	01/01/2000 21:00:00	0.792
24SCS10	01/01/2000 21:15:00	0.792
24SCS10	01/01/2000 21:30:00	0.792
24SCS10	01/01/2000 21:45:00	0.792
24SCS10	01/01/2000 22:00:00	0.72
24SCS10	01/01/2000 22:15:00	0.72
24SCS10	01/01/2000 22:30:00	0.72
24SCS10	01/01/2000 22:45:00	0.72
24SCS10	01/01/2000 23:00:00	0.72
24SCS10	01/01/2000 23:15:00	0.72
24SCS10	01/01/2000 23:30:00	0.72
24SCS10	01/01/2000 23:45:00	0.72
24SCS10	01/02/2000 00:00:00	0

;Rainfall (mm/hr)

24SCS100	01/01/2000 00:00:00	1.548
24SCS100	01/01/2000 00:15:00	1.548
24SCS100	01/01/2000 00:30:00	1.548
24SCS100	01/01/2000 00:45:00	1.548
24SCS100	01/01/2000 01:00:00	0.7224
24SCS100	01/01/2000 01:15:00	0.7224
24SCS100	01/01/2000 01:30:00	0.7224
24SCS100	01/01/2000 01:45:00	0.7224
24SCS100	01/01/2000 02:00:00	1.3416
24SCS100	01/01/2000 02:15:00	1.3416
24SCS100	01/01/2000 02:30:00	1.3416
24SCS100	01/01/2000 02:45:00	1.3416
24SCS100	01/01/2000 03:00:00	1.3416
24SCS100	01/01/2000 03:15:00	1.3416
24SCS100	01/01/2000 03:30:00	1.3416
24SCS100	01/01/2000 03:45:00	1.3416
24SCS100	01/01/2000 04:00:00	1.7544
24SCS100	01/01/2000 04:15:00	1.7544
24SCS100	01/01/2000 04:30:00	1.7544
24SCS100	01/01/2000 04:45:00	1.7544
24SCS100	01/01/2000 05:00:00	1.548
24SCS100	01/01/2000 05:15:00	1.548
24SCS100	01/01/2000 05:30:00	1.548
24SCS100	01/01/2000 05:45:00	1.548
24SCS100	01/01/2000 06:00:00	2.064
24SCS100	01/01/2000 06:15:00	2.064
24SCS100	01/01/2000 06:30:00	2.064
24SCS100	01/01/2000 06:45:00	2.064
24SCS100	01/01/2000 07:00:00	2.064
24SCS100	01/01/2000 07:15:00	2.064
24SCS100	01/01/2000 07:30:00	2.064
24SCS100	01/01/2000 07:45:00	2.064
24SCS100	01/01/2000 08:00:00	2.7864
24SCS100	01/01/2000 08:15:00	2.7864
24SCS100	01/01/2000 08:30:00	2.7864
24SCS100	01/01/2000 08:45:00	2.7864
24SCS100	01/01/2000 09:00:00	3.3024
24SCS100	01/01/2000 09:15:00	3.3024
24SCS100	01/01/2000 09:30:00	3.7152
24SCS100	01/01/2000 09:45:00	3.7152
24SCS100	01/01/2000 10:00:00	4.7472
24SCS100	01/01/2000 10:15:00	4.7472
24SCS100	01/01/2000 10:30:00	6.3984
24SCS100	01/01/2000 10:45:00	6.3984
24SCS100	01/01/2000 11:00:00	9.9072
24SCS100	01/01/2000 11:15:00	9.9072
24SCS100	01/01/2000 11:30:00	42.9312
24SCS100	01/01/2000 11:45:00	113.9328
24SCS100	01/01/2000 12:00:00	14.8608
24SCS100	01/01/2000 12:15:00	14.8608
24SCS100	01/01/2000 12:30:00	7.6368
24SCS100	01/01/2000 12:45:00	7.6368
24SCS100	01/01/2000 13:00:00	5.5728
24SCS100	01/01/2000 13:15:00	5.5728
24SCS100	01/01/2000 13:30:00	4.3344
24SCS100	01/01/2000 13:45:00	4.3344
24SCS100	01/01/2000 14:00:00	3.3024
24SCS100	01/01/2000 14:15:00	3.3024
24SCS100	01/01/2000 14:30:00	3.3024
24SCS100	01/01/2000 14:45:00	3.3024
24SCS100	01/01/2000 15:00:00	2.8896
24SCS100	01/01/2000 15:15:00	2.8896
24SCS100	01/01/2000 15:30:00	2.8896
24SCS100	01/01/2000 15:45:00	2.8896
24SCS100	01/01/2000 16:00:00	2.2704
24SCS100	01/01/2000 16:15:00	2.2704
24SCS100	01/01/2000 16:30:00	2.2704
24SCS100	01/01/2000 16:45:00	2.2704
24SCS100	01/01/2000 17:00:00	2.3736
24SCS100	01/01/2000 17:15:00	2.3736
24SCS100	01/01/2000 17:30:00	2.3736
24SCS100	01/01/2000 17:45:00	2.3736
24SCS100	01/01/2000 18:00:00	1.548
24SCS100	01/01/2000 18:15:00	1.548
24SCS100	01/01/2000 18:30:00	1.548
24SCS100	01/01/2000 18:45:00	1.548
24SCS100	01/01/2000 19:00:00	1.2384
24SCS100	01/01/2000 19:15:00	1.2384
24SCS100	01/01/2000 19:30:00	1.2384
24SCS100	01/01/2000 19:45:00	1.2384
24SCS100	01/01/2000 20:00:00	1.7544
24SCS100	01/01/2000 20:15:00	1.7544
24SCS100	01/01/2000 20:30:00	1.7544
24SCS100	01/01/2000 20:45:00	1.7544
24SCS100	01/01/2000 21:00:00	1.1352
24SCS100	01/01/2000 21:15:00	1.1352
24SCS100	01/01/2000 21:30:00	1.1352
24SCS100	01/01/2000 21:45:00	1.1352
24SCS100	01/01/2000 22:00:00	1.032
24SCS100	01/01/2000 22:15:00	1.032
24SCS100	01/01/2000 22:30:00	1.032
24SCS100	01/01/2000 22:45:00	1.032
24SCS100	01/01/2000 23:00:00	1.032
24SCS100	01/01/2000 23:15:00	1.032
24SCS100	01/01/2000 23:30:00	1.032
24SCS100	01/01/2000 23:45:00	1.032
24SCS100	01/02/2000 00:00:00	0

;Rainfall (mm/hr)

24SCS120	01/01/2000 00:00:00	1.8576
24SCS120	01/01/2000 00:15:00	1.8576
24SCS120	01/01/2000 00:30:00	1.8576
24SCS120	01/01/2000 00:45:00	1.8576
24SCS120	01/01/2000 01:00:00	0.86688
24SCS120	01/01/2000 01:15:00	0.86688
24SCS120	01/01/2000 01:30:00	0.86688
24SCS120	01/01/2000 01:45:00	0.86688
24SCS120	01/01/2000 02:00:00	1.60992
24SCS120	01/01/2000 02:15:00	1.60992
24SCS120	01/01/2000 02:30:00	1.60992
24SCS120	01/01/2000 02:45:00	1.60992
24SCS120	01/01/2000 03:00:00	1.60992
24SCS120	01/01/2000 03:15:00	1.60992
24SCS120	01/01/2000 03:30:00	1.60992
24SCS120	01/01/2000 03:45:00	1.60992
24SCS120	01/01/2000 04:00:00	2.10528
24SCS120	01/01/2000 04:15:00	2.10528
24SCS120	01/01/2000 04:30:00	2.10528
24SCS120	01/01/2000 04:45:00	2.10528
24SCS120	01/01/2000 05:00:00	1.8576
24SCS120	01/01/2000 05:15:00	1.8576
24SCS120	01/01/2000 05:30:00	1.8576
24SCS120	01/01/2000 05:45:00	1.8576
24SCS120	01/01/2000 06:00:00	2.4768
24SCS120	01/01/2000 06:15:00	2.4768
24SCS120	01/01/2000 06:30:00	2.4768
24SCS120	01/01/2000 06:45:00	2.4768
24SCS120	01/01/2000 07:00:00	2.4768
24SCS120	01/01/2000 07:15:00	2.4768
24SCS120	01/01/2000 07:30:00	2.4768
24SCS120	01/01/2000 07:45:00	2.4768
24SCS120	01/01/2000 08:00:00	3.34368
24SCS120	01/01/2000 08:15:00	3.34368
24SCS120	01/01/2000 08:30:00	3.34368
24SCS120	01/01/2000 08:45:00	3.34368
24SCS120	01/01/2000 09:00:00	3.96288
24SCS120	01/01/2000 09:15:00	3.96288
24SCS120	01/01/2000 09:30:00	4.45824
24SCS120	01/01/2000 09:45:00	4.45824
24SCS120	01/01/2000 10:00:00	5.69664
24SCS120	01/01/2000 10:15:00	5.69664
24SCS120	01/01/2000 10:30:00	7.67808
24SCS120	01/01/2000 10:45:00	7.67808
24SCS120	01/01/2000 11:00:00	11.88864
24SCS120	01/01/2000 11:15:00	11.88864
24SCS120	01/01/2000 11:30:00	51.51744
24SCS120	01/01/2000 11:45:00	136.7193
24SCS120	01/01/2000 12:00:00	17.83296
24SCS120	01/01/2000 12:15:00	17.83296
24SCS120	01/01/2000 12:30:00	9.16416
24SCS120	01/01/2000 12:45:00	9.16416
24SCS120	01/01/2000 13:00:00	6.68736
24SCS120	01/01/2000 13:15:00	6.68736
24SCS120	01/01/2000 13:30:00	5.20128
24SCS120	01/01/2000 13:45:00	5.20128
24SCS120	01/01/2000 14:00:00	3.96288
24SCS120	01/01/2000 14:15:00	3.96288
24SCS120	01/01/2000 14:30:00	3.96288
24SCS120	01/01/2000 14:45:00	3.96288
24SCS120	01/01/2000 15:00:00	3.46752
24SCS120	01/01/2000 15:15:00	3.46752
24SCS120	01/01/2000 15:30:00	3.46752
24SCS120	01/01/2000 15:45:00	3.46752
24SCS120	01/01/2000 16:00:00	2.72448
24SCS120	01/01/2000 16:15:00	2.72448
24SCS120	01/01/2000 16:30:00	2.72448
24SCS120	01/01/2000 16:45:00	2.72448
24SCS120	01/01/2000 17:00:00	2.84832
24SCS120	01/01/2000 17:15:00	2.84832
24SCS120	01/01/2000 17:30:00	2.84832
24SCS120	01/01/2000 17:45:00	2.84832
24SCS120	01/01/2000 18:00:00	1.8576
24SCS120	01/01/2000 18:15:00	1.8576
24SCS120	01/01/2000 18:30:00	1.8576
24SCS120	01/01/2000 18:45:00	1.8576
24SCS120	01/01/2000 19:00:00	1.48608
24SCS120	01/01/2000 19:15:00	1.48608
24SCS120	01/01/2000 19:30:00	1.48608
24SCS120	01/01/2000 19:45:00	1.48608
24SCS120	01/01/2000 20:00:00	2.10528
24SCS120	01/01/2000 20:15:00	2.10528
24SCS120	01/01/2000 20:30:00	2.10528
24SCS120	01/01/2000 20:45:00	2.10528
24SCS120	01/01/2000 21:00:00	1.36224
24SCS120	01/01/2000 21:15:00	1.36224
24SCS120	01/01/2000 21:30:00	1.36224
24SCS120	01/01/2000 21:45:00	1.36224
24SCS120	01/01/2000 22:00:00	1.2384
24SCS120	01/01/2000 22:15:00	1.2384
24SCS120	01/01/2000 22:30:00	1.2384
24SCS120	01/01/2000 22:45:00	1.2384
24SCS120	01/01/2000 23:00:00	1.2384
24SCS120	01/01/2000 23:15:00	1.2384
24SCS120	01/01/2000 23:30:00	1.2384
24SCS120	01/01/2000 23:45:00	1.2384
24SCS120	01/02/2000 00:00:00	0

;Rainfall (mm/hr)

24SCS2	01/01/2000 00:00:00	0.72
24SCS2	01/01/2000 00:15:00	0.72
24SCS2	01/01/2000 00:30:00	0.72
24SCS2	01/01/2000 00:45:00	0.72
24SCS2	01/01/2000 01:00:00	0.336
24SCS2	01/01/2000 01:15:00	0.336
24SCS2	01/01/2000 01:30:00	0.336
24SCS2	01/01/2000 01:45:00	0.336
24SCS2	01/01/2000 02:00:00	0.624
24SCS2	01/01/2000 02:15:00	0.624
24SCS2	01/01/2000 02:30:00	0.624
24SCS2	01/01/2000 02:45:00	0.624
24SCS2	01/01/2000 03:00:00	0.624
24SCS2	01/01/2000 03:15:00	0.624
24SCS2	01/01/2000 03:30:00	0.624
24SCS2	01/01/2000 03:45:00	0.624
24SCS2	01/01/2000 04:00:00	0.816
24SCS2	01/01/2000 04:15:00	0.816
24SCS2	01/01/2000 04:30:00	0.816
24SCS2	01/01/2000 04:45:00	0.816
24SCS2	01/01/2000 05:00:00	0.72
24SCS2	01/01/2000 05:15:00	0.72
24SCS2	01/01/2000 05:30:00	0.72
24SCS2	01/01/2000 05:45:00	0.72
24SCS2	01/01/2000 06:00:00	0.96
24SCS2	01/01/2000 06:15:00	0.96
24SCS2	01/01/2000 06:30:00	0.96
24SCS2	01/01/2000 06:45:00	0.96
24SCS2	01/01/2000 07:00:00	0.96
24SCS2	01/01/2000 07:15:00	0.96
24SCS2	01/01/2000 07:30:00	0.96
24SCS2	01/01/2000 07:45:00	0.96
24SCS2	01/01/2000 08:00:00	1.296
24SCS2	01/01/2000 08:15:00	1.296
24SCS2	01/01/2000 08:30:00	1.296
24SCS2	01/01/2000 08:45:00	1.296
24SCS2	01/01/2000 09:00:00	1.536
24SCS2	01/01/2000 09:15:00	1.536
24SCS2	01/01/2000 09:30:00	1.728
24SCS2	01/01/2000 09:45:00	1.728
24SCS2	01/01/2000 10:00:00	2.208
24SCS2	01/01/2000 10:15:00	2.208
24SCS2	01/01/2000 10:30:00	2.976
24SCS2	01/01/2000 10:45:00	2.976
24SCS2	01/01/2000 11:00:00	4.608
24SCS2	01/01/2000 11:15:00	4.608
24SCS2	01/01/2000 11:30:00	19.968
24SCS2	01/01/2000 11:45:00	52.992
24SCS2	01/01/2000 12:00:00	6.912
24SCS2	01/01/2000 12:15:00	6.912

```
24SCS2           01/01/2000 12:30:00   3.552
24SCS2           01/01/2000 12:45:00   3.552
24SCS2           01/01/2000 13:00:00   2.592
24SCS2           01/01/2000 13:15:00   2.592
24SCS2           01/01/2000 13:30:00   2.016
24SCS2           01/01/2000 13:45:00   2.016
24SCS2           01/01/2000 14:00:00   1.536
24SCS2           01/01/2000 14:15:00   1.536
24SCS2           01/01/2000 14:30:00   1.536
24SCS2           01/01/2000 14:45:00   1.536
24SCS2           01/01/2000 15:00:00   1.344
24SCS2           01/01/2000 15:15:00   1.344
24SCS2           01/01/2000 15:30:00   1.344
24SCS2           01/01/2000 15:45:00   1.344
24SCS2           01/01/2000 16:00:00   1.056
24SCS2           01/01/2000 16:15:00   1.056
24SCS2           01/01/2000 16:30:00   1.056
24SCS2           01/01/2000 16:45:00   1.056
24SCS2           01/01/2000 17:00:00   1.104
24SCS2           01/01/2000 17:15:00   1.104
24SCS2           01/01/2000 17:30:00   1.104
24SCS2           01/01/2000 17:45:00   1.104
24SCS2           01/01/2000 18:00:00   0.72
24SCS2           01/01/2000 18:15:00   0.72
24SCS2           01/01/2000 18:30:00   0.72
24SCS2           01/01/2000 18:45:00   0.72
24SCS2           01/01/2000 19:00:00   0.576
24SCS2           01/01/2000 19:15:00   0.576
24SCS2           01/01/2000 19:30:00   0.576
24SCS2           01/01/2000 19:45:00   0.576
24SCS2           01/01/2000 20:00:00   0.816
24SCS2           01/01/2000 20:15:00   0.816
24SCS2           01/01/2000 20:30:00   0.816
24SCS2           01/01/2000 20:45:00   0.816
24SCS2           01/01/2000 21:00:00   0.528
24SCS2           01/01/2000 21:15:00   0.528
24SCS2           01/01/2000 21:30:00   0.528
24SCS2           01/01/2000 21:45:00   0.528
24SCS2           01/01/2000 22:00:00   0.48
24SCS2           01/01/2000 22:15:00   0.48
24SCS2           01/01/2000 22:30:00   0.48
24SCS2           01/01/2000 22:45:00   0.48
24SCS2           01/01/2000 23:00:00   0.48
24SCS2           01/01/2000 23:15:00   0.48
24SCS2           01/01/2000 23:30:00   0.48
24SCS2           01/01/2000 23:45:00   0.48
24SCS2           01/02/2000 00:00:00   0

;Rainfall (mm/hr)
24SCS25          01/01/2000 00:00:00   1.26
24SCS25          01/01/2000 00:15:00   1.26
24SCS25          01/01/2000 00:30:00   1.26
24SCS25          01/01/2000 00:45:00   1.26
24SCS25          01/01/2000 01:00:00   0.588
24SCS25          01/01/2000 01:15:00   0.588
24SCS25          01/01/2000 01:30:00   0.588
24SCS25          01/01/2000 01:45:00   0.588
24SCS25          01/01/2000 02:00:00   1.092
24SCS25          01/01/2000 02:15:00   1.092
24SCS25          01/01/2000 02:30:00   1.092
24SCS25          01/01/2000 02:45:00   1.092
24SCS25          01/01/2000 03:00:00   1.092
24SCS25          01/01/2000 03:15:00   1.092
24SCS25          01/01/2000 03:30:00   1.092
24SCS25          01/01/2000 03:45:00   1.092
24SCS25          01/01/2000 04:00:00   1.428
24SCS25          01/01/2000 04:15:00   1.428
24SCS25          01/01/2000 04:30:00   1.428
24SCS25          01/01/2000 04:45:00   1.428
24SCS25          01/01/2000 05:00:00   1.26
24SCS25          01/01/2000 05:15:00   1.26
24SCS25          01/01/2000 05:30:00   1.26
24SCS25          01/01/2000 05:45:00   1.26
24SCS25          01/01/2000 06:00:00   1.68
24SCS25          01/01/2000 06:15:00   1.68
24SCS25          01/01/2000 06:30:00   1.68
24SCS25          01/01/2000 06:45:00   1.68
24SCS25          01/01/2000 07:00:00   1.68
24SCS25          01/01/2000 07:15:00   1.68
24SCS25          01/01/2000 07:30:00   1.68
24SCS25          01/01/2000 07:45:00   1.68
24SCS25          01/01/2000 08:00:00   2.268
24SCS25          01/01/2000 08:15:00   2.268
24SCS25          01/01/2000 08:30:00   2.268
24SCS25          01/01/2000 08:45:00   2.268
24SCS25          01/01/2000 09:00:00   2.688
24SCS25          01/01/2000 09:15:00   2.688
24SCS25          01/01/2000 09:30:00   3.024
24SCS25          01/01/2000 09:45:00   3.024
24SCS25          01/01/2000 10:00:00   3.864
24SCS25          01/01/2000 10:15:00   3.864
24SCS25          01/01/2000 10:30:00   5.208
24SCS25          01/01/2000 10:45:00   5.208
24SCS25          01/01/2000 11:00:00   8.064
24SCS25          01/01/2000 11:15:00   8.064
24SCS25          01/01/2000 11:30:00   34.944
24SCS25          01/01/2000 11:45:00   92.736
24SCS25          01/01/2000 12:00:00   12.096
24SCS25          01/01/2000 12:15:00   12.096
24SCS25          01/01/2000 12:30:00   6.216
24SCS25          01/01/2000 12:45:00   6.216
24SCS25          01/01/2000 13:00:00   4.536
24SCS25          01/01/2000 13:15:00   4.536
24SCS25          01/01/2000 13:30:00   3.528
24SCS25          01/01/2000 13:45:00   3.528
24SCS25          01/01/2000 14:00:00   2.688
24SCS25          01/01/2000 14:15:00   2.688
24SCS25          01/01/2000 14:30:00   2.688
24SCS25          01/01/2000 14:45:00   2.688
24SCS25          01/01/2000 15:00:00   2.352
24SCS25          01/01/2000 15:15:00   2.352
24SCS25          01/01/2000 15:30:00   2.352
24SCS25          01/01/2000 15:45:00   2.352
24SCS25          01/01/2000 16:00:00   1.848
24SCS25          01/01/2000 16:15:00   1.848
24SCS25          01/01/2000 16:30:00   1.848
24SCS25          01/01/2000 16:45:00   1.848
24SCS25          01/01/2000 17:00:00   1.932
24SCS25          01/01/2000 17:15:00   1.932
24SCS25          01/01/2000 17:30:00   1.932
24SCS25          01/01/2000 17:45:00   1.932
24SCS25          01/01/2000 18:00:00   1.26
24SCS25          01/01/2000 18:15:00   1.26
24SCS25          01/01/2000 18:30:00   1.26
24SCS25          01/01/2000 18:45:00   1.26
24SCS25          01/01/2000 19:00:00   1.008
24SCS25          01/01/2000 19:15:00   1.008
24SCS25          01/01/2000 19:30:00   1.008
24SCS25          01/01/2000 19:45:00   1.008
24SCS25          01/01/2000 20:00:00   1.428
24SCS25          01/01/2000 20:15:00   1.428
24SCS25          01/01/2000 20:30:00   1.428
24SCS25          01/01/2000 20:45:00   1.428
24SCS25          01/01/2000 21:00:00   0.924
24SCS25          01/01/2000 21:15:00   0.924
24SCS25          01/01/2000 21:30:00   0.924
24SCS25          01/01/2000 21:45:00   0.924
24SCS25          01/01/2000 22:00:00   0.84
24SCS25          01/01/2000 22:15:00   0.84
24SCS25          01/01/2000 22:30:00   0.84
24SCS25          01/01/2000 22:45:00   0.84
24SCS25          01/01/2000 23:00:00   0.84
24SCS25          01/01/2000 23:15:00   0.84
24SCS25          01/01/2000 23:30:00   0.84
24SCS25          01/01/2000 23:45:00   0.84
24SCS25          01/02/2000 00:00:00   0

;Rainfall (mm/hr)
24SCS5           01/01/2000 00:00:00   0.936
24SCS5           01/01/2000 00:15:00   0.936
24SCS5           01/01/2000 00:30:00   0.936
24SCS5           01/01/2000 00:45:00   0.936
24SCS5           01/01/2000 01:00:00   0.4368
24SCS5           01/01/2000 01:15:00   0.4368
24SCS5           01/01/2000 01:30:00   0.4368
24SCS5           01/01/2000 01:45:00   0.4368
24SCS5           01/01/2000 02:00:00   0.8112
24SCS5           01/01/2000 02:15:00   0.8112
24SCS5           01/01/2000 02:30:00   0.8112
24SCS5           01/01/2000 02:45:00   0.8112
24SCS5           01/01/2000 03:00:00   0.8112
24SCS5           01/01/2000 03:15:00   0.8112
24SCS5           01/01/2000 03:30:00   0.8112
24SCS5           01/01/2000 03:45:00   0.8112
24SCS5           01/01/2000 04:00:00   1.0608
24SCS5           01/01/2000 04:15:00   1.0608
24SCS5           01/01/2000 04:30:00   1.0608
24SCS5           01/01/2000 04:45:00   1.0608
24SCS5           01/01/2000 05:00:00   0.936
24SCS5           01/01/2000 05:15:00   0.936
24SCS5           01/01/2000 05:30:00   0.936
24SCS5           01/01/2000 05:45:00   0.936
24SCS5           01/01/2000 06:00:00   1.248
24SCS5           01/01/2000 06:15:00   1.248
24SCS5           01/01/2000 06:30:00   1.248
24SCS5           01/01/2000 06:45:00   1.248
24SCS5           01/01/2000 07:00:00   1.248
24SCS5           01/01/2000 07:15:00   1.248
24SCS5           01/01/2000 07:30:00   1.248
24SCS5           01/01/2000 07:45:00   1.248
24SCS5           01/01/2000 08:00:00   1.6848
24SCS5           01/01/2000 08:15:00   1.6848
24SCS5           01/01/2000 08:30:00   1.6848
24SCS5           01/01/2000 08:45:00   1.6848
24SCS5           01/01/2000 09:00:00   1.9968
24SCS5           01/01/2000 09:15:00   1.9968
24SCS5           01/01/2000 09:30:00   2.2464
24SCS5           01/01/2000 09:45:00   2.2464
24SCS5           01/01/2000 10:00:00   2.8704
24SCS5           01/01/2000 10:15:00   2.8704
24SCS5           01/01/2000 10:30:00   3.8688
24SCS5           01/01/2000 10:45:00   3.8688
24SCS5           01/01/2000 11:00:00   5.9904
24SCS5           01/01/2000 11:15:00   5.9904
24SCS5           01/01/2000 11:30:00   25.9584
24SCS5           01/01/2000 11:45:00   68.8896
24SCS5           01/01/2000 12:00:00   8.9856
24SCS5           01/01/2000 12:15:00   8.9856
24SCS5           01/01/2000 12:30:00   4.6176
24SCS5           01/01/2000 12:45:00   4.6176
24SCS5           01/01/2000 13:00:00   3.3696
24SCS5           01/01/2000 13:15:00   3.3696
24SCS5           01/01/2000 13:30:00   2.6208
24SCS5           01/01/2000 13:45:00   2.6208
24SCS5           01/01/2000 14:00:00   1.9968
24SCS5           01/01/2000 14:15:00   1.9968
24SCS5           01/01/2000 14:30:00   1.9968
24SCS5           01/01/2000 14:45:00   1.9968
24SCS5           01/01/2000 15:00:00   1.7472
24SCS5           01/01/2000 15:15:00   1.7472
24SCS5           01/01/2000 15:30:00   1.7472
24SCS5           01/01/2000 15:45:00   1.7472
24SCS5           01/01/2000 16:00:00   1.3728
24SCS5           01/01/2000 16:15:00   1.3728
24SCS5           01/01/2000 16:30:00   1.3728
24SCS5           01/01/2000 16:45:00   1.3728
24SCS5           01/01/2000 17:00:00   1.4352
24SCS5           01/01/2000 17:15:00   1.4352
24SCS5           01/01/2000 17:30:00   1.4352
24SCS5           01/01/2000 17:45:00   1.4352
24SCS5           01/01/2000 18:00:00   0.936
24SCS5           01/01/2000 18:15:00   0.936
24SCS5           01/01/2000 18:30:00   0.936
24SCS5           01/01/2000 18:45:00   0.936
24SCS5           01/01/2000 19:00:00   0.7488
24SCS5           01/01/2000 19:15:00   0.7488
24SCS5           01/01/2000 19:30:00   0.7488
24SCS5           01/01/2000 19:45:00   0.7488
24SCS5           01/01/2000 20:00:00   1.0608
24SCS5           01/01/2000 20:15:00   1.0608
24SCS5           01/01/2000 20:30:00   1.0608
24SCS5           01/01/2000 20:45:00   1.0608
24SCS5           01/01/2000 21:00:00   0.6864
24SCS5           01/01/2000 21:15:00   0.6864
24SCS5           01/01/2000 21:30:00   0.6864
24SCS5           01/01/2000 21:45:00   0.6864
24SCS5           01/01/2000 22:00:00   0.624
24SCS5           01/01/2000 22:15:00   0.624
24SCS5           01/01/2000 22:30:00   0.624
24SCS5           01/01/2000 22:45:00   0.624
24SCS5           01/01/2000 23:00:00   0.624
24SCS5           01/01/2000 23:15:00   0.624
24SCS5           01/01/2000 23:30:00   0.624
24SCS5           01/01/2000 23:45:00   0.624
24SCS5           01/02/2000 00:00:00   0

;Rainfall (mm/hr)
24SCS50          01/01/2000 00:00:00   1.404
24SCS50          01/01/2000 00:15:00   1.404
24SCS50          01/01/2000 00:30:00   1.404
24SCS50          01/01/2000 00:45:00   1.404
24SCS50          01/01/2000 01:00:00   0.6552
24SCS50          01/01/2000 01:15:00   0.6552
24SCS50          01/01/2000 01:30:00   0.6552
24SCS50          01/01/2000 01:45:00   0.6552
24SCS50          01/01/2000 02:00:00   1.2168
24SCS50          01/01/2000 02:15:00   1.2168
24SCS50          01/01/2000 02:30:00   1.2168
24SCS50          01/01/2000 02:45:00   1.2168
24SCS50          01/01/2000 03:00:00   1.2168
24SCS50          01/01/2000 03:15:00   1.2168
24SCS50          01/01/2000 03:30:00   1.2168
24SCS50          01/01/2000 03:45:00   1.2168
24SCS50          01/01/2000 04:00:00   1.5912
24SCS50          01/01/2000 04:15:00   1.5912
24SCS50          01/01/2000 04:30:00   1.5912
24SCS50          01/01/2000 04:45:00   1.5912
24SCS50          01/01/2000 05:00:00   1.404
24SCS50          01/01/2000 05:15:00   1.404
24SCS50          01/01/2000 05:30:00   1.404
24SCS50          01/01/2000 05:45:00   1.404
24SCS50          01/01/2000 06:00:00   1.872
24SCS50          01/01/2000 06:15:00   1.872
24SCS50          01/01/2000 06:30:00   1.872
24SCS50          01/01/2000 06:45:00   1.872
24SCS50          01/01/2000 07:00:00   1.872
24SCS50          01/01/2000 07:15:00   1.872
24SCS50          01/01/2000 07:30:00   1.872
24SCS50          01/01/2000 07:45:00   1.872
24SCS50          01/01/2000 08:00:00   2.5272
24SCS50          01/01/2000 08:15:00   2.5272
24SCS50          01/01/2000 08:30:00   2.5272
24SCS50          01/01/2000 08:45:00   2.5272
24SCS50          01/01/2000 09:00:00   2.9952
24SCS50          01/01/2000 09:15:00   2.9952
24SCS50          01/01/2000 09:30:00   3.3696
24SCS50          01/01/2000 09:45:00   3.3696
24SCS50          01/01/2000 10:00:00   4.3056
24SCS50          01/01/2000 10:15:00   4.3056
24SCS50          01/01/2000 10:30:00   5.803199
24SCS50          01/01/2000 10:45:00   5.803199
24SCS50          01/01/2000 11:00:00   8.9856
24SCS50          01/01/2000 11:15:00   8.9856
24SCS50          01/01/2000 11:30:00   38.9376
24SCS50          01/01/2000 11:45:00   103.3344
24SCS50          01/01/2000 12:00:00   13.4784
24SCS50          01/01/2000 12:15:00   13.4784
24SCS50          01/01/2000 12:30:00   6.9264
```

```
24SCS50          01/01/2000 12:45:00    6.9264
24SCS50          01/01/2000 13:00:00    5.0544
24SCS50          01/01/2000 13:15:00    5.0544
24SCS50          01/01/2000 13:30:00    3.9312
24SCS50          01/01/2000 13:45:00    3.9312
24SCS50          01/01/2000 14:00:00    2.9952
24SCS50          01/01/2000 14:15:00    2.9952
24SCS50          01/01/2000 14:30:00    2.9952
24SCS50          01/01/2000 14:45:00    2.9952
24SCS50          01/01/2000 15:00:00    2.6208
24SCS50          01/01/2000 15:15:00    2.6208
24SCS50          01/01/2000 15:30:00    2.6208
24SCS50          01/01/2000 15:45:00    2.6208
24SCS50          01/01/2000 16:00:00    2.0592
24SCS50          01/01/2000 16:15:00    2.0592
24SCS50          01/01/2000 16:30:00    2.0592
24SCS50          01/01/2000 16:45:00    2.0592
24SCS50          01/01/2000 17:00:00    2.1528
24SCS50          01/01/2000 17:15:00    2.1528
24SCS50          01/01/2000 17:30:00    2.1528
24SCS50          01/01/2000 17:45:00    2.1528
24SCS50          01/01/2000 18:00:00    1.404
24SCS50          01/01/2000 18:15:00    1.404
24SCS50          01/01/2000 18:30:00    1.404
24SCS50          01/01/2000 18:45:00    1.404
24SCS50          01/01/2000 19:00:00    1.1232
24SCS50          01/01/2000 19:15:00    1.1232
24SCS50          01/01/2000 19:30:00    1.1232
24SCS50          01/01/2000 19:45:00    1.1232
24SCS50          01/01/2000 20:00:00    1.5912
24SCS50          01/01/2000 20:15:00    1.5912
24SCS50          01/01/2000 20:30:00    1.5912
24SCS50          01/01/2000 20:45:00    1.5912
24SCS50          01/01/2000 21:00:00    1.0296
24SCS50          01/01/2000 21:15:00    1.0296
24SCS50          01/01/2000 21:30:00    1.0296
24SCS50          01/01/2000 21:45:00    1.0296
24SCS50          01/01/2000 22:00:00    0.936
24SCS50          01/01/2000 22:15:00    0.936
24SCS50          01/01/2000 22:30:00    0.936
24SCS50          01/01/2000 22:45:00    0.936
24SCS50          01/01/2000 23:00:00    0.936
24SCS50          01/01/2000 23:15:00    0.936
24SCS50          01/01/2000 23:30:00    0.936
24SCS50          01/01/2000 23:45:00    0.936
24SCS50          01/02/2000 00:00:00    0

;Rainfall (mm/hr)
3CHI10           01/01/2000 00:00:00    3.755
3CHI10           01/01/2000 00:10:00    4.478
3CHI10           01/01/2000 00:20:00    5.593
3CHI10           01/01/2000 00:30:00    7.551
3CHI10           01/01/2000 00:40:00    11.936
3CHI10           01/01/2000 00:50:00    30.856
3CHI10           01/01/2000 01:00:00    122.142
3CHI10           01/01/2000 01:10:00    35.237
3CHI10           01/01/2000 01:20:00    18.159
3CHI10           01/01/2000 01:30:00    12.238
3CHI10           01/01/2000 01:40:00    9.269
3CHI10           01/01/2000 01:50:00    7.492
3CHI10           01/01/2000 02:00:00    6.309
3CHI10           01/01/2000 02:10:00    5.465
3CHI10           01/01/2000 02:20:00    4.831
3CHI10           01/01/2000 02:30:00    4.338
3CHI10           01/01/2000 02:40:00    3.942
3CHI10           01/01/2000 02:50:00    3.617
3CHI10           01/01/2000 03:00:00    0

;Rainfall (mm/hr)
3CHI100          01/01/2000 00:00:00    5.339
3CHI100          01/01/2000 00:10:00    6.376
3CHI100          01/01/2000 00:20:00    7.977
3CHI100          01/01/2000 00:30:00    10.797
3CHI100          01/01/2000 00:40:00    17.136
3CHI100          01/01/2000 00:50:00    45.128
3CHI100          01/01/2000 01:00:00    178.107
3CHI100          01/01/2000 01:10:00    51.056
3CHI100          01/01/2000 01:20:00    26.163
3CHI100          01/01/2000 01:30:00    17.571
3CHI100          01/01/2000 01:40:00    13.277
3CHI100          01/01/2000 01:50:00    10.712
3CHI100          01/01/2000 02:00:00    9.008
3CHI100          01/01/2000 02:10:00    7.793
3CHI100          01/01/2000 02:20:00    6.883
3CHI100          01/01/2000 02:30:00    6.174
3CHI100          01/01/2000 02:40:00    5.607
3CHI100          01/01/2000 02:50:00    5.142
3CHI100          01/01/2000 03:00:00    0

;Rainfall (mm/hr)
3CHI120          01/01/2000 00:00:00    6.406801
3CHI120          01/01/2000 00:10:00    7.6512
3CHI120          01/01/2000 00:20:00    9.572401
3CHI120          01/01/2000 00:30:00    12.9564
3CHI120          01/01/2000 00:40:00    20.5632
3CHI120          01/01/2000 00:50:00    54.1536
3CHI120          01/01/2000 01:00:00    213.7284
3CHI120          01/01/2000 01:10:00    61.2672
3CHI120          01/01/2000 01:20:00    31.3956
3CHI120          01/01/2000 01:30:00    21.0852
3CHI120          01/01/2000 01:40:00    15.9324
3CHI120          01/01/2000 01:50:00    12.8544
3CHI120          01/01/2000 02:00:00    10.8096
3CHI120          01/01/2000 02:10:00    9.351601
3CHI120          01/01/2000 02:20:00    8.259601
3CHI120          01/01/2000 02:30:00    7.4088
3CHI120          01/01/2000 02:40:00    6.7284
3CHI120          01/01/2000 02:50:00    6.170401
3CHI120          01/01/2000 03:00:00    0

;Rainfall (mm/hr)
3CHI2            01/01/2000 00:00:00    2.491
3CHI2            01/01/2000 00:10:00    2.966
3CHI2            01/01/2000 00:20:00    3.696
3CHI2            01/01/2000 00:30:00    4.976
3CHI2            01/01/2000 00:40:00    7.828
3CHI2            01/01/2000 00:50:00    19.966
3CHI2            01/01/2000 01:00:00    76.805
3CHI2            01/01/2000 01:10:00    22.777
3CHI2            01/01/2000 01:20:00    11.852
3CHI2            01/01/2000 01:30:00    8.025
3CHI2            01/01/2000 01:40:00    6.096
3CHI2            01/01/2000 01:50:00    4.938
3CHI2            01/01/2000 02:00:00    4.165
3CHI2            01/01/2000 02:10:00    3.613
3CHI2            01/01/2000 02:20:00    3.197
3CHI2            01/01/2000 02:30:00    2.873
3CHI2            01/01/2000 02:40:00    2.613
3CHI2            01/01/2000 02:50:00    2.4
3CHI2            01/01/2000 03:00:00    0

;Rainfall (mm/hr)
3CHI25           01/01/2000 00:00:00    4.358
3CHI25           01/01/2000 00:10:00    5.202
3CHI25           01/01/2000 00:20:00    6.506
3CHI25           01/01/2000 00:30:00    8.801
3CHI25           01/01/2000 00:40:00    13.954
3CHI25           01/01/2000 00:50:00    36.302
3CHI25           01/01/2000 01:00:00    144.693
3CHI25           01/01/2000 01:10:00    41.479
3CHI25           01/01/2000 01:20:00    21.286
3CHI25           01/01/2000 01:30:00    14.308
3CHI25           01/01/2000 01:40:00    10.818
3CHI25           01/01/2000 01:50:00    8.732
3CHI25           01/01/2000 02:00:00    7.345
3CHI25           01/01/2000 02:10:00    6.356
3CHI25           01/01/2000 02:20:00    5.615
3CHI25           01/01/2000 02:30:00    5.038
3CHI25           01/01/2000 02:40:00    4.576
3CHI25           01/01/2000 02:50:00    4.197
3CHI25           01/01/2000 03:00:00    0

;Rainfall (mm/hr)
3CHI5            01/01/2000 00:00:00    3.256
3CHI5            01/01/2000 00:10:00    3.881
3CHI5            01/01/2000 00:20:00    4.844
3CHI5            01/01/2000 00:30:00    6.532
3CHI5            01/01/2000 00:40:00    10.308
3CHI5            01/01/2000 00:50:00    26.792
3CHI5            01/01/2000 01:00:00    103.93
3CHI5            01/01/2000 01:10:00    30.286
3CHI5            01/01/2000 01:20:00    15.655
3CHI5            01/01/2000 01:30:00    10.568
3CHI5            01/01/2000 01:40:00    8.013
3CHI5            01/01/2000 01:50:00    6.482
3CHI5            01/01/2000 02:00:00    5.462
3CHI5            01/01/2000 02:10:00    4.733
3CHI5            01/01/2000 02:20:00    4.186
3CHI5            01/01/2000 02:30:00    3.76
3CHI5            01/01/2000 02:40:00    3.418
3CHI5            01/01/2000 02:50:00    3.137
3CHI5            01/01/2000 03:00:00    0

;Rainfall (mm/hr)
3CHI50           01/01/2000 00:00:00    4.828
3CHI50           01/01/2000 00:10:00    5.766
3CHI50           01/01/2000 00:20:00    7.214
3CHI50           01/01/2000 00:30:00    9.763
3CHI50           01/01/2000 00:40:00    15.496
3CHI50           01/01/2000 00:50:00    40.401
3CHI50           01/01/2000 01:00:00    161.471
3CHI50           01/01/2000 01:10:00    46.17
3CHI50           01/01/2000 01:20:00    23.66
3CHI50           01/01/2000 01:30:00    15.89
3CHI50           01/01/2000 01:40:00    12.006
3CHI50           01/01/2000 01:50:00    9.687
3CHI50           01/01/2000 02:00:00    8.146
3CHI50           01/01/2000 02:10:00    7.047
3CHI50           01/01/2000 02:20:00    6.224
3CHI50           01/01/2000 02:30:00    5.583
3CHI50           01/01/2000 02:40:00    5.07
3CHI50           01/01/2000 02:50:00    4.649
3CHI50           01/01/2000 03:00:00    0

;Rainfall (mm/hr)
4hr-25mm         01/01/2000 00:00:00    1.777
4hr-25mm         01/01/2000 00:15:00    2.357
4hr-25mm         01/01/2000 00:30:00    3.618
4hr-25mm         01/01/2000 00:45:00    8.975
4hr-25mm         01/01/2000 01:00:00    45.631
4hr-25mm         01/01/2000 01:15:00    11.911
4hr-25mm         01/01/2000 01:30:00    6.051
4hr-25mm         01/01/2000 01:45:00    4.108
4hr-25mm         01/01/2000 02:00:00    3.138
4hr-25mm         01/01/2000 02:15:00    2.555
4hr-25mm         01/01/2000 02:30:00    2.165
4hr-25mm         01/01/2000 02:45:00    1.885
4hr-25mm         01/01/2000 03:00:00    1.675
4hr-25mm         01/01/2000 03:15:00    1.509
4hr-25mm         01/01/2000 03:30:00    1.376
4hr-25mm         01/01/2000 03:45:00    1.266

;Rainfall (mm/hr)
6CHI10           01/01/2000 00:00:00    1.944
6CHI10           01/01/2000 00:10:00    2.097
6CHI10           01/01/2000 00:20:00    2.278
6CHI10           01/01/2000 00:30:00    2.499
6CHI10           01/01/2000 00:40:00    2.772
6CHI10           01/01/2000 00:50:00    3.122
6CHI10           01/01/2000 01:00:00    3.585
6CHI10           01/01/2000 01:10:00    4.231
6CHI10           01/01/2000 01:20:00    5.199
6CHI10           01/01/2000 01:30:00    6.823
6CHI10           01/01/2000 01:40:00    10.137
6CHI10           01/01/2000 01:50:00    20.829
6CHI10           01/01/2000 02:00:00    122.142
6CHI10           01/01/2000 02:10:00    41.92
6CHI10           01/01/2000 02:20:00    21.263
6CHI10           01/01/2000 02:30:00    13.557
6CHI10           01/01/2000 02:40:00    9.991
6CHI10           01/01/2000 02:50:00    7.945
6CHI10           01/01/2000 03:00:00    6.62
6CHI10           01/01/2000 03:10:00    5.692
6CHI10           01/01/2000 03:20:00    5.004
6CHI10           01/01/2000 03:30:00    4.474
6CHI10           01/01/2000 03:40:00    4.052
6CHI10           01/01/2000 03:50:00    3.708
6CHI10           01/01/2000 04:00:00    3.422
6CHI10           01/01/2000 04:10:00    3.181
6CHI10           01/01/2000 04:20:00    2.973
6CHI10           01/01/2000 04:30:00    2.794
6CHI10           01/01/2000 04:40:00    2.636
6CHI10           01/01/2000 04:50:00    2.497
6CHI10           01/01/2000 05:00:00    2.373
6CHI10           01/01/2000 05:10:00    2.262
6CHI10           01/01/2000 05:20:00    2.162
6CHI10           01/01/2000 05:30:00    2.071
6CHI10           01/01/2000 05:40:00    1.988
6CHI10           01/01/2000 05:50:00    1.912
6CHI10           01/01/2000 06:00:00    0

;Rainfall (mm/hr)
6CHI100          01/01/2000 00:00:00    2.752
6CHI100          01/01/2000 00:10:00    2.969
6CHI100          01/01/2000 00:20:00    3.228
6CHI100          01/01/2000 00:30:00    3.542
6CHI100          01/01/2000 00:40:00    3.933
6CHI100          01/01/2000 00:50:00    4.432
6CHI100          01/01/2000 01:00:00    5.095
6CHI100          01/01/2000 01:10:00    6.021
6CHI100          01/01/2000 01:20:00    7.412
6CHI100          01/01/2000 01:30:00    9.748
6CHI100          01/01/2000 01:40:00    14.532
6CHI100          01/01/2000 01:50:00    30.054
6CHI100          01/01/2000 02:00:00    178.559
6CHI100          01/01/2000 02:10:00    60.818
6CHI100          01/01/2000 02:20:00    30.678
6CHI100          01/01/2000 02:30:00    19.483
6CHI100          01/01/2000 02:40:00    14.32
6CHI100          01/01/2000 02:50:00    11.366
6CHI100          01/01/2000 03:00:00    9.456
6CHI100          01/01/2000 03:10:00    8.119
6CHI100          01/01/2000 03:20:00    7.131
6CHI100          01/01/2000 03:30:00    6.37
6CHI100          01/01/2000 03:40:00    5.765
6CHI100          01/01/2000 03:50:00    5.272
6CHI100          01/01/2000 04:00:00    4.863
6CHI100          01/01/2000 04:10:00    4.517
6CHI100          01/01/2000 04:20:00    4.22
6CHI100          01/01/2000 04:30:00    3.964
6CHI100          01/01/2000 04:40:00    3.739
6CHI100          01/01/2000 04:50:00    3.54
6CHI100          01/01/2000 05:00:00    3.363
6CHI100          01/01/2000 05:10:00    3.205
6CHI100          01/01/2000 05:20:00    3.062
6CHI100          01/01/2000 05:30:00    2.932
6CHI100          01/01/2000 05:40:00    2.814
6CHI100          01/01/2000 05:50:00    2.706
6CHI100          01/01/2000 06:00:00    0

;Rainfall (mm/hr)
6CHI120          01/01/2000 00:00:00    3.3024
6CHI120          01/01/2000 00:10:00    3.5628
6CHI120          01/01/2000 00:20:00    3.8736
6CHI120          01/01/2000 00:30:00    4.2504
6CHI120          01/01/2000 00:40:00    4.7196
6CHI120          01/01/2000 00:50:00    5.3184
6CHI120          01/01/2000 01:00:00    6.114
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6CHI120          01/01/2000 01:10:00   7.2252
6CHI120          01/01/2000 01:20:00   8.894401
6CHI120          01/01/2000 01:30:00   11.6976
6CHI120          01/01/2000 01:40:00   17.4384
6CHI120          01/01/2000 01:50:00   36.0648
6CHI120          01/01/2000 02:00:00   214.2708
6CHI120          01/01/2000 02:10:00   72.98161
6CHI120          01/01/2000 02:20:00   36.8136
6CHI120          01/01/2000 02:30:00   23.3796
6CHI120          01/01/2000 02:40:00   17.184
6CHI120          01/01/2000 02:50:00   13.6392
6CHI120          01/01/2000 03:00:00   11.3472
6CHI120          01/01/2000 03:10:00   9.742801
6CHI120          01/01/2000 03:20:00   8.5572
6CHI120          01/01/2000 03:30:00   7.644
6CHI120          01/01/2000 03:40:00   6.918
6CHI120          01/01/2000 03:50:00   6.3264
6CHI120          01/01/2000 04:00:00   5.8356
6CHI120          01/01/2000 04:10:00   5.420401
6CHI120          01/01/2000 04:20:00   5.064
6CHI120          01/01/2000 04:30:00   4.7568
6CHI120          01/01/2000 04:40:00   4.4868
6CHI120          01/01/2000 04:50:00   4.248
6CHI120          01/01/2000 05:00:00   4.0356
6CHI120          01/01/2000 05:10:00   3.846
6CHI120          01/01/2000 05:20:00   3.6744
6CHI120          01/01/2000 05:30:00   3.5184
6CHI120          01/01/2000 05:40:00   3.3768
6CHI120          01/01/2000 05:50:00   3.2472
6CHI120          01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6CHI2            01/01/2000 00:00:00   1.297
6CHI2            01/01/2000 00:10:00   1.398
6CHI2            01/01/2000 00:20:00   1.518
6CHI2            01/01/2000 00:30:00   1.663
6CHI2            01/01/2000 00:40:00   1.843
6CHI2            01/01/2000 00:50:00   2.074
6CHI2            01/01/2000 01:00:00   2.379
6CHI2            01/01/2000 01:10:00   2.803
6CHI2            01/01/2000 01:20:00   3.439
6CHI2            01/01/2000 01:30:00   4.501
6CHI2            01/01/2000 01:40:00   6.66
6CHI2            01/01/2000 01:50:00   13.563
6CHI2            01/01/2000 02:00:00   76.805
6CHI2            01/01/2000 02:10:00   27.028
6CHI2            01/01/2000 02:20:00   13.849
6CHI2            01/01/2000 02:30:00   8.88
6CHI2            01/01/2000 02:40:00   6.566
6CHI2            01/01/2000 02:50:00   5.234
6CHI2            01/01/2000 03:00:00   4.369
6CHI2            01/01/2000 03:10:00   3.761
6CHI2            01/01/2000 03:20:00   3.311
6CHI2            01/01/2000 03:30:00   2.963
6CHI2            01/01/2000 03:40:00   2.686
6CHI2            01/01/2000 03:50:00   2.46
6CHI2            01/01/2000 04:00:00   2.272
6CHI2            01/01/2000 04:10:00   2.113
6CHI2            01/01/2000 04:20:00   1.976
6CHI2            01/01/2000 04:30:00   1.858
6CHI2            01/01/2000 04:40:00   1.754
6CHI2            01/01/2000 04:50:00   1.662
6CHI2            01/01/2000 05:00:00   1.58
6CHI2            01/01/2000 05:10:00   1.507
6CHI2            01/01/2000 05:20:00   1.441
6CHI2            01/01/2000 05:30:00   1.38
6CHI2            01/01/2000 05:40:00   1.326
6CHI2            01/01/2000 05:50:00   1.275
6CHI2            01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6CHI25           01/01/2000 00:00:00   2.249
6CHI25           01/01/2000 00:10:00   2.426
6CHI25           01/01/2000 00:20:00   2.637
6CHI25           01/01/2000 00:30:00   2.893
6CHI25           01/01/2000 00:40:00   3.212
6CHI25           01/01/2000 00:50:00   3.619
6CHI25           01/01/2000 01:00:00   4.159
6CHI25           01/01/2000 01:10:00   4.914
6CHI25           01/01/2000 01:20:00   6.046
6CHI25           01/01/2000 01:30:00   7.947
6CHI25           01/01/2000 01:40:00   11.837
6CHI25           01/01/2000 01:50:00   24.442
6CHI25           01/01/2000 02:00:00   144.693
6CHI25           01/01/2000 02:10:00   49.392
6CHI25           01/01/2000 02:20:00   24.95
6CHI25           01/01/2000 02:30:00   15.861
6CHI25           01/01/2000 02:40:00   11.666
6CHI25           01/01/2000 02:50:00   9.263
6CHI25           01/01/2000 03:00:00   7.71
6CHI25           01/01/2000 03:10:00   6.622
6CHI25           01/01/2000 03:20:00   5.817
6CHI25           01/01/2000 03:30:00   5.197
6CHI25           01/01/2000 03:40:00   4.705
6CHI25           01/01/2000 03:50:00   4.303
6CHI25           01/01/2000 04:00:00   3.97
6CHI25           01/01/2000 04:10:00   3.688
6CHI25           01/01/2000 04:20:00   3.446
6CHI25           01/01/2000 04:30:00   3.237
6CHI25           01/01/2000 04:40:00   3.054
6CHI25           01/01/2000 04:50:00   2.892
6CHI25           01/01/2000 05:00:00   2.747
6CHI25           01/01/2000 05:10:00   2.618
6CHI25           01/01/2000 05:20:00   2.501
6CHI25           01/01/2000 05:30:00   2.396
6CHI25           01/01/2000 05:40:00   2.299
6CHI25           01/01/2000 05:50:00   2.211
6CHI25           01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6CHI5            01/01/2000 00:00:00   1.69
6CHI5            01/01/2000 00:10:00   1.822
6CHI5            01/01/2000 00:20:00   1.979
6CHI5            01/01/2000 00:30:00   2.169
6CHI5            01/01/2000 00:40:00   2.406
6CHI5            01/01/2000 00:50:00   2.708
6CHI5            01/01/2000 01:00:00   3.109
6CHI5            01/01/2000 01:10:00   3.667
6CHI5            01/01/2000 01:20:00   4.504
6CHI5            01/01/2000 01:30:00   5.905
6CHI5            01/01/2000 01:40:00   8.759
6CHI5            01/01/2000 01:50:00   17.944
6CHI5            01/01/2000 02:00:00   104.193
6CHI5            01/01/2000 02:10:00   36.002
6CHI5            01/01/2000 02:20:00   18.319
6CHI5            01/01/2000 02:30:00   11.702
6CHI5            01/01/2000 02:40:00   8.634
6CHI5            01/01/2000 02:50:00   6.872
6CHI5            01/01/2000 03:00:00   5.73
6CHI5            01/01/2000 03:10:00   4.929
6CHI5            01/01/2000 03:20:00   4.335
6CHI5            01/01/2000 03:30:00   3.877
6CHI5            01/01/2000 03:40:00   3.513
6CHI5            01/01/2000 03:50:00   3.216
6CHI5            01/01/2000 04:00:00   2.969
6CHI5            01/01/2000 04:10:00   2.76
6CHI5            01/01/2000 04:20:00   2.58
6CHI5            01/01/2000 04:30:00   2.425
6CHI5            01/01/2000 04:40:00   2.289
6CHI5            01/01/2000 04:50:00   2.168
6CHI5            01/01/2000 05:00:00   2.061
6CHI5            01/01/2000 05:10:00   1.965
6CHI5            01/01/2000 05:20:00   1.878
6CHI5            01/01/2000 05:30:00   1.799
6CHI5            01/01/2000 05:40:00   1.727
6CHI5            01/01/2000 05:50:00   1.661
6CHI5            01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6CHI50           01/01/2000 00:00:00   2.489
6CHI50           01/01/2000 00:10:00   2.685
6CHI50           01/01/2000 00:20:00   2.919
6CHI50           01/01/2000 00:30:00   3.203
6CHI50           01/01/2000 00:40:00   3.556
6CHI50           01/01/2000 00:50:00   4.008
6CHI50           01/01/2000 01:00:00   4.608
6CHI50           01/01/2000 01:10:00   5.445
6CHI50           01/01/2000 01:20:00   6.702
6CHI50           01/01/2000 01:30:00   8.815
6CHI50           01/01/2000 01:40:00   13.141
6CHI50           01/01/2000 01:50:00   27.177
6CHI50           01/01/2000 02:00:00   161.471
6CHI50           01/01/2000 02:10:00   54.997
6CHI50           01/01/2000 02:20:00   27.742
6CHI50           01/01/2000 02:30:00   17.619
6CHI50           01/01/2000 02:40:00   12.949
6CHI50           01/01/2000 02:50:00   10.278
6CHI50           01/01/2000 03:00:00   8.551
6CHI50           01/01/2000 03:10:00   7.342
6CHI50           01/01/2000 03:20:00   6.448
6CHI50           01/01/2000 03:30:00   5.76
6CHI50           01/01/2000 03:40:00   5.213
6CHI50           01/01/2000 03:50:00   4.768
6CHI50           01/01/2000 04:00:00   4.397
6CHI50           01/01/2000 04:10:00   4.084
6CHI50           01/01/2000 04:20:00   3.817
6CHI50           01/01/2000 04:30:00   3.584
6CHI50           01/01/2000 04:40:00   3.381
6CHI50           01/01/2000 04:50:00   3.201
6CHI50           01/01/2000 05:00:00   3.041
6CHI50           01/01/2000 05:10:00   2.898
6CHI50           01/01/2000 05:20:00   2.769
6CHI50           01/01/2000 05:30:00   2.651
6CHI50           01/01/2000 05:40:00   2.545
6CHI50           01/01/2000 05:50:00   2.447
6CHI50           01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6SCS10           01/01/2000 00:00:00   3.564
6SCS10           01/01/2000 00:15:00   1.6632
6SCS10           01/01/2000 00:30:00   3.0888
6SCS10           01/01/2000 00:45:00   3.0888
6SCS10           01/01/2000 01:00:00   4.0392
6SCS10           01/01/2000 01:15:00   3.564
6SCS10           01/01/2000 01:30:00   4.752
6SCS10           01/01/2000 01:45:00   4.752
6SCS10           01/01/2000 02:00:00   6.4152
6SCS10           01/01/2000 02:15:00   8.078401
6SCS10           01/01/2000 02:30:00   12.8304
6SCS10           01/01/2000 02:45:00   101.6928
6SCS10           01/01/2000 03:00:00   25.8984
6SCS10           01/01/2000 03:15:00   11.4048
6SCS10           01/01/2000 03:30:00   7.6032
6SCS10           01/01/2000 03:45:00   6.652801
6SCS10           01/01/2000 04:00:00   5.2272
6SCS10           01/01/2000 04:15:00   5.4648
6SCS10           01/01/2000 04:30:00   3.564
6SCS10           01/01/2000 04:45:00   2.8512
6SCS10           01/01/2000 05:00:00   4.0392
6SCS10           01/01/2000 05:15:00   2.6136
6SCS10           01/01/2000 05:30:00   2.376
6SCS10           01/01/2000 05:45:00   2.376
6SCS10           01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6SCS100          01/01/2000 00:00:00   5.22
6SCS100          01/01/2000 00:15:00   2.436
6SCS100          01/01/2000 00:30:00   4.524
6SCS100          01/01/2000 00:45:00   4.524
6SCS100          01/01/2000 01:00:00   5.916
6SCS100          01/01/2000 01:15:00   5.22
6SCS100          01/01/2000 01:30:00   6.96
6SCS100          01/01/2000 01:45:00   6.96
6SCS100          01/01/2000 02:00:00   9.396
6SCS100          01/01/2000 02:15:00   11.832
6SCS100          01/01/2000 02:30:00   18.792
6SCS100          01/01/2000 02:45:00   148.944
6SCS100          01/01/2000 03:00:00   37.932
6SCS100          01/01/2000 03:15:00   16.704
6SCS100          01/01/2000 03:30:00   11.136
6SCS100          01/01/2000 03:45:00   9.744
6SCS100          01/01/2000 04:00:00   7.656
6SCS100          01/01/2000 04:15:00   8.004
6SCS100          01/01/2000 04:30:00   5.22
6SCS100          01/01/2000 04:45:00   4.176
6SCS100          01/01/2000 05:00:00   5.916
6SCS100          01/01/2000 05:15:00   3.828
6SCS100          01/01/2000 05:30:00   3.48
6SCS100          01/01/2000 05:45:00   3.48
6SCS100          01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6SCS120          01/01/2000 00:00:00   6.264
6SCS120          01/01/2000 00:15:00   2.9232
6SCS120          01/01/2000 00:30:00   5.4288
6SCS120          01/01/2000 00:45:00   5.4288
6SCS120          01/01/2000 01:00:00   7.099201
6SCS120          01/01/2000 01:15:00   6.264
6SCS120          01/01/2000 01:30:00   8.352
6SCS120          01/01/2000 01:45:00   8.352
6SCS120          01/01/2000 02:00:00   11.2752
6SCS120          01/01/2000 02:15:00   14.1984
6SCS120          01/01/2000 02:30:00   22.5504
6SCS120          01/01/2000 02:45:00   178.7328
6SCS120          01/01/2000 03:00:00   45.5184
6SCS120          01/01/2000 03:15:00   20.0448
6SCS120          01/01/2000 03:30:00   13.3632
6SCS120          01/01/2000 03:45:00   11.6928
6SCS120          01/01/2000 04:00:00   9.187201
6SCS120          01/01/2000 04:15:00   9.6048
6SCS120          01/01/2000 04:30:00   6.264
6SCS120          01/01/2000 04:45:00   5.0112
6SCS120          01/01/2000 05:00:00   7.099201
6SCS120          01/01/2000 05:15:00   4.5936
6SCS120          01/01/2000 05:30:00   4.176
6SCS120          01/01/2000 05:45:00   4.176
6SCS120          01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6SCS2            01/01/2000 00:00:00   2.232
6SCS2            01/01/2000 00:15:00   1.0416
6SCS2            01/01/2000 00:30:00   1.9344
6SCS2            01/01/2000 00:45:00   1.9344
6SCS2            01/01/2000 01:00:00   2.5296
6SCS2            01/01/2000 01:15:00   2.232
6SCS2            01/01/2000 01:30:00   2.976
6SCS2            01/01/2000 01:45:00   2.976
6SCS2            01/01/2000 02:00:00   4.0176
6SCS2            01/01/2000 02:15:00   5.0592
6SCS2            01/01/2000 02:30:00   8.0352
6SCS2            01/01/2000 02:45:00   63.6864
6SCS2            01/01/2000 03:00:00   16.2192
6SCS2            01/01/2000 03:15:00   7.1424
6SCS2            01/01/2000 03:30:00   4.7616
6SCS2            01/01/2000 03:45:00   4.1664
6SCS2            01/01/2000 04:00:00   3.2736
6SCS2            01/01/2000 04:15:00   3.4224
6SCS2            01/01/2000 04:30:00   2.232
6SCS2            01/01/2000 04:45:00   1.7856
6SCS2            01/01/2000 05:00:00   2.5296
6SCS2            01/01/2000 05:15:00   1.6368
6SCS2            01/01/2000 05:30:00   1.488
6SCS2            01/01/2000 05:45:00   1.488
6SCS2            01/01/2000 06:00:00   0

;Rainfall (mm/hr)
6SCS25           01/01/2000 00:00:00   4.212
6SCS25           01/01/2000 00:15:00   1.9656
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6SCS25          01/01/2000 00:30:00  3.6504
6SCS25          01/01/2000 00:45:00  3.6504
6SCS25          01/01/2000 01:00:00  4.7736
6SCS25          01/01/2000 01:15:00  4.212
6SCS25          01/01/2000 01:30:00  5.616
6SCS25          01/01/2000 01:45:00  5.616
6SCS25          01/01/2000 02:00:00  7.5816
6SCS25          01/01/2000 02:15:00  9.5472
6SCS25          01/01/2000 02:30:00  15.1632
6SCS25          01/01/2000 02:45:00  120.1824
6SCS25          01/01/2000 03:00:00  30.6072
6SCS25          01/01/2000 03:15:00  13.4784
6SCS25          01/01/2000 03:30:00  8.9856
6SCS25          01/01/2000 03:45:00  7.8624
6SCS25          01/01/2000 04:00:00  6.1776
6SCS25          01/01/2000 04:15:00  6.4584
6SCS25          01/01/2000 04:30:00  4.212
6SCS25          01/01/2000 04:45:00  3.3696
6SCS25          01/01/2000 05:00:00  4.7736
6SCS25          01/01/2000 05:15:00  3.0888
6SCS25          01/01/2000 05:30:00  2.808
6SCS25          01/01/2000 05:45:00  2.808
6SCS25          01/01/2000 06:00:00  0

;Rainfall (mm/hr)
6SCS5           01/01/2000 00:00:00  3.024
6SCS5           01/01/2000 00:15:00  1.4112
6SCS5           01/01/2000 00:30:00  2.6208
6SCS5           01/01/2000 00:45:00  2.6208
6SCS5           01/01/2000 01:00:00  3.4272
6SCS5           01/01/2000 01:15:00  3.024
6SCS5           01/01/2000 01:30:00  4.032
6SCS5           01/01/2000 01:45:00  4.032
6SCS5           01/01/2000 02:00:00  5.4432
6SCS5           01/01/2000 02:15:00  6.854401
6SCS5           01/01/2000 02:30:00  10.8864
6SCS5           01/01/2000 02:45:00  86.28481
6SCS5           01/01/2000 03:00:00  21.9744
6SCS5           01/01/2000 03:15:00  9.676801
6SCS5           01/01/2000 03:30:00  6.4512
6SCS5           01/01/2000 03:45:00  5.6448
6SCS5           01/01/2000 04:00:00  4.4352
6SCS5           01/01/2000 04:15:00  4.6368
6SCS5           01/01/2000 04:30:00  3.024
6SCS5           01/01/2000 04:45:00  2.4192
6SCS5           01/01/2000 05:00:00  3.4272
6SCS5           01/01/2000 05:15:00  2.2176
6SCS5           01/01/2000 05:30:00  2.016
6SCS5           01/01/2000 05:45:00  2.016
6SCS5           01/01/2000 06:00:00  0

;Rainfall (mm/hr)
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6SCS50          01/01/2000 00:15:00  2.2008
6SCS50          01/01/2000 00:30:00  4.0872
6SCS50          01/01/2000 00:45:00  4.0872
6SCS50          01/01/2000 01:00:00  5.3448
6SCS50          01/01/2000 01:15:00  4.716
6SCS50          01/01/2000 01:30:00  6.288
6SCS50          01/01/2000 01:45:00  6.288
6SCS50          01/01/2000 02:00:00  8.4888
6SCS50          01/01/2000 02:15:00  10.6896
6SCS50          01/01/2000 02:30:00  16.9776
6SCS50          01/01/2000 02:45:00  134.5632
6SCS50          01/01/2000 03:00:00  34.2696
6SCS50          01/01/2000 03:15:00  15.0912
6SCS50          01/01/2000 03:30:00  10.0608
6SCS50          01/01/2000 03:45:00  8.8032
6SCS50          01/01/2000 04:00:00  6.9168
6SCS50          01/01/2000 04:15:00  7.2312
6SCS50          01/01/2000 04:30:00  4.716
6SCS50          01/01/2000 04:45:00  3.7728
6SCS50          01/01/2000 05:00:00  5.3448
6SCS50          01/01/2000 05:15:00  3.4584
6SCS50          01/01/2000 05:30:00  3.144
6SCS50          01/01/2000 05:45:00  3.144
6SCS50          01/01/2000 06:00:00  0

;Depth (m)
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POND            01/01/2000 00:02:00  0
POND            01/01/2000 00:03:00  0
POND            01/01/2000 00:04:00  0
POND            01/01/2000 00:05:00  0
POND            01/01/2000 00:06:00  0
POND            01/01/2000 00:07:00  0
POND            01/01/2000 00:08:00  0
POND            01/01/2000 00:09:00  0
POND            01/01/2000 00:10:00  0
POND            01/01/2000 00:11:00  0
......
Too many data points (720 in total).

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       OGS              OGS_Unit
Node       POND             Pond
Link       CULV-1           Culvert

[MAP]
DIMENSIONS      467683.7855     5030256.94645   467898.8685     5030527.44855
UNITS           Meters

[COORDINATES]
;;Node          X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Ditch           467770.833         5030279.242
OF1             467764.696         5030276.585
OF2             467862.637         5030430.33
J3              467763.915         5030297.109
OGS             467762.549         5030300.204
POND            467741.875         5030351.271
SU1             467762.068         5030301.327

[VERTICES]
;;Link          X-Coord            Y-Coord
;;-------------- ------------------ ------------------
W1              467745.933         5030349.124
W1              467763.697         5030305.328

[POLYGONS]
;;Subcatchment  X-Coord            Y-Coord
;;-------------- ------------------ ------------------
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B2	467705.051	5030450.148
B2	467705.012	5030450.235
B2	467704.969	5030450.321
B2	467704.923	5030450.404
B2	467704.875	5030450.487
B2	467704.824	5030450.567
B2	467704.77	5030450.646
B2	467704.713	5030450.723
B2	467704.654	5030450.798
B2	467704.592	5030450.871
B2	467704.527	5030450.941
B2	467704.461	5030451.009
B2	467704.391	5030451.075
B2	467704.32	5030451.139
B2	467704.247	5030451.2
B2	467704.171	5030451.258
B2	467704.093	5030451.314
B2	467704.014	5030451.367
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B2	467703.85	5030451.464
B2	467703.765	5030451.508
B2	467703.679	5030451.55
B2	467703.592	5030451.588
B2	467703.503	5030451.624
B2	467703.413	5030451.656
B2	467703.322	5030451.685
B2	467703.23	5030451.711
B2	467703.137	5030451.734
B2	467703.044	5030451.753
B2	467702.95	5030451.77
B2	467702.855	5030451.783
B2	467702.76	5030451.792
B2	467702.665	5030451.799
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B2	467702.379	5030451.798
B2	467702.283	5030451.791
B2	467702.188	5030451.781
B2	467702.094	5030451.768
B2	467702	5030451.751
B2	467701.906	5030451.731
B2	467701.814	5030451.708
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B2	467701.631	5030451.652
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B2	467701.366	5030451.544
B2	467701.28	5030451.502
B2	467701.195	5030451.458
B2	467701.113	5030451.41
B2	467701.032	5030451.359
B2	467700.952	5030451.306
B2	467700.875	5030451.25
B2	467700.8	5030451.191
B2	467700.727	5030451.13
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B2	467700.587	5030451
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B2	467700.395	5030450.787
B2	467700.336	5030450.712
B2	467700.279	5030450.635
B2	467700.226	5030450.556
B2	467700.175	5030450.475
B2	467700.127	5030450.393
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B2	467700.04	5030450.223
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B2	467699.782	5030449.211
B2	467699.778	5030449.115
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B2	467699.808	5030448.639
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SWM_Block	467738.415	5030363.766

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SWM_Block	467739.15	5030363.182
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SWM_Block	467739.795	5030362.951
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SWM_Block	467739.964	5030362.921
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SWM_Block	467740.307	5030362.897
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SWM_Block	467759.119	5030368.021
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SWM_Block	467759.44	5030367.503
SWM_Block	467759.475	5030367.423
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SWM_Block	467767.163	5030347.198
SWM_Block	467767.197	5030347.12
SWM_Block	467767.234	5030347.043
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SWM_Block	467767.316	5030346.893
SWM_Block	467767.361	5030346.82
SWM_Block	467767.408	5030346.749
SWM_Block	467767.457	5030346.68
SWM_Block	467767.509	5030346.612
SWM_Block	467767.563	5030346.546
SWM_Block	467767.62	5030346.482
SWM_Block	467767.678	5030346.42
SWM_Block	467767.739	5030346.36
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SWM_Block	467767.866	5030346.246
SWM_Block	467767.933	5030346.192
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SWM_Block	467768.071	5030346.092
SWM_Block	467768.142	5030346.046
SWM_Block	467768.216	5030346.002
SWM_Block	467768.29	5030345.96
SWM_Block	467768.366	5030345.921
SWM_Block	467768.443	5030345.885
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SWM_Block	467785.982	5030338.005
SWM_Block	467786.062	5030337.974
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SWM_Block	467795.143	5030340.725
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SWM_Block	467795.577	5030340.769
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SWM_Block	467796.012	5030340.737
SWM_Block	467796.098	5030340.721
SWM_Block	467796.183	5030340.703
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SWM_Block	467796.352	5030340.657
SWM_Block	467796.435	5030340.629
SWM_Block	467796.517	5030340.599
SWM_Block	467796.598	5030340.566
SWM_Block	467796.677	5030340.53
SWM_Block	467796.756	5030340.492
SWM_Block	467796.833	5030340.45
SWM_Block	467796.908	5030340.406
SWM_Block	467796.982	5030340.36
SWM_Block	467797.054	5030340.31
SWM_Block	467797.125	5030340.259
SWM_Block	467797.193	5030340.205
SWM_Block	467797.26	5030340.148
SWM_Block	467797.325	5030340.089
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SWM_Block	467797.448	5030339.965
SWM_Block	467797.506	5030339.9
SWM_Block	467797.562	5030339.833
SWM_Block	467797.615	5030339.764
SWM_Block	467797.666	5030339.693
SWM_Block	467797.715	5030339.62
SWM_Block	467797.761	5030339.546
SWM_Block	467797.804	5030339.47
SWM_Block	467797.845	5030339.393
SWM_Block	467797.883	5030339.314
SWM_Block	467797.918	5030339.234
SWM_Block	467805.067	5030320.419
SWM_Block	467805.095	5030320.337
SWM_Block	467805.12	5030320.253
SWM_Block	467805.142	5030320.168
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SWM_Block	467805.191	5030319.911
SWM_Block	467805.201	5030319.824
SWM_Block	467805.208	5030319.737
SWM_Block	467805.213	5030319.649
SWM_Block	467805.214	5030319.562
SWM_Block	467805.212	5030319.474
SWM_Block	467805.207	5030319.387
SWM_Block	467805.199	5030319.3
SWM_Block	467805.188	5030319.213
SWM_Block	467805.173	5030319.127
SWM_Block	467805.156	5030319.041
SWM_Block	467805.136	5030318.956
SWM_Block	467805.113	5030318.871
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SWM_Block	467805.058	5030318.705
SWM_Block	467805.026	5030318.624
SWM_Block	467804.992	5030318.544
SWM_Block	467804.954	5030318.464
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SWM_Block	467804.871	5030318.311
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SWM_Block	467804.778	5030318.163
SWM_Block	467804.727	5030318.091
SWM_Block	467804.674	5030318.022
SWM_Block	467804.618	5030317.954
SWM_Block	467804.561	5030317.889
SWM_Block	467804.501	5030317.825
SWM_Block	467804.438	5030317.764
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SWM_Block	467804.973	5030316.097
SWM_Block	467757.573	5030298.19
SWM_Block	467699.987	5030447.997
SWM_Block	467699.952	5030448.086
SWM_Block	467699.92	5030448.176
SWM_Block	467699.892	5030448.267
SWM_Block	467699.866	5030448.359
SWM_Block	467699.844	5030448.452
SWM_Block	467699.824	5030448.545
SWM_Block	467699.808	5030448.639
SWM_Block	467699.796	5030448.734
SWM_Block	467699.786	5030448.829
SWM_Block	467699.78	5030448.925
SWM_Block	467699.778	5030449.02
SWM_Block	467699.778	5030449.115
SWM_Block	467699.782	5030449.211
SWM_Block	467699.789	5030449.306
SWM_Block	467699.8	5030449.401
SWM_Block	467699.814	5030449.496
SWM_Block	467699.831	5030449.59
SWM_Block	467699.851	5030449.683
SWM_Block	467699.875	5030449.775
SWM_Block	467699.901	5030449.867
SWM_Block	467699.931	5030449.958
SWM_Block	467699.964	5030450.047
SWM_Block	467700	5030450.136
SWM_Block	467700.04	5030450.223
SWM_Block	467700.082	5030450.309
SWM_Block	467700.127	5030450.393
SWM_Block	467700.175	5030450.475
SWM_Block	467700.226	5030450.556
SWM_Block	467700.279	5030450.635
SWM_Block	467700.336	5030450.712
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SWM_Block	467700.456	5030450.86
SWM_Block	467700.52	5030450.931
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SWM_Block	467700.727	5030451.13
SWM_Block	467700.8	5030451.191
SWM_Block	467700.875	5030451.25
SWM_Block	467700.952	5030451.306
SWM_Block	467701.032	5030451.359
SWM_Block	467701.113	5030451.41
SWM_Block	467701.195	5030451.458
SWM_Block	467701.28	5030451.502
SWM_Block	467701.366	5030451.544
SWM_Block	467701.453	5030451.583
SWM_Block	467701.541	5030451.619
SWM_Block	467701.631	5030451.652
SWM_Block	467701.722	5030451.681
SWM_Block	467701.814	5030451.708
SWM_Block	467701.906	5030451.731
SWM_Block	467702	5030451.751
SWM_Block	467702.094	5030451.768
SWM_Block	467702.188	5030451.781
SWM_Block	467702.283	5030451.791
SWM_Block	467702.379	5030451.798
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SWM_Block	467702.569	5030451.802
SWM_Block	467702.665	5030451.799
SWM_Block	467702.76	5030451.792
SWM_Block	467702.855	5030451.783
SWM_Block	467702.95	5030451.77
SWM_Block	467703.044	5030451.753
SWM_Block	467703.137	5030451.734
SWM_Block	467703.23	5030451.711
SWM_Block	467703.322	5030451.685
SWM_Block	467703.413	5030451.656
SWM_Block	467703.503	5030451.624
SWM_Block	467703.592	5030451.588
SWM_Block	467703.679	5030451.55
SWM_Block	467703.765	5030451.508
SWM_Block	467703.85	5030451.464
SWM_Block	467703.933	5030451.417
SWM_Block	467704.014	5030451.367
SWM_Block	467704.093	5030451.314
SWM_Block	467704.171	5030451.258
SWM_Block	467704.247	5030451.2
SWM_Block	467704.32	5030451.139
SWM_Block	467704.391	5030451.075
SWM_Block	467704.461	5030451.009
SWM_Block	467704.527	5030450.941
SWM_Block	467704.592	5030450.871
SWM_Block	467704.654	5030450.798
SWM_Block	467704.713	5030450.723
SWM_Block	467704.77	5030450.646
SWM_Block	467704.824	5030450.567

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SWM_Block        467704.875         5030450.487
SWM_Block        467704.923         5030450.404
SWM_Block        467704.969         5030450.321
SWM_Block        467705.012         5030450.235
SWM_Block        467705.051         5030450.148
SWM_Block        467705.088         5030450.06
SWM_Block        467705.121         5030449.97

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 3
  Number of nodes ........... 7
  Number of links ........... 6
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ------------------------------------------------------------------------
  Rainfall             3CHI100                        INTENSITY    10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                       Area     Width   %Imperv    %Slope Rain Gage
Outlet
  -----------------------------------------------------------------------------
---------------------------
  B1                         0.37    111.91      3.25    2.0000 Rainfall
OF2
  B2                         1.84    180.23     25.76    2.0000 Rainfall
POND
  SWM_Block                  0.31    211.33     39.92    3.0000 Rainfall
POND


  ************
  Node Summary
  ************
                                                Invert      Max.    Ponded    External
  Name                 Type                      Elev.     Depth      Area    Inflow
  -------------------------------------------------------------------------------
  Ditch                JUNCTION                  84.30      1.00       0.0
  OF1                  OUTFALL                   84.28      0.48       0.0
  OF2                  OUTFALL                   85.41      0.00       0.0
  J3                   STORAGE                   84.74      1.19       0.0
  OGS                  STORAGE                   84.61      1.32       0.0
  POND                 STORAGE                   85.10      0.84       0.0
  SU1                  STORAGE                   84.61      1.32       0.0


  ************
  Link Summary
  ************
  Name             From Node        To Node          Type            Length
%Slope Roughness
  -----------------------------------------------------------------------------
--------------
  C1               SU1              OGS              CONDUIT            2.1
2.3816    0.0130
  C2               OGS              J3               CONDUIT            4.5
2.0004    0.0130
  C3               Ditch            OF1              CONDUIT            6.7
0.2990    0.0250
  CULV-1           J3               Ditch            CONDUIT           16.0
0.3750    0.0240
  OR1              POND             SU1              ORIFICE
  W1               POND             SU1              WEIR


  *********************
  Cross Section Summary
  *********************
                                        Full     Full     Hyd.     Max.   No. of
Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
Flow
  -----------------------------------------------------------------------------
--------
  C1               CIRCULAR             0.45     0.16     0.11     0.45        1
440.02
  C2               CIRCULAR             0.45     0.16     0.11     0.45        1
403.27
  C3               Ditch                0.48     2.01     0.30     7.56        1
1967.71
  CULV-1           ARCH                 0.50     0.27     0.15     0.68        1
192.59


  ****************
  Transect Summary
  ****************

  Transect Ditch
  Area:
            0.0019     0.0070     0.0131     0.0199     0.0273
            0.0354     0.0441     0.0535     0.0636     0.0743
            0.0857     0.0977     0.1103     0.1235     0.1372
            0.1514     0.1662     0.1816     0.1975     0.2140
            0.2310     0.2486     0.2667     0.2853     0.3045
            0.3243     0.3445     0.3654     0.3874     0.4103
            0.4343     0.4594     0.4855     0.5124     0.5397
            0.5671     0.5949     0.6228     0.6510     0.6794
            0.7081     0.7371     0.7668     0.7975     0.8290
            0.8614     0.8948     0.9290     0.9640     1.0000
  Hrad:
            0.0161     0.0390     0.0655     0.0899     0.1129
            0.1348     0.1559     0.1762     0.1960     0.2153
            0.2342     0.2535     0.2738     0.2938     0.3134
            0.3328     0.3518     0.3707     0.3894     0.4078
            0.4261     0.4445     0.4627     0.4808     0.4988
            0.5166     0.5344     0.5443     0.5503     0.5572
            0.5649     0.5732     0.5822     0.6018     0.6273
            0.6525     0.6774     0.7021     0.7266     0.7509
            0.7749     0.8016     0.8304     0.8580     0.8842
            0.9094     0.9335     0.9566     0.9787     1.0000
  Width:
            0.1028     0.1587     0.1768     0.1949     0.2129
            0.2310     0.2491     0.2672     0.2852     0.3033
            0.3214     0.3385     0.3537     0.3688     0.3840
            0.3992     0.4144     0.4295     0.4447     0.4599
            0.4750     0.4899     0.5048     0.5197     0.5346
            0.5495     0.5644     0.5878     0.6164     0.6449
            0.6735     0.7020     0.7306     0.7452     0.7516
            0.7581     0.7646     0.7710     0.7775     0.7840
            0.7904     0.8053     0.8297     0.8540     0.8783
            0.9027     0.9270     0.9513     0.9757     1.0000


  *********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
```

```
  not just on results from each reporting time step.
  *********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Infiltration Method ...... CURVE_NUMBER
  Flow Routing Method ...... DYNWAVE
  Surcharge Method ......... EXTRAN
  Starting Date ............ 01/01/2000 00:00:00
  Ending Date .............. 01/02/2000 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00
  Routing Time Step ........ 1.00 sec
  Variable Time Step ....... YES
  Maximum Trials ........... 8
  Number of Threads ........ 1
  Head Tolerance ........... 0.001500 m


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.180        71.708
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.052        20.708
  Surface Runoff ...........         0.126        50.023
  Final Storage ............         0.003         1.329
  Continuity Error (%) .....        -0.492


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.126         1.258
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.002
  External Outflow .........         0.126         1.256
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.003         0.034
  Final Stored Volume ......         0.003         0.034
  Continuity Error (%) .....         0.348


  ***************************
  Time-Step Critical Elements
  ***************************
  Link C1 (81.20%)


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link OR1 (15)
  Link C3 (13)
  Link C1 (1)


  *************************
  Routing Time Step Summary
  *************************
  Minimum Time Step           :      0.64 sec
  Average Time Step           :      0.90 sec
  Maximum Time Step           :      1.00 sec
  Percent in Steady State     :      0.00
  Average Iterations per Step :      2.00
  Percent Not Converging      :      0.00
  Time Step Frequencies       :
     1.000 -  0.871 sec       :     81.36 %
     0.871 -  0.758 sec       :      7.41 %
     0.758 -  0.660 sec       :      6.63 %
     0.660 -  0.574 sec       :      4.60 %
     0.574 -  0.500 sec       :      0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  -----------------------------------------------------------------------------
--------------------------------------------
                           Total      Total      Total      Total     Imperv
Perv     Total       Total     Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff   Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm
mm          mm    10^6 ltr       LPS
  -----------------------------------------------------------------------------
--------------------------------------------
  B1                       71.71       0.00       0.00      32.74       2.28
38.06      38.06        0.14    55.32   0.531
  B2                       71.71       0.00       0.00      18.46      18.14
52.22      52.22        0.96   309.24   0.728
  SWM_Block                71.71       0.00       0.00      19.79      28.06
23.13      51.19        0.16   115.26   0.714


  ******************
  Node Depth Summary
  ******************

  -----------------------------------------------------------------------------
--
                                 Average  Maximum  Maximum  Time of Max
Reported
                                   Depth    Depth      HGL   Occurrence    Max
Depth
  Node                 Type       Meters   Meters   Meters  days hr:min
Meters
  -----------------------------------------------------------------------------
--
  Ditch                JUNCTION     0.88     0.88    85.18     0  02:06
0.88
  OF1                  OUTFALL      0.90     0.90    85.18     0  00:00
0.90
  OF2                  OUTFALL      0.00     0.00    85.41     0  00:00
0.00
  J3                   STORAGE      0.44     0.46    85.20     0  02:11
0.46
  OGS                  STORAGE      0.57     0.58    85.19     0  02:11
0.58
  POND                 STORAGE      0.25     0.50    85.60     0  02:11
0.50
  SU1                  STORAGE      0.58     0.64    85.25     0  02:12
0.64


  *******************
  Node Inflow Summary
  *******************

  -----------------------------------------------------------------------------
-----------------
```

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
Ditch	JUNCTION	0.00	81.10	0 02:12	0	1.12	0.400
OF1	OUTFALL	0.00	81.69	0 02:11	0	1.12	0.000
OF2	OUTFALL	55.32	55.32	0 01:10	0.14	0.14	0.000
J3	STORAGE	0.00	81.11	0 02:12	0	1.12	0.000
OGS	STORAGE	0.00	81.07	0 02:12	0	1.12	-0.000
POND	STORAGE	384.23	384.23	0 01:10	1.12	1.13	-0.001
SU1	STORAGE	0.00	81.05	0 02:11	0	1.12	0.001

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
Ditch	JUNCTION	19.84	0.000	0.120

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
J3	0.001	35	0	0	0.001	36	0 02:11	81.10
OGS	0.001	43	0	0	0.001	44	0 02:11	81.11
POND	0.231	16	0	0	0.681	46	0 02:11	81.05
SU1	0.000	44	0	0	0.000	49	0 02:12	81.07

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	99.04	15.14	81.69	1.118
OF2	18.52	10.16	55.32	0.140
System	58.78	25.30	92.64	1.258

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	81.07	0 02:12	0.61	0.18	0.78
C2	CONDUIT	81.11	0 02:12	0.55	0.20	0.87
C3	CHANNEL	81.69	0 02:11	0.04	0.04	1.00
CULV-1	CONDUIT	81.10	0 02:12	0.30	0.42	0.96
OR1	ORIFICE	12.47	0 02:38			1.00
W1	WEIR	68.60	0 02:11			0.30

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class -----								
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
CULV-1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C3	24.00	24.00	24.00	0.01	0.01
CULV-1	0.01	0.01	11.88	0.01	0.01

Analysis begun on: Mon Dec 12 10:06:28 2022
Analysis ended on: Mon Dec 12 10:06:29 2022
Total elapsed time: 00:00:01

Hydrologic Parameters

Table 1: Pre-Development Conditions

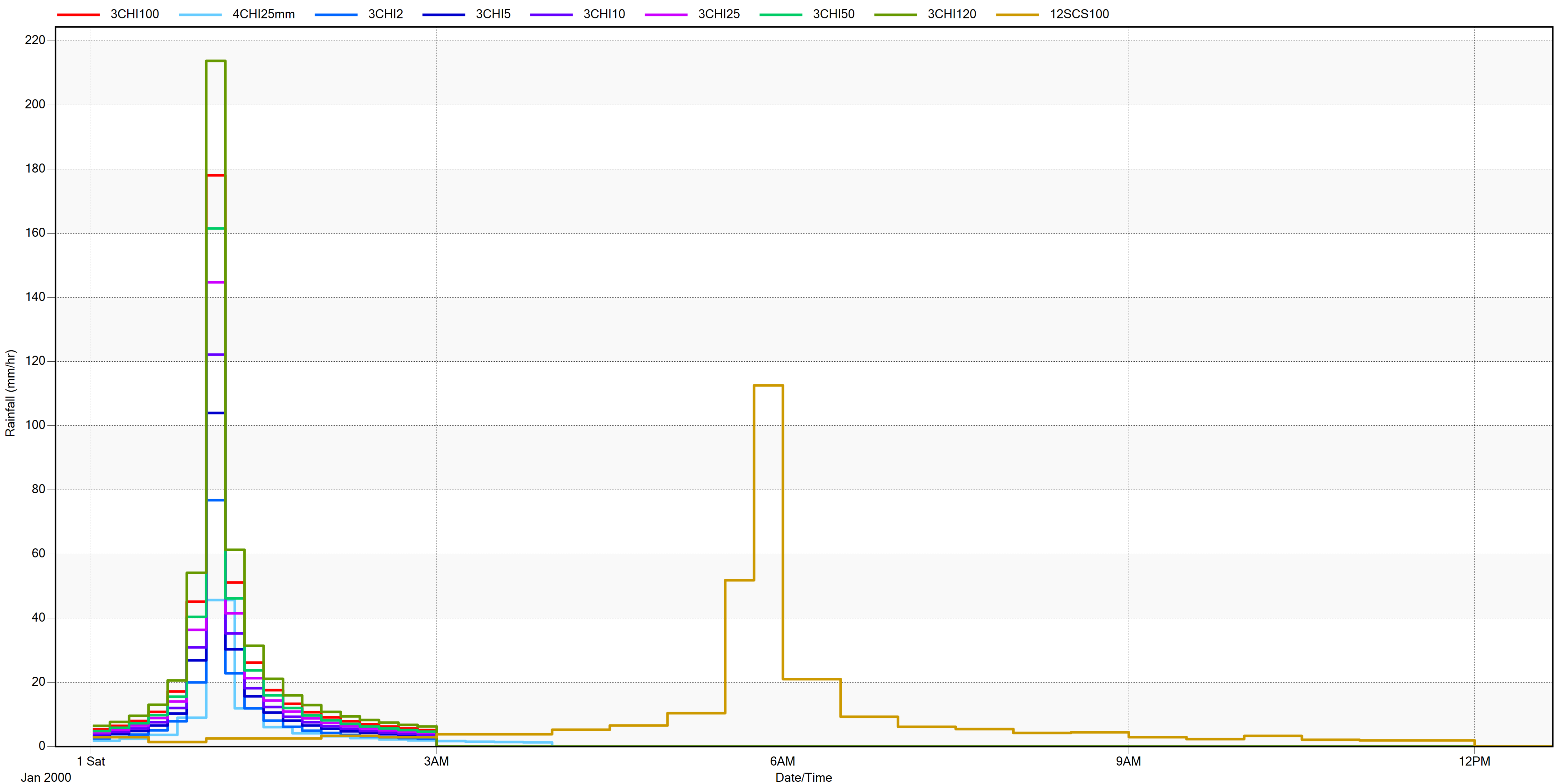
Name	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	CN
S1	2.013	231.963	86.772	0.707	0	0.013	0.25	1.57	4.67	OUTLET	100	82
S2	0.500	151.840	32.936	2.060	0	0.013	0.25	1.57	4.67	OUTLET	100	82

Table 2: Existing Conditions

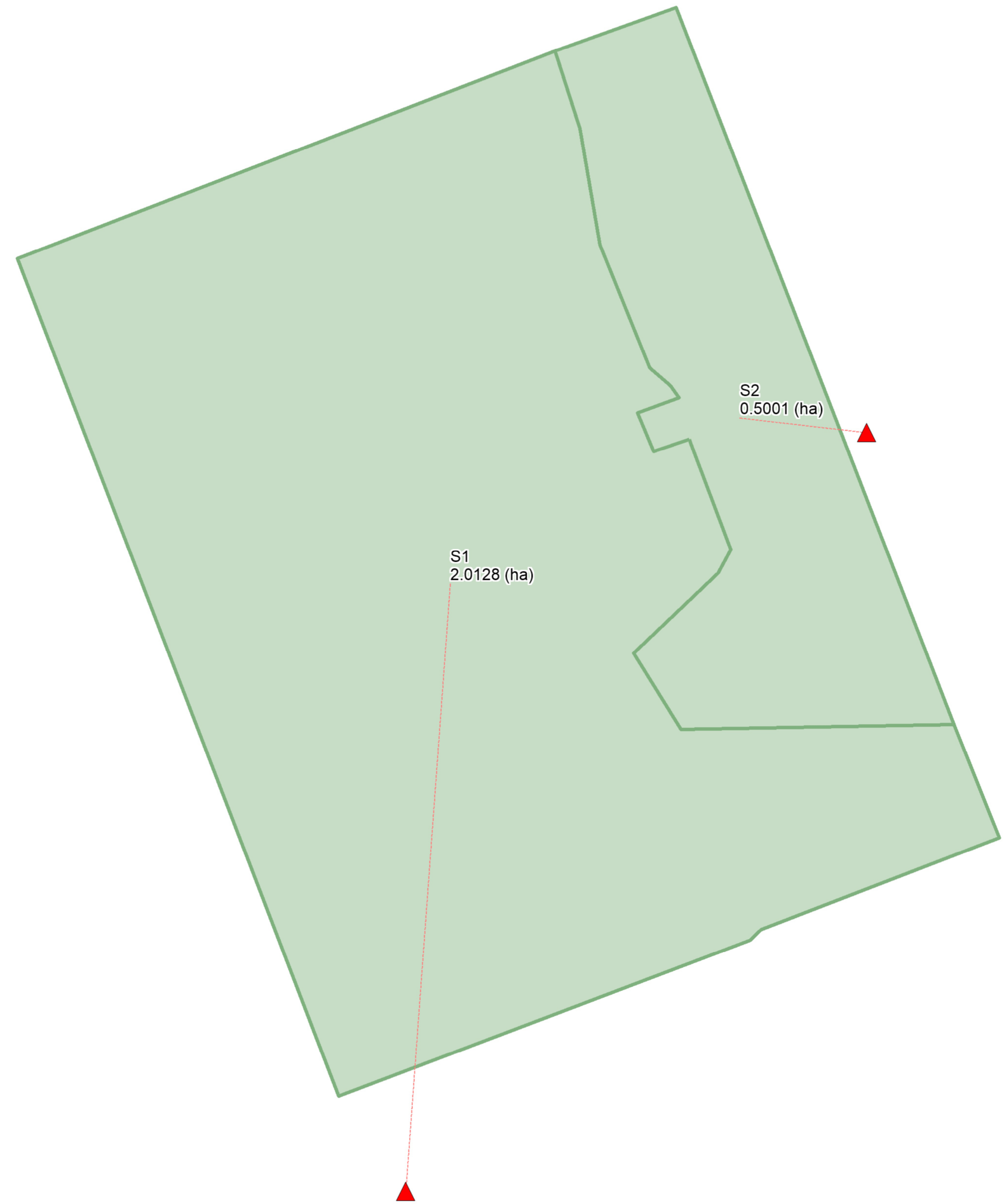
Name	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	CN
S1	1.093	107.730	101.494	0.732	0.20	0.013	0.25	1.57	4.67	OUTLET	100	85.94
S2	0.379	151.000	25.106	2.000	13.81	0.013	0.25	1.57	4.67	OUTLET	100	85.60
S4	0.900	57.019	157.860	1.000	60.92	0.013	0.25	1.57	4.67	OUTLET	100	82.00
S5	0.141	125.440	11.232	33.330	45.68	0.013	0.25	1.57	4.67	OUTLET	100	83.69

Table 3: Post Development Conditions

Name	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	CN
B1	0.368	111.909	32.875	2	3.25	0.013	0.25	1.57	4.67	PERVIOUS	100	84
B2	1.839	180.230	102.02	2	25.76	0.013	0.25	1.57	4.67	PERVIOUS	100	90.47
SWM_BLOCK	0.309	211.330	14.617	3	39.92	0.013	0.25	1.57	4.67	OUTLET	100	84



PROJECT: **Hydro One Operations Centre** **3450 Frank Kenny Road, Orléans ON**			
DRAWING: Hyteographs			
J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS	This drawing is copyright protected and may not be reproduced or use for purposes other than execution of the described work without the express written consent of J.L. Richards & Associates Limited.	DESIGN: BP DRAWN: BP CHECKED: BP	JLR NO.: 31500-000 DRAWING NO.: Figure 1



Legend

- Outfalls
- Subcatchments

N

45 m

PROJECT:

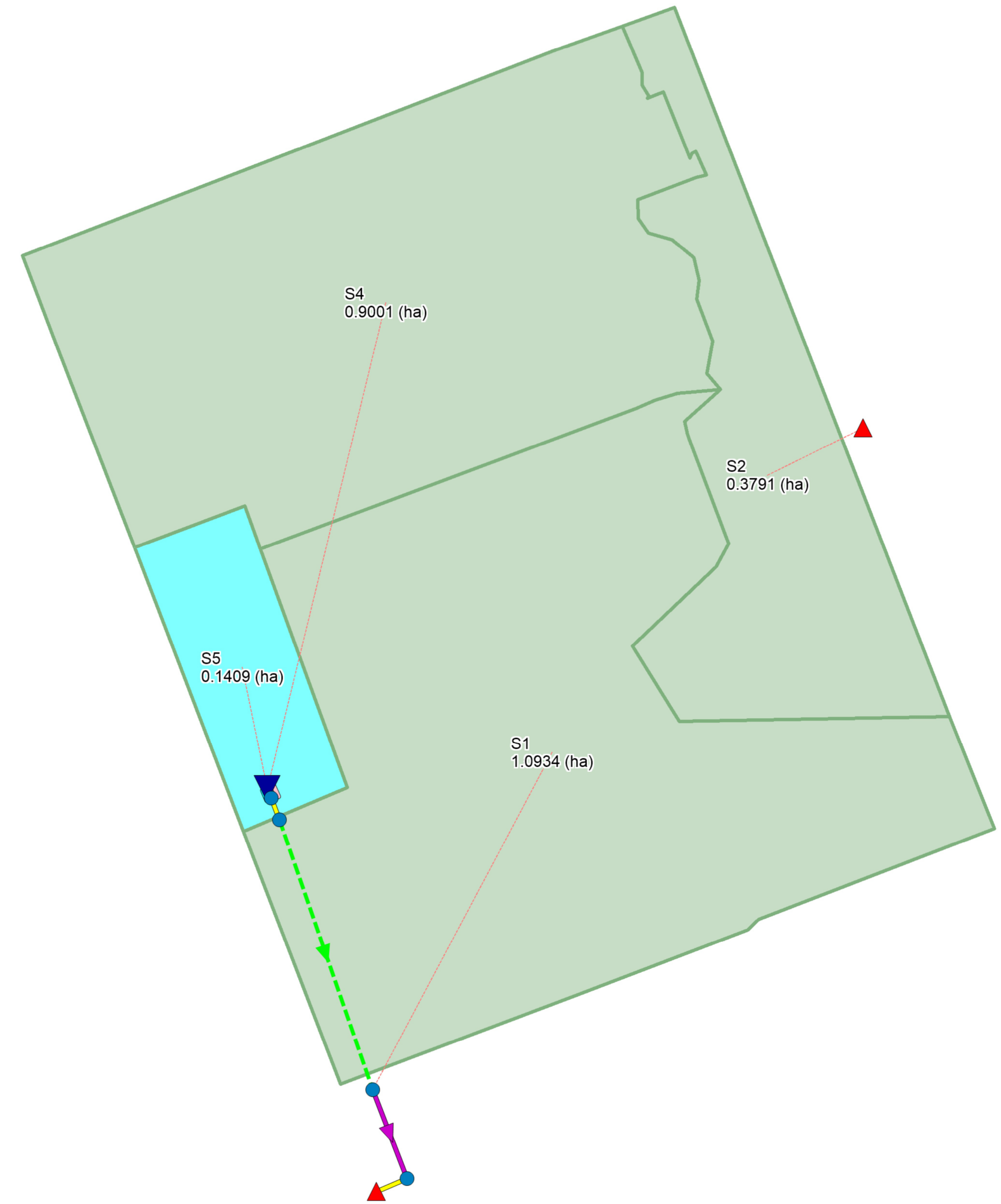
Hydro One Oprations Centre
3450 Frank Kenny Road, Orleans, ON

DRAWING:

Stormwater Management Report
Pre-Development Condition Model Schematic

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	ID	JLR NO.:	31500-000
DRAWN:	ID	DRAWING NO.:	FIGURE E-1
CHECKED:	BP		



Legend

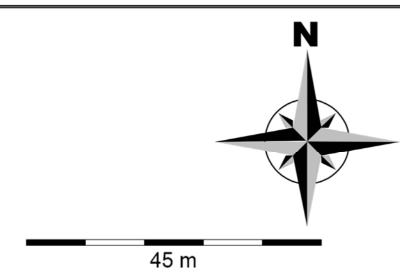
- Junctions
- Outfalls
- Dry Pond - Existing Condition

Conduits

- Conduits
- Conduits
- Outlet Channel
- Culvert
- Orifices
- Weirs

Subcatchments

- Site
- SWM Block - Dry Pond



PROJECT:

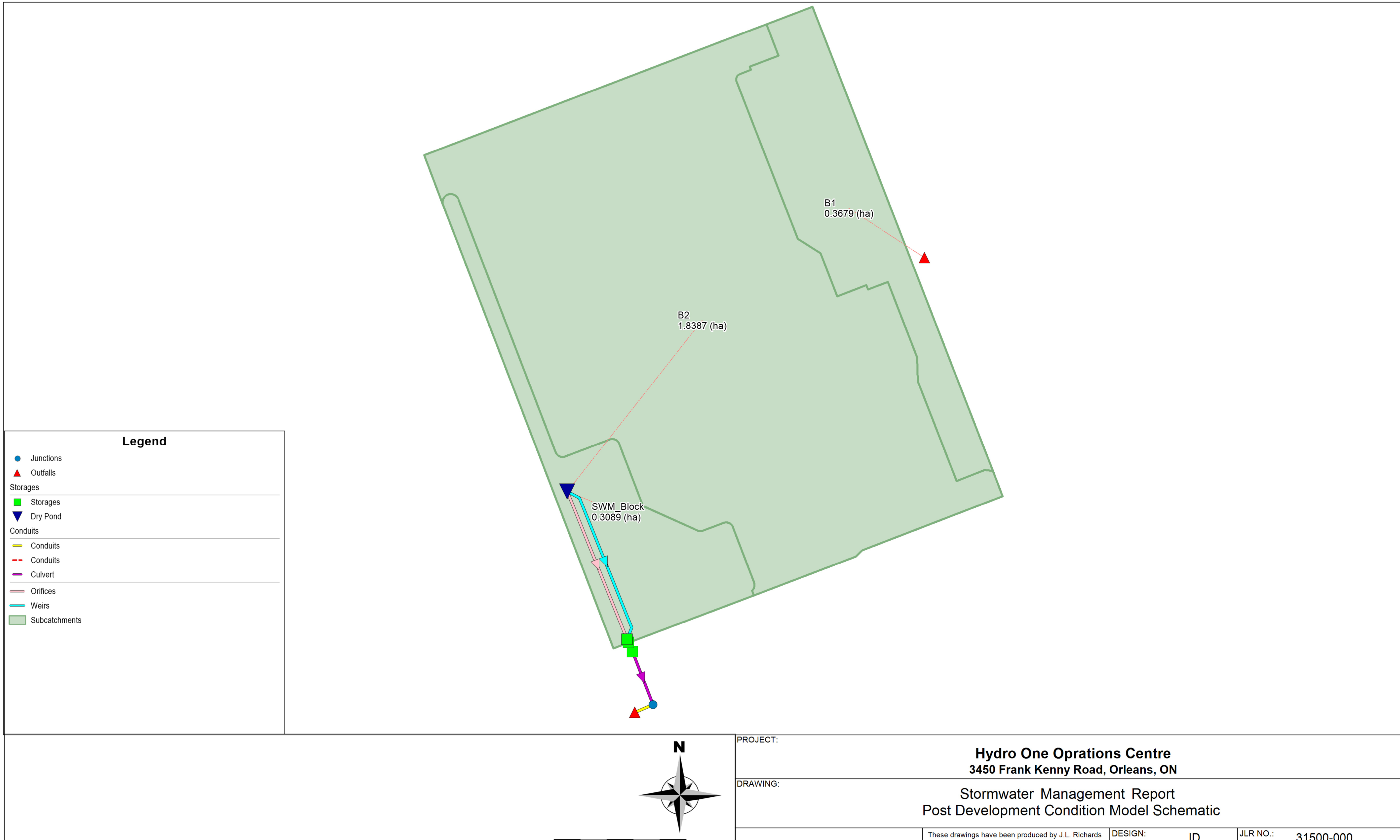
Hydro One Oprations Centre
3450 Frank Kenny Road, Orleans, ON

DRAWING:

Stormwater Management Report
Existing Development Model Schematic

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	ID	JLR NO.:	31500-000
DRAWN:	ID	DRAWING NO.:	FIGURE E-2
CHECKED:	BP		



PROJECT:

Hydro One Oprations Centre
3450 Frank Kenny Road, Orleans, ON

DRAWING:

Stormwater Management Report
Post Development Condition Model Schematic

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

DESIGN:	ID	JLR NO.:	31500-000
DRAWN:	ID	DRAWING NO.:	FIGURE E-3
CHECKED:	BP		

ECHELON ENVIRONMENTAL

CDS AVERAGE ANNUAL EFFICIENCY FOR TSS REMOVAL & TOTAL ANNUAL VOLUME TREATED

CDS

Project: Honi Orleans
Location: Orleans
OGS ID: OGS

Engineer: JL Richards
Contact: Marie-France Duthilleul
Date: 6/Dec/22

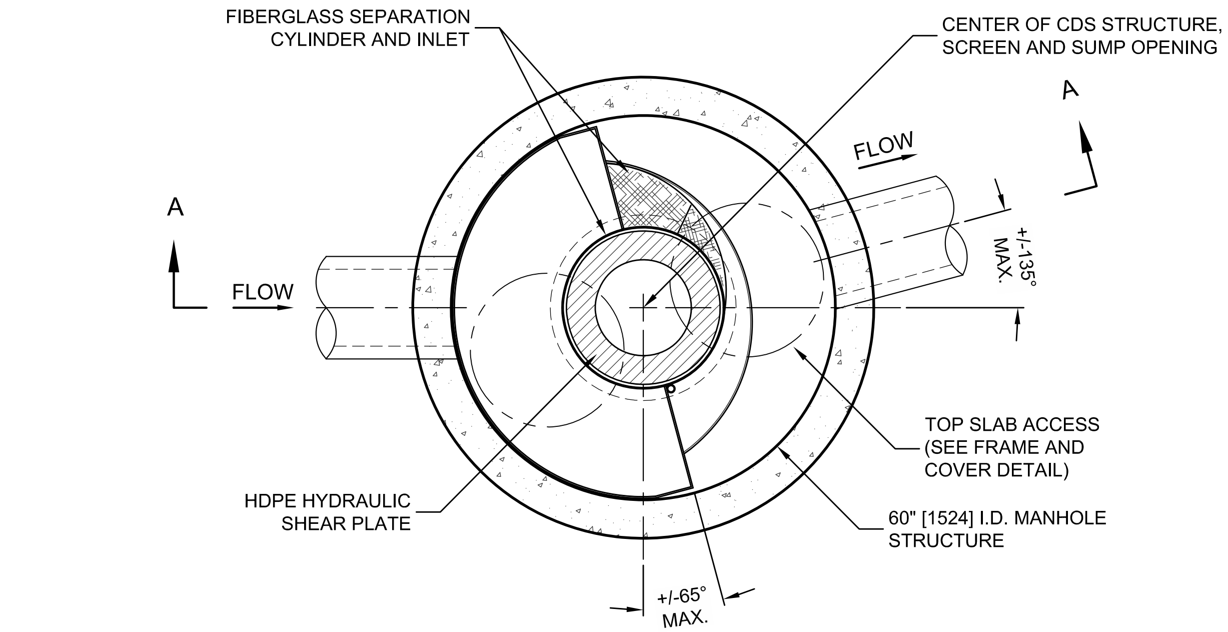
Area: 2.14 ha
Rc: 0.73
Upstream Storage: 686 m3
CDS Model: PMSU2015_5ES

Treatment Capacity: 20 l/s
Particle Size Distribution: FINE
IDF Rainfall Data: City of Ottawa

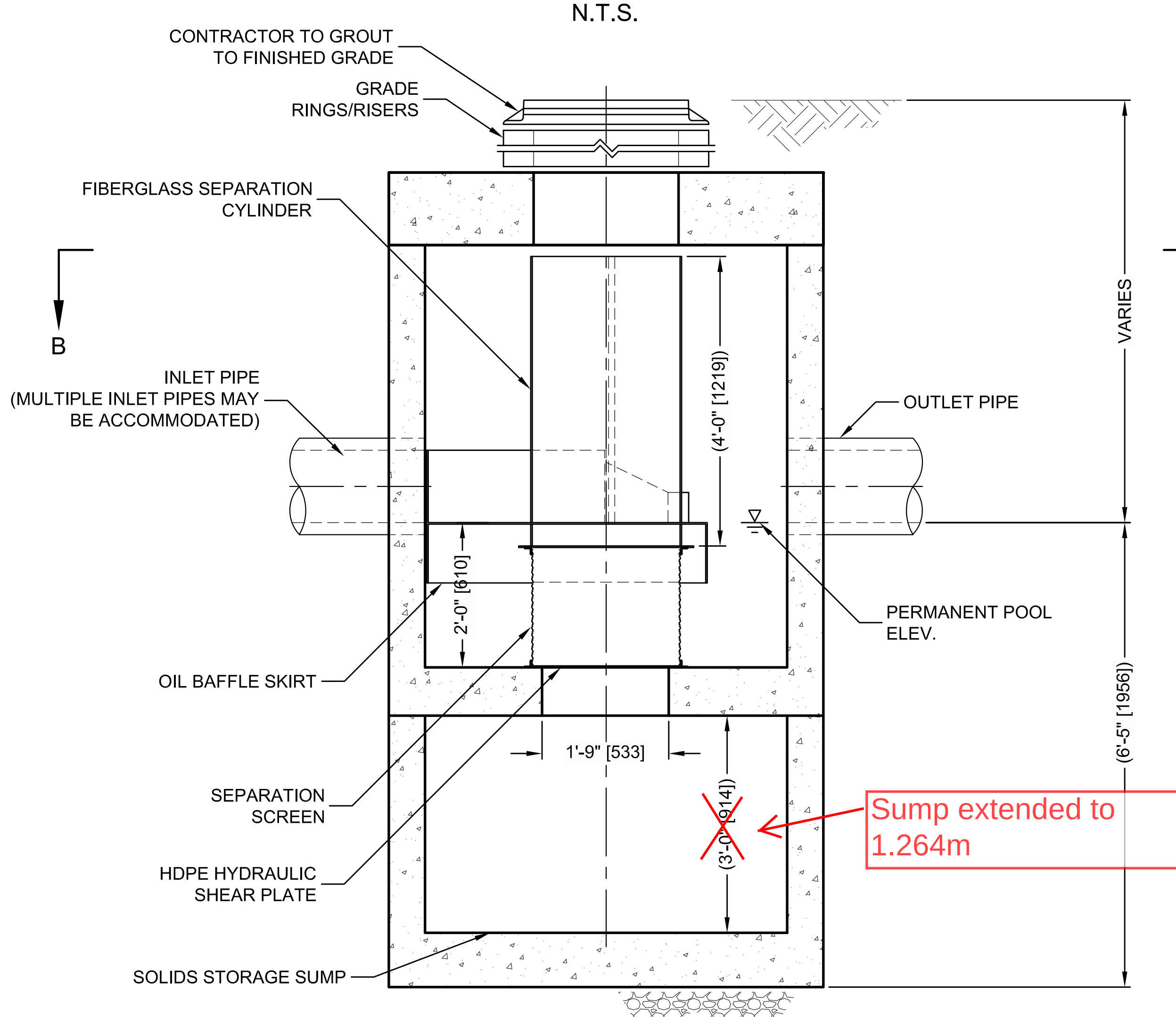
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.083	3.11	94.98	16924	16924	**100.00**	3.11	3.11	0.00	100.00
2-M	0.1667	3.83	94.10	20686	20686	**99.75**	3.83	3.83	0.00	100.00
3-M	0.25	4.43	93.36	23829	23829	**98.17**	4.43	4.43	0.00	100.00
4-M	0.333	4.98	92.68	26697	26697	**95.04**	4.98	4.98	0.00	100.00
5-M	0.417	5.90	91.53	31549	31549	**90.91**	5.90	5.90	0.00	100.00
6-M	0.5	6.82	90.38	36400	36400	**86.47**	6.82	6.82	0.00	100.00
7-M	0.583	7.07	90.07	37693	37693	**82.01**	7.07	7.07	0.00	100.00
8-M	0.667	7.31	89.76	38986	38986	**77.67**	7.31	7.31	0.00	100.00
9-M	0.75	7.56	89.45	40279	40279	**73.64**	7.56	7.56	0.00	100.00
10-M	0.833	8.01	88.88	42681	42681	**69.90**	8.01	8.01	0.00	100.00
11-M	0.917	8.46	88.31	45082	45082	**66.40**	8.46	8.46	0.00	100.00
1-Yr	1	8.91	87.74	47483	47483	**63.21**	8.91	8.91	0.00	100.00
2-Yr	2	9.60	86.85	51191	51191	**39.35**	9.60	9.60	0.00	100.00
5-Yr	5	21.50	70.53	114959	116979	**18.13**	21.50	20.10	1.39	98.27
10-Yr	10	35.80	42.42	122141	202794	**9.52**	35.80	20.10	15.70	60.23
25-Yr	25	55.40	27.56	123481	315177	**3.92**	55.40	20.10	35.30	39.18
50-Yr	50	72.90	22.01	123745	395485	**1.98**	72.90	20.10	52.79	31.29
100-Yr	100	91.80	18.28	123912	476714	**1.00**	91.80	20.10	71.69	25.99

Average Annual TSS Removal Efficiency [%]: **90.2** Ave. Ann. T. Volume [%]: **99.0**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations



PLAN VIEW B-B
N.T.S.



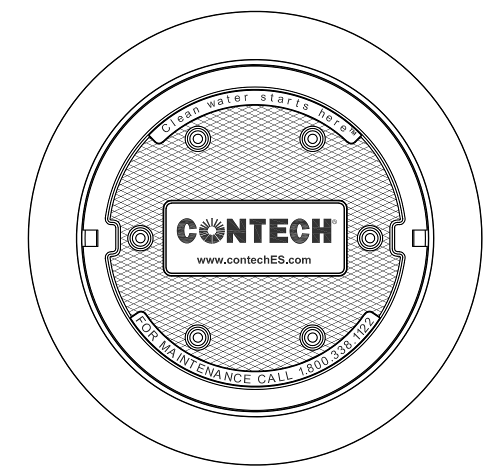
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CDS PMSU2015-5-C DESIGN NOTES

THE STANDARD CDS PMSU2015-5-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
CUSTOMIZABLE SUMP DEPTH AVAILABLE
ANTI-FLOTATION DESIGN AVAILABLE UPON REQUEST



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

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

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 WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS 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 HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

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 CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD 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.

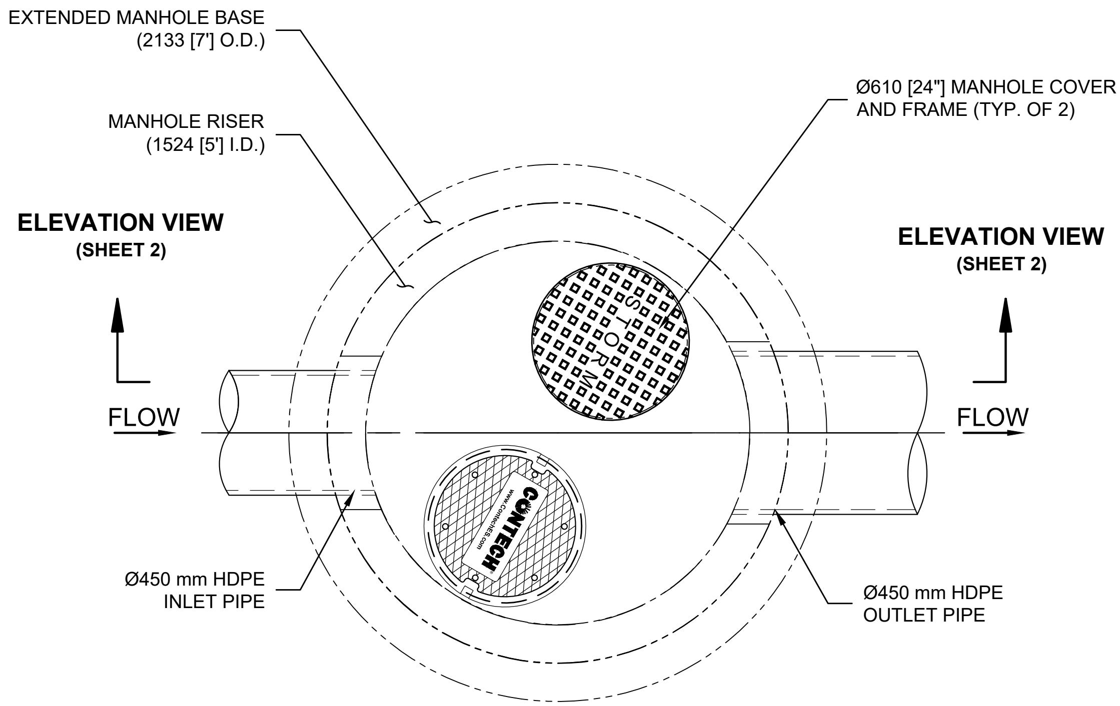
CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS PMSU2015-5-C
INLINE CDS
STANDARD DETAIL

C:\USERS\HUDA.ECHELONENV\DOCUMENTS\START ITEMS\PMSU SAMPLE DRAWINGS\5\CDS2015-5-C-DTL.DWG 5/29/2022 11:50 PM

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

PLAN VIEW



CDS MODEL PMSU2015-5-C,
0.7 CFS TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

MCON

ALL UNITS IN mm UNLESS NOTED OTHERWISE.

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ENGINEERED SOLUTIONS LLC
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877-907-8676 207-885-9830 207-885-9825 FAX

HONI ORLEANS
ORLEANS, ON
SITE DESIGNATION: OGS

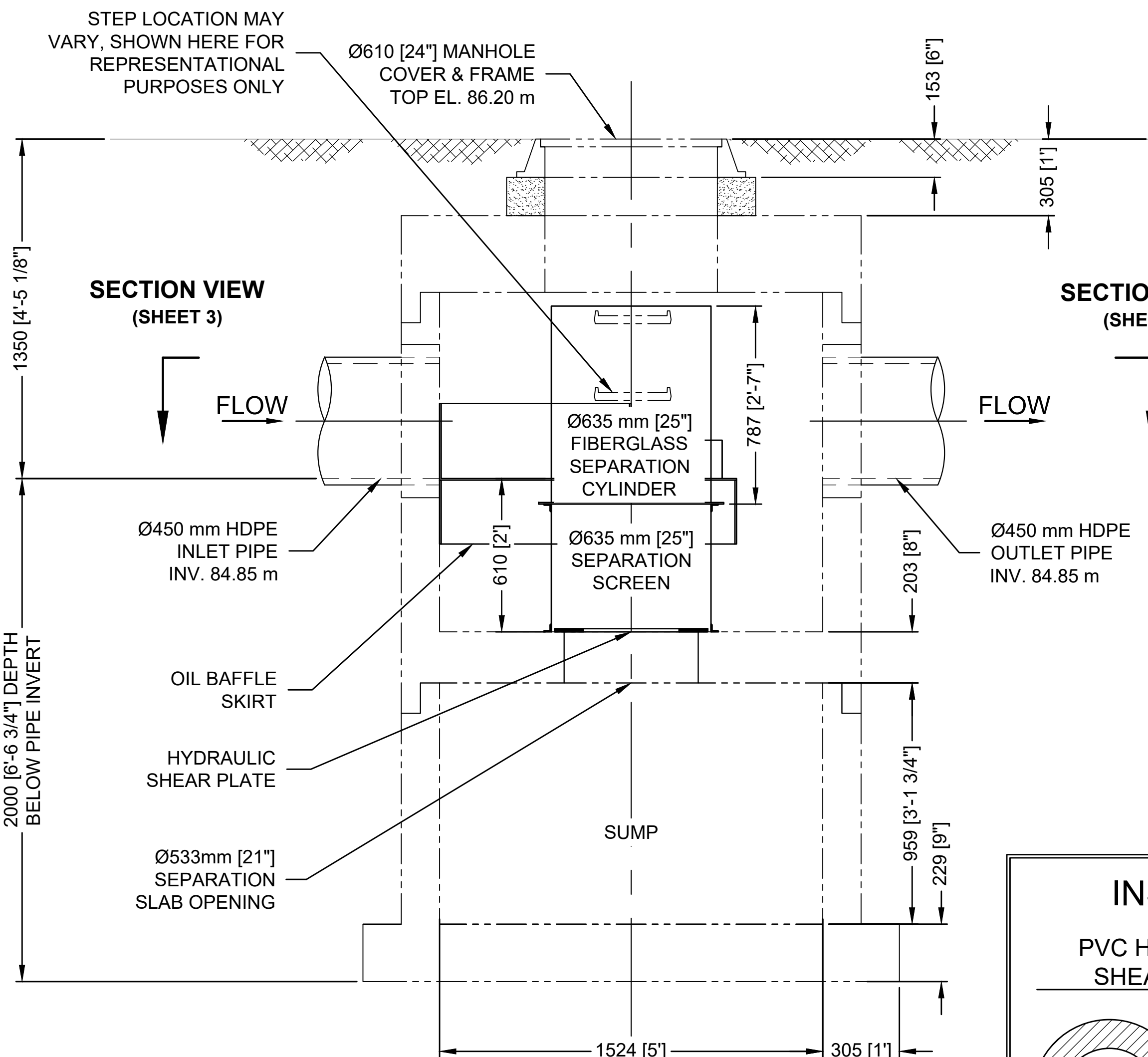
JOB No. : 10041-001	SCALE : 1:30
DATE : 9/1/2022	SHEET : 1
DRAWN : LY	
APPROV. :	

Echelon Environmental, 55 Albert Street, Suite 200, Markham, Ontario L3P 2T4 Tel: (905) 948-0000 Fax: (905) 948-0577

\\FILESERVER-ND\PUBLIC SHARE\2.0 ALL PROJECTS\2022 PROJECTS\HONI ORLEANS\CAD\CDS SHOP DRAWINGS - HONI ORLEANS.DWG 9/7/2022 12:15 PM

ELEVATION VIEW

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.



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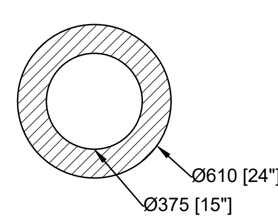
PVC HYDRAULIC SHEAR PLATE



PLAN VIEW

NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF CONCRETE SECTIONS

CDS MODEL PMSU2015-5-C, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

MCON

ALL UNITS IN mm UNLESS NOTED OTHERWISE.

CONTECH ENGINEERED SOLUTIONS LLC www.contechES.com 200 Enterprise Drive, Scarborough, ME 04074 877-907-8676 207-885-9830 207-885-9825 FAX	HONI ORLEANS ORLEANS, ON SITE DESIGNATION: OGS	JOB No. : 10041-001	SCALE : 1:30
		DATE : 9/1/2022	SHEET : 2
		DRAWN : LY	
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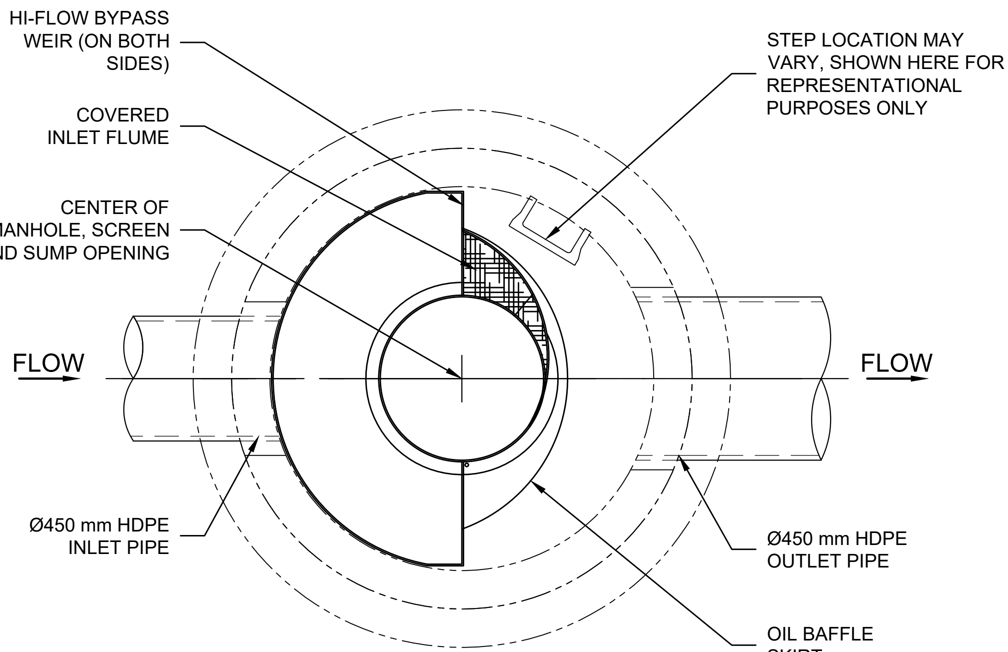
SECTION VIEW



CDS MODEL PMSU2015-5-C, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

MCON

ALL UNITS IN mm UNLESS NOTED OTHERWISE.

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		DATE: 9/1/2022	SHEET: 3
		DRAWN: LY	
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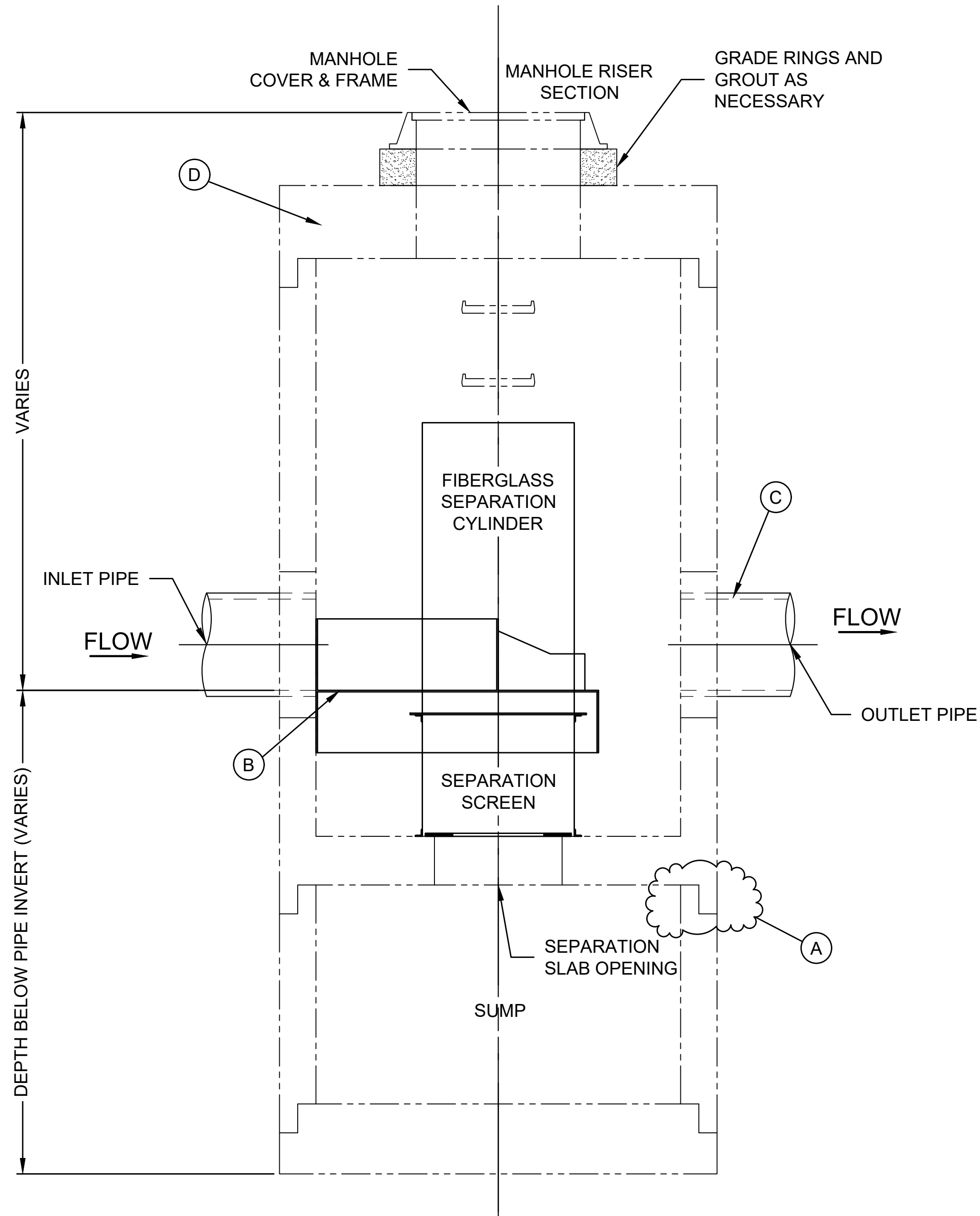
CONSTRUCTION NOTES



CONSTRUCTION NOTES:

A. APPLY BUTYL MASTIC AND/OR GROUT TO SEAL JOINTS OF MANHOLE STRUCTURE. APPLY LOAD TO MASTIC SEAL IN JOINTS OF MH SECTIONS TO COMPRESS SEALANT IF NECESSARY. UNIT MUST BE WATER TIGHT, HOLDING WATER UP TO FLOWLINE INVERT (MINIMUM).
B. BEFORE PLACING MORE PRECAST COMPONENTS OR BACKFILLING, ENSURE FIBERGLASS INLET AND PIPE INLET INVERT ELEVATIONS MATCH.
C. USE FLEXIBLE GASKETING OR GROUT TO SEAL INLET & OUTLET PIPE CONNECTIONS.
D. ENSURE THAT TOP SLAB IS PLACED CORRECTLY AS SHOWN ON DRAWINGS; USE GRADE RINGS, BLOCKS AND/OR GROUT TO MATCH FINISHED GRADE - SEAL AS REQ'D.

GENERAL NOTES:

1. CDS UNIT COMES COMPLETE W/ FIBERGLASS INLET/OIL BAFFLE & SEPARATION SCREEN ASSEMBLY PRE-INSTALLED AND PARTIALLY DISASSEMBLED FOR SHIPPING; CONTRACTOR TO RE-FASTEN ASSEMBLIES WHERE APPLICABLE.
2. INSTALL CDS UNIT PER CDS INSTALLATION SPECIFICATIONS.
3. CONTRACTOR TO BE EQUIPPED TO HANDLE THE HEAVIEST PICK SECTION.

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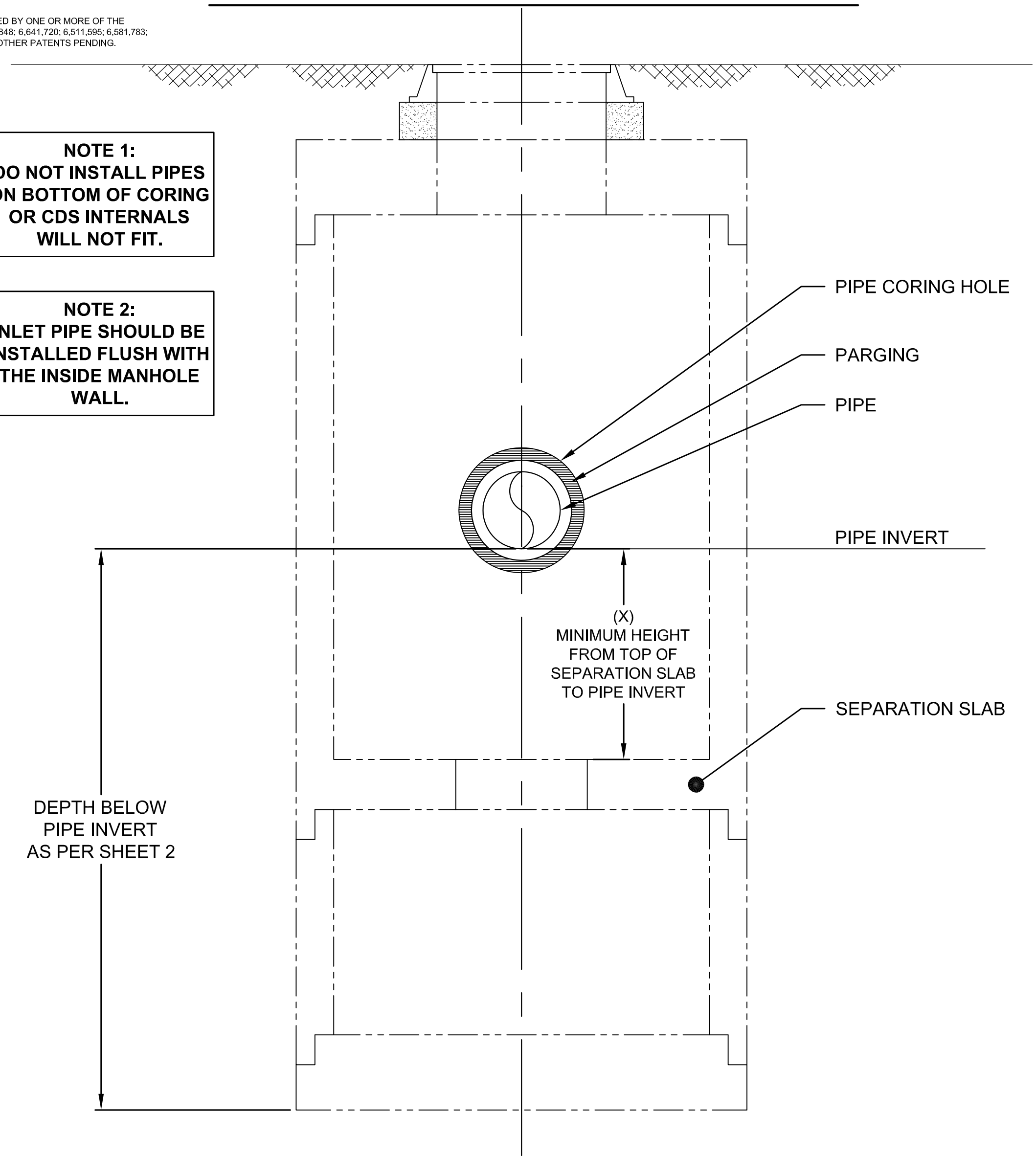
HONI ORLEANS
ORLEANS, ON
SITE DESIGNATION: OGS

JOB No. : 10041-001	SCALE : 1:30
DATE : 9/1/2022	SHEET : 4
DRAWN : LY	
APPROV. :	

CDS INTERNALS HEIGHT

NOTE 1:
DO NOT INSTALL PIPES ON BOTTOM OF CORING OR CDS INTERNALS WILL NOT FIT.

NOTE 2:
INLET PIPE SHOULD BE INSTALLED FLUSH WITH THE INSIDE MANHOLE WALL.



HEIGHT OF CDS INTERNALS

CDS MODEL	DIMENSION X (m)	CDS MODEL	DIMENSION X (M)
20_15	0.610	40_30	1.080
20_20	0.787	40_40	1.397
20_25	0.889	40_45	1.524
30_20	0.838	56_40	1.397
30_25	0.940	56_53	1.804
30_30	1.080	56_68	2.311
30_35	1.250	56_78	2.616

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PROJECT NAME
CITY, ON
SITE DESIGNATION: CDS

JOB No. : XXXX-XXX	SCALE : NTS
DATE : XX/XX/XXXX	SHEET : 5
DRAWN : XX	
APPROV. :	

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

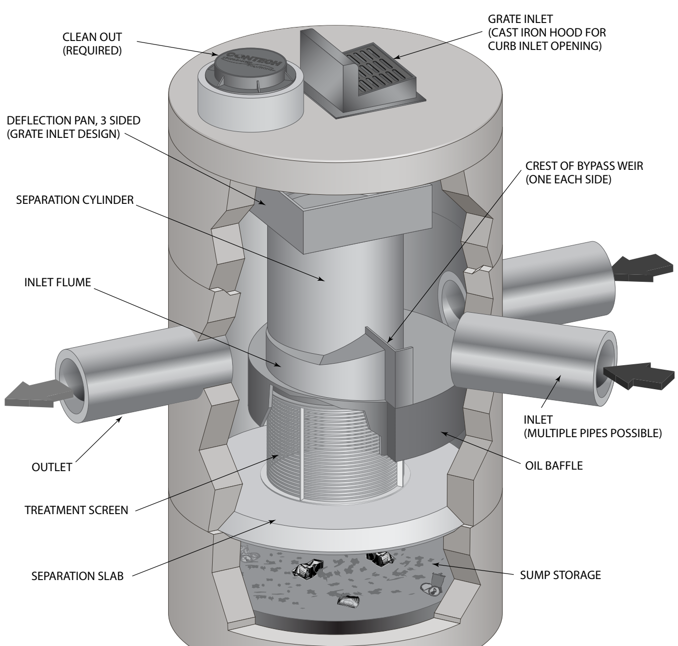
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

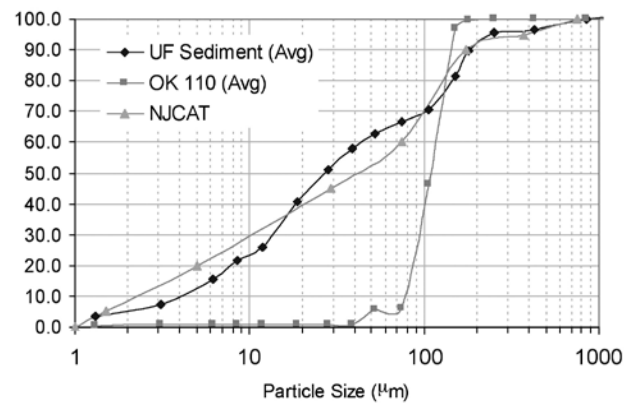


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

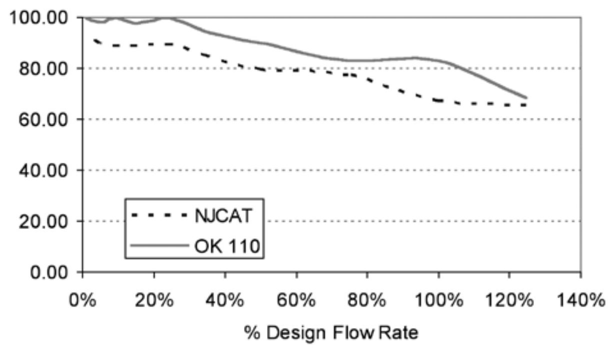


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

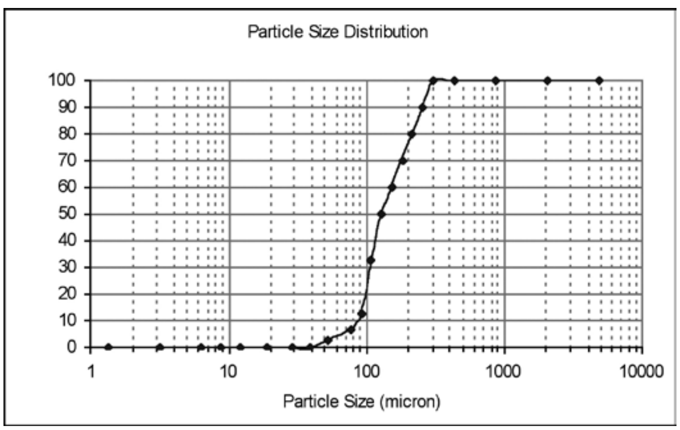


Figure 3. WASDOE PSD

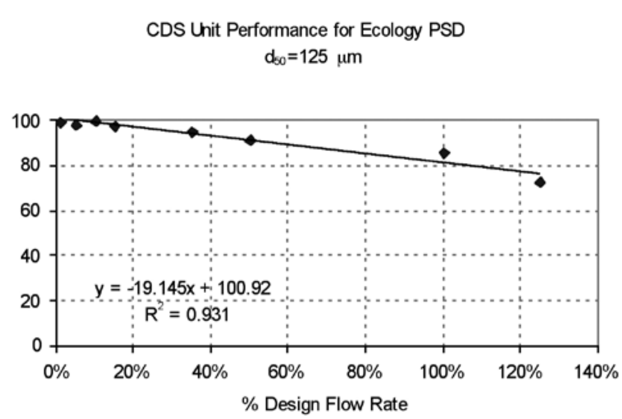


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

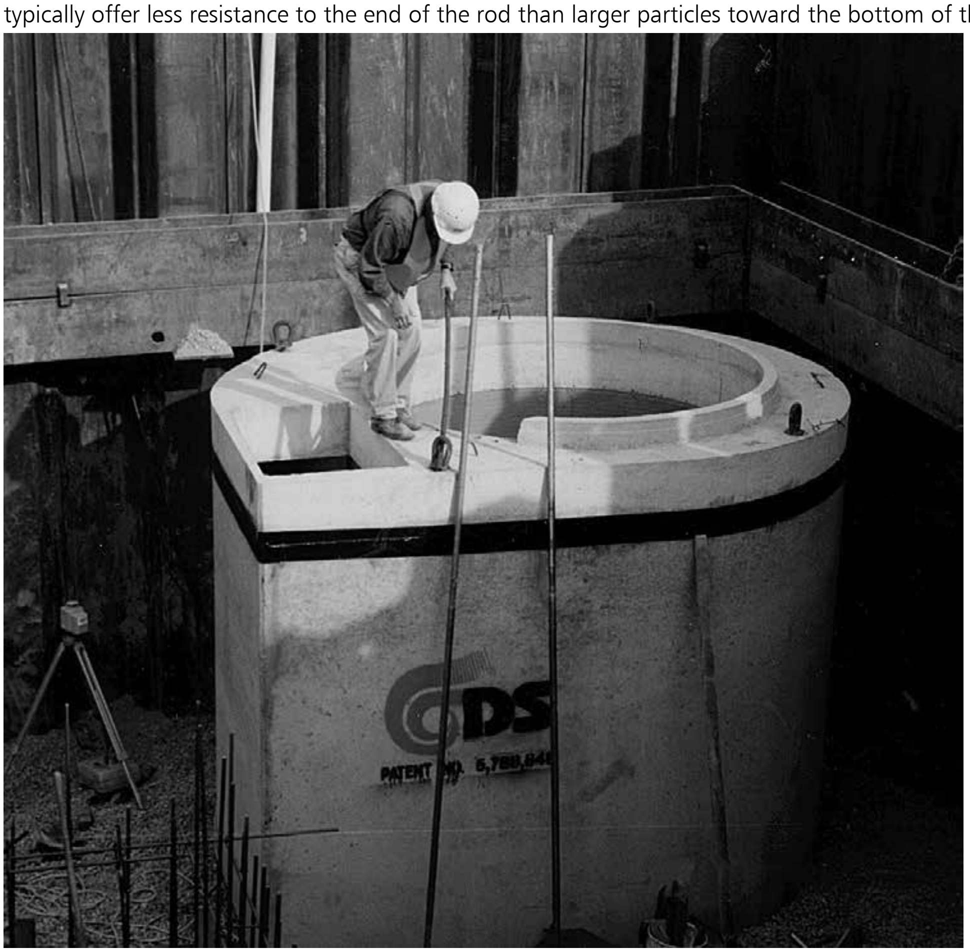
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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Contech Engineered Solutions provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, earth stabilization and stormwater treatment products. For information on other Contech division offerings, visit www.ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

cds_manual 3/17 PDF

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

CDS Hydrodynamic Separator®

Developed by CONTECH Engineered Solutions LLC
Scarborough, Maine, USA

Registration: GPS-ETV_VR2020-03-31_CDS

In accordance with

ISO 14034:2016

**Environmental Management —
Environmental Technology Verification (ETV)**

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 31, 2020
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The CDS® is a Stormwater treatment device designed to remove pollutants, including sediment, trash and hydrocarbons from Stormwater runoff. The CDS is typically comprised of a manhole that houses flow and screening controls that use a combination of swirl concentration and continuous deflective separation.

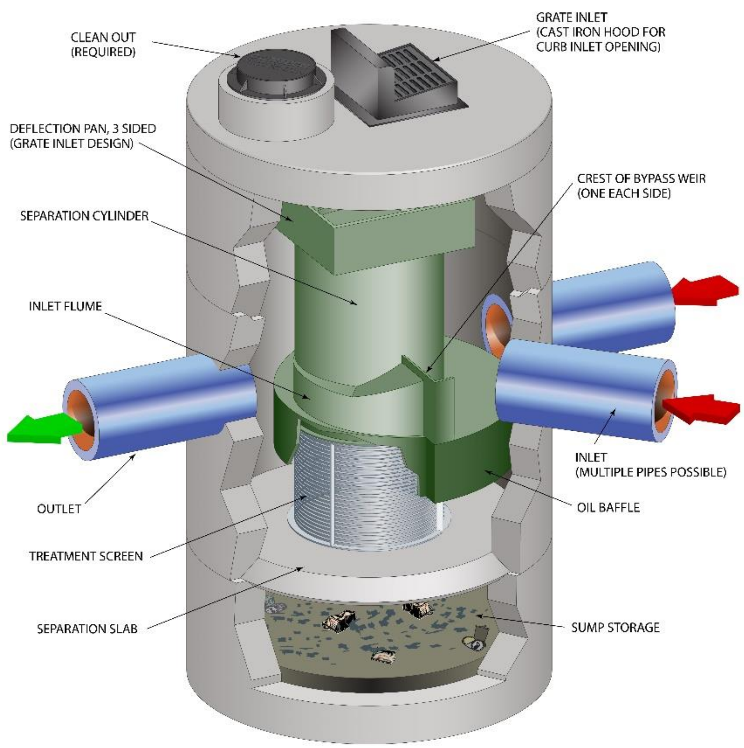

Figure 1. Graphic of typical inline CDS unit and core components.

When stormwater runoff enters the CDS unit's diversion chamber, the diversion pan guides the flow into the unit's separation chamber. The water and associated gross pollutants contained within the separation cylinder are kept in continuous circular motion by the energy generated from the incoming flow. This has the effect of a continuous deflective separation of the pollutants and their eventual deposition into the sump storage below. A perforated screen plate allows the filtered water to pass through to a volute return system and thence to the outlet pipe. The oil and other light liquids are retained within the oil baffle. Figure 1 shows a schematic representation of a typical CDS unit including critical components

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Contech CDS-4 OGS device, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program requirements. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test[1]:

During the sediment capture test, the Contech CDS OGS device with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removed 74, 70, 63, 53, 45, 42, 32 and 23 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1893 L/min/m^2, respectively.

Scour test[a]:

During the scour test, the Contech CDS OGS device with preloaded test sediment reaching 50% of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 1.8, 6.5, 8.2, 11.2, and 309.3 mg/L during a test run[2] with approximately 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[a]:

During the light liquid re-entrainment test, the Contech CDS OGS device with surrogate low-density polyethylene beads preloaded within the oil collection skirt area, representing floating liquid to a volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.9, 98.6, 99.5, and 99.7 percent of loaded beads by volume during a test run[2] with 5 minutes duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

[1] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

[2] See variance #1 in "Variances from testing procedure" section below.

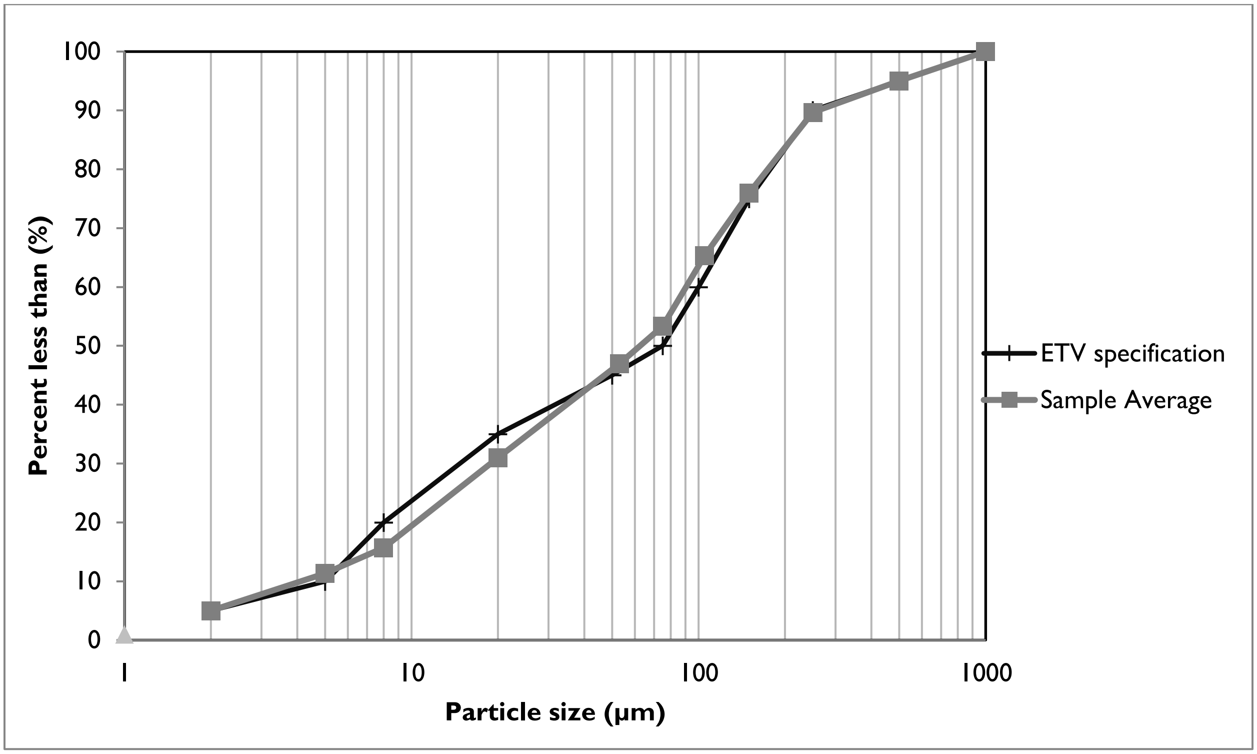

Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at eight surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the calculated removal efficiencies were above 100% for certain particle size fractions (marked with asterisks in Table 1). These discrepancies are not entirely avoidable and may be attributed to errors relating to the blending of sediment, collection of representative samples, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" in Table 1 are based on measurements of the total injected and retained sediment mass, and are therefore not subject to sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) at specified surface loading rates.

Particle size fraction (µm)	Surface loading rate (L/min/m²)							
	40	80	200	400	600	1000	1400	1893
>500	100	100*	66	79	97	100*	84	77
250 - 500	100*	100*	85	95	100*	91	100*	75
150 - 250	99	100*	100*	97	100	75	68	37
105 - 150	100	100*	100*	74	47	45	30	27
75 - 105	90	91	100*	61	33	36	26	18
53 - 75	71	27	54	100	42	44	15	16
20 - 53	65	51	20	8	10	8	5	4
8 - 20	28	22	9	7	1	1	2	1
5 – 8	30	9	0	8	2	0	1	0
<5	11	8	16	2	6	5	2	2
All particle sizes by mass balance	**73.5**	**70.3**	**63.4**	**52.6**	**45.1**	**41.5**	**32.4**	**23.0**

* Removal efficiencies were calculated to be above 100%. Calculated values typically ranged between 101 and 175% (average 126%). Higher values were observed for the >500 µm and 150-250 µm size fractions during the 80 L/min/m² test run. See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the retained sediment at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased.

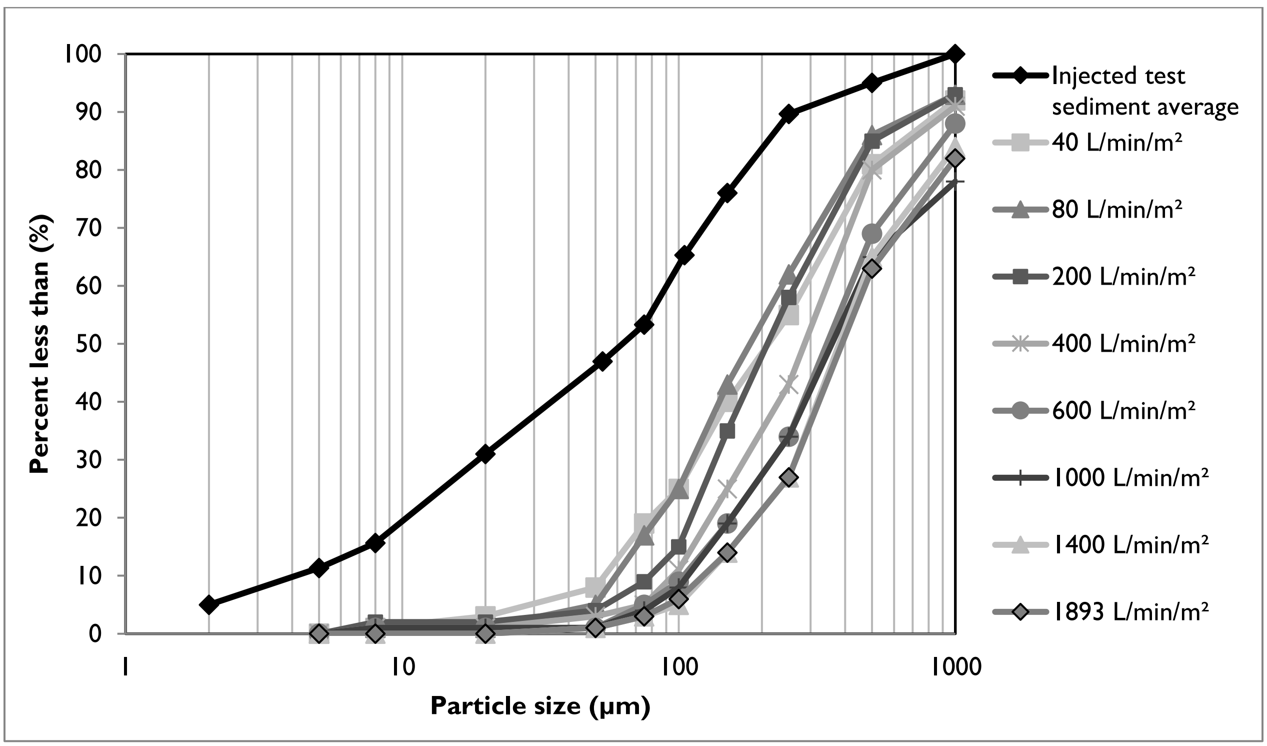

Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Sediment was also pre-loaded to the same depth on the separation slab (see Figure 1) since sediment was observed to have been deposited in this area during the sediment capture test. Clean water was run through the device at five surface loading rates over a 36 minute period. The test was stopped and started after the second flow rate in order to change flow meters. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water and the smallest 5% of particles captured during the 40 L/min/m² sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001.

Table 2. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m²)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L)[†]	Average (mg/L)
1	200	1.03	0.5	1.0	1.8
		2.03		1.6	
		3.03		1.8	
		4.03		1.8	
		5.03		2.6	
2	800	6.23	2.0	5.0	6.5
		7.23		6.7	
		8.23		9.4	
		9.23		5.4	
		10.23		5.9	
3	1400	11.43[‡]	2.0	3.1	8.2
		12.43		11.0	
		13.43		14.6	
		14.43		7.1	
		15.43		5.2	
4	2000	17.20	3.2	7.3	11.2
		18.20		22.8	
		19.20		6.9	
		20.20		6.8	
		21.20		12.1	
5	2600	22.40	8.5	248.5	309.3
		23.40		83.0	
		24.40		438.9	
		25.40		338.7	
		26.40		437.5	

[†] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the smallest 5% of sediment particles (i.e. d5) removed during the 40 L/min/m² capture test, minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.
[‡] See variance #1 in "Variances from testing procedure" section below.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 3. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2) over a 38 minute period. As with the sediment scour test, flow was stopped and started after the second flow rate to change flow meters. Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 3. Light liquid re-entrainment test results.

Target Flow (L/min/m^2)	Time Stamp	Collected Volume (L)	Collected Mass (g)	Percent re-entrained by volume	Percent retained by volume
200	10:48:42	27 pellets	0.8	0.01	99.99
800	10:55:09	0.07	41	0.12	99.88
1400	11:06:59	0.8	439	1.37	98.63
2000	11:13:00	0.31	177	0.53	99.47
2600	11:19:00	0.18	98	0.31	99.69
Interim Collection Net		0.025	14.2	0.04	99.96
Total Loaded		58.3	33398	--	--
Total Re-entrained		1.385	770	--	--
Percent Re-entrained and retained		--	--	2.38	97.62

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. It was necessary to change flow meters during the scour and light liquid re-entrainment test, as the required flows exceeded the minimum and/or maximum range of any single meter. After the loading rate of 800 L/min/m^2, the flow was gradually shut down and re-initiated through the larger meter immediately after closing the valve controlling flows to the small meter. The transition time of 1-minute for each target flow was followed, resulting in an elapsed time of 3 minutes to reach the next target flow of 1400 L/min/m^2. This procedure was approved by CETV prior to testing, in recognition that most particles susceptible to scour at low flows would not be in the sump at higher flows. Similarly, re-entrainment of the oil beads was not expected to be significantly affected by the flow meter change.

2. As part of the capture test, evaluation of the 40 L/min/m^2 surface loading rate was split into 3 parts due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually shutdown to prevent capture of particles that would have been washed out under normal circumstances. The amended procedure was reviewed and approved by the verifier prior to testing.

3. Inflow concentrations during the 40 L/min/m^2 surface loading rate varied from 162 mg/L to 246 mg/L, which is wider than specified ±25 mg/L range in the Procedure.

Verification

This verification was first completed in March 2017 and is considered valid for subsequent renewal periods every three (3) years thereafter, subject to review and confirmation of the original performance and performance claims. The original verification was completed by the Toronto and Region Conservation Authority of Mississauga, Ontario, Canada using the Canadian ETV Program's General Verification Protocol (June 2012) and taking into account ISO 14034:2016. This ETV renewal is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***.

Data and information provided by Contech Engineered Solutions to support the performance claim included the following: Performance test report prepared by Alden Research Laboratory, Inc of Holden, Massachusetts, USA and dated February 2015; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the CDS Stormwater Treatment System please contact:

CONTECH Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME
04074 USA
Tel: 207-885-9830
info@conteches.com
www.conteches.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

BEST MANAGED COMPANIES CANADA Platinum member

www.jlrichards.ca

Ottawa

343 Preston Street
Tower II, Suite 1000
Ottawa ON Canada
K1S 1N4
Tel: 613 728-3571
ottawa@jlrichards.ca

Kingston

203-863 Princess Street
Kingston ON Canada
K7L 5N4
Tel: 613 544-1424

kingston@jlrichards.ca

Sudbury

314 Countryside Drive
Sudbury ON Canada
P3E 6G2
Tel: 705 522-8174

sudbury@jlrichards.ca

Timmins

201-150 Algonquin Blvd. East
Timmins ON Canada
P4N 1A7
Tel: 705 360-1899
timmins@jlrichards.ca

North Bay

200-175 Progress Road
North Bay ON Canada
P1A 0B8
Tel: 705 495-7597

northbay@jlrichards.ca

Hawkesbury

326 Bertha Street
Hawkesbury ON Canada
K6A 2A8
Tel: 613 632-0287

hawkesbury@jlrichards.ca

Guelph

107-450 Speedvale Ave. West
Guelph ON Canada
N1H 7Y6
Tel: 519 763-0713

guelph@jlrichards.ca

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS