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3.0 Methodology

Primary tasks completed for this updated pre-development wetland water balance have included:

A. Submission of a water balance Terms of Reference (TofR) to Conservation Halton in fall 2022 (no comments were received);

B. Characterization of the physical setting using published information from the following government agencies: (i) the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and (ii) the Ontario Geological Survey (OGS), as well as a review of other existing on-site investigation reports (e.g. Soil-Mat, 2011 and 2013) as well as a previous study of the Site (Terra-Dynamics, 2014);

C. Field investigation tasks: (i) soil hand-augering and (ii) surface water level monitoring using manual and datalogging pressure transducer measurements. Additional tasks completed as part of the hydrogeological study included (a) manual groundwater level measurements, (b) groundwater level monitoring using datalogging pressure transducers, and (c) manual surface water flows; and,

D. Modelling of pre-development monthly water balance conditions through consideration of: surface water catchments, land cover, soils, climate normals and wetland hydroperiods in order to inform site design.

4.0 Physical Setting

The Site is located within East Flamborough Township, part of Lots 2, 3, 4 and 5, of Concession 1, City of Burlington, Regional Municipality of Halton within the Halton Region Conservation Authority (Conservation Halton) (Figure 1). The Site is bounded by Canadian National Railway lines to the south, the Aldershot GO Station to the west, King Road to the east and Highway 403 to the north (Figure 2).

The natural areas of the Site are currently mapped primarily as meadow (45%), with other mapped vegetation including: thicket (19%), annual row crop (10%), deciduous forest (12%), woodland (10%), swamp (3%) and open water (1%) (Natural Resource Solutions Inc. (NRSI), 2026).

The Site is regionally located on the Iroquois Plain (Chapman and Putnam, 1984) with the ridge of the historic Lake Iroquois mapped as roughly north to south, bisecting the Site, close to the ground surface elevation of 106 to 107 m above sea level (ASL) (Figure 2), with the Indian and Falcon Creeks cutting through this feature.

4.1 Surface Water

Intermittent watercourses at the Site flowing from north to south and include: (i) Indian Creek, (ii) Falcon Creek and (iii) two tributaries of Grindstone Creek (Figure 2). The eastern Grindstone Creek Tributary includes a man-made online pond from past agricultural activities and is located within the 110.4 m ASL ground surface contour. Hydrographs applicable to the on-site wetland monitoring are presented within Appendix A, with the additional surface water location hydrographs presented in Terra-Dynamics's Hydrogeological and Hydrological Assessment (2026).

Although the creeks have eroded through the silty clay and glacial till they are still underlain by low permeability clayey materials (Terra-Dynamics, 2014).

The watercourse water depths have been fairly shallow, e.g. Indian Creek is 75 cm or less, Falcon creek is 125 cm or less, the eastern Grindstone Creek Tributary is 45 cm or less and the western Grindstone Creek Tributary is 90 cm or less (Terra-Dynamics, 2026).

Dry conditions have been historically observed at (i) the eastern Grindstone Creek tributary pond station (pond level <110.25 m ASL) in July 2013 and its southern outflow in summer 2013 and (ii) the outflow of Falcon Creek in September 2013. Surface water flow was measured to decline upstream to downstream at the Site during very dry weather measurements (e.g. summer and fall seasons of 2022, Appendix 9), however, given the very low flow values recorded at the upstream locations the limited water was ponding and evaporating prior to reaching downstream locations where dry conditions were noted. However, flows were measured to often increase across the Site during wet weather events. Inflow values in the east Grindstone Creek Tributary were often greater than flows recorded at the outflow location due to the retention capabilities of the Grindstone Creek Pond (Figure 2). Previous surface water field investigations documented surface water level responses to precipitation events when precipitation events were greater than 10 mm/day (Terra-Dynamics, 2014). Similar surface water conditions were observed in more recent monitoring, from July 2022 to November 2024 (Terra-Dynamics, 2026).

Monitoring locations within Indian Creek are occasionally dry during the summer and fall seasons (Terra-Dynamics, 2026).

The inlet location for Falcon Creek was not recorded as going dry during the monitoring period with depths in the channel not decreasing below 4 cm, however stagnant conditions of ponding in low points in the channel occurred during dry conditions (Terra-Dynamics, 2026).

Surface water levels in the Grindstone Creek western tributary (SG-GC-WI) were generally 15 cm to 40 cm deep in summer/early fall 2023 and 2024, with occasional dry periods (Appendix A).

All four watercourses exhibit “flashy” responses to precipitation, with quick response times to precipitation events followed by quickly decreasing water levels indicative of runoff conditions.

Monthly precipitation values from 2022 to 2024 are presented in Table 1 from the Hamilton Royal Botanical Gardens (RBG) Climate Station, with comparisons to historical climate normals from 1981 to 2010 for this climate station (Environment Canada, 2025a/b).

As described in Table 2 below, the Site only includes a small portion of each of the three watercourse subwatersheds (Indian, Falcon and Grindstone Creek). Urbantech Consulting (Urbantech) (2026) have also mapped local drainage catchments for the Site, as well as the area to the north which flows towards the Site (Appendix C).

Table 2 - Watercourse Subwatershed (SWS) Information

Watercourse	SWS		Watercourse		
	Area* (ha)	% On-site	Distance Upstream of Site (km)	Distance Downstream to Hamilton Harbour (km)	On-site Reach Length m (%)
Indian Creek	607	4%	2.0	3.6	400 (7%)
Falcon Creek	542	4%	2.3	2.2	400 (8%)
Grindstone Creek	568	1%	0.7	5.3	240 (4%)

Notes: * - Conservation Halton

Urbantech (2026) has completed floodplain mapping for Falcon and Indian Creeks, however floodplain mapping was not completed for the Grindstone Creeks as it is our understanding it is not required due to small upgradient catchments.

4.2 Soils

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) (2025) have regionally mapped four soil types at the Site (Appendix B, Gillespie, Wicklund and Miller, 1971). Their results are summarized in Table 3.

Table 3 – Historic/Background Soil Information (Gillespie, Wicklund & Miller, 1971)

Soil Type	HSG	Parent Material	Soil Details	Area (ha) (% of Site)
Springvale Sandy Loam	A	Outwash sand and gravel	Reddish-brown gravelly sandy loam, slightly stoney, underlain by gravel. Associated with central portion of Site, generally east of Falcon Creek.	8.4 (17%)
Trafalgar Silty Clay Loam	B	Clay till derived from Queenston shale	Stone free silty clay loam, grades into decomposed shale bedrock/clay till. Regionally mapped in western portion of Site.	14.7 (30%)
Winona Sandy Loam	C	Medium sand over clay till	Stone free sandy loam, overlying moderately stoney clay till, underlain by clay till. Associated with south side of Lake Iroquois shoreline and eastern portion of Site.	19.8 (40%)
Oneida Loam	C	Clay till	Slightly stoney loam, overlying clay with red and black shale pieces. Small northeast and southeast portions of Site.	3.6 (7%)

Notes: HSG – Hydrologic Soil Group (Table 4), and 2.7 ha (5%) of Site unmapped by OMAFRA since classified as ravine associated with Falcon Creek

However, field investigations have indicated variations to the above regional mapping:

1. Springvale Sandy Loam: half of this area was identified in the field as less permeable silty clay, as reported by Terra-Dynamics at monitoring wells MW-6 and MW-7 and by Soil-Mat at borehole BH-4 (2011).

2. Trafalgar Silty Clay Loam: areas identified as swamp wetland vegetation by NRSI (2026) are underlain by poorly sorted clay with fines as determined by hand-auger investigation and laboratory grain-size analyses (Section 4.7.2).

3. Winona Sandy Loam: most of this area was identified in the field as silty clay till or fill (likely more suitably mapped as Oneida Loam) except near Terra-Dynamics monitoring well MW-5 and Soil-Mat borehole BH-5 (2011).

4. Oneida Loam: a small area of silty sand to sandy silt was identified in the field at Terra-Dynamics monitoring well MW-8 and Soil-Mat borehole BH-3 (2013).

In summary, less permeable soils have generally been identified at the Site than what was historically regionally mapped. Limited opportunities for infiltration in permeable soils may be present in the central and western portions of the Site, however, additional field investigations will be required to confirm actual infiltration potential. It is recommended in future to produce a Site soil map based on the results of field investigations following completion of a Site surficial geology map (Section 4.3) to assist with the potential municipal requirements for Low Impact Development (LID) infiltration measures. It is recommended that this be completed once a Site Plan is finalized as the changing of grades may have an impact on the Site's available surficial soils.

Table 4 - Hydrologic Soil Groups (USDA, 1986)

HSG Group	Soil description
A	sand, loamy sand or sandy loam
B	silt loam or loam
C	sandy clay loam
D	clay loam, silty clay loam, sandy clay, silty clay or clay

4.3 Overburden Geology

The Study Area is situated on a 7 to 13.6 m thick layer consisting of a mixture of low permeability silty clay and clayey glacial till (Halton Till) based on site-specific investigations.

The Site is shown in geologic cross-section on Figure 3 with reference to Figure 2. Additional hydrogeological details, including borehole logs, and an additional cross section can be found in Terra-Dynamics's Hydrogeological and Hydrological Assessment (2026).

Within the Study Area, or eastern half of the Site, the overburden is predominantly silty clay with areas of 0.2 to 2 m thick sand to sandy silt documented at (i) Monitoring well MW-8 and Soil-Mat borehole BH-3 (2013) at the northern, higher elevation area in the northeast of the study area and (ii) Monitoring well MW-5, Soil-Mat boreholes BH-5 (2013) and BH-5 (2011) and DS Consultants Ltd. BH24-8 in the southwest corner of the study area (Figure 2).

The central and western portions of the Site are also underlain by low permeability silty clay to clayey till, however, the limited borehole geotechnical records (Soil-Mat, 2013) indicate some sand to silty/clayey sand, typically observed as having a thickness of 1 to 2 m. This is shown in the southwest-northeast hydrogeologic cross-section (Figure 3).

It is recommended a Site surficial geology map be prepared once additional geotechnical and hydrogeological investigations for the western portion of the Site are completed. This new map will better represent on-site conditions than existing surficial geology mapping by the Ontario Geological Survey (2003) which over-represents sand at the Site based on investigations to-date.

4.4 Bedrock Geology

The Site is underlain by red shale of the Queenston Formation (Terra-Dynamics, 2026). It is laterally extensive across Southern Ontario, New York State and the State of Michigan. Beneath the site it is greater than 120 m and forms an extensive low permeability aquitard (Armstrong and Sergerie, 2002).

At the ridge associated with the Glacial Lake Iroquois Shoreline, the Queenston Shale was encountered at the following depths:

- 10.1 m BGS (metres below ground surface) (MW-8-D);
- 10.7 m BGS (MW-6-D);
- and at 12.3 m BGS (BH24-7, DS Consultants Ltd. (2024).

Below the ridge, the Queenston Shale was encountered at the following depths:

- 7.3 m BGS (MW-1);
- 8.8 m BGS (BH-5, Soil Mat (2011));
- 7.7 m BGS, 11.3 m BGS, 13.6 m BGS (BH 24-16, BH24-17 and BH24-8, DS Consultants Ltd. (2024).

West of the Site at the GO Station, OGS geotechnical boreholes drilled in the 1960s indicate bedrock depths ranging from 5.7 to 6.1 m BGS (OGS, 2012).

A southerly regional dip in the bedrock surface is present towards Hamilton Harbour. Additional hydrogeological details can be found in Terra-Dynamics's Hydrogeological and Hydrological Assessment (2026).

4.5 Hydrogeologic Setting

The overburden at the Site has been previously documented as an aquitard as shown by low hydraulic conductivities (Terra-Dynamics, 2026). Groundwater flow in the clayey aquitard is generally southwards towards Hamilton Harbour. The shallow groundwater table responds quickly to precipitation events at most monitoring wells, likely as a result of fracturing in the upper aquitard and/or recharge to the surficial sandy silt/silty sand where present (e.g. MW-8-S and MW-5). The deeper potentiometric surface of the Queenston Shale does not show evidence of response to precipitation events but has a similar seasonal trend to the shallow groundwater table. Although surficial sand in the western and central portions of the Site may allow for higher infiltration rates, intermediate groundwater recharge will still be limited by the underlying silty clay aquitard to less than 125 mm/year (Table 5).

Table 5 – Typical Annual Infiltration (Recharge) Rates (mm/year)

Predominant Soil Textures	City of Hamilton (COH, 2013)	Ministry of the Environment, Conservation and Parks (MECP, 1995)
Coarse Sand and Gravel	250	>250
Fine to Medium Sand	200	200-250
Silty Sand	175	150-200
Sandy Silt	150	
Silt	125	125-150
Clayey Silt	100	100-125
Clay	75	<100

4.6 Pre-development Conservation Halton Subwatershed Water Balance Modelling

Conservation Halton has previously completed pre-development water balance modelling for the period of 1989-1997, as part of provincial water budgeting for the source water protection program (Conservation Halton, 2010). The modelling was completed using the United States Geological Survey (USGS) Precipitation Runoff Modelling System (PRMS). The daily PRMS simulated values of the water budget were averaged on a monthly basis over the 8-year simulation period to determine monthly average rates. Modelled annual and monthly water balance results for the subwatersheds of (i) Grindstone Creek 224, (ii) Falcon Creek, and (iii) Indian Creek are listed in Tables 6, 7, 8 and 9 (Conservation Halton, 2010). The modelled average Site recharge rate from the PRMS 100 m by 100 m grid was calculated as 247 mm/year.

However, the modelled recharge rates are in excess of the Site conditions as regional datasets were used, being part of a regional study, but not informed by on-site investigations. The modelled recharge rates in excess of Site conditions are likely the result of the PRMS model using the OGS surficial geology mapping, which over-represents sand at the Site (Section 4.3), e.g. in the eastern part of the Site. As a result, it is recommended to apply the infiltration/recharge rates shown on Table 5 for the Site water balance.

Table 6 - Water Balance (1989-1997) Averages

Subwatershed	Precipitation	Actual Evapotranspiration	Recharge*	Runoff
	(mm/year)			
Grindstone Creek 224	932	589	200	148
Falcon Creek	921	564	187	175
Indian Creek	907	533	211	167

Note: * - Regional values in excess of conditions found on-site

Table 7 - Grindstone Creek 224 Monthly Runoff and Recharge

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Runoff (mm)	22	23	23	13	9	5	8	8	6	11	11	9
Recharge (mm)	25	22	28	31	16	4	4	4	5	11	27	23

Table 8 - Falcon Creek Monthly Runoff and Recharge

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Runoff (mm)	24	23	23	15	11	8	11	11	9	14	14	13
Recharge (mm)	28	23	26	27	14	2	2	4	3	8	26	25

Table 9 - Indian Creek Monthly Runoff and Recharge

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Runoff (mm)	22	19	19	14	12	8	11	12	10	15	14	12
Recharge (mm)	31	26	27	27	15	3	4	5	4	12	29	27

4.6.1 Site Pre-Development Water Balance Modelling

As noted above in Sections 4.2, 4,3 and 4.5, the existing surficial geology mapping by the Ontario Geological Survey (2003) over-represents the extent of surficial sand at the Site when compared to the completed field investigations to-date. When comparing the recharge values presented in Table 6 from Conservation Halton to Table 5, which displays commonly used infiltration rates by the MECP (1995) and City of Hamilton (2013), the infiltration rates prescribed by Conservation Halton would incorrectly classify the Site soils as silty sand to fine/medium sand. While sand is present in limited specific locations, as noted in Section 4.3, on-site investigations completed to date by Terra-Dynamics (2014/2026), DS Consultants (2024) and Soil-Mat (2011) display that surficial soils are predominately a mixture of low permeability silty clay and clayey glacial till.

In-situ hydraulic conductivity testing of Terra-Dynamics monitoring wells were completed and are presented in Table 10 below, with the location of each monitoring well displayed on Figure 2. Additional hydrogeological details can be found in Terra-Dynamics's Hydrogeological and Hydrological Assessment (2026).

Table 10. Summary of *In-situ* Hydraulic Conductivity Tests

Well I.D.	Geologic Formation	Horizontal Hydraulic Conductivity (m/sec)	Estimated Vertical Hydraulic Conductivity (m/sec)	Estimated Infiltration (mm/hour)
MW-2	Silty Clay Till	1.0×10^{-8}	1.0×10^{-9}	7
MW-3	Silty Clay Till and Silty Clay	2.2×10^{-8}	2.2×10^{-9}	9
MW-4	Silty Clay Till and Silty Clay	4.3×10^{-10}	4.3×10^{-11}	3
MW-5	Silty Clay and Silty Clay Till	8.1×10^{-10}	8.1×10^{-11}	4
MW-6-S	Silty Clay Till and Silty Clay	6.5×10^{-8}	6.5×10^{-9}	12
MW-6-D	Silty Clay	1.8×10^{-9}	NA*	NA*

Well I.D.	Geologic Formation	Horizontal Hydraulic Conductivity (m/sec)	Estimated Vertical Hydraulic Conductivity (m/sec)	Estimated Infiltration (mm/hour)
MW-7	Silty Clay with Thin Sand Lens	2.3×10^{-6}	NA**	NA**
MW-8-S	Silty Clay with Lenses of Sand and Silt	7.9×10^{-9}	7.9×10^{-10}	7
MW-8-D	Silty Clay and Queenston Shale	3.2×10^{-9}	NA*	NA*
Geometric Mean		9.3×10^{-9}	5.8×10^{-10}	6

Notes: vertical hydraulic conductivity approximated as 1/10 of horizontal (Todd and Mays, 2004), NA: Not Applicable for deeper, potentiometric surface monitoring wells, NA** - not included as the hydraulic conductivity is of the minor sand not the majority silty clay matrix*

The silty clay and silty clay till exhibit a very low horizontal hydraulic conductivity with a geometric mean of the nine tests referenced in Table 10 of 9×10^{-9} m/sec, indicating that the clay-based overburden within the Study Area of the Site is an aquitard. While the monitoring wells presented on Table 10 are screened to depths of greater than 2 m BGS (with the exception of the deep wells at MW-6 and MW-8), the values provided characterize the potential infiltration rates of the surficial geology at the Site.

Vertical hydraulic conductivity values for the shallow, water table monitoring wells were estimated as being one order of magnitude lower than the horizontal hydraulic conductivity (Todd and Mays, 2004). Using estimated vertical hydraulic conductivity values, infiltration rates were also estimated (Table 10) via a Credit Valley Conservation (CVC) methodology (CVC, 2012). Estimated infiltration rates ranged from 3 to 12 mm/hour with a geometric mean of 6 mm/hour.

Based upon the annual infiltration rate values provided in Table 5 by the MECP and City of Hamilton, the classification of on-site soils, as well as the Site-specific infiltration values presented in Table 10, an assumed annual infiltration of 100 mm/year (clayey silt) to 125 mm/year (silt) is a reasonable approximation for the Site based upon field investigations to date.

4.6.1 Site Post-Development Water Balance Modelling

Development of the Site from a mix of agricultural fields and forests will increase the Site's imperviousness. The future Site impervious area is currently projected as 82% Urbantech (2026). The proposed area for development at the Site is 35.15 ha, with a percent impervious of 82%, resulting in a total impervious area change of 28.82 ha (Urbantech, 2026).

At a Site level, this imperviousness equates to a loss of infiltration of 28,823 to 36,029 m^3/year (i.e. 100 to 125 mm/year recharge x 35.15 ha x 82%). Daily precipitation records from the closest Environment Canada weather station (Hamilton RBG) were analyzed from five years (2021 to 2025) to provide design information to inform addressing the future deficit (Environment Canada, 2025b) (Table 11).

Table 11 - Hamilton RBG Daily Precipitation Summary

Year	Annual Precipitation	Daily Precipitation Depth (mm) Sum*				
	(mm)	1-5	1-10	1-15	1-20	1-25
2021	988	524	724	822	890	932
2022	679	358	499	573	615	648
2023	1,008	458	674	787	872	929
2024 (Leap)	920	388	582	699	778	830
2025	646	339	487	562	602	625
5-year Average	848	413	593	688	751	793
5-year Median	954	423	628	743	825	879

Notes: * - Days greater than category included only at the category depth

The post-development Site deficit could be 'made-up' from on-site infiltration of 5 mm daily storm events with a 'capture area' for infiltration from clean roof runoff of between 6.98 to 8.73 ha. This area could be reduced to 4.86 to 6.08 ha for on-site infiltration of 10 mm daily storm events. The ranges represent consideration of pre-development recharge rates ranging from 100 to 125 mm/year.

In future, specific areas for in-situ infiltration testing may identify opportunities for stormwater infiltration via Low Impact Development (LID) approaches. However, infiltration design will need to account for grading/cut and fill plans for the Site due to soil heterogeneities.

It is our understanding that the low pre-development infiltration rates (less than the MECP-recommended 15 mm/hour) of the native clayey silt to silty clay till overburden may limit the effectiveness of infiltration-based measures such as trenches, soakaway pits, or pervious pipes, however, the MECP does not prohibit their use but advises caution in their application (MECP, 2003/2022). Given the existing Site conditions, including the calculated infiltration rates of the surficial geology and the observed seasonally high groundwater levels within the on-site monitoring well (Terra-Dynamics, 2026), achieving a 0% Site water balance deficit may not be feasible. Discussion regarding a potential reduction in the Site deficit requirements is recommended once Site plans are finalized. City of Burlington (2020) states within their Stormwater Management Design Guidelines "*The City of Burlington may (in consultation with Conservation Halton where appropriate), in its sole discretion, consider a reduced infiltration and water budget requirement if the proponent is able to clearly demonstrate that meeting the preceding is not feasible on the site, due to physical constraints such as an elevated groundwater condition, bedrock or other system constraints*".

4.7 Wetlands

NRSI have mapped the following wetlands at the Site (NRSI, 2026, Figures 4 and 5):

a. Two wetlands associated with the Grindstone Creek tributaries;
b. One wetland within the Grindstone Creek subwatershed but within close proximity to the eastern tributary; and
c. Two very small wetlands are located between Falcon Creek and Grindstone Creek .

The area coverage of wetlands are less than previous Ministry of Natural Resources and Forestry (MNRF) mapping (2020).

A small Mineral Meadow Marsh (MAM) of 0.1 ha was also identified on the northern edge of a Mineral Cultural Thicket (CUT1) along the eastern boundary of the Site with no connection to any surface watercourse (NRSI, 2026). Due to its small size, it has not been considered further at this time.

An additional small Willow Mineral Thicket Swamp (SWT2-2) of 0.03 ha was also identified within the proposed Block-8 (Figure 4), however it is our understanding that this will be removed to accommodate the construction of Block-8, and as a result this has not been considered further at this time (NRSI, 2026).

4.7.1 Wetland Ecological Land Classification

The five wetlands mapped by NRSI (2026) are in the western portion of the Site. The Ecological Land Classifications (ELCs) for the wetlands were Green Ash Mineral Deciduous Swamp (SWD2-2), Mineral Deciduous Swamp (SWD4), or Broad-leaved Sedge Mineral Meadow Marsh Type (MAM2-6). The wetlands were between 0.01 and 0.49 hectares in size (Figure 4). Wetland descriptions of conditions are summarized below from NRSI (2026):

> SWD4: A canopy of Crack Willow southeast of a man-made pond on the eastern tributary of Grindstone Creek, that has Green Ash saplings throughout. During 2022, shallow standing water (20 to 30 cm) was present during the spring and into early June, and the water elevation within the swamp appeared to reflect the water level elevation in the pond but no direct connection was identified through the berm which separates them by 15 m, and by the fall vegetation survey standing water was not present.

Historical aerial photos from 1953 and 1963 (McMaster University, 2023), indicate that the 'berm' between SWD4 and the man-made pond was previously a road.

> SWD2-2: Two areas of Green Ash Swamp are present in the northwest portion of the Site and are associated with tributaries of Grindstone Creek. The western feature receives surface water from north of Highway 403 and conveys it to the west, while the hydrology of the eastern feature reflects the water level of the on-line pond. During 2022, seasonal shallow water (average of 5 to 10 cm) was present from the spring melt until May, saturated soil in June, and dry conditions for the remainder of the year. The western-most SWD2-2 has poorly defined, to undefined banks, that are overtopped during spring conditions.
>
> MAM2-6: Predominantly Lake Sedge with smaller amounts of wetland forbs and hold standing water during the spring.

4.7.2 Wetland Soils

Terra-Dynamics completed a shallow hand-auger soil investigation of three of swamp wetlands (both SWD2-2 and SWD4) mapped by NRSI in 2023. A fourth area was also investigated that was previously identified as a palustrine swamp by MNRF (2020) adjacent to the east side of Falcon Creek but has been subsequently re-mapped as a Mineral Cultural Woodland Ecosite (CUW1) by NRSI (2026). The hand-auger soil sampling is shown on Figure 4 which was completed to depths of between 0.6 and 1.0 metres,

the assumed C horizon. The soil sampling results are summarized in Table 12 along with the results of the laboratory grain-size analyses and classification using HydrogeoSieveXL (Devlin, 2015) (Appendix B).

Table 12 - Wetland and Former Wetland Soil Sampling

Location	Field Soil Description	Sample Depth (metres)	Horizon C Sample				HydrogeoSieveXL Grain-Size Classification
			Gravel %	Sand %	Silt %	Clay %	
HA-1 (former wetland)	Silty fine sand overlying grey silty clay with trace gravel	0.75-0.87	1	8	43	48	Poorly sorted clay with fines
HA-2 (SWD4)	Red silt/clay	0.45-0.58	0	1	65	34	
HA-3 (SWD2-2 West Tributary)	Organics overlying brown/grey clay becoming red	0.40-0.85	0	2	51	47	
HA-4 (SWD2-2 East Tributary)	Organic silt/clay overlying brown/grey clay becoming red	0.85-0.98	0	16	33	51	

The results correspond with the previous reporting by MNRF that identified wetland soils as "*largely clay based, with silty clay, silty clay loam and clay loam the predominant soil types*" (MNRF, 2020). The wetlands are underlain by aquitard material and their calculated hydraulic conductivities are less than 10^{-9} m/s. These values were calculated using the laboratory grain-size analyses and the Excel-tool HydrogeoSieveXL (Devlin, 2015) (Appendix B). Given the soil texture results, HA-2 soils can be considered HSG C, and HA-3/HA-4 soils can be considered HSG D, for the wetland water balance modelling, as HSG Group C soils typically have 20-40% clay and HSG Group D soils typically have >40% clay (USDA, 2007).

4.7.3 Wetland Surface Water Catchments

Topographic contours were analyzed to map on-site surface water catchments for the wetlands while also considering the existing Conservation Halton subwatershed boundaries (Figure 2).

The Site's northwest Green Ash Mineral Deciduous Swamps (SWD2-2) are located within separate portions of Grindstone Creek, reflecting the influence of the two tributaries. The Mineral Deciduous Swamp (SWD4) is located within the Conservation Halton Falcon Creek subwatershed.

Off-site drainage contributions to the wetlands were also considered from lands north of the property boundary. This was completed using Urbantech's pre-development drainage catchments refined to account for existing land use conditions north of the Site (Urbantech, 2026) (Figure 5). Total surface water catchment areas, as well as the area of the on-site portions are presented in Table 13 below. The two MAM2-6 wetlands are relatively small (<0.02 ha) and fall within the SWD-4 surface water catchment. Consequently, individual catchments have not been delineated for these small wetlands as topographic contours suggest the features drain toward SWD-4.

Table 13 – Wetland Catchment Site Summary Information

Site Sub-Watershed	ELC	Wetland Area (ha)	Wetland HSG	Total Catchment Area (ha)	On-Site Catchment Area (ha)	Percentage of Catchment On-Site
Grindstone Creek West	SWD2-2	0.48	D	14.19	0.68	5%
Grindstone Creek East	SWD2-2	0.36	D	12.94	0.39	3%
Falcon Creek*	SWD4	0.54	C	3.68	3.68	100%
Falcon Creek*	MAM2-6 (East)	0.01	C/D^	N/A	N/A	N/A
Falcon Creek*	MAM2-6 (West)	0.02	C/D^	N/A	N/A	N/A

Note: N/A= Not Applicable
* - Assignment of Falcon Creek based upon Conservation Halton subwatershed mapping
^-Assumed HSG C/D due to proximity to nearby SWD2-2 and SWD4

4.7.4 Wetland Hydroperiods

A hydroperiod is defined as "*the seasonal pattern of the water level of a wetland…It characterizes each type of wetland, and the constancy of its pattern from year to year ensures a reasonable stability for that wetland. It defines the rise and fall of a wetland's surface and subsurface water by integrating all of the inflows and outflows"* (Mitsch and Gosselink, 2007).

Mitsch and Gosselink (2007) report that alluvial swamps "*…respond sharply to local rainfall events…*" (Figure 7) similar to that observed at the surface water gauge on the eastern and western Grindstone Creek tributaries (SG-GCI and SG-GC-WI, Figure 4, Appendix A).

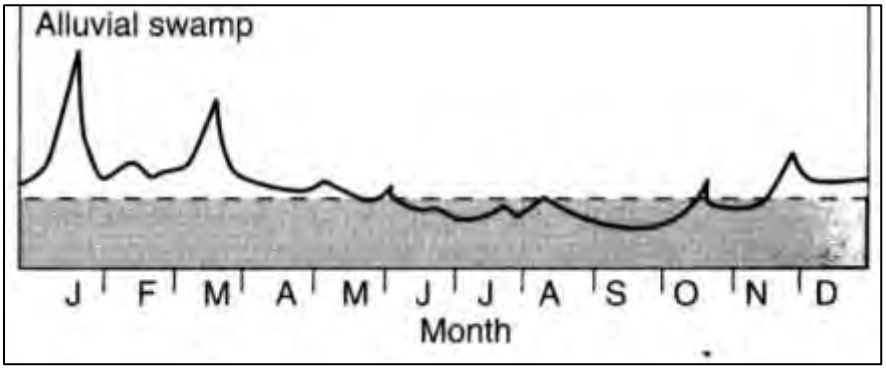


Figure 7 – Alluvial Swamp Hydroperiod (Mitsch and Gosselink, 2007)
Note: shading indicated below ground surface

Mitsch and Gosselink (2007) also report that the "*hydroperiods of many bottomland hardwood forests and swamps have distinct periods of surface flooding in the winter and early spring due to snow and ice conditions followed by spring floods but otherwise have a water table that can be a meter or more below the surface*" (Figure 8). The observations of surface water conditions at the SWD4 wetland by NRSI (2023) in 2022 are similar to this description and can be described by the hydrograph below (Figure 8).

Also, similar conditions have been noted at a wetland monitored by Conservation Halton on lacustrine clays below the Niagara Escarpment (Conservation Halton, 2023). It is surmised that the 2023-2024 hydrograph at SG-2 reflects the above-average precipitation conditions in 2023 and 2024 as noted above (Table 1).

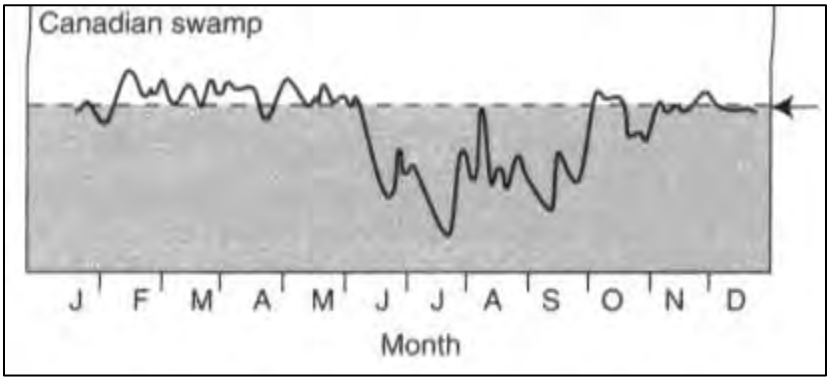


Figure 8 – Canadian Swamp Hydroperiod (Mitsch and Gosselink, 2007)
Note: arrow indicates wetland ground surface

4.7.5 Wetland Water Levels

The Green Ash Mineral Deciduous Swamps (SWD2-2) are proposed classified as riverine wetlands although they have intermittent palustrine inflow and outflow (NRSI, 2026).

The eastern Grindstone Creek wetland is located between the 110.4 to 112 m ASL ground surface contours (Figure 4). Surface water levels from the upstream inlet (SG-GCI) were generally between 111.1 and 111.3 m ASL from July 2022 to November 2024. However, responses to large precipitation events was somewhat higher with surface water elevations as high as 111.5 m ASL (Appendix A).

The western Grindstone Creek wetland is located between the 109 to 110 m ASL ground surface contours (Figure 4). Surface water levels were generally between 109.5 and 110 m ASL (SG-GC-WI) from June 2023 until November 2024. However, surface water responses to precipitation events could be as high as 110.34 m ASL (Appendix A). Summer 2024 dry periods were also present, with increases in surface water levels as responses to precipitation events (Appendix A). It would be expected that the green ash swamp root zone could reach the monitored surface water elevations with an expected rooting depth of 1 m (McBean, Rovers and Farquhar, 1995).

The Mineral Deciduous Swamp (SWD4) is classified as an isolated wetland having no defined inflow or outflow. The swamp is separated from the adjacent pond to the west by a berm (former road) with a height of between 0.5 and 1 m. The swamp is located within the 110 m ASL ground surface contour, and the adjacent pond is within the 110.4 m ASL contour (Figure 4). The swamp is underlain by clay (HA-2) to clayey silt which is underlain by clayey sand (BH-8, Soil-Mat, 2013). Terra-Dynamics began wetland water level monitoring at staff gauge SG-2 in January 2023 (Figure 4) to document wetland water levels. From January 2023 to November 2024 water level elevations at SG-2 were generally between 109.5 to 110.1 m ASL, with responses to large precipitation events displaying surface water elevations as high as 110.4 m ASL (Appendix A). Ponded conditions were noted at SG-2 for the majority of the monitoring

period, with the exception of late summer to early fall of 2024, when dry conditions were observed. The surface water levels of the adjacent pond were higher than the SWD4 wetland surface water levels. Surface water level declines in May, June, July and September 2023 were noted to occur at rates of 8-10 mm/day, similar to declines in the Grindstone Creek pond.

The SWD4 wetland is largely supplied with water by precipitation as shown by the summer 2023 and 2024 hydroperiod being wetter than average conditions due to the above average precipitation. 2023 was a year with above-average precipitation from January to August (142% of average precipitation), except below average precipitation in May (32% of average precipitation), and September to November (45%), and average precipitation conditions in December (101%) (Table 1). Similarly, precipitation conditions in 2024 were above average from January to July (128% of average precipitation), with January (193% of average precipitation) and July (231% of average precipitation) well above average conditions, and below average conditions for the remainder of the year (Table 1).

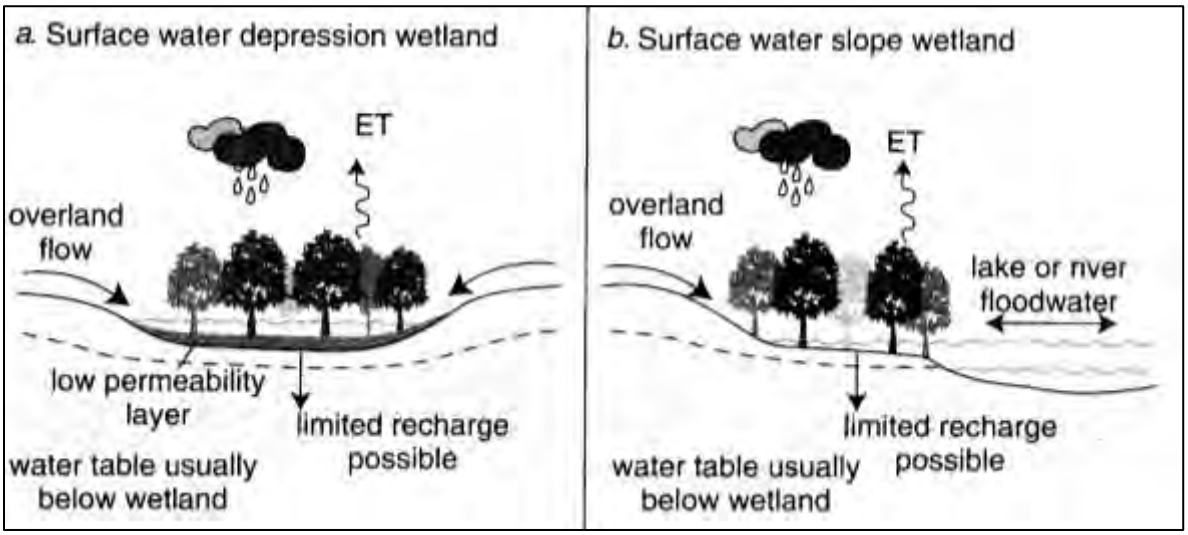
Water level monitoring has not been completed at the two Broad-leaved Sedge Mineral Meadow Marsh Type (MAM2-6) wetlands. However, it is expected their hydroperiods would be similar, or less wet than the nearby Mineral Deciduous Swamp (SWD4). This is proposed because they are within the same topographic surface water catchment but are located upgradient.

4.7.6 Wetland Characterizations

The wetlands proposed classifications are either (a) *surface water depression wetlands* or *(b) surface water slope wetlands* (Figures 6a and 6b) (Mitsch and Gosselink, 2007).

The Deciduous Swamp wetland (SWD4) reasonably fits the description of a surface water depression wetland. A surface water depression wetland is summarized as a: "*wetland…dominated by surface runoff and precipitation, with little groundwater outflow due to a layer or low-permeability soils*…" (Mitsch and Gosselink, 2007). Low permeability soils have been noted at the Site and the Mineral Deciduous Swamp (SWD4) fits this description. The two smaller Broad-leaved Sedge Mineral Meadow Marsh Type (MAM2-6) wetland polygons are also assumed to be classified as surface water depression wetlands, given there is no direct watercourse to supply water, the available topographic contours and the description provided by NRSI (2026).

The Green Ash Mineral Deciduous Swamps (SWD2-2) reasonably fit the description of a surface water slope wetland. A surface water slope wetland is summarized as a: "*wetland…generally found in alluvial soil adjacent to a lake or stream and is fed, to some degree, by precipitation and surface runoff but more important, by overbank flooding from the adjacent stream, river or lake. Hydroperiods of these wetlands match the seasonal patterns of the adjacent bodies of water, with relatively rapid wetting and drying*" (Mitsch and Gosselink, 2007).



Figures 6a/6b - Surface water depression and surface water slope wetlands (Mitsch and Gosselink, 2007)

4.7.7 Soil Water Holding Capacity

The soil water holding capacities (SWHC) for the wetland polygons (Table 14) were assigned based upon the observed hydrologic soil groups (Section 4.7.2) and values from previous wetland SWHC designations used in conservation authority water budgeting (AquaResource Inc. and NPCA, 2009).

Table 14 – Wetland Catchment Soil Summary Information

Site Sub-Watershed	ELC	Wetland Area (ha)	Wetland HSG	SWHC (mm)
Grindstone Creek West	SWD2-2	0.48	D	350
Grindstone Creek East	SWD2-2	0.36	D	350
Falcon Creek*	SWD4	0.54	C	400
Falcon Creek*	MAM2-6 (East)	0.01	C/D^	350-400^
Falcon Creek*	MAM2-6 (West)	0.02	C/D^	350-400^

Note: * - Assignment of Falcon Creek based upon Conservation Halton subwatershed
^-Assumed HSG C/D due to proximity to SWD2-2 and SWD4

5.0 Wetland Water Balance Assessment

A monthly wetland water balance assessment has been completed and was informed by Conservation Halton's Draft Wetland Water Balance Assessment Guidelines (2022). It is noted that the MECP (2003) water balance approach is typically concerned with the evaluation of post-development conditions to prevent (i) increased runoff, and/or (ii) reduction in groundwater recharge. However, based upon the wetland characterizations (Section 4.7.4), surface water flow, not groundwater discharge, is the key source for the hydrologic function for these swamps after precipitation. Consequently, '*maintenance of pre-development monthly saturated conditions via runoff to maintain the wetland hydroperiod*' is the criteria for the water balance assessment.

5.1 Monthly Water Balance Example

An example of water balance modelling from the University of Waterloo is shown below (Figure 9). Annual groundwater recharge begins in the fall following '*soil water utilization*' and '*deficit*' in the summer. Soil water utilization corresponds with evapotranspiration exceeding the precipitation supply. Annual groundwater recharge occurs during the same time period that groundwater levels rise. However, in this example it is noted that the soil water holding capacity (SWHC) modelled was very low at only 100 mm compared to the higher SWHC of the Site wetlands of between 350 to 400 mm.

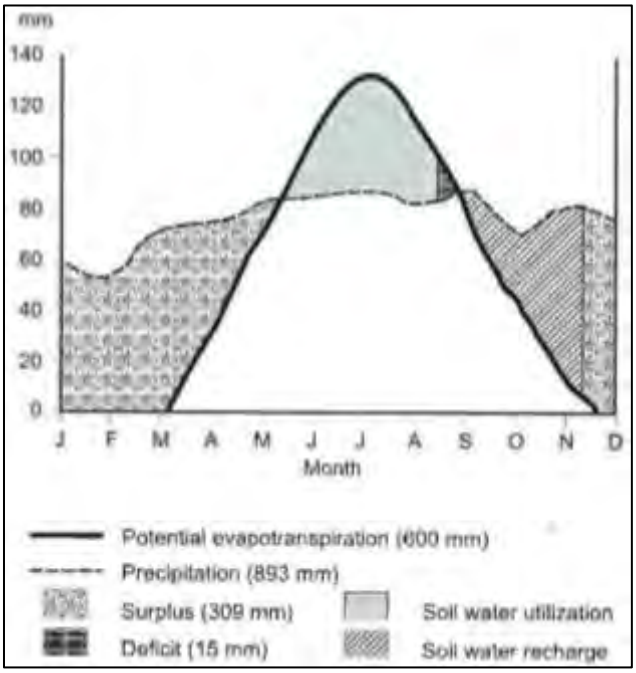


Figure 9 – Brantford Average Water Balance (Sanderson, 2004)

5.2 Wetland Water Balances

Monthly wetland water balances were completed using the U.S. Geological Survey (USGS) Monthly Water Balance Model (McCabe and Markstrom, 2007), which only considers direct precipitation to the wetland. Temperature and precipitation data were obtained using 30-year climate normal inputs (1981-2010) from the Hamilton RBG Station (Environment Canada, 2025a). Monthly wetland water balance modelling results (Tables 15a and 15b) were produced for the wetland SWHC at the Site (Section 4.7.7) and are summarized below in Table 16 (presented without decimal places). As noted in Section 4.7.7, the two wetland polygons associated with MAM2-6 are relatively small (<0.02 ha) and are located within the topographic surface water catchment for SWD-4, as a result they have not been individually modelled. Similar trends were noted in each of these cases and are summarized as follows:

1. Potential evapotranspiration exceeded precipitation for June, July and August, i.e. soil water utilization occurred;
2. Soil water holding capacities were less than saturated for the months of June through October;
3. The highest soil water deficit was in August; and

4. Soil water recharge occurred in September and October as shown by the increase in soil moisture and reduced deficit.

Table 16 – Average Monthly Wetland Water Balance (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	57	57	64	73	86	73	83	90	81	72	91	72
Actual[1] (mm) Evapotranspiration	10	11	21	39	71	107	123	98	59	32	17	11
Hydrologic Soil Group C (SWHC 400 mm, SWD4)												
Soil Moisture (mm)	400	400	400	400	400	**363**	**318**	**304**	**322**	**358**	400	400
Soil Water[2] Depletion (mm)	0	0	0	0	0	**37**	**82**	**96**	**78**	**42**	0	0
Hydrological Soil Group D (SWHC 350 mm, SWD2-2)												
Soil Moisture (mm)	350	350	350	350	350	**313**	**269**	**256**	**273**	**309**	350	350
Soil Water[2] Depletion (mm)	0	0	0	0	0	**37**	**81**	**94**	**77**	**41**	0	0

Note: [1] Modelled in USGS Monthly Water Balance Model
[2] Difference between the SWHC and the modelled soil moisture

5.2.1 2023-2024 Wetland Water Balances

Monthly wetland water balances were also completed for 2023-2024 using data from the Hamilton RBG Station (Environment Canada, 2025b) to correspond with the most recent surface water level monitoring. Monthly wetland water balance modelling results (Tables 17a and 17b) were produced for the wetland SWHC at the Site (Section 4.7.7) and are summarized below in Table 18 (2023) and Table 19 (2024) (presented without decimal places). Similar trends were noted for each SWHC and are summarized as follows by year:

<u>2023:</u>
1. Potential evapotranspiration exceeded precipitation for May, June and September, i.e. soil water utilization occurred;
2. Soil water holding capacities were less than saturated for the months of January, May, June, September through November;
3. The highest soil water deficit was in June; and
4. Soil water recharge occurred in January (following a modelled deficit in fall 2022), October and November as shown by the increase in soil moisture and reduced deficit.

<u>2024:</u>
1. Potential evapotranspiration exceeded precipitation for June and August, and slightly lower in September (2 mm difference), i.e. soil water utilization occurred;
2. Soil water holding capacities were less than saturated for the months of June, and August through November;
3. The highest soil water deficit was in September; and
4. Soil water recharge occurred in October and November as shown by the increase in soil moisture and reduced deficit.

Table 18 – 2023 Monthly Wetland Water Balance (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	76	83	124	102	27	90	194	131	13	51	45	73
Actual[1] (mm) Evapotranspiration	13	14	22	44	68	102	125	94	65	37	17	14
Hydrologic Soil Group C (SWHC 400 mm, SWD4)												
Soil Moisture (mm)	**371**	400	400	400	**358**	**341**	400	400	**348**	**359**	**386**[3]	400
Soil Water[2] Depletion (mm)	**29**	0	0	0	**42**	**59**	0	0	**52**	**41**	**15**[3]	0
Hydrological Soil Group D (SWHC 350 mm, SWD2-2)												
Soil Moisture (mm)	**326**[3]	350	350	350	**308**	**291**	350	350	**298**	**309**	**336**[3]	250
Soil Water[2] Depletion (mm)	**25**[3]	0	0	0	**42**	**59**	0	0	**52**	**41**	**15**[3]	0

Note: [1] Modelled in USGS Monthly Water Balance Model
[2] Difference between the SWHC and the modelled soil moisture

Table 19 – 2024 Monthly Wetland Water Balance (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Precipitation (mm)	109	25	45	85	91	82	191	52	68	52	42
Actual[1] (mm) Evapotranspiration	12	15	26	42	81	109	127	102	66	36	20
Hydrologic Soil Group C (SWHC 400 mm, SWD4)											
Soil Moisture (mm)	400	400	400	400	400	**370**	400	**348**	**347**	**361**[3]	**381**
Soil Water[2] Depletion (mm)	0	0	0	0	0	**30**	0	**52**	**53**	**40**[3]	**19**
Hydrological Soil Group D (SWHC 350 mm, SWD2-2)											
Soil Moisture (mm)	350	350	350	350	350	**320**	350	**298**	**297**	**311**[3]	**331**
Soil Water[2] Depletion (mm)	0	0	0	0	0	**30**	0	**52**	**53**	**40**[3]	**19**

Note: [1] Modelled in USGS Monthly Water Balance Model
[2] Difference between the SWHC and the modelled soil moisture
[3] Combined values above the maximum (350 or 400) due to rounding of values

The modelling above reasonably matches the water level monitoring completed at SG-2, located within the SWD4 wetland polygon. This supports the wetland being primarily supplied water via precipitation, with runoff also providing supply under favourable conditions.

The modelling above does not reflect water level monitoring completed at SG-GC-I (SWD2-2 East) and SG-GC-WI (SWD2-2 West) as these staff gauges displayed sustained hydroperiods throughout the majority of the monitoring period. This supports that the wetlands hydroperiods are not driven by direct precipitation and on-site runoff but rather are supplied water from their the larger upgradient/off-site catchments.

5.3 Wetland Water Balance Assessment

As introduced in Section 5.0, "*maintenance of pre-development monthly saturated conditions via runoff, to maintain the wetland hydroperiod",* is the criteria for the wetland water balance assessment. Assessment of this condition has been identified as a concern on average only for the months of June through October, when the average monthly wetland water balance indicated less than saturated conditions may be expected if direct precipitation alone is relied upon to maintain average saturated conditions. The runoff areas required for the wetlands to have saturated conditions in June through October were calculated and are presented in Tables 20a, 20b and 20c.

SWD4 Wetland

It is modelled that upgradient on-site runoff may sustain saturated conditions during June and October at the SWD4 Wetland. This is because the upgradient runoff area of the SWD4 wetland (3.68 ha) is larger than the modelled catchment areas that are required to saturate the wetland during June and October, i.e. 2.50 and 1.62 hectares, respectively (Table 20a).

Table 20a – Modelled Summer Runoff to SWD4 Wetland

Month	Jun	Jul	Aug	Sep	Oct
Soil Water [1] Depletion (mm) [see Table 16a]	37.4	82.2	95.6	77.9	41.9
Wetland Soil Water Depletion Volume[2] (m^3)	202.0	443.9	516.2	420.7	226.3
Modelled Runoff (Section 4.6) (mm) [see Table 8]	8	11	11	9	14
Upgradient area [3] required to produce saturated wetland – Drainage Area (ha)	**2.52**	4.04	4.69	4.67	**1.62**

Notes: [1] Difference between the SWHC (400 mm) and the modelled soil moisture
[2] Depletion depth multiplied by the area of SWD4 Wetland (0.54 ha).
[3] Volume of soil water depletion (m^3) divided by monthly modelled runoff (mm) (from Table 8) converted to hectares

The proposed Site Plan (Appendix D) displayed on Figure 5, displays the removal of approximately 0.20 ha of the SWD4 wetland and the removal of approximately 1.97 ha of the catchment to accommodate the construction of Street A and Block-8. These reductions result in a new approximate wetland size of 0.34 ha and a catchment area of 1.71 ha. Table 20b below displays those updated post-development conditions of the wetland.

Table 20b – Modelled Summer Runoff to SWD4 Wetland

Month	Jun	Jul	Aug	Sep	Oct
Soil Water [1] Depletion (mm) [see Table 16a]	37.4	82.2	95.6	77.9	41.9
Wetland Soil Water Depletion Volume[2] (m^3)	127.2	279.5	325.0	264.9	142.5
Modelled Runoff (Section 4.6) (mm) [see Table 8]	8	11	11	9	14
Upgradient area [3] required to produce saturated wetland – Drainage Area (ha)	**1.59**	2.54	2.95	2.94	**1.02**

Notes: [1] Difference between the SWHC (400 mm) and the modelled soil moisture
[2] Depletion depth multiplied by the area of SWD4 Wetland (0.34 ha).
[3] Volume of soil water depletion (m^3) divided by monthly modelled runoff (mm) (from Table 8) converted to hectares

Under these post-development conditions, with the reduced wetland area and smaller catchment, the SWD4 wetland is expected to remain sufficient to maintain saturated conditions during June and October, similar to the pre-development conditions.

As noted in Section 4.7.1, this wetland contains a berm of approximately 0.5-1.0 m in height along the southern portion of the wetland boundary, which allows for the ponding of water at this location to sustain the wetland. Future designs of this area should incorporate a berm of similar size to maintain the existing wetland conditions.

SWD2-2 Eastern Wetland

It is modelled that upgradient on-site runoff would not sustain saturated conditions at the SWD2-2 Eastern Wetland. This is because the on-site upgradient runoff area (0.39 ha) is smaller than the modelled catchment areas that are required to saturate the wetland (Table 20c). However, as noted in Section 4.7.3 (Table 13), the on-site portion of the catchment accounts for approximately 3% of the total 12.94 ha catchment (which includes the off-site portion to the north of the Site). As such, any changes to the catchment on-site are not expected to impact the wetland hydroperiod, as the off-site catchment sustains saturated conditions during average conditions.

Table 20c – Modelled Summer Runoff to SWD2-2 Eastern Tributary Wetland

Month	Jun	Jul	Aug	Sep	Oct
Soil Water [1] Depletion (mm) [see Table 16b]	37.4	81.5	94.5	76.7	40.8
Wetland Soil Water Depletion Volume[2] (m^3)	134.6	293.4	340.2	276.1	146.9
Modelled Runoff (Section 4.6) (mm) [see Table 7]	5	8	8	6	11
Upgradient area [3] required to produce saturated wetland – Drainage Area (ha)	2.69	3.67	4.25	4.60	1.34

Notes: [1] Difference between the SWHC (350 mm) and the modelled soil moisture
[2] Depletion depth multiplied by the area of SWD2-2 Eastern Wetland (0.36 ha).
[3] Volume of soil water depletion (m^3) divided by monthly modelled runoff (mm) (from Table 7) converted to hectares

SWD2-2 Western Wetland

It is modelled that upgradient on-site runoff would not sustain saturated conditions at the SWD2-2 Western Wetland. This is because the upgradient runoff area (0.68 ha) is smaller than the modelled catchment areas that are required to saturate the wetland (Table 20d). However, as noted in Section 4.7.3 (Table 13), the on-site portion of the catchment accounts for approximately 5% of the total 14.19 ha catchment (which includes the off-site portion to the north of the Site). As such, any changes to the catchment on-site are not expected to impact the wetland hydroperiod, as the off-site catchment sustains saturated conditions during average conditions.

Table 20d – Modelled Summer Runoff to SWD2-2 Western Tributary Wetland

Month	Jun	Jul	Aug	Sep	Oct
Soil Water [1] Depletion (mm) [see Table 16b]	37.4	81.5	94.5	76.7	40.8
Wetland Soil Water Depletion Volume[2] (m^3)	179.5	391.2	453.6	368.2	195.8
Modelled Runoff (Section 4.6) (mm) [see Table 7]	5	8	8	6	11

Month	Jun	Jul	Aug	Sep	Oct
Upgradient area [3] required to produce saturated wetland – Drainage Area (ha)	3.59	4.89	5.67	6.14	1.78

Notes: [1] Difference between the SWHC (350 mm) and the modelled soil moisture
[2] Depletion depth multiplied by the area of SWD2-2 Western Wetland (0.48 ha).
[3] Volume of soil water depletion (m^3) divided by monthly modelled runoff (mm) (from Table 7) converted to hectares

Runoff values from Table 7 and 8 were used for these calculations, however as noted in Sections 4.6 and 4.61, these values assumed a higher monthly recharge/infiltration rate than the Site-specific investigations have shown and as result a lower monthly runoff. However, even with a pro-rated runoff increase of 66% for Falcon Creek Subwatershed (SWD4) and 63% for Grindstone Creek Subwatershed (SWD2-2), to account for a reduction in recharge/infiltration, the conclusions provided below remain the same.

6.0 Conclusions and Recommendations

The following conclusions are provided:

1. The Site is underlain by a silty clay aquitard overlying the Queenston Shale aquitard. Limited sandy soils of 1 to 2 m thickness are mapped in some areas of the Site, principally associated with the western portion of the Site.

2. Five wetlands are mapped as underlain by low permeability silty clay to clay, consisting of either surface water depression or surface water slope wetlands.

3. Average modelled wetland water balance conditions for supply by precipitation alone included potential evapotranspiration as exceeding precipitation for June, July, and August, with soil water holding capacities less than saturated for June through October.

4. The SWD4 wetland surface water catchment may sustain the wetland hydroperiod in June and October. The proposed reduction in wetland and catchment area during post-development is expected to continue to maintain existing conditions at the wetland.

5. The two SWD2-2 Grindstone Creek wetlands were identified to be supplied with water primarily from upgradient off-site not on-site overland runoff. The upgradient catchments maintained saturated conditions throughout the year under pre-development conditions and may continue to do so under post-development conditions.

The following recommendations are provided:

1. Complete additional geotechnical and hydrogeological investigations of the western and central portions of the Site.

2. Complete an updated Site surficial geology map and refine the Site water balance if required.

3. Complete in-situ infiltration testing to inform potential Low Impact Development measures.

4. If the southern portion of the SWD4 wetland is to be removed, a berm of similar construction to existing conditions should be constructed to continue to maintain the existing hydroperiod of the wetland.

We trust this information is sufficient for your present needs. Please do not hesitate to contact us if you have any questions.

Yours truly,

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Attachments
Figure 1 – Location of Subject Lands
Figure 2 – Base Map
Figure 3 – Geologic Cross-Section A-A' West-East
Figure 4 – Wetland Information
Figure 5- Wetland Surface Water Catchments
Table 1 – Precipitation Analyses- Hamilton Royal Botanic Gardens
Tables 15a/15b – USGS Wetland Monthly Wetland Water Balances (1981-2010)
Tables 17a/17b – USGS Wetland Monthly Wetland Water Balances (2023-24)
Appendix A – Hydrographs
Appendix B – Soils Information
Appendix C – Urbantech Pre-Development Storm Drainage Area
Appendix D- 1200 King Road Site and Landscape Plan (2026)

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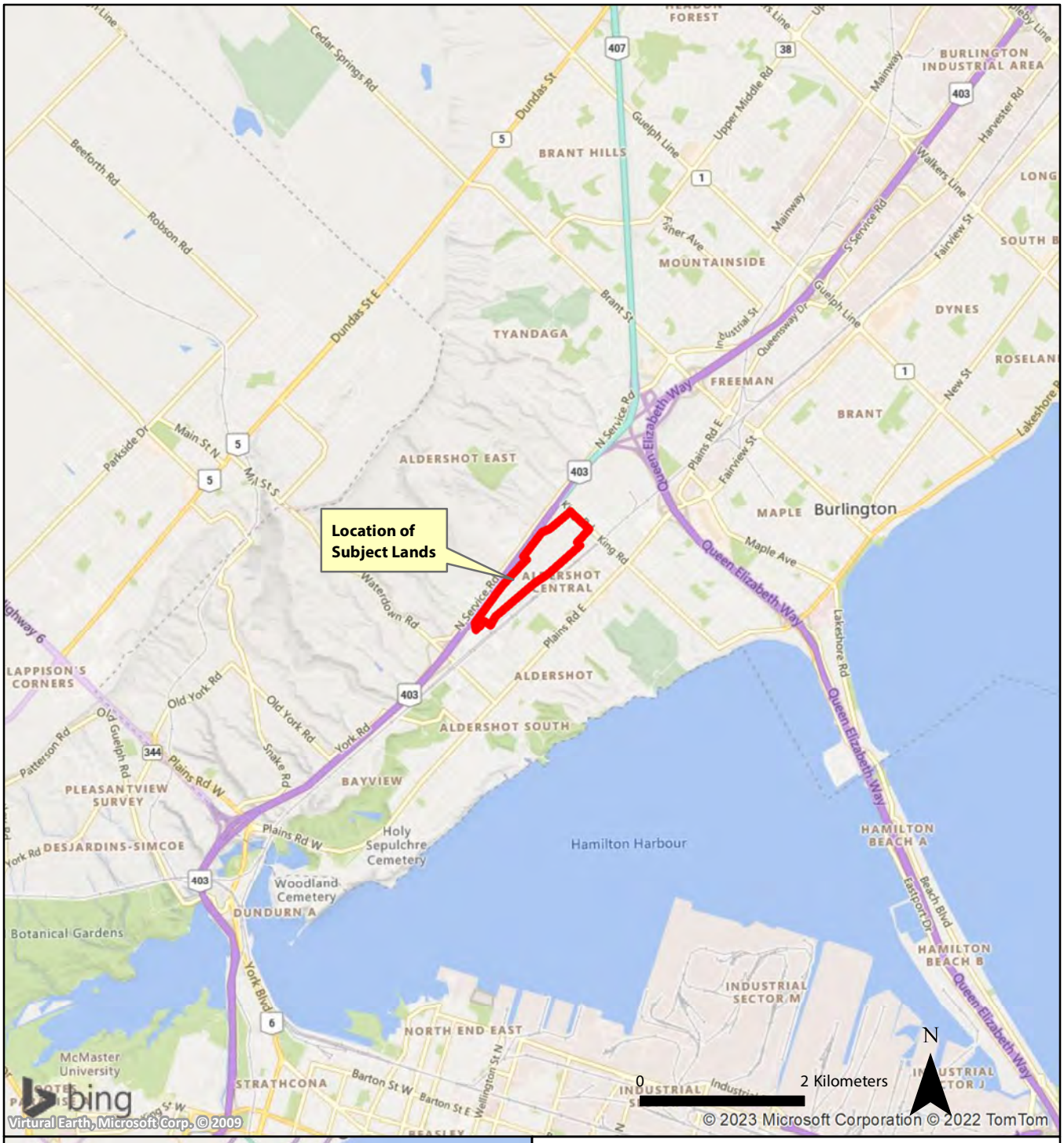
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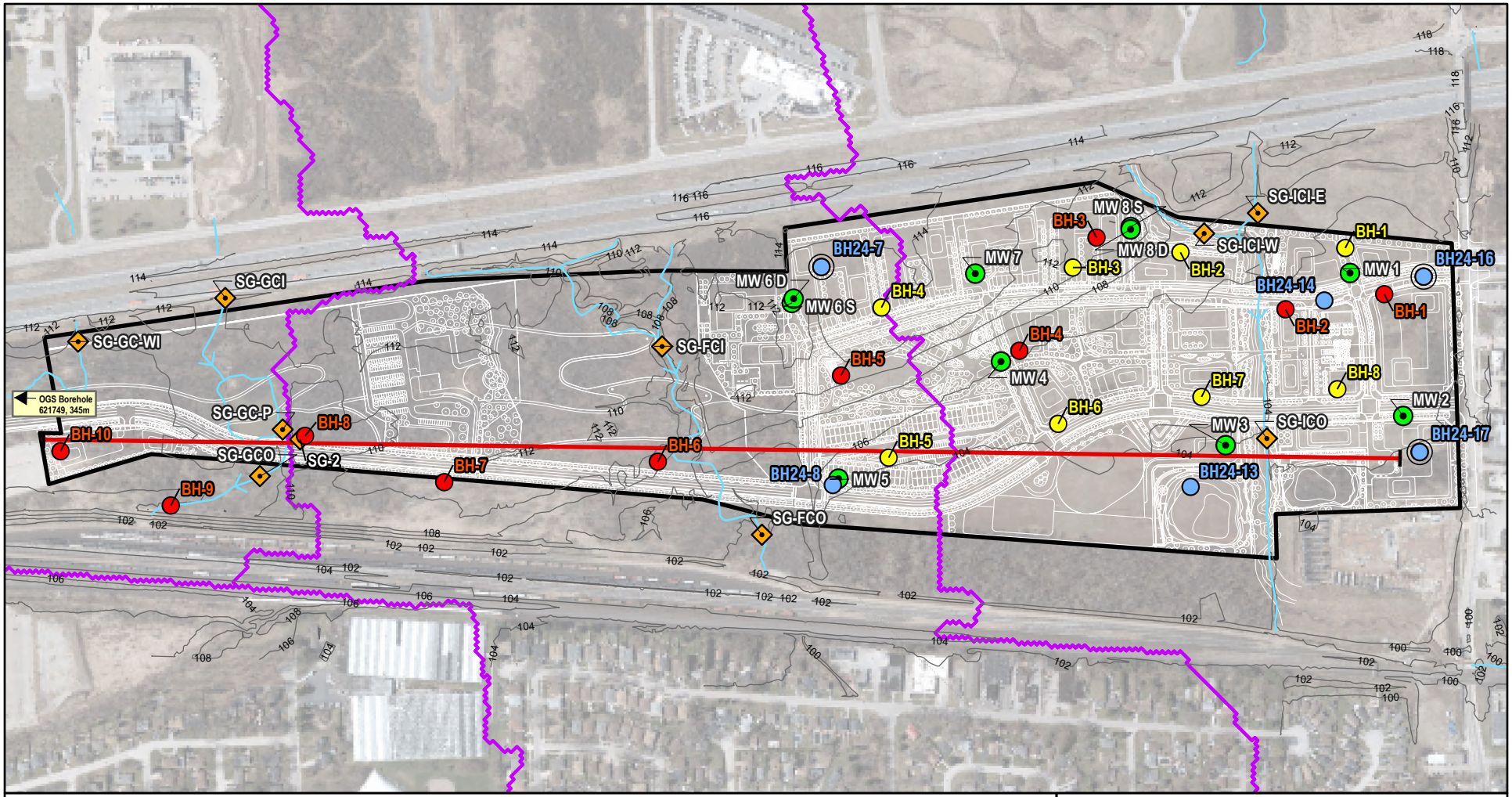
Location of Subject Lands

1200 King Road, Aldershot

Terra-Dynamics inc.

Project No. 493	Figure 1

Path: H:\TERRA_DYNAMICS\8755 - Terra-Dynamics 261 1200 King Road Aldershot\gis\mxd\Figure 1 Location of Subject Lands.mxd Revised: March 1, 2023



Property Boundary
Watercourse
Line of Geologic Cross-section
Subwatersheds - Conservation Halton
Monitoring Well

MW6D Staff Gauge
SG-GCI Borehole, Soil-Mat 2011
Borehole, Soil-Mat 2013
Borehole, DS Consultants 2024
Monitoring Well, DS Consultants 2024

Site Plan: 23117_1299King_SITEPLAN_26_02_06.dwg

Base Map

1200 King Road, Aldershot Wetland Water Balance

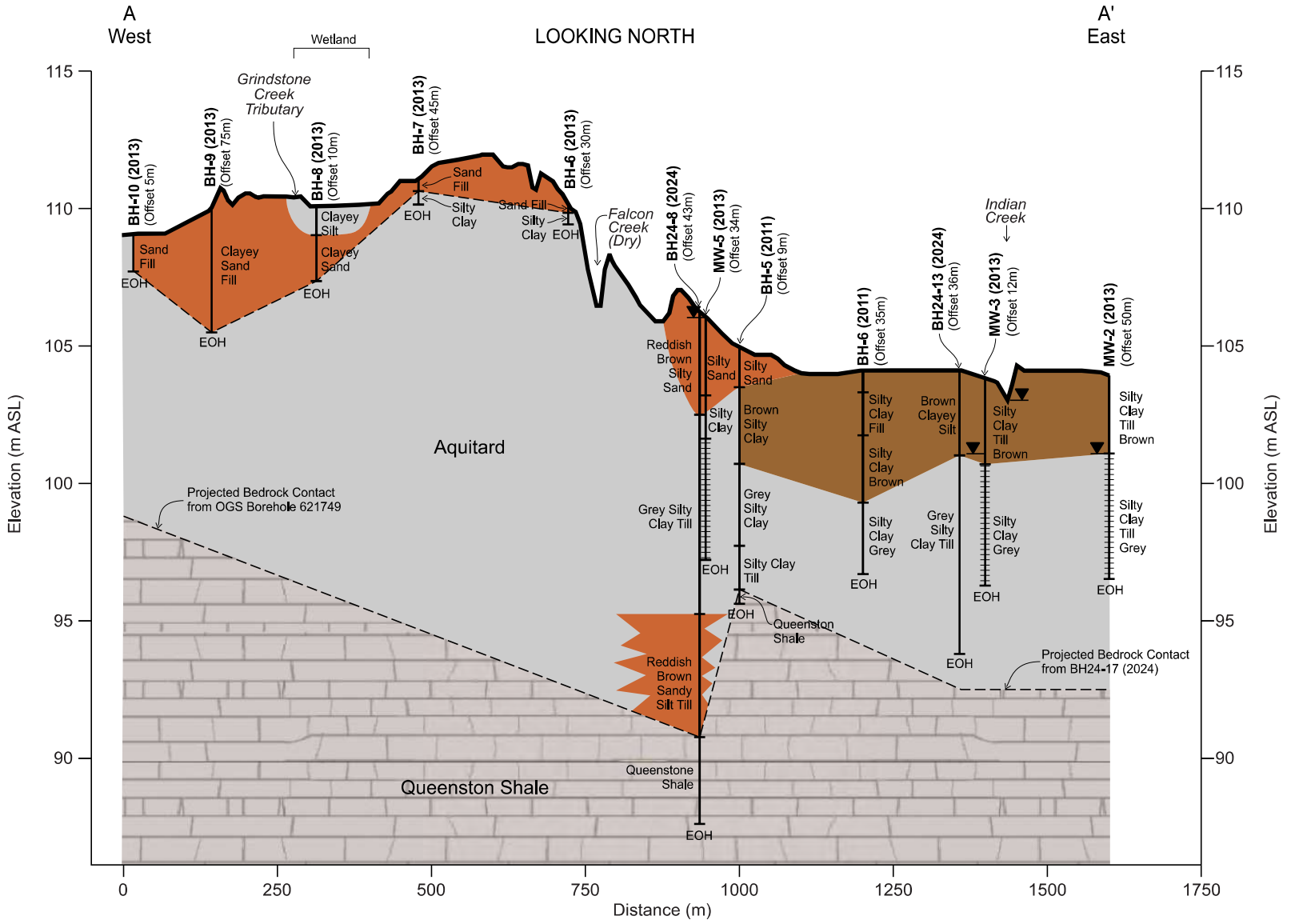
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Figure 2

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Borehole/Monitoring Well

EOH End of Hole

Water Level (mASL) Nov. 15, 2022

Monitoring Well Screen

Sand/Fill/Silty Sand/Clayey Sand

Brown Clay

Grey Clay

Bedrock

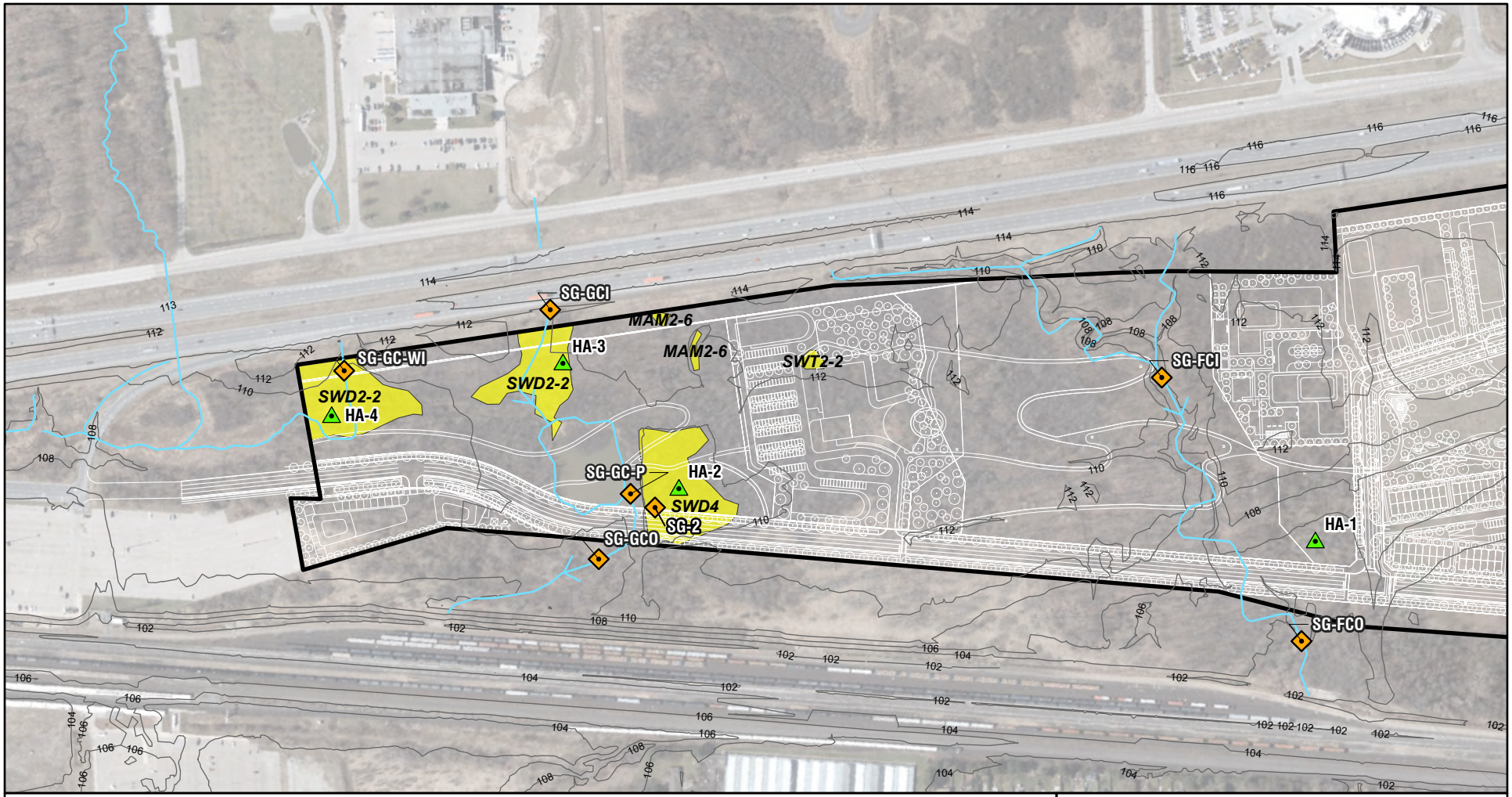
Note:
2024 borehole surface elevations are approximate and not surveyed.

Hydrogeologic Cross-section A-A'

1200 King Road, Aldershot, Wetland Water Balance

Terra-Dynamics inc.

Figure 3



Property Boundary

Watercourse

Ground Surface Contours

SG-GCI Staff Gauge

HA-1 Hand-auger Hole

SWD4 ELC Wetland (NRSI, 2026)

Ecological Land Classification Codes:

SWD2-2: Green Ash Mineral Deciduous Swamp

SWD4: Deciduous Swamp

MAM2-6: Broad-leaved Sedge Mineral Meadow Marsh Type

SWT2-2: Willow Mineral Thicket Swamp

Site Plan: 23117_1299King_SITEPLAN_26_02_06.dwg

Wetland Information

1200 King Road, Aldershot
Wetland Water Balance

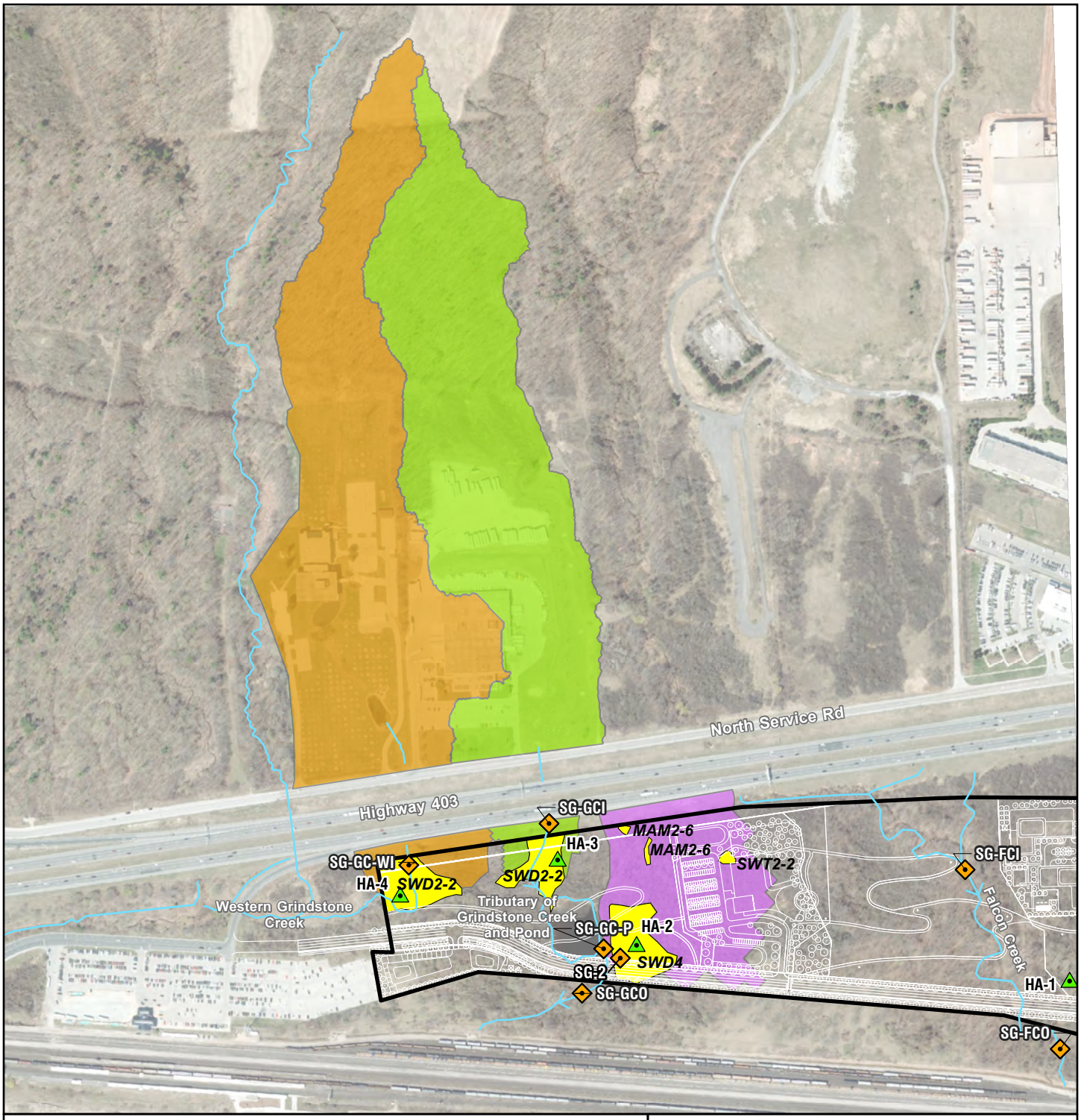
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Figure 4

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Property Boundary

Watercourse

SG-GCI Hand-auger Hole

HA-1 Staff Gauge

SWD4 ELC Wetland (NRSI, 2026)

Ecological Land Classification Codes:

SWD2-2: Green Ash Mineral Deciduous Swamp

SWD4: Deciduous Swamp

MAM2-6: Broad-leaved Sedge Mineral Meadow Marsh Type

SWT2-2: Willow Mineral Thicket Swamp

Wetland Catchments (2026)

SWD2-2 West

SWD2-2 East

SWD4

Site Plan: 23117_1299King_SITEPLAN_26_02_06.dwg

Wetland Surface Water Catchments

1200 King Road, Aldershot
Wetland Water Balance

Terra-Dynamics inc.

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Figure 5

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Table 1

Hamilton RBG 2022-2024 Precipitation Conditions Analyses

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Sum
Average Precipitation (mm)	56.8	57.2	63.7	73.3	85.5	72.7	82.7	89.7	80.9	71.6	91.3	71.9	897
2022 Hamilton RBG	40.3	94.6	62.9	47.9	52.8	66.1	60.0	77.3	27.4	27.8	44.7	77.0	679
1-month Average +/- 100%	71%	165%	99%	65%	62%	91%	73%	86%	34%	39%	49%	107%	76%
3-Month Average +/- 100%	45%	86%	111%	106%	74%	72%	74%	83%	65%	55%	41%	64%	
2023 Hamilton RBG	76.0	83.3	123.6	101.5	27.4	89.5	193.9	130.6	13.3	51.1	45.4	72.7	1008
1-month Average +/- 100%	134%	146%	194%	138%	32%	123%	234%	146%	16%	71%	50%	101%	112%
3-Month Average +/- 100%	90%	127%	159%	159%	113%	94%	129%	169%	133%	81%	45%	72%	
2024 Hamilton RBG	109.4	24.5	45.5	84.7	90.7	82.2	191.0	52.4	68.3	51.9	42.2	76.7	920
1-month Average +/- 100%	193%	43%	71%	116%	106%	113%	231%	58%	84%	72%	46%	107%	102%
3-Month Average +/- 100%	103%	94%	101%	80%	99%	111%	151%	133%	123%	71%	67%	73%	

Notes: Blue shading indicates above-average precipitation conditions, orange shading below-average conditions
Grey shading indicates average conditions (i.e. within 5% of 100%)
Data from Environment Canada Hamilton RBG Station 6153301
Climate normals from 1981-2010

TABLE 15a

USGS Wetland Monthly Water Balance (1981-2010) - 400 mm SWHC

Date	P	PET	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus	ROtotal	Comments
January	56.8	9.5	29.2	400	9.5	0	26	29.2	31.8	Surplus
February	57.2	11.2	39.8	400	11.2	0	30.8	39.8	36.6	Surplus
March	63.7	21	61.7	400	21	0	9.3	61.7	51	Surplus
April	73.3	39.1	39.8	400	39.1	0	0	39.8	47.8	Surplus
May	85.5	71.2	10.1	400	71.2	0	0	10.1	31.4	Surplus
June	72.7	106.5	-37.4	362.6	106.5	0	0	0	17.2	Soil Water Utilization
July	82.7	127.9	-49.4	317.8	123.3	4.6	0	0	10.9	Soil Water Utilization
August	89.7	102.1	-16.9	304.4	98.6	3.5	0	0	7.9	Soil Water Utilization
September	80.9	59.1	17.7	322.1	59.1	0	0	0	5.7	Soil Water Recharge
October	71.6	32	36	358.1	32	0	0	0	4.4	Soil Water Recharge
November	91.3	16.7	70.1	400	16.7	0	0	28.2	19.1	Surplus
December	71.9	10.7	49.9	400	10.7	0	9	49.9	34.5	Surplus
Sum	897.3				598.9				298.3	

TABLE 15b

USGS Wetland Monthly Water Balance (1981-2010) - 350 mm SWHC

Date	P	PET	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus	ROtotal	Comments
January	56.8	9.5	29.2	350	9.5	0	26	29.2	32	Surplus
February	57.2	11.2	39.8	350	11.2	0	30.8	39.8	36.6	Surplus
March	63.7	21	61.7	350	21	0	9.3	61.7	51	Surplus
April	73.3	39.1	39.8	350	39.1	0	0	39.8	47.8	Surplus
May	85.5	71.2	10.1	350	71.2	0	0	10.1	31.4	Surplus
June	72.7	106.5	-37.4	312.6	106.5	0	0	0	17.2	Soil Water Utilization
July	82.7	127.9	-49.4	268.5	122.7	5.3	0	0	10.9	Soil Water Utilization
August	89.7	102.1	-16.9	255.5	98.2	3.9	0	0	7.9	Soil Water Utilization
September	80.9	59.1	17.7	273.2	59.1	0	0	0	5.7	Soil Water Recharge
October	71.6	32	36	309.2	32	0	0	0	4.4	Soil Water Recharge
November	91.3	16.7	70.1	350	16.7	0	0	29.3	19.6	Surplus
December	71.9	10.7	49.9	350	10.7	0	9	49.9	34.8	Surplus
Sum	897.3				597.9				299.3	

TABLE 17a

USGS Monthly Water Balance- 400 mm SWHC (2023-2024, HSG C)

Date	P	PET	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus	ROtotal	Comments
January-2023	76.0	12.6	58.6	370.7	12.6	0.0	6.0	0.0	2.9	Soil Water Utilization
February-2023	83.3	14.3	65.2	400.0	14.3	0.0	6.6	35.9	21.1	Surplus
March-2023	123.6	22.4	99.3	400.0	22.4	0.0	3.2	99.3	64.0	Surplus
April-2023	101.5	43.5	56.1	400.0	43.5	0.0	0.0	56.1	62.5	Surplus
May-2023	27.4	68.1	-42.1	357.9	68.1	0.0	0.0	0.0	30.1	Soil Water Utilization
June-2023	89.5	103.9	-18.9	341.0	101.9	2.0	0.0	0.0	18.8	Soil Water Utilization
July-2023	193.9	124.8	59.4	400.0	124.8	0.0	0.0	0.4	17.1	Surplus
August-2023	130.6	93.6	30.4	400.0	93.6	0.0	0.0	30.4	25.4	Surplus
September-2023	13.3	64.9	-52.3	347.7	64.9	0.0	0.0	0.0	10.1	Soil Water Utilization
October-2023	51.1	37.1	11.4	359.1	37.1	0.0	0.0	0.0	7.3	Soil Water Recharge
November-2023	45.4	16.8	26.4	385.5	16.8	0.0	0.0	0.0	4.6	Soil Water Recharge
December-2023	72.7	14.3	54.8	400.0	14.3	0.0	0.0	40.3	24.9	Surplus
January-2024	109.4	11.5	80.1	400.0	11.5	0.0	14.2	80.1	54.2	Surplus
February-2024	24.5	14.8	18.9	400.0	14.8	0.0	4.1	18.9	35.8	Surplus
March-2024	45.4	26.0	21.3	400.0	26.0	0.0	0.0	21.3	30.3	Surplus
April-2024	84.7	42.4	38.1	400.0	42.4	0.0	0.0	38.1	37.3	Surplus
May-2024	90.7	81.1	5.1	400.0	81.1	0.0	0.0	5.1	23.6	Surplus
June-2024	82.2	108.5	-30.4	369.6	108.5	0.0	0.0	0.0	13.7	Soil Water Utilization
July-2024	191.0	127.1	54.3	400.0	127.1	0.0	0.0	23.9	26.3	Surplus
August-2024	52.4	101.5	-51.7	348.3	101.5	0.0	0.0	0.0	11.0	Soil Water Utilization
September-2024	68.3	66.1	-1.2	347.2	66.0	0.2	0.0	0.0	7.6	Soil Water Utilization
October-2024	51.9	36.0	13.3	360.5	36.0	0.0	0.0	0.0	4.7	Soil Water Recharge
November-2024	42.2	19.6	20.5	381.0	19.6	0.0	0.0	0.0	3.2	Soil Water Recharge

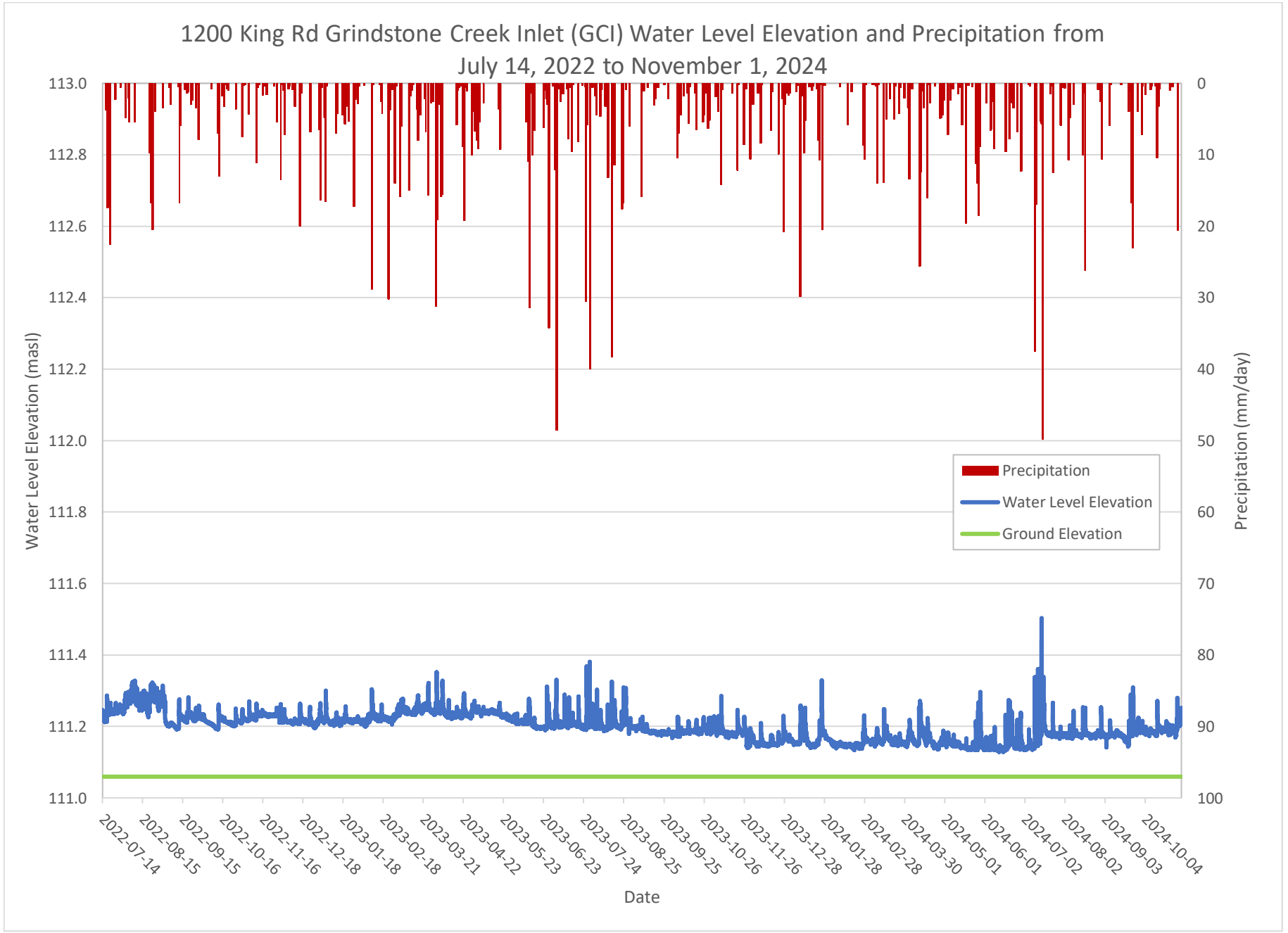
TABLE 17b

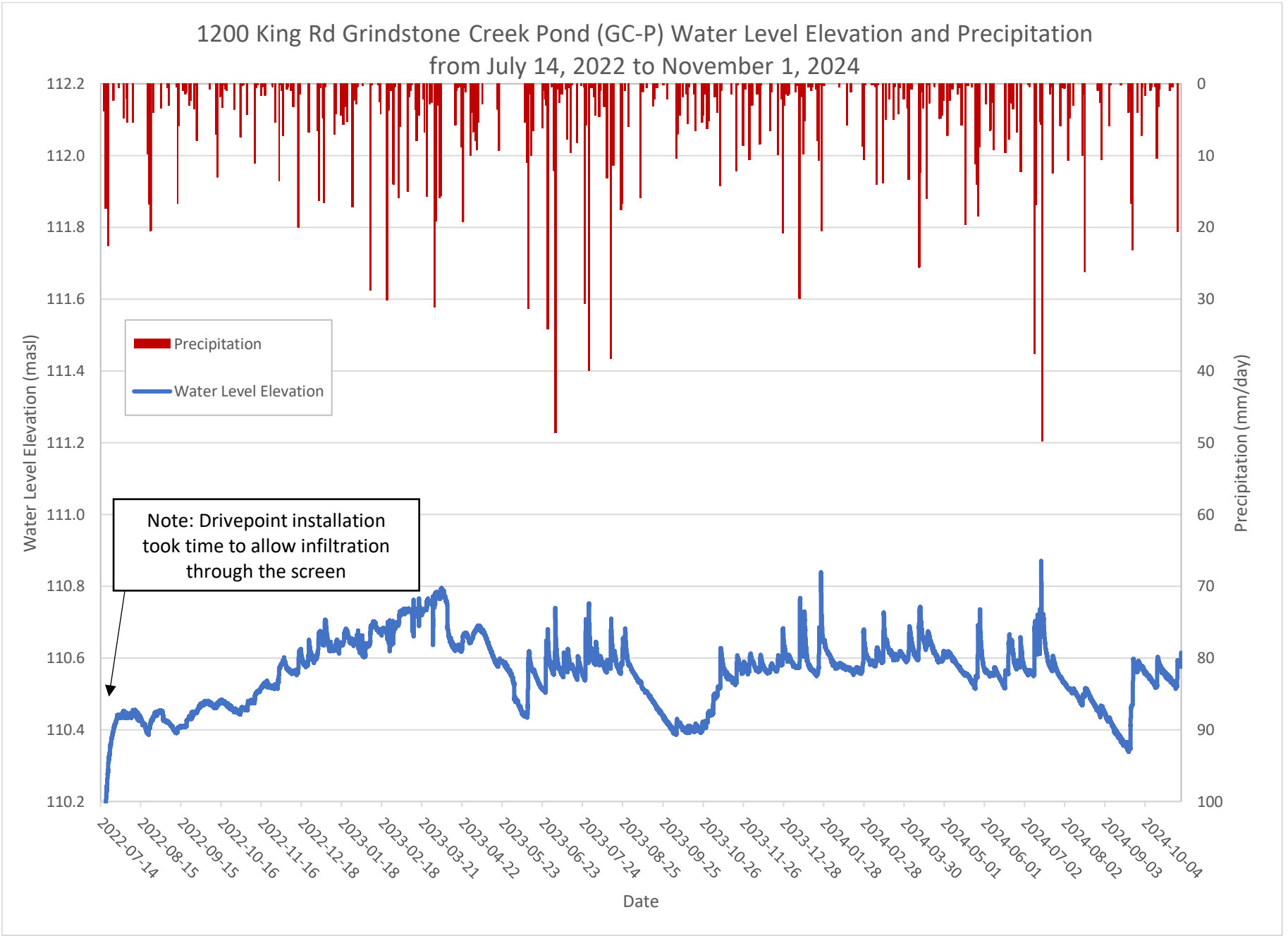
USGS Monthly Water Balance- 350 mm SWHC (2023-2024, HSG D)

Date	P	PET	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus	ROtotal	Comments
January-2023	76.0	12.6	58.6	325.5	12.6	0.0	6.0	0.0	2.9	Soil Water Utilization
February-2023	83.3	14.3	65.2	350.0	14.3	0.0	6.6	40.7	23.5	Surplus
March-2023	123.6	22.4	99.3	350.0	22.4	0.0	3.2	99.3	65.2	Surplus
April-2023	101.5	43.5	56.1	350.0	43.5	0.0	0.0	56.1	63.1	Surplus
May-2023	27.4	68.1	-42.1	307.9	68.1	0.0	0.0	0.0	30.4	Soil Water Utilization
June-2023	89.5	103.9	-18.9	291.3	101.6	2.3	0.0	0.0	19.0	Soil Water Utilization
July-2023	193.9	124.8	59.4	350.0	124.8	0.0	0.0	0.7	17.3	Surplus
August-2023	130.6	93.6	30.4	350.0	93.6	0.0	0.0	30.4	25.6	Surplus
September-2023	13.3	64.9	-52.3	297.7	64.9	0.0	0.0	0.0	10.2	Soil Water Utilization
October-2023	51.1	37.1	11.4	309.1	37.1	0.0	0.0	0.0	7.3	Soil Water Recharge
November-2023	45.4	16.8	26.4	335.5	16.8	0.0	0.0	0.0	4.6	Soil Water Recharge
December-2023	72.7	14.3	54.8	350.0	14.3	0.0	0.0	40.3	25.0	Surplus
January-2024	109.4	11.5	80.1	350.0	11.5	0.0	14.2	80.1	54.2	Surplus
February-2024	24.5	14.8	18.9	350.0	14.8	0.0	4.1	18.9	35.8	Surplus
March-2024	45.4	26.0	21.3	350.0	26.0	0.0	0.0	21.3	30.3	Surplus
April-2024	84.7	42.4	38.1	350.0	42.4	0.0	0.0	38.1	37.3	Surplus
May-2024	90.7	81.1	5.1	350.0	81.1	0.0	0.0	5.1	23.6	Surplus
June-2024	82.2	108.5	-30.4	319.6	108.5	0.0	0.0	0.0	13.7	Soil Water Utilization
July-2024	191.0	127.1	54.3	350.0	127.1	0.0	0.0	23.9	26.3	Surplus
August-2024	52.4	101.5	-51.7	298.3	101.5	0.0	0.0	0.0	11.0	Soil Water Utilization
September-2024	68.3	66.1	-1.2	297.2	65.9	0.2	0.0	0.0	7.6	Soil Water Utilization
October-2024	51.9	36.0	13.3	310.5	36.0	0.0	0.0	0.0	4.7	Soil Water Recharge
November-2024	42.2	19.6	20.5	331.0	19.6	0.0	0.0	0.0	3.2	Soil Water Recharge

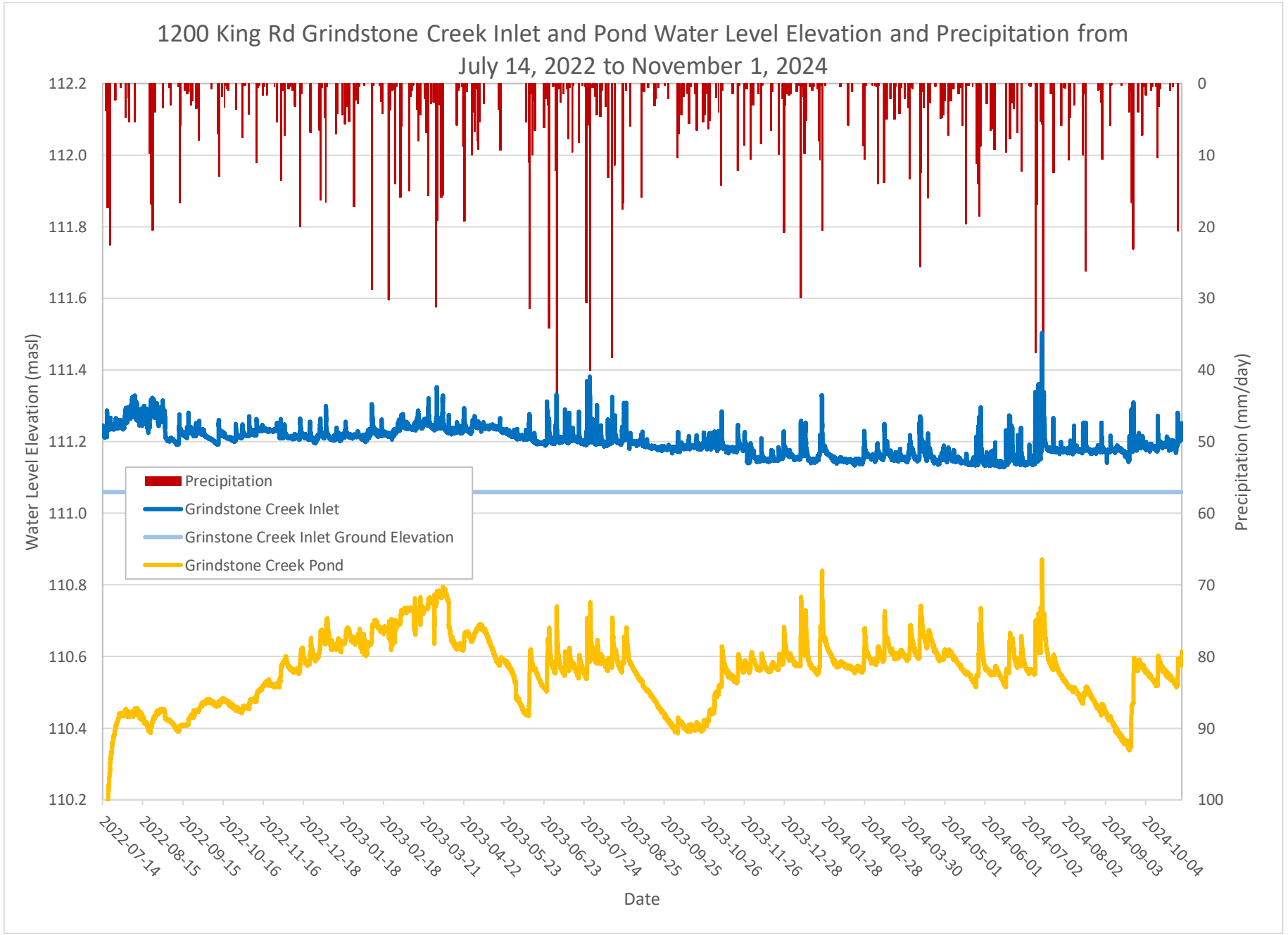
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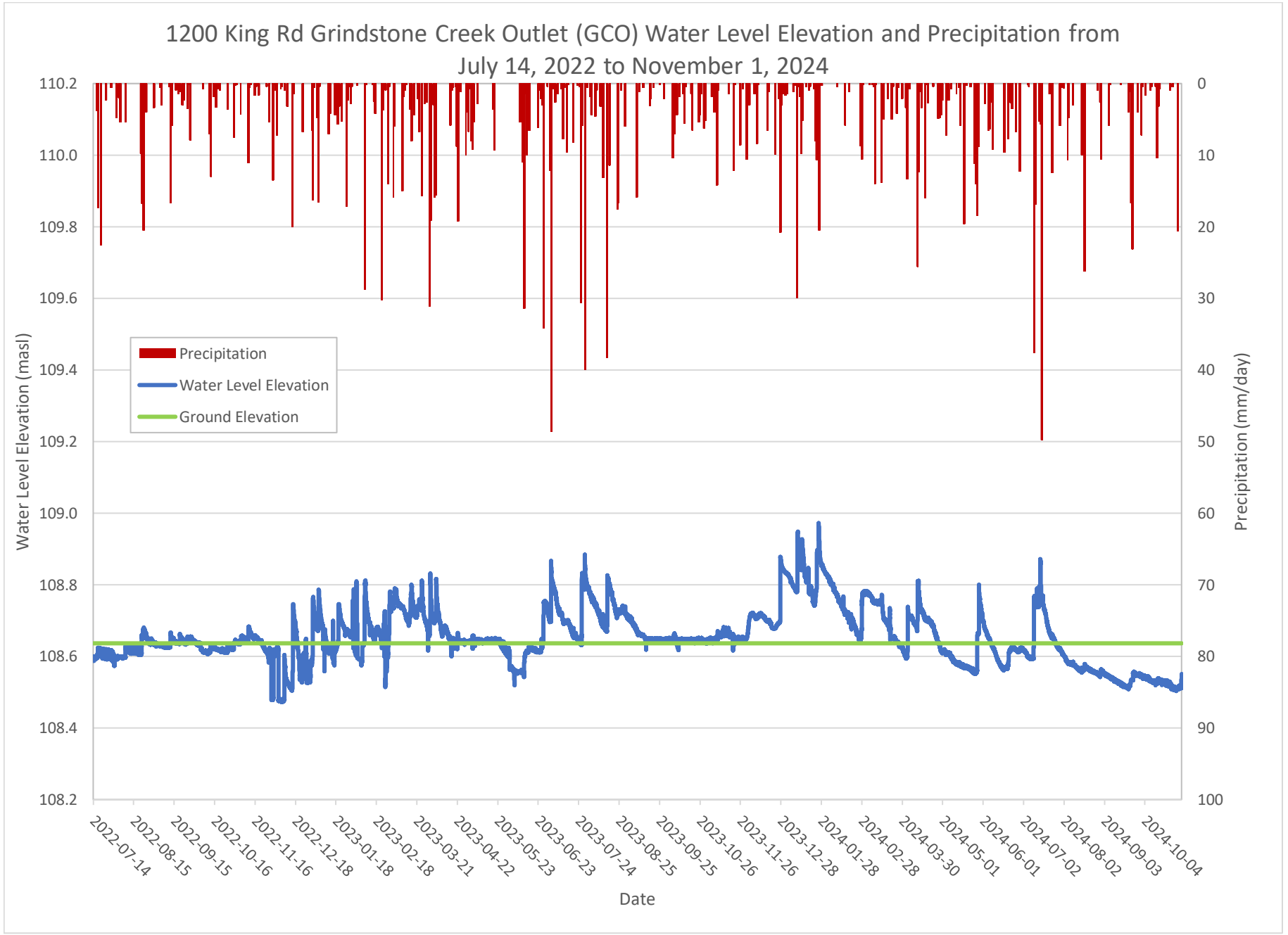
Hydrographs

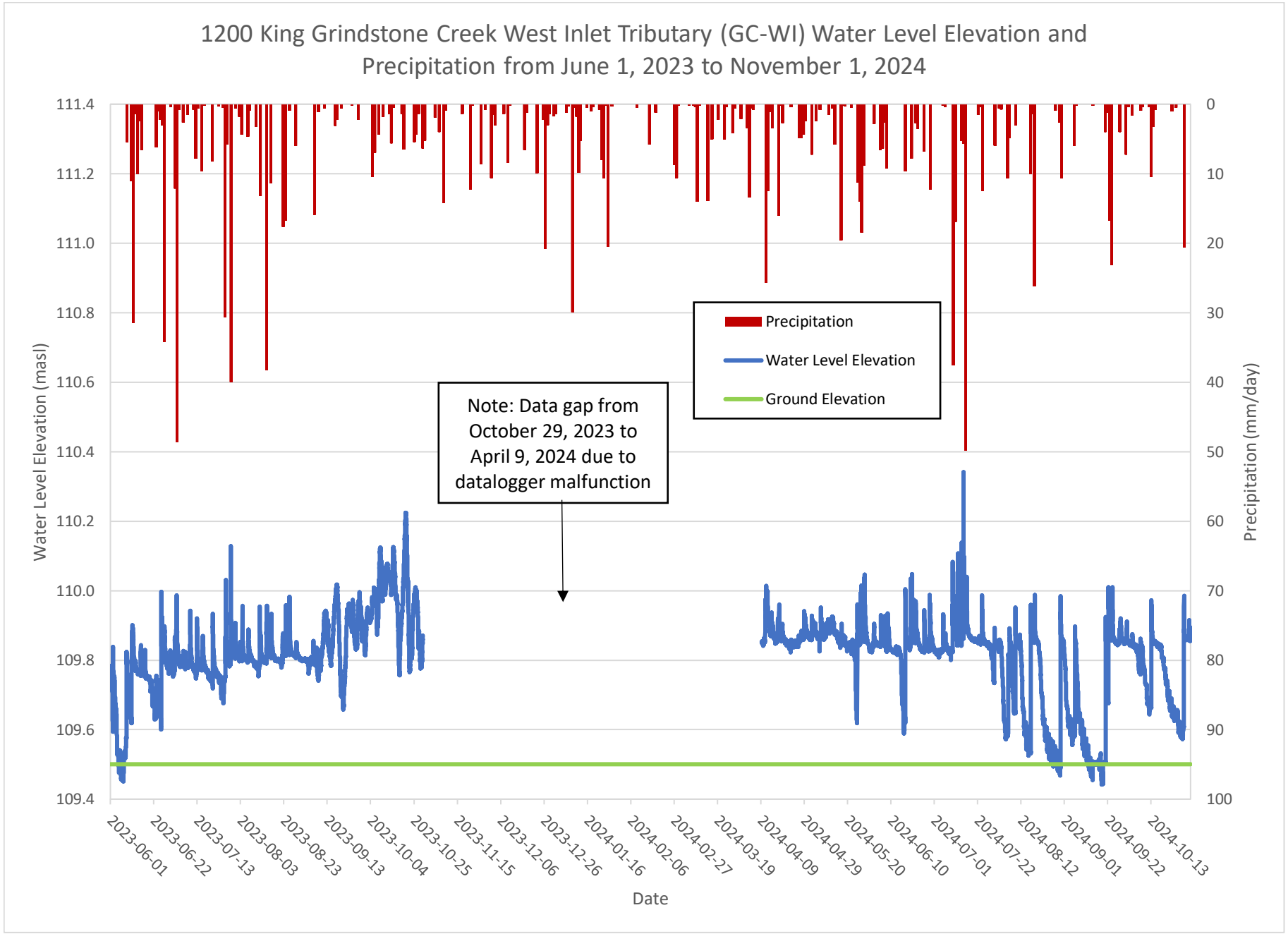

1200 King Rd Grindstone Creek Inlet (GCI) Water Level Elevation and Precipitation from July 14, 2022 to November 1, 2024
Water Level Elevation (masl)
Precipitation (mm/day)
Date
Precipitation
Water Level Elevation
Ground Elevation
113.0
112.8
112.6
112.4
112.2
112.0
111.8
111.6
111.4
111.2
111.0
0
10
20
30
40
50
60
70
80
90
100
2022-07-14
2022-08-15
2022-09-15
2022-10-16
2022-11-16
2022-12-18
2023-01-18
2023-02-18
2023-03-21
2023-04-22
2023-05-23
2023-06-23
2023-07-24
2023-08-25
2023-09-25
2023-10-26
2023-11-26
2023-12-28
2024-01-28
2024-02-28
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2024-07-02
2024-08-02
2024-09-03
2024-10-04



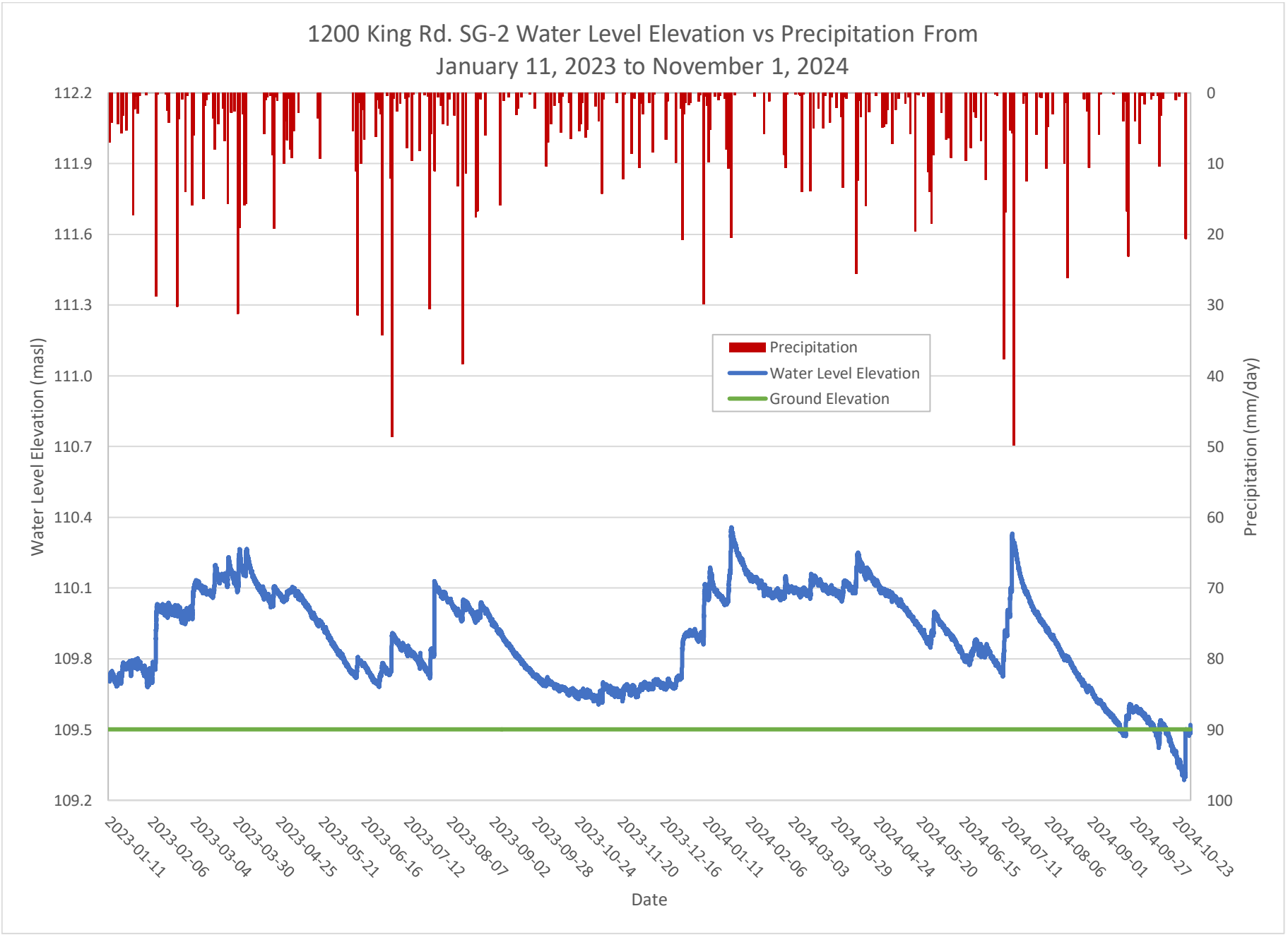
Terra-Dynamics Inc.


1200 King Rd Grindstone Creek Inlet and Pond Water Level Elevation and Precipitation from July 14, 2022 to November 1, 2024
Water Level Elevation (masl)
Precipitation (mm/day)
Date
Precipitation
Grindstone Creek Inlet
Grinstone Creek Inlet Ground Elevation
Grindstone Creek Pond
112.2
112.0
111.8
111.6
111.4
111.2
111.0
110.8
110.6
110.4
110.2
0
10
20
30
40
50
60
70
80
90
100
2022-07-14
2022-08-15
2022-09-15
2022-10-16
2022-11-16
2022-12-18
2023-01-18
2023-02-18
2023-03-21
2023-04-22
2023-05-23
2023-06-23
2023-07-24
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2023-12-28
2024-01-28
2024-02-28
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2024-06-01
2024-07-02
2024-08-02
2024-09-03
2024-10-04

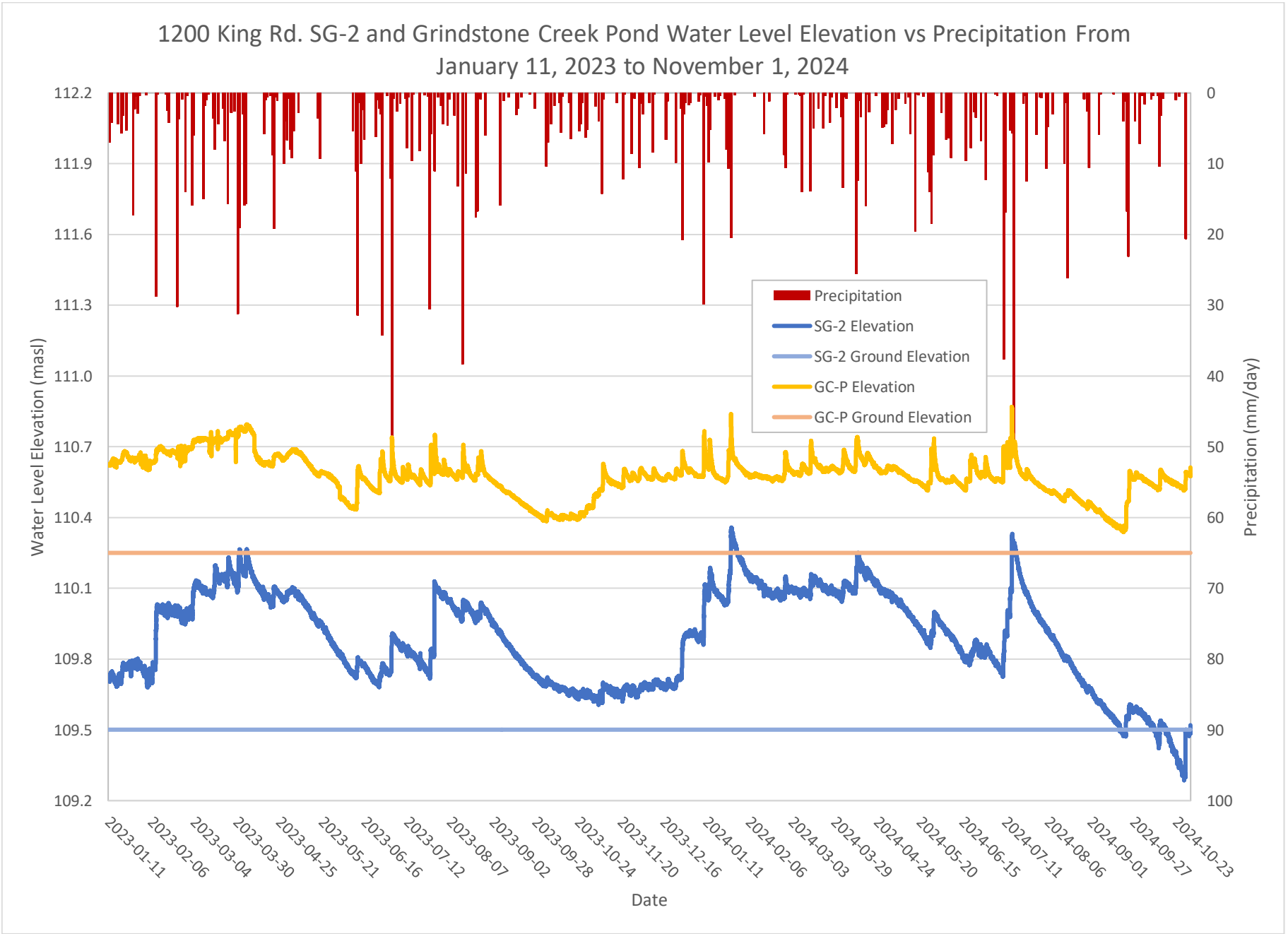

1200 King Rd Grindstone Creek Outlet (GCO) Water Level Elevation and Precipitation from July 14, 2022 to November 1, 2024
Water Level Elevation (masl)
Precipitation (mm/day)
Precipitation
Water Level Elevation
Ground Elevation
110.2
110.0
109.8
109.6
109.4
109.2
109.0
108.8
108.6
108.4
108.2
0
10
20
30
40
50
60
70
80
90
100
2022-07-14
2022-08-15
2022-09-15
2022-10-16
2022-11-16
2022-12-18
2023-01-18
2023-02-18
2023-03-21
2023-04-22
2023-05-23
2023-06-23
2023-07-24
2023-08-25
2023-09-25
2023-10-26
2023-11-26
2023-12-28
2024-01-28
2024-02-28
2024-03-30
2024-05-01
2024-06-01
2024-07-02
2024-08-02
2024-09-03
2024-10-04
Date



Terra-Dynamics Inc.



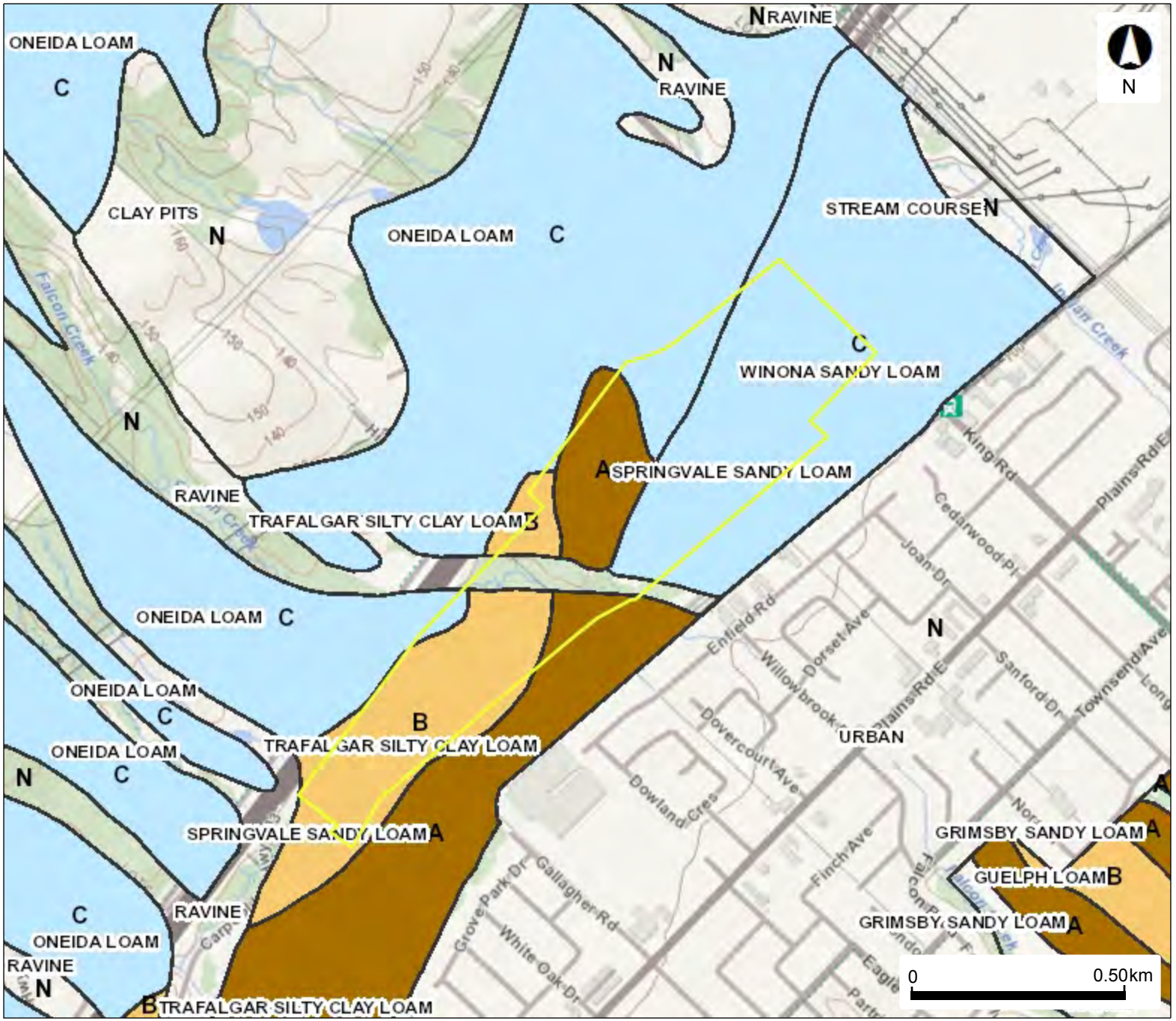
Terra-Dynamics Inc.


1200 King Rd. SG-2 and Grindstone Creek Pond Water Level Elevation vs Precipitation From January 11, 2023 to November 1, 2024
Water Level Elevation (masl)
Precipitation (mm/day)
Date
Precipitation
SG-2 Elevation
SG-2 Ground Elevation
GC-P Elevation
GC-P Ground Elevation
112.2
111.9
111.6
111.3
111.0
110.7
110.4
110.1
109.8
109.5
109.2
0
10
20
30
40
50
60
70
80
90
100
2023-01-11
2023-02-06
2023-03-04
2023-03-30
2023-04-25
2023-05-21
2023-06-16
2023-07-12
2023-08-07
2023-09-02
2023-09-28
2023-10-24
2023-11-20
2023-12-16
2024-01-11
2024-02-06
2024-03-03
2024-03-29
2024-04-24
2024-05-20
2024-06-15
2024-07-11
2024-08-06
2024-09-01
2024-09-27
2024-10-23

Appendix B

Soils Information

OMAFRA Soil and HSG



Legend

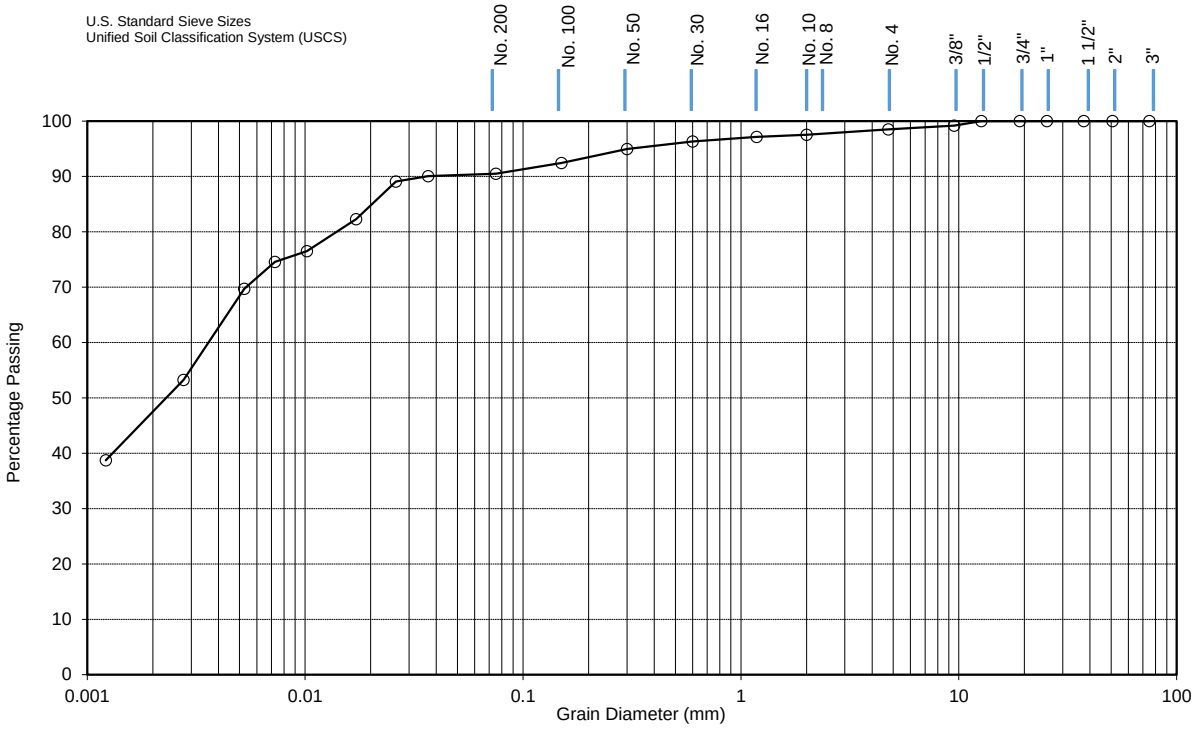
- Soil Name Label
- Hydrologic Soil Group
  - A - High
  - B - Moderate
  - C - Slow
  - D - Very Slow

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

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Map Created: 12/12/2022
Map Center: 43.32233 N, -79.84647 W

Mechanical & Hydrometer Analyses



CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

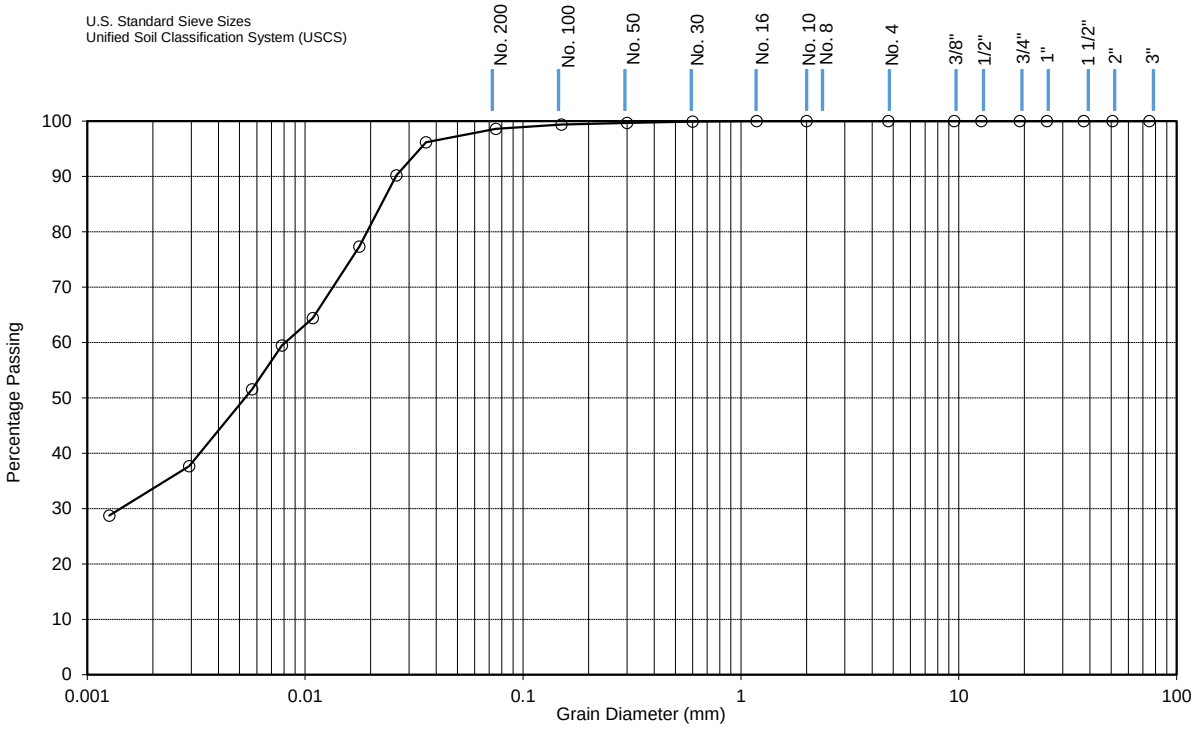
Lab No.:	**23-003**	Notes:			
Borehole No.:	**HA-1**				
Sample No.:					
CLAY [%]:	**48**	Soil Description:	**Brown Clay and Silt w/ traces of Sand and Gravel**		
SILT [%]:	**43**		**C.L. - Inorganic clays of low to medium plasticity to**		
SAND [%]:	**8**		**M.L. - Inorganic silts and very fine sands**		
GRAVEL [%]:	**1**	Estimated Infiltration Rate [mm/hr] :	**< 5**	Estimated Permeability, k [cm/s]	**10^{-8}**
D_{10} (Effective Diam. in mm):	**0.0003**	Coefficient of Uniformity C_U:	**12.3**	Coefficient of Curvature C_C:	**0.6**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

1200 King Street, Burlington ON

January 2023	**Grain Size Analysis No. 1**	**Project No.: SM 230001-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

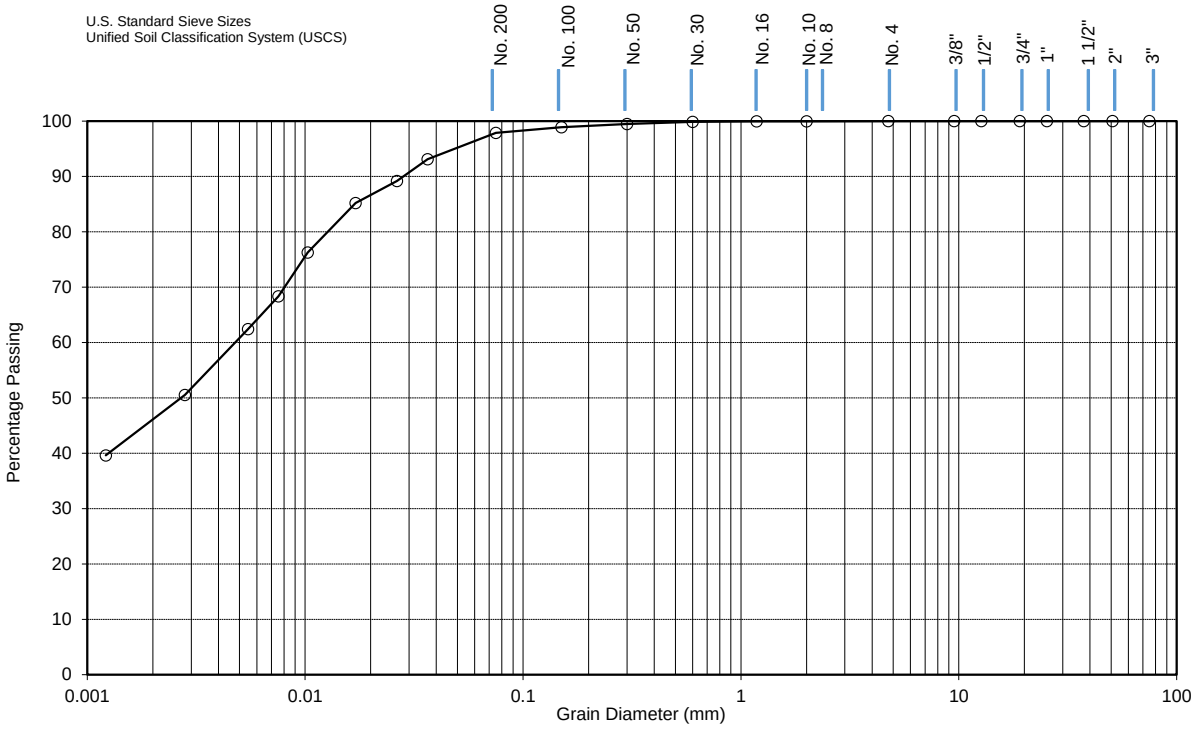
Lab No.:	**23-004**	Notes:			
Borehole No.:	**HA-2**				
Sample No.:					
CLAY [%]:	**34**	Soil Description:	**Reddish Brown Clayey Silt w/ a trace of Sand**		
SILT [%]:	**65**		**M.L. - Clayey silts with slight plasticity, inorganic silts and very fine sands**		
SAND [%]:	**1**				
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**< 5**	Estimated Permeability, k [cm/s]	**10^{-8}**
D_{10} (Effective Diam. in mm):	**0.0003**	Coefficient of Uniformity C_U:	**26.7**	Coefficient of Curvature C_C:	**0.9**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

1200 King Street, Burlington ON

January 2023	**Grain Size Analysis No. 2**	**Project No.: SM 230001-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE

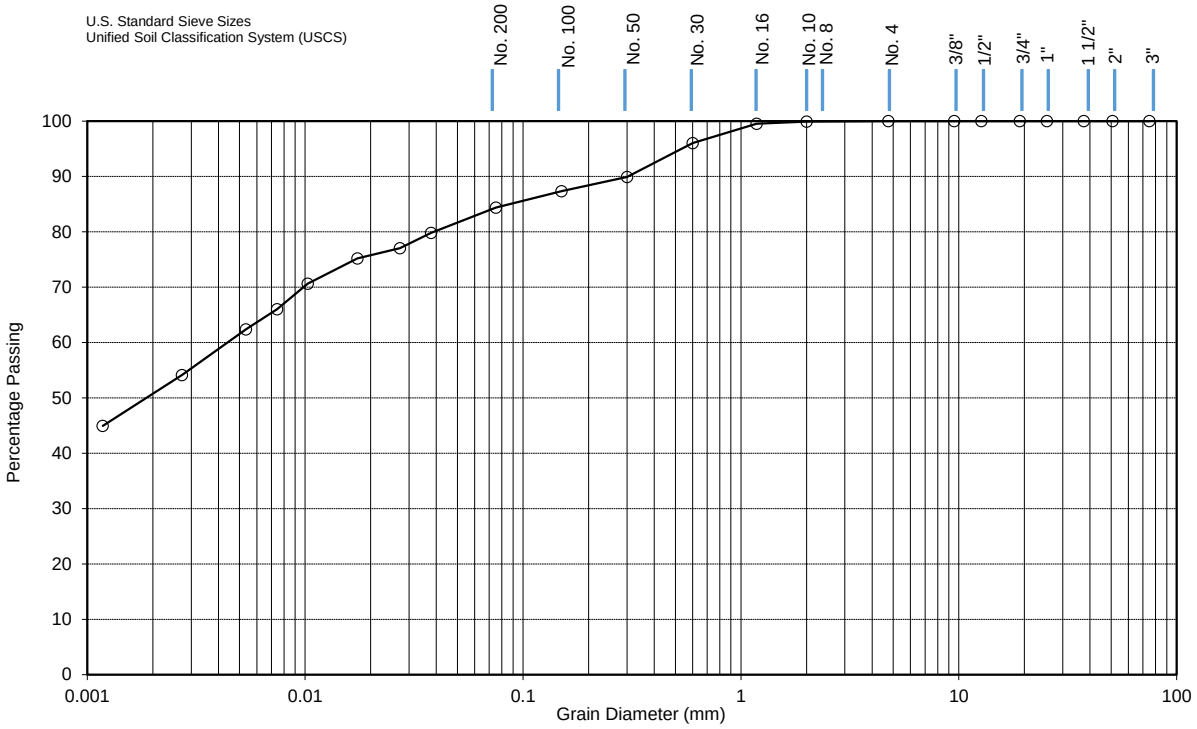
Lab No.:	**23-005**	Notes:			
Borehole No.:	**HA-3**				
Sample No.:					
CLAY [%]:	**47**	Soil Description:	**Reddish Brown Silt and Clay w/ a trace of Sand**		
SILT [%]:	**51**		**M.H. - Inorganic silts to C.L. - Inorganic clays of low to medium plasticity**		
SAND [%]:	**2**				
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**< 5**	Estimated Permeability, k [cm/s]	**10^{-8}**
D_{10} (Effective Diam. in mm):	**0.0002**	Coefficient of Uniformity C_U:	**24.0**	Coefficient of Curvature C_C:	**0.4**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

1200 King Street, Burlington ON

January 2023	**Grain Size Analysis No. 3**	**Project No.: SM 230001-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE

Lab No.:	**23-006**	Notes:			
Borehole No.:	**HA-4**				
Sample No.:					
CLAY [%]:	**51**	Soil Description:	**Brown Silty Clay w/ some Sand**		
SILT [%]:	**33**		**C.L. - Silty clays to M.L. - Inorganic silts and very fine sands**		
SAND [%]:	**16**				
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**< 5**	Estimated Permeability, k [cm/s]	**10^{-8}**
D_{10} (Effective Diam. in mm):	**0.0001**	Coefficient of Uniformity C_U:	**43.0**	Coefficient of Curvature C_C:	**0.4**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

1200 King Street, Burlington ON

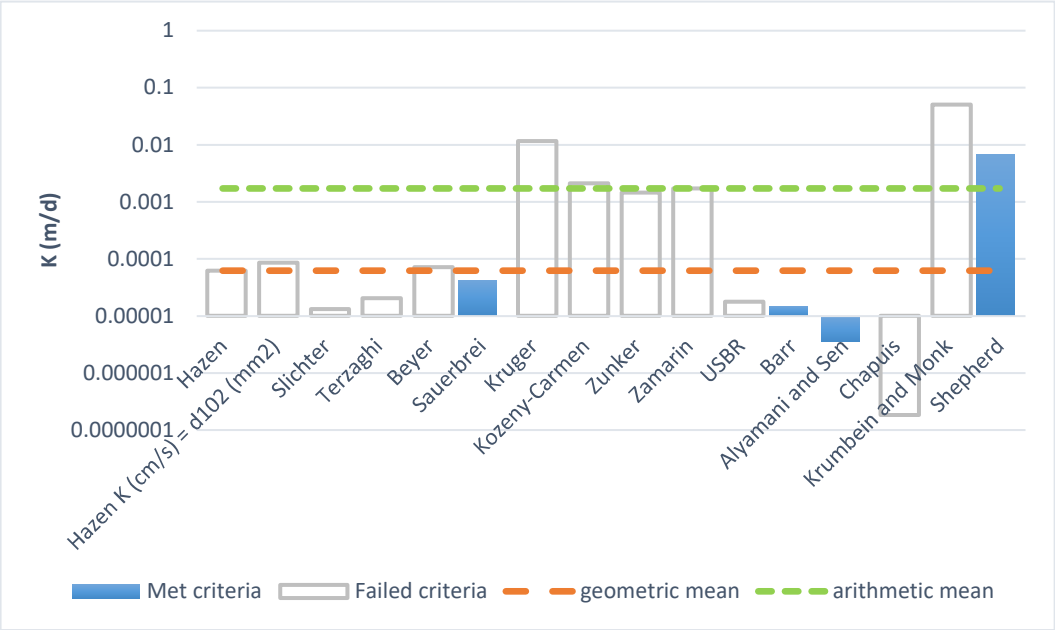
January 2023	**Grain Size Analysis No. 4**	**Project No.: SM 230001-T**

K from Grain Size Analysis Report Date: 16-Jan-23

Sample Name: HA-1, 1200 King Road, Aldershot/Burlington

Mass Sample (g): 100 T (oC) 20

Poorly sorted clay with fines



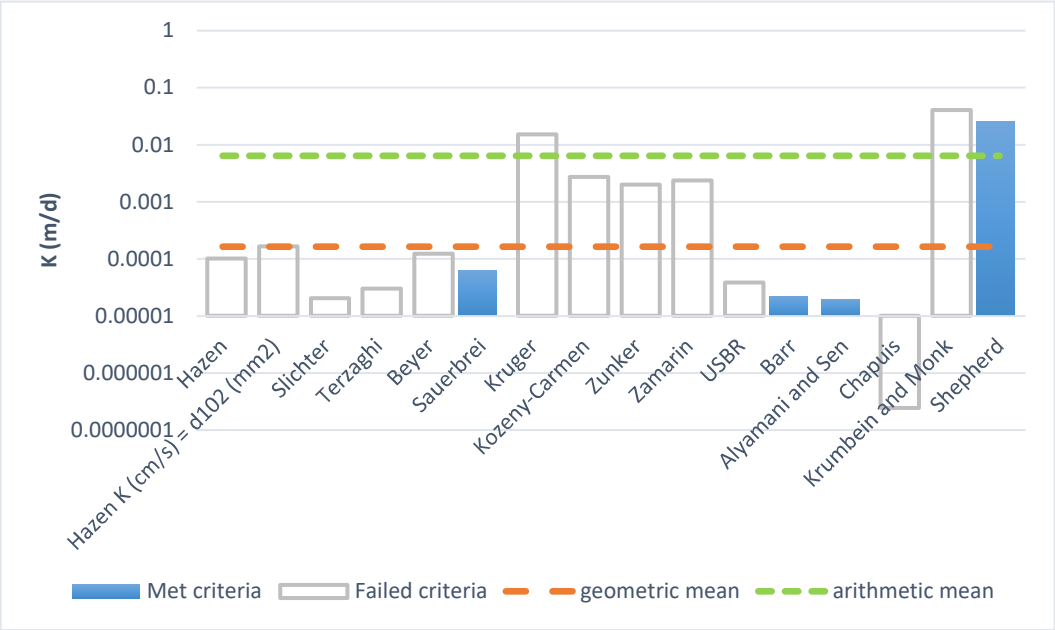
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	7.E-08	7.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	1.E-07	1.E-09	0.00	
Slichter	2.E-08	2.E-10	0.00	
Terzaghi	2.E-08	2.E-10	0.00	
Beyer	8.E-08	8.E-10	0.00	
Sauerbrei	5.E-08	5.E-10	0.00	
Kruger	1.E-05	1.E-07	0.01	
Kozeny-Carmen	2.E-06	2.E-08	0.00	
Zunker	2.E-06	2.E-08	0.00	
Zamarin	2.E-06	2.E-08	0.00	
USBR	2.E-08	2.E-10	0.00	
Barr	2.E-08	2.E-10	0.00	
Alyamani and Sen	4.E-09	4.E-11	0.00	
Chapuis	2.E-10	2.E-12	0.00	
Krumbein and Monk	6.E-05	6.E-07	0.05	
Shepherd	8.E-06	8.E-08	0.01	
geometric mean	7.E-08	7.E-10	0.00	
arithmetic mean	2.E-06	2.E-08	0.00	

K from Grain Size Analysis Report Date: 16-Jan-23

Sample Name: HA-2, 1200 King Road, Aldershot/Burlington

Mass Sample (g): 100 T (oC) 20

Poorly sorted clay with fines



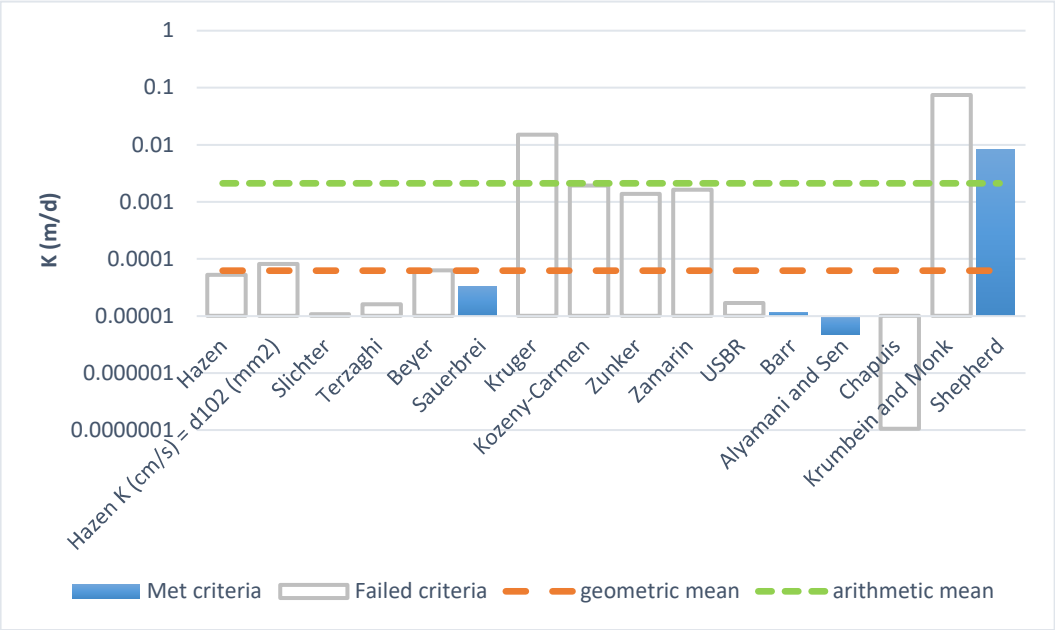
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.E-07	1.E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	2.E-07	2.E-09	0.00	
Slichter	2.E-08	2.E-10	0.00	
Terzaghi	3.E-08	3.E-10	0.00	
Beyer	1.E-07	1.E-09	0.00	
Sauerbrei	7.E-08	7.E-10	0.00	
Kruger	2.E-05	2.E-07	0.02	
Kozeny-Carmen	3.E-06	3.E-08	0.00	
Zunker	2.E-06	2.E-08	0.00	
Zamarin	3.E-06	3.E-08	0.00	
USBR	4.E-08	4.E-10	0.00	
Barr	3.E-08	3.E-10	0.00	
Alyamani and Sen	2.E-08	2.E-10	0.00	
Chapuis	3.E-10	3.E-12	0.00	
Krumbein and Monk	5.E-05	5.E-07	0.04	
Shepherd	3.E-05	3.E-07	0.03	
geometric mean	2.E-07	2.E-09	0.00	
arithmetic mean	7.E-06	7.E-08	0.01	

K from Grain Size Analysis Report Date: 16-Jan-23

Sample Name: HA-3, 1200 King Road, Aldershot/Burlington

Mass Sample (g): 100 T (oC) 20

Poorly sorted clay with fines



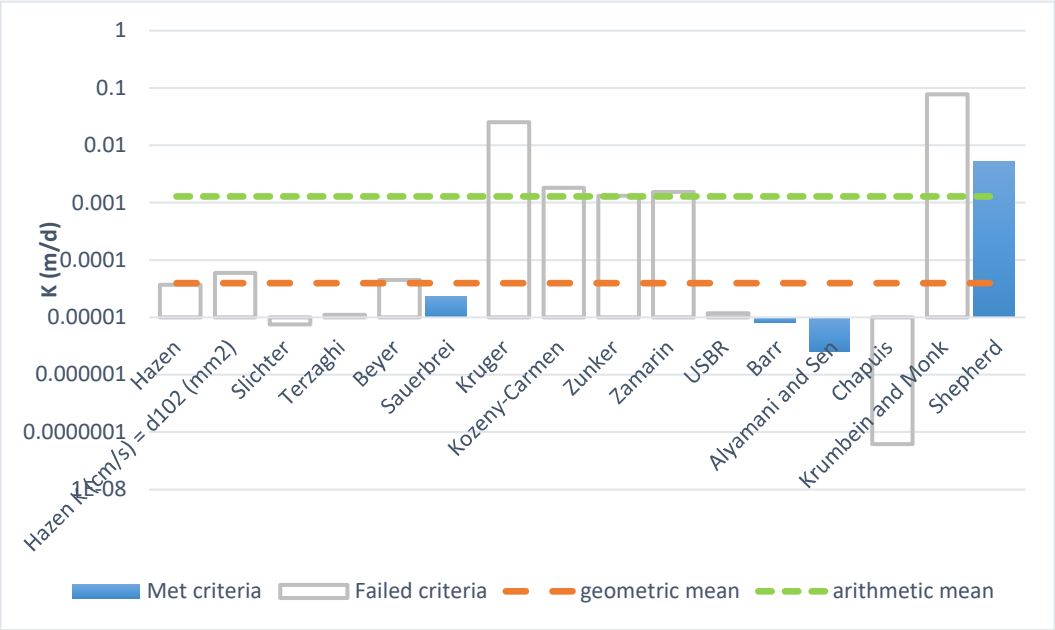
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	6.E-08	6.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	9.E-08	9.E-10	0.00	
Slichter	1.E-08	1.E-10	0.00	
Terzaghi	2.E-08	2.E-10	0.00	
Beyer	7.E-08	7.E-10	0.00	
Sauerbrei	4.E-08	4.E-10	0.00	
Kruger	2.E-05	2.E-07	0.01	
Kozeny-Carmen	2.E-06	2.E-08	0.00	
Zunker	2.E-06	2.E-08	0.00	
Zamarin	2.E-06	2.E-08	0.00	
USBR	2.E-08	2.E-10	0.00	
Barr	1.E-08	1.E-10	0.00	
Alyamani and Sen	6.E-09	6.E-11	0.00	
Chapuis	1.E-10	1.E-12	0.00	
Krumbein and Monk	9.E-05	9.E-07	0.07	
Shepherd	1.E-05	1.E-07	0.01	
geometric mean	7.E-08	7.E-10	0.00	
arithmetic mean	2.E-06	2.E-08	0.00	

K from Grain Size Analysis Report Date: 16-Jan-23

Sample Name: HA-4, 1200 King Road, Aldershot/Burlington

Mass Sample (g): 100 T (oC) 20

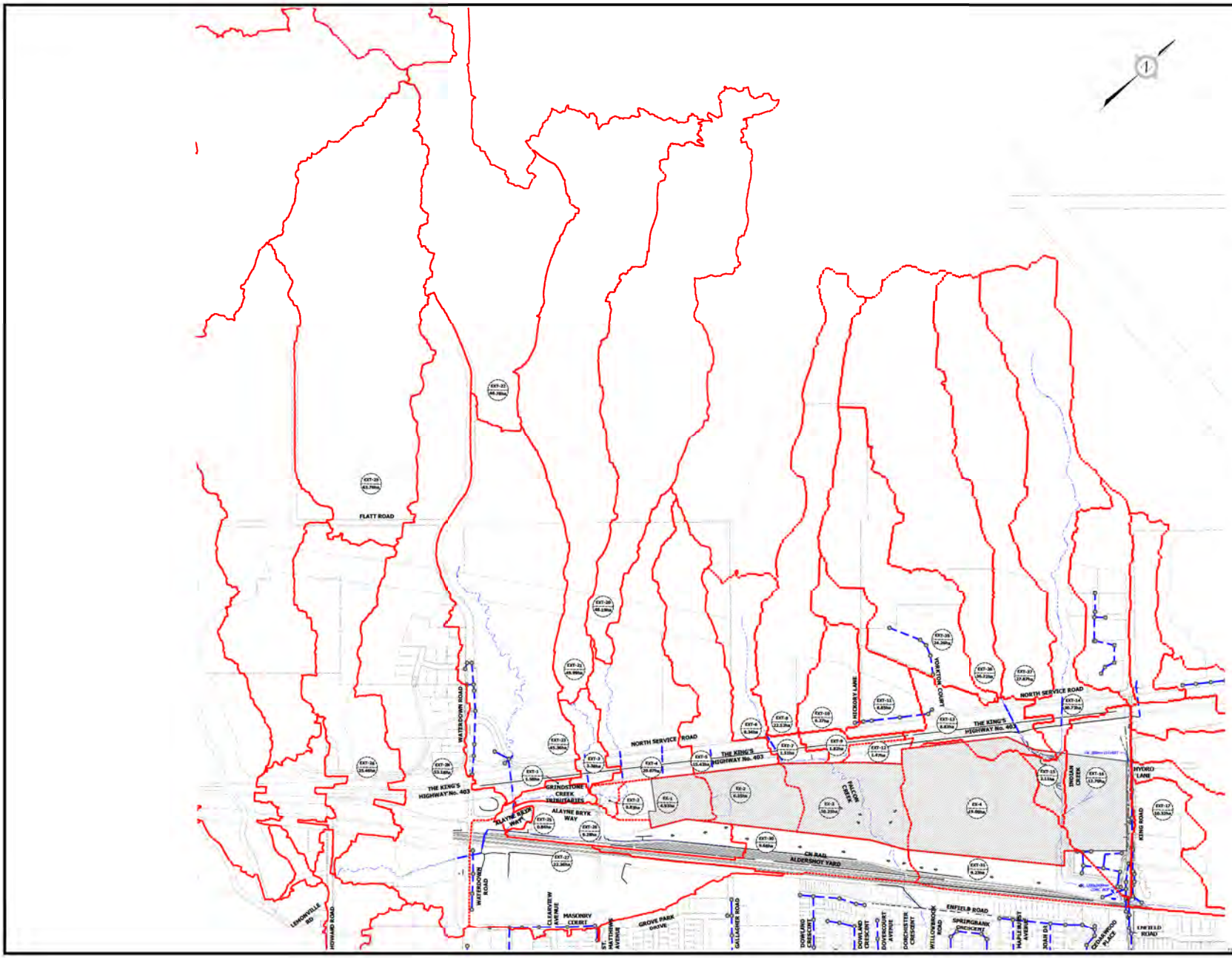
Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.E-08	4.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	7.E-08	7.E-10	0.00	
Slichter	9.E-09	9.E-11	0.00	
Terzaghi	1.E-08	1.E-10	0.00	
Beyer	5.E-08	5.E-10	0.00	
Sauerbrei	3.E-08	3.E-10	0.00	
Kruger	3.E-05	3.E-07	0.03	
Kozeny-Carmen	2.E-06	2.E-08	0.00	
Zunker	2.E-06	2.E-08	0.00	
Zamarin	2.E-06	2.E-08	0.00	
USBR	1.E-08	1.E-10	0.00	
Barr	9.E-09	9.E-11	0.00	
Alyamani and Sen	3.E-09	3.E-11	0.00	
Chapuis	7.E-11	7.E-13	0.00	
Krumbein and Monk	9.E-05	9.E-07	0.08	
Shepherd	6.E-06	6.E-08	0.01	
geometric mean	5.E-08	5.E-10	0.00	
arithmetic mean	2.E-06	2.E-08	0.00	

Appendix C:

Urbantech Pre-Development Storm Drainage Area





KEY PLAN
N.T.S.

LEGEND

- LIMIT OF DEVELOPMENT
- EXISTING STORM SEWER AND MANHOLE
- EXISTING WATERCOURSE
- EX3 / 20.3 ha — EXISTING AREA I.D. / EXISTING DRAINAGE AREA (Ha.)
- EXISTING STORM DRAINAGE BOUNDARY
- EXISTING CONTOUR & ELEVATION
- EXISTING OVERLAND FLOW ROUTE
- SITE (REF. DWG STM 1)

BENCHMARK
ELEVATIS PAS ARE RELATED TO GEODCETIC DATUM AND ARE DERIVED FROM THE PAR BENCHMARK No. 11960880.
ELEVATION = 268.33

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1200 KING ROAD
CITY OF BURLINGTON

PRE-DEVELOPMENT STORM DRAINAGE AREA (OVERALL)

PROJECT No.	DATE	SCALE	DWG No.
22-287	MAR. 2024	1:6000	STM-1A

Appendix D

1200 King Road Site and Landscape Plan (2026)

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Revision	Date

NOT FOR CONSTRUCTION

WITHOUT PREJUDICE

ISSUED FOR COORDINATION 26-02-10



Revision	Date
6 ISSUED FOR COORDINATION	2026-02-10
5 ISSUED FOR COORDINATION	2025-02-06
4 ISSUED FOR COORDINATION	2025-12-22
3 ISSUED FOR UDE	2025-02-14
2 ISSUED FOR DRAFT ZBA	2024-09-26
1 ISSUED FOR OPA SETTLEMENT	2024-06-26

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1200 KING ROAD

1200 King Road, Burlington, ON

SHEET TITLE

SITE AND LANDSCAPE PLAN

DRAWN BY:	Author
CHECKED BY:	Checker
PROJECT START DATE:	DD.MM.YR
PROJECT NO.:	20117
SHEET NUMBER	A0.07

1 SITE AND LANDSCAPE PLAN
A0.07 1 : 2000