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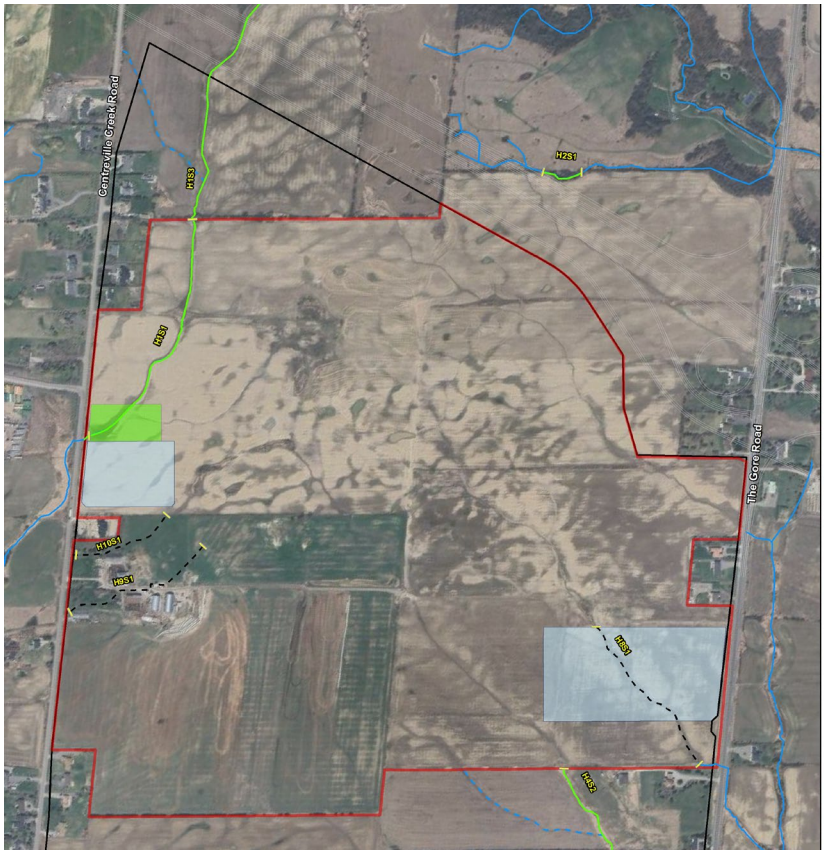
APPENDIX D

WETLAND DESIGN

Wetland Relocation and Compensation Area Conceptual Design Brief

Wildfield Village Development

Caledon, Ontario



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Submitted:
August 27, 2025

GEO Morphix Project No. 24105



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2.0	Second report submission to Client and project team	Rachel Abbott, B.Sc., G.I.T. Alicia Sword, BLA., OALA, CSLA	P. Villard, PhD, P.Geo., CAN-CISEC, EP, CERP	August 28th, 2025

Disclaimer

This report presents professional opinions and findings of a scientific and technical nature based on the knowledge and information available at the time of preparation. This document is prepared solely for the Client, and the data, interpretations, suggestions, recommendations, and opinions expressed in the report pertains only to the project being completed for the Client.

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1 Introduction

GEO Morphix Ltd. was retained by Global Properties Inc. to provide a wetland restoration design in support of the future development within the Wildfield Village Secondary Plan Area at Centreville Creek Road in Caledon, Ontario. The development lands are situated in the West Humber River Subwatershed. The Wildfield Village Secondary Plan Area spans approximately 358 ha bounded by The Gore Road to the east, Mayfield Road to the south, Centreville Creek Road to the west, and agricultural fields to the north. Several headwater drainage features of the West Humber River originate within or transect the western and eastern portion of the subject lands. The current land use is predominantly agricultural, with several rural residential homes located along the bordering roads.

Various studies have been completed supporting the Wildfield Village Secondary Plan Area to establish watershed policies, objectives, opportunities, constraints, and management strategies. This has included the Wildfield Village Phase 2 Local Subwatershed Study (LSWS) prepared by SCS Consulting Group Ltd. and GEI Consultants Inc. (2024). The LSWS included fluvial geomorphological characterization of headwater drainage features within the subject Lands to support future land use planning as well as various ecological and wetland-based assessments. The Humber River Watershed Characterization Report prepared by Toronto and Region Conservation Authority (TRCA, 2023) is also a relevant document that provides fluvial geomorphological characterization for the overall watershed.

The proposed Wildfield Village development will be completed through multiple phases. As part of Phase one of development, only the northern portion of the development block, herein referred to as the 'subject lands', will be advanced. The subject lands span approximately 138 ha comprising of approximately 35% of the Wildfield Village Secondary Plan Area. A map of the subject lands and the surrounding area is provided in **Appendix A**, for reference.

In support of the development for the subject lands, we have developed a wetland restoration design for the relocation of several non-significant wetland features. The proposed design also provides an opportunity to conserve swale length associated with the removal of headwater drainage features (HDF). The existing wetlands on site are reasonably homogenous and do not provide a wide range of habitat features or hydroperiods. The features are also historically modified and degraded due to adjacent land use practices (e.g., agriculture). The wetland restoration will ensure that the function of wetland features is enhanced.

This design brief is provided to facilitate a review of the proposed design. We have provided a summary of background information and studies completed for the subject lands, including various headwater drainage feature and wetland assessments. This provides context for restoration targets and objectives. We have also outlined design considerations and technical details associated with wetland restoration and have provided recommendations for implementation and monitoring of the proposed features.

2 Background Review and Desktop Assessment

The Humber River is the largest watershed in Toronto and Region Conservation's jurisdiction, with a drainage area of approximately 90,258 ha. The watershed contains five subwatersheds including the Main Humber River, East Humber River, West Humber River, Lower Humber River, and Black Creek. The West Humber River subwatershed which contains the subject lands has a drainage area of approximately 20,362 ha. The upstream portion of this watershed originates in the rural communities through the Greenbelt region with some sections including the Niagara Escarpment and Oak Ridges Moraine. The lower to middle portion of this watershed is generally urbanized. The City of Toronto, Region of Peel, and portions of the Region of York, County of Simcoe, and County of Dufferin all occupy a portion of its drainage area (TRCA, 2023).

The subject lands span approximately 358 ha, of which approximately a third drains to the western branch of the West Humber River, and approximately two thirds drain to the eastern branch of the West Humber River. The confluence between the two branches is located approximately 2.8 km south of the proposed development block, with a combined drainage area of 4,527 ha.

The proposed development will include a combination of residential developments and urban core. The north portion of the subject lands will be serviced by three stormwater management (SWM) ponds; one of which will outlet to a tributary to the western branch of the West Humber River, and two of which will outlet to two separate features to the eastern branch of the West Humber River.

Under existing conditions, the subject lands contain a series of small, low-order headwater drainage features. Defined watercourses are not present within the lands, but the existing HDFs drain downstream to the larger watercourse systems and tributaries of the Humber River. Previous geomorphic data/reports and headwater drainage feature information collected by others are further summarized below.

2.1 Humber River Characterization Report – TRCA

A review of site plans and pertinent watershed reports published by TRCA was completed to inform and provide context regarding local hydrology and stream morphology. Through the watershed characterization process watercourses, HDFs, and wetlands were assessed. The watercourses were determined as perennial, intermittent, or unknown. The HDFs were assessed to be either intermittent (12%) or unknown (88%) however overall management classifications were not determined.

A classification of erosion sensitivity within the Humber River Watershed was conducted in 2023 as part of the Humber River Watershed Characterization Report (TRCA, 2023). The receiving watercourses downstream from the proposed development were included within the characterization report. The erosion sensitivity classification was completed based on erosion thresholds, results from rapid geomorphic assessments, specific stream power ratios, and cross-sectional changes as measured using erosion pins (TRCA, 2023). It should be noted that the tributaries within the subject lands were omitted from this assessment due to their relatively minor drainage area.

2.2 Local Subwatershed Study, Phase 2 – Impact Study

The Wildfield Village LSWS was prepared by SCS Consulting Group Ltd. (SCS) and GEI Consultants Inc. (SCS and GEI, 2024). The LSWS included fluvial geomorphological characterization of drainage features within the subject lands to support future land use planning. The geomorphological work included stream reach delineation, rapid geomorphological field assessments, headwater drainage feature assessments, erosion threshold analysis, and proposed management strategies for natural heritage features and headwater drainage features.

Reaches within the subject lands were previously delineated at a high-level as part of the Scoped Subwatershed Study prepared by Wood (2022) via a desktop review and windshield survey. However, the reach delineation was further refined specifically for headwater drainage features in the LSWS prepared by SCS and GEI for the subject lands. Reach delineation from the LSWS is graphically presented in **Appendix A**, for reference.

Multiple headwater drainage features were identified through the subject lands including Reaches **H1S1**, **H1S3**, **H10S1**, **H9S1**, and **H8S1**. Reaches **H1S1**, **H1S3**, **H10S1**, and **H9S1** generally flow in a southerly direction and cross Centreville Creek Road along the western boundary of the subject lands. Reach **H8S1** generally flows in a west to east direction off-site before ultimately discharging to the West Humber River, east of The Gore Road. The reaches were identified as HDFs that pass through active agricultural fields. The extent of the reaches is provided in a map under **Appendix A**.

Reaches **H10S1**, **H9S1**, and **H8S1** were assigned an HDF management classification of *no management* under the LSWS. The HDF management classification of *no management* indicates that the HDFs may be removed from the landscape without any requirement to replicate existing feature form or function.

Reach **H1S1** and **H1S3** were recommended to have a final management classification of *mitigation*, which allows for the removal of the features if the feature's function is replicated through future stormwater management including approaches such as lot level conveyance measures and / or LID stormwater options. As such, all HDFs lengths in the subject lands are proposed for removal in the post development scenario based on the feature classifications completed by GEI.

In addition to the delineation of the headwater drainage features outlined above, several wetlands were identified and evaluated within the LSWS. Seven wetlands (Wetlands 2,3,4,5,6,7, and 17) with a total area of 0.49 ha were present in the Phase 1 lands and were determined to be non-significant. The LSWS provided direction to relocate and/or restore these wetlands in one single area identified as a "Wetland Relocation and Compensation Area". The LSWS indicated that the wetland area should address the following:

- Greater than 1:1 compensation ratio
- Construction generally near existing wetland locations
- Achieve a net gain in overall function of the community
- Include wildlife enhancements such as the creation of breeding amphibian habitat, fish habitat, and terrestrial crayfish habitat

A Wetland Relocation and Compensation Area is proposed along the western boundary of the subject lands, situated roughly at the downstream extent of *mitigation* HDF Reach **H1S1**, which is proposed for removal. The area is a rectangular shape and provides a unique space that can accommodate wetland relocation and compensation requirements as well as the addition of bioswale features. Despite the *mitigation* classification for Reach **H1S1**, the proposed compensation area provides an opportunity to conserve swale length and overall feature form from *mitigation* Reach **H1S1**.

The following report sections provide a summary of the design objectives for the Wetland Relocation and Compensation Area as well as technical details associated with swale and wetland creation, as well as proposed habitat features. Direction for detailed design, implementation, and monitoring is also provided.

3 Wetland Relocation and Compensation Area Design

3.1 Design Objectives

GEO Morphix has developed a restoration design to replicate form and function of various wetland and swale features proposed to be relocated and restored on-site. The proposed design will enhance and restore connectivity with existing natural heritage features and compensate for the removal of existing headwater drainage features, swales, and wetlands on-site. The existing headwater drainage features have provided detention and retention functions regarding both flow and sediment. The design will maintain and enhance these functions while increasing morphology and diversity and ensure that the areas are naturalized and stable over the long-term.

The existing wetlands and headwater/swale features on site are reasonably homogenous and do not provide a wide range of habitat features or hydroperiods. Wetlands of various sizes and depths are proposed throughout the restoration area to enhance available habitats and provide a range of hydroperiod functions. The wetland area proposed in the conceptual design is approximately 6,776 m^2 (0.6776 ha), which exceeds the 0.56 ha requirement for wetland area replication.

A green swale has been integrated into the restoration areas to allow for replication and enhancement of both form and function of HDF Reach **H1S1**. The feature function of **H1S1** is being addressed through appropriate SWM, but the proposed design compensation area provides a further opportunity to conserve swale length associated with this reach. The design swale features will trap and filter phosphorus, sequester carbon, modify the hydrologic cycle, provide for evapotranspiration, and produce organic carbon for downstream systems. The combined length of swale features provided in the design plan totals approximately 448 m.

Conceptual design drawings for the wetland restoration area are provided in **Appendix B**, for reference.

Note that the current restoration concepts simply show wetland swale and habitat features. The concepts have been designed to target meadow marsh and mineral shallow cattail marsh vegetation communities but planting areas have not been defined at this stage. A full range of enhancements and features can be provided at later stages. The designs are conceptual and are considered preliminary.

3.1.1 Conceptual Restoration Design Details

A conceptual swale and wetland design has been developed at the downstream end of the existing Reach **H1S1**, immediately adjacent to a future SWM Pond. A small, meandering swale system is proposed to convey water from a clean water pipe through a series of online pocket wetlands and connect to the upstream extent of the retained portion downstream of Centreville Creek Road. The total length of the proposed swale design is 476 m, with a total area of pocket wetland features proposed for replication of approximately 6,776 m^2 (0.6776 ha).

The design is intended to enhance and compensate for removing existing, morphologically limited wetlands on site as well as a portion of *mitigation* HDF swale length, where possible. The proposed design will provide feature form, length, and function while incorporating pocket wetland features to promote infiltration evapotranspiration and produce organic carbon for the downstream system. The wetlands have been designed with a diversity of topography, including wetland depths ranging from 0.30 m to 0.55 m and a small berm with a height of 0.20 m to provide separation between the swales. The designed depths in the wetland offer the opportunity to have a wide variety of habitats supporting shallow cattail mineral marsh and meadow marsh species, allowing the wetland to meet the requirements for the replicated feature. A landscape architect will complete the proposed planting plan and provide the appropriate plant species for the restoration.

The pocket wetland features will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form. They also provide functional benefits such as short-term water retention and sediment banking. They will be irregularly shaped to maximize the perimeter for a given area, which increases the potential for edge effects. These wetlands' short-term water retention function helps polish the water and moderate water discharge. Combined with the integrated swale feature, these features will increase system diversity and function, provide habitat features, and enhance overall productivity for the downstream natural heritage system.

3.2 Bioswale Design

The recommended restoration design incorporates a swale that has shallow and deep undulations. The shallow and deep undulation system will significantly improve the channel, as it mimics a natural system and aquatic habitat. In summary, the shallow and deep undulation system offers numerous benefits, namely:

- Channel bed relief for flow variability
- Water aeration in shallow sections
- Relatively quiescent flows in deep sections provide refuge for fish during high flows
- Increased depths in deep section to provide relatively cool water
- In-channel energy dissipation

In support of the headwater function, the shallow and deep undulation sequences will be combined with online wetlands, which provide areas of poorly formed channel. The shallow and deep undulation system offers numerous benefits and enhancements compared to the existing features. Given that this feature is low-gradient and will be vegetation controlled, the shallow sections are unlikely to have a hydraulic signature consistent with formal hydraulic definitions of riffles, given that the Froude number in the designed shallow section is less than 1. The terminology is used for simplicity and constructability, given that the design has distinct units with differences in hydraulics, cross-sectional symmetry, bankfull geometries, and sedimentology.

Channel dimensions are determined by bankfull discharge, representing what is generally referred to as the *channel-forming discharge* or the *dominant discharge*. Several methods can be applied to select an appropriate bankfull discharge. Back-calculation of discharge from a reference reach and support from hydrological modelling is usually the most appropriate. Given the significant historical modifications and anticipated changes in hydrology likely to occur due to the proposed development, a discharge based on hydrologic modelling was used to determine an appropriate bankfull discharge for the design. The bankfull discharges used to model the sections were assumed to be equivalent to the modelled 1.5-year flow. Based on hydrologic modelling, the bankfull discharge were determined to be 0.29 m^3/s.

Shallow and deep undulation geometries and anticipated bankfull conditions are provided in **Table 2**. A simple Manning's approach was used to iteratively back-calculate bankfull dimensions for the proposed HDF channel. Since pool areas are designed to contain ineffective space, this model over-predicts the amount of discharge they convey. However, the modelled values for the shallow areas better predict the channel capacity.

The 2-year discharge used to size the bankfull channel was provided by DSEL (2025) and is summarized in **Table 1**, below. Bankfull capacity for channels generally has a range from the 1- to 2-year return events.

Table 1: Reach H1S1 2-year return period discharge used in conceptual design based on hydrologic modelling (DSEL, 2025)

Reach	2-year return period discharge (m^3/s)
Reach H1S1	0.29

A simple Manning's approach was used to iteratively back-calculate bankfull dimensions for the proposed designs. Since pool sections are designed to contain ineffective space, this model over-predicts the amount of discharge they convey. The modelled values for the shallow sections better predict the channel's capacity. Channel geometries and anticipated bankfull conditions for the proposed swale are provided in **Table 2.** The swale is referred to as Design Reach **H1S1**, and will have an overall bankfull gradient of 0.17% for 448 m. The bankfull width and depth range from 2.30 m to 2.90 m, and 0.35 m to 0.50 m, respectively.

Table 2: Bankfull parameters for designed Reach H1S1

Channel parameter	Design Reach H1S1	
	Shallow Undulation††	Deep Undulation†
Bankfull width (m)	2.30	2.90
Average bankfull depth (m)	0.26	0.30
Maximum bankfull depth (m)	0.35	0.50
Bankfull width-to-depth ratio	6.57	5.79
Channel gradient (%)	0.50	0.17
Bankfull gradient (%)	0.17	
Radius of curvature (m)‡	6	
Riffle-pool spacing (m)‡‡	18	
Manning's roughness coefficient, *n*	0.05	0.04
Mean bankfull velocity (m/s) *	0.50	0.40
Bankfull discharge (m^3/s) *	0.29	0.35
Discharge to accommodate (m^3/s)	0.29	
Tractive force at bankfull (N/m^2)	17	8
Stream power (W/m)	14	6
Unit stream power (W/m^2)	8	3
Froude Number (unitless)	0.31	0.23

Channel parameter	Design Reach H1S1	
	Shallow Undulation††	Deep Undulation†
Maximum grain size entrained (m) **	0.02	0.01
Mean grain size entrained **	0.01	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
* Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative
** Based on Shields equation (Miller et al. (1977), assuming Shields parameter equals 0.06 (gravel)

The sizing of the proposed substrate materials was guided by a review of hydraulic conditions (i.e., tractive force, flow competence) in the typical HDF cross sections. The HDF bed substrate is derived by balancing the average shear stress acting on the bed with the critical shear stress for the material. When the critical shear stress slightly exceeds the average shear stress acting on the bed, sediment transport is initiated. Miller et al. (1977) was used to calculate the maximum and average substrate grain size entrained under the anticipated flow conditions, using the following equation (Eq. 1):

$$\theta = \frac{\tau_{cr}}{(\rho_S - \rho_W) g D} \qquad \text{[Eq. 1]}$$

where θ is Shields parameter (dimensionless; assumed to equal 0.06 for gravel), τ_{cr} is the critical shear stress acting on the sediment particles (N/m^2; values provided in **Table 2**), ρ_s is the density of sediment (kg/m^3), ρ_w is the density of water (kg/m^3), g is the acceleration due to gravity (m/s^2), and D is the characteristic particle diameter of the sediment.

In the realigned **HDF**, a granular and native material is proposed for the shallow sections to provide a stable bed and level of sorting.

Granular 'B' consists of a mix of rounded stone where approximately 20% - 50% of the stone is greater than 0.005 m in diameter, with nothing larger than 0.15 m in diameter. It should contain no post-construction materials. The granular 'B' will always have a core of sediment that is not entrained under bankfull flow conditions. This maintains the character of the native material, while providing slightly higher stability and opportunity for sediment sorting. The gravel also provides opportunities for infiltration, filtration, and detention of water within the pore spaces to provide additional benefits by elongating the hydroperiod. The proposed mix will also improve aquatic habitat by increasing diversity between the riffle and pool substrates.

Immediately after construction, the outer banks of the meander bends (i.e., cutbanks) may experience relatively higher erosive flows, which could lead to meander bend migration. As such, all cutbanks are bioengineered for additional stability. A 100% biodegradable erosion control blanket, Filtrexx™ Siltsoxx® and live stakes will be installed along the banks in the riffle and pool sections for immediate erosion protection. Over time, the blanket and Siltsoxx® will biodegrade, while the live stakes establish in the immediate overbank areas to provide long-term soil stability.

3.3 Habitat Features

The design incorporates several habitat elements within the wetland compensation area to improve riparian habitat and promote wildlife biodiversity. Habitat designs incorporate varying topographies and woody debris to maximize the potential for wildlife passage, forage, and residency. The habitat elements proposed include brush mattresses, brush piles, porous woody debris jams, enhanced volant/raptor poles, and rock piles habitat features. The accompanying drawings in **Appendix B** provide design details and directions for implementing the proposed habitat features. The features presented in **Appendix B** are for illustration purposes. The location, density, and selection of features will be completed during the detailed design phase.

Brush mattress is proposed along the outside meander bend of the tortuous meanders. This treatment consists of live brush cuttings installed parallel to the banks and tied with coir twine and stakes. The brush mattress will provide bank stability and improve aquatic habitat through shading and foraging opportunities.

Brush piles consist of logs, snags and other wood debris arranged in a stable interconnected mound shaped like a pallet. The brush piles are also planted with native fruit-bearing vines, which provide forage opportunities for wildlife. Brush piles are placed at various locations along the length of the floodplain.

Porous woody debris jams are proposed throughout the bioswale. These features consist of a layering of partially buried logs and woody debris along the channel bed, followed by a layer of root wads and a second layer of logs. The root wads and second layer of logs will be placed in a manner that leaves intermittent pore space open at various points between berm and the wetland bank, allowing for fish passage. Porous woody debris jams enhance bank stability while improving aquatic habitat and overall habitat complexity.

Enhanced volant raptor poles are constructed from large tree trunks, embedded into the ground, serving as larger raptors' perches. Sections of the trunk are also carved out to allow for bat roosting.

Rock piles are a mix of stones of varying sizes to create small mounds. These features provide hibernation habitats for various terrestrial species. The base of the piles is partially buried to prevent rock falls. Rock piles are installed at various locations along the length of the floodplain.

3.4 Wetland Water Availability Assessment

A wetland water availability analysis was undertaken to determine if water inputs to the proposed wetland located within the 1.1 ha Wetland Relocation and Compensation Area are sufficient to sustain the proposed wetland marsh communities (i.e., meadow marsh, mineral shallow cattail marsh). As detailed above, the proposed wetland feature covers 6,800m^2 and is designed as a sequence of six online wetland features connected via a 462 m long swale which meanders through the wetland. Each proposed online wetland feature has an average depth of 0.3 m and a maximum depth of 0.55 m. During periods when the connecting swale and shallower wetland areas are dry the deeper areas of the online wetland features (i.e., overwintering pools) will have maximum ponded water depths 0.20 m.

The proposed wetland area will be fed primarily by runoff from a 45.28-ha drainage area located north of the subject site that will be intercepted by a surface water collector along the subject site's northern boundary. The intercepted drainage will flow underground through a 640 m long Clean Water Pipe (CWP) and outlet at the upstream end of the proposed wetland. Additionally, there will be minor water contributions from direct precipitation to the 1.1 ha wetland area, and via runoff from 0.3 ha of residential backyard areas bordering the wetland. As the wetland is designed as a riparian feature, all higher magnitude flows will be conveyed through the wetland with longer term water storage confined to the overwintering pools.

To determine if post-development flows are sufficient to maintain the meadow marsh and mineral shallow cattail marsh community types planned for the Wetland Relocation and Compensation Area, a wetland water availability analysis was completed using the results from a catchment-wide continuous hydrological simulation model (DSEL, 2025). The hydrological simulation results were obtained for a model flow node located at the inlet to the proposed wetland. The continuous hydrology data were used to generate daily, weekly, and monthly hydrographs of mean discharge for the modelling period (i.e., 1986-2007).

The hydrological modelling results indicated that streamflow to the wetland is intermittent and associated with runoff from precipitation events from early spring (April) to late fall (November). Model results indicated no runoff during winter (December - March). Mean monthly runoff into the wetland via the CWP ranges from 0.13 l/s (November) to 3.34 l/s (August), with an average value of 1.46 l/s or 146.6 m^3/day. During the growing season, rainfall-runoff events routinely generate average daily flows which equal or exceed 15 l/s or 1500 m^3/day. These flows are sufficient to regularly inundate the online wetlands on a weekly to monthly basis during the summer growing season.

Based on the geological and hydrological assessment results in the draft Local Subwatershed Study (GEI, 2024), shallow groundwater seepage into and from the wetland is expected to be negligible. Halton Till is uniformly encountered across the site, and this surficial till unit is characterized by low permeability, which limits infiltration and shallow groundwater flow. The shallow subsurface characteristics at the site mean that baseflow contributions to surface water features are expected to be negligible, an assessment supported by reported field investigations which indicate no evidence of point source discharge or zones of significant groundwater discharge at the site (GEI, 2024).

Therefore, hydrological modelling estimates indicate that inputs from relatively frequent rainfall-runoff events (i.e., weekly to monthly) are sufficient to periodically inundate and saturate the wetland area. The design of the wetland facilitates relatively rapid drainage of this water via the connecting swale feature, with only the deeper overwintering pools retaining ponded water. These deeper portions of the wetlands cover a combined area of approximately 1,054 m^2 with an average depth of 250 mm below the base of the adjacent shallower wetland areas.

During the growing season, evapotranspiration is the primary hydrological process controlling water loss within the overwintering pools with average evapotranspiration rates of 3-4 mm/day. Maximum daily evapotranspiration rates during the summer months, when evapotranspiration is highest, typically range from 5-7 mm/day. An estimate of average summertime evaporation losses from the wetland pools indicates that in the absence of rainfall-runoff inputs, the overwintering pools would remain wet for periods ranging from approximately 30-60 days. The modelled hydrological conditions indicate that the pools will remain perpetually wet through the year, while the shallower online wetland areas will flood during relatively frequent precipitation events and then dry out.

Analysis of the results obtained from the post-development hydrological simulation model indicate that the hydrological regime of the Wetland Relocation and Compensation Area is expected to provide appropriate conditions for both Meadow Marsh and Mineral Shallow Cattail Marsh communities.

For reference, hydrographs of modelled daily and weekly runoff to Wetland Relocation and Compensation Area feature are provided in **Appendix C** along with hydrographs of average daily runoff for a dry, average, and wet year.

3.5 Site Restoration Recommendations

Newly constructed features can be vulnerable to erosion. This is particularly true before vegetation has been established along the channel banks. While low-flow events should not intensify erosion, the concern for erosion occurs when high flows or precipitation events occur during construction.

For immediate erosion protection, mechanical stabilization in the form of 100% biodegradable erosion control blankets (i.e., coir cloth, jute mat, etc.) and Filtrexx™ Siltsoxx® should be used. The blankets and Siltsoxx® will biodegrade over time, which serves as a short-term stabilization measure.

For long-term stability, implementing planting plans within each corridor is recommended. This includes deep-rooting native grasses and other herbaceous species seeded along and within channel sections, prescription of flood-tolerant native shrub and tree species, and use of native seed banks within the local soil from a wetland soil salvage. Shrubs should be planted close to the channel margins to maximize stabilization and channel cover benefit.

Potential erosion locations should be anticipated and reflected in the planting plans. Live staking, and shrub stock should be used adjacent to the channel bank to provide immediate benefit and long-term infilling. If appropriate live staking methods are followed, this method should provide more significant benefits than simple potted or bare root shrub plating. This is because of the potential for higher densities with live staking. Wattle bank treatments are proposed to provide additional channel stability at tortuous meander bends.

4 Design Implementation

4.1 Design Expectations

The design expectations generally follow those outlined in the Local Subwatershed Study (SCS and GEI, 2024). The proposed wetland and swale design is expected to improve aquatic and terrestrial habitat by allowing retention and detention of flows and sediment and providing a stable form. The proposed features will provide capacity for flooding during storm events and contain the flood levels within the pocket wetlands. The design also allows natural processes to maintain HDF form and function, reducing the operational requirements for long-term stewardship and maintenance.

The existing wetlands and headwater/swale features on site are reasonably homogenous and are morphologically limited. Due to the limited range of hydroperiods and morphological variability, there is a compromised capacity to retain flows. The main goal of this design is to provide a range of hydroperiods, enhanced habitat, and greater variability to swale and wetland morphology. Adding more complex sediments will provide added benefits by maintaining the character of native material while providing slightly higher stability and opportunity for sediment sorting.

4.2 Construction Timing

Based on resident fish species and their respective life cycles, in-stream work will be restricted to July 1 to March 31 unless otherwise directed by the Ministry of Northern Development, Mines Natural Resources and Forestry (MDMNRF).

Vegetation removals associated with clearing, site access and staging should occur outside the key breeding bird period identified by Environment Canada for migratory birds to ensure compliance with the *Migratory Birds Convention Act, 1994* (MBCA) and *Migratory Bird Regulations*. The breeding season for migratory birds in this part of the country typically extends from as early as March 1 to as late as September 15. Should tree removals be required during critical breeding bird season, a qualified biologist should inspect those trees to ensure they do not contain nesting birds. It is understood that the MBCA is not limited to cutting woody vegetation but is also applied to topsoil stripping and grubbing activities, as ground-nesting bird species are protected under the Act.

4.3 Best Management Practices

A Wildlife Scientific Collection Authorization (WSCA) and/or a License to Collect Fish for Scientific Purposes from the MNRF prior to any fauna salvage works within the proposed areas during the window specified on the permit. Any captured fauna will be transferred to a suitable location at a minimum 30 m from the area of disturbance. Fish rescues will be completed during the appropriate windows (July 1 to March 15) within the existing feature and the diversion channel before these features are decommissioned. Any fish captured will be relocated to an appropriate location downstream, as determined by a qualified professional.

Site inspection should be performed by an inspector with experience overseeing channel works, as this type of work differs considerably from engineering projects. An experienced inspector will quickly and appropriately respond to issues that may arise and ensure that construction proceeds following the approved design and contract. The construction limits will be delineated to prevent unanticipated impacts on natural surroundings, including trees and the watercourse.

All isolated work areas will be dewatered to perform work under dry conditions. Water will be pumped to a sediment filtration system located at least 30 m from the receiving creek, allowed to naturally flow over a well-vegetated surface, and ultimately returned to the channel downstream of the work area. This will allow particles to settle before reaching the watercourse.

All materials and equipment will be stored and operated in such a manner that prevents any deleterious substances from entering the water. Vehicle and equipment re-fuelling and/or maintenance will be conducted away from the watercourse and be free of fluid leaks and externally cleaned/degreased to prevent the release of deleterious substances.

4.4 Post-Construction Monitoring

A post-construction monitoring program is recommended to assess the performance of the implemented design. Monitoring observations can also determine the need for remedial works if required. The following monitoring and reporting activities are suggested:

- General observations should be documented after construction and after the first significant flooding event to identify any potential areas of erosion concern
- Collection of a photographic record of site conditions
- General vegetation surveys completed annually after construction and for the duration of the monitoring period to determine the survivorship of the plant materials (any dead, diseased or damaged plant materials will be replaced within the warranty period)
- Four vegetation belt transects will be completed to determine the vegetation composition and survivorship
- Annual reporting to summarize construction activities (i.e., design implementation), and subsequent year-end reports for the duration of the monitoring period

The monitoring would commence immediately after construction, and sites would be reviewed annually to identify the system's natural variability. Reporting would be provided annually, with a summary report at the end of the monitoring period.

We trust this report meets your current requirements. Should you have any questions or concerns, please contact the undersigned.

Respectfully submitted,



Paul Villard Ph.D., P.Geo., CAN-CISEC, EP, CERP
Director, Principal Geomorphologist



Alicia Sword, BLA, OALA, CSLA
Sr. Environmental Designer, Practice Lead

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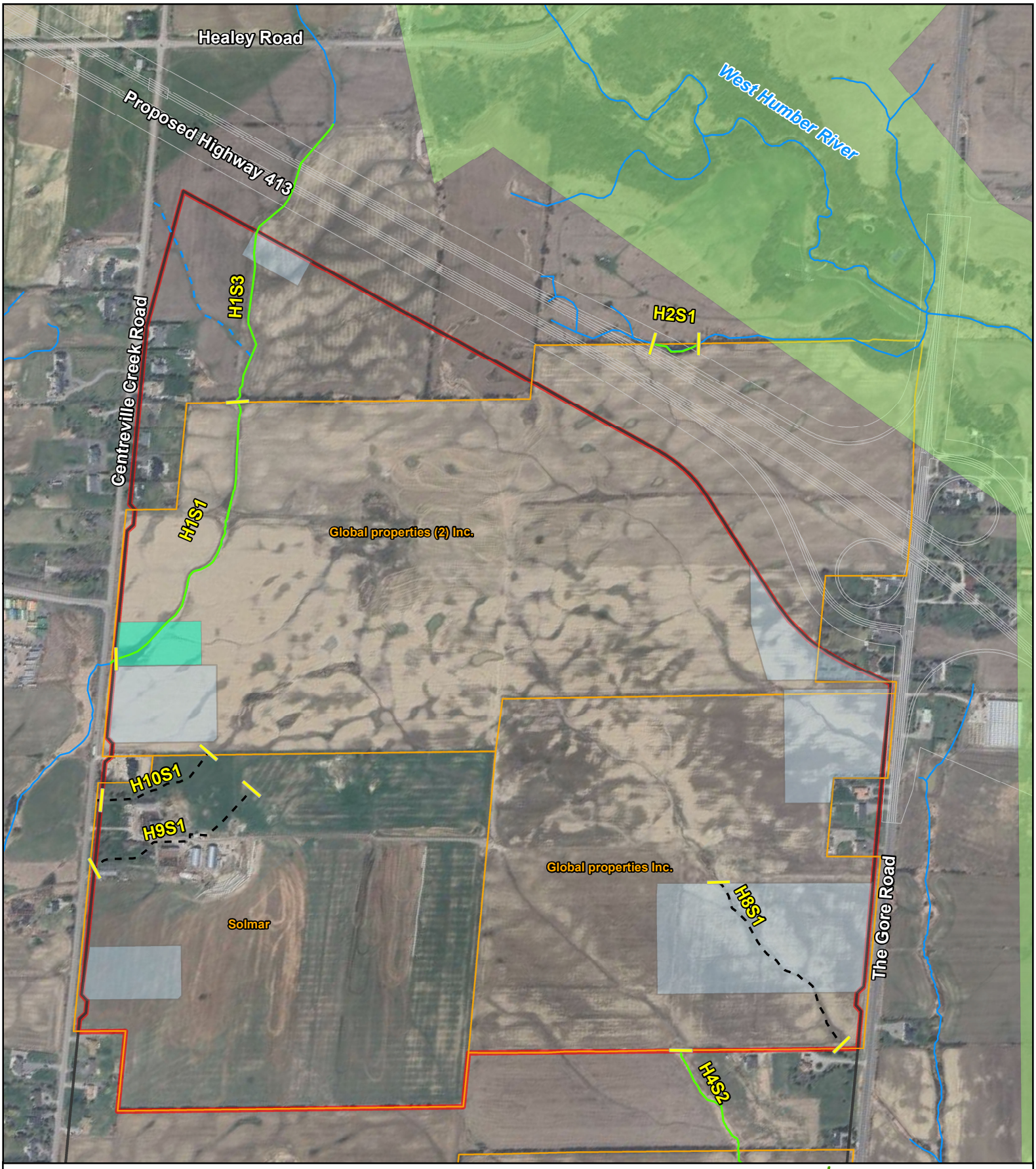
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Wood. 2022b. Scoped Subwatershed Study, Part B: Detailed Studies and Impact Assessment (Final Report). Prepared for the Regional Municipality of Peel.

Wood. 2022c. Scoped Subwatershed Study, Part C: Implementation Plan (Final Report). Prepared for the Regional Municipality of Peel.

Appendix A:
Study Area Map



Legend

- Reach Break and ID
- Watercourse
- Potential Drainage Feature

HDF Management Recommendations

- Mitigation
- No Management Required
- Green Belt NHS
- Proposed SWM Ponds
- Wetland Relocation and Compensation Area
- Future Highway
- Participating Property
- Study Area
- Approximate Phase 1 Boundary

Wildfield Village
Proposed SWM Pond Locations

West Humber River Tributaries

Caledon, Ontario

GEO MORPHIX™

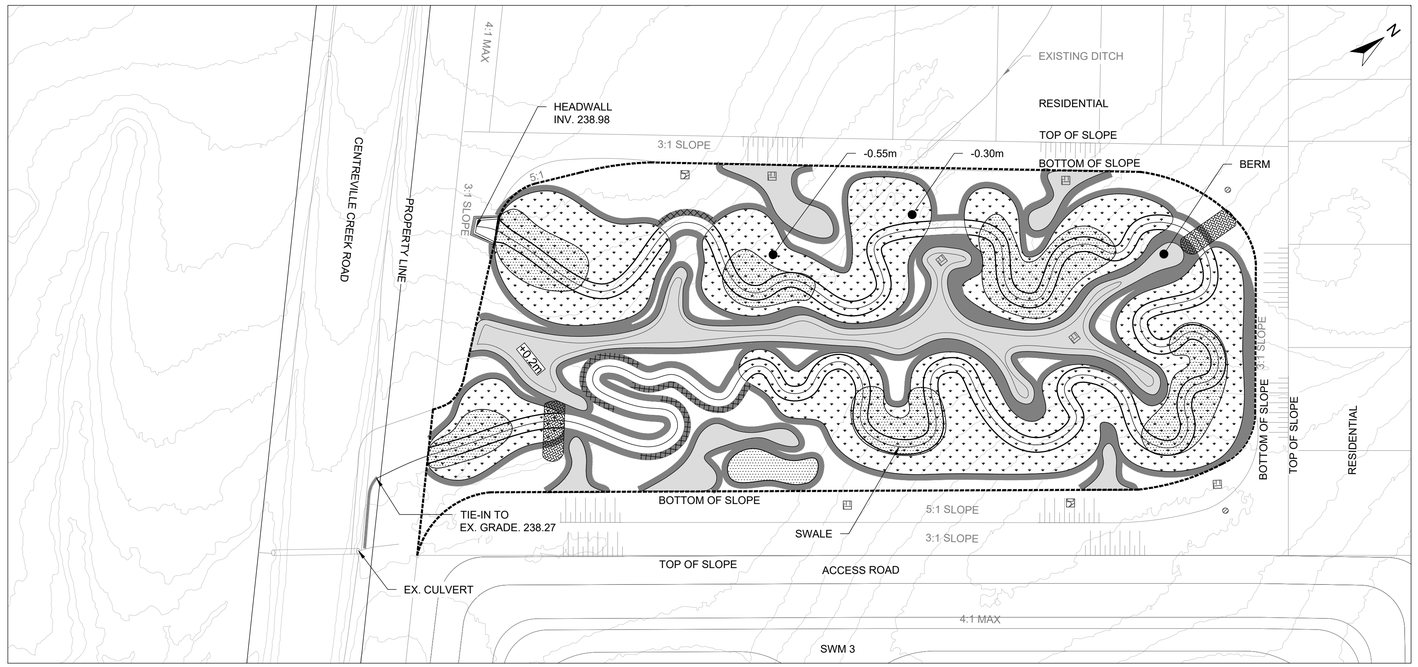
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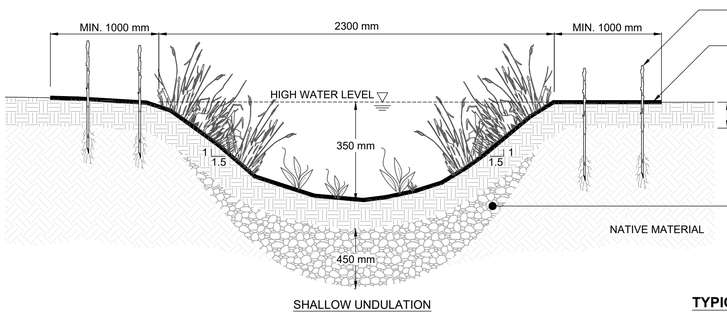
Imagery: Google, 2024. Watercourse, HDF, Green Belt, Participating Properties, Study Area, Proposed Highway 413, Proposed SWMPt: DSEL, 2024. Reach Break and ID: GEI, 2024.
Print Date: January 2025. PN24105. Drawn By: M.O., K.W., G.U.

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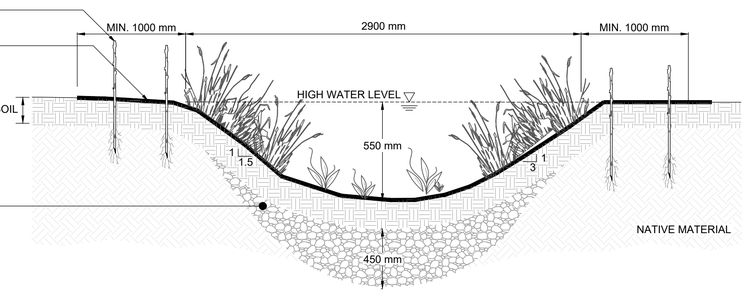
Appendix B:
Wetland Restoration Design



PLANFORM
1:500

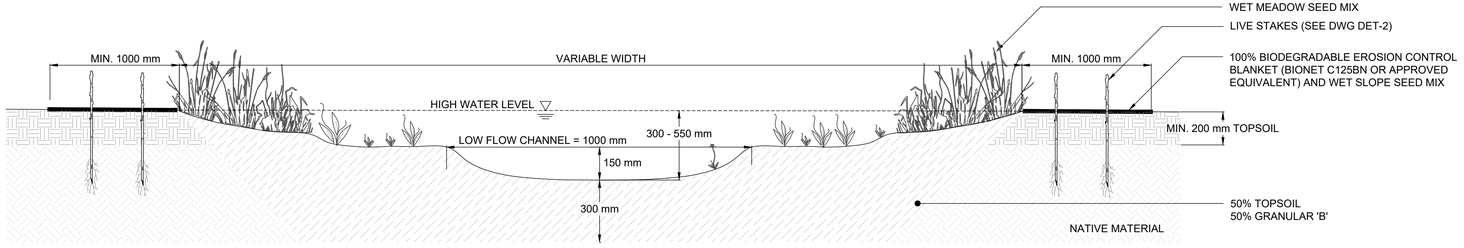


SHALLOW UNDULATION



DEEP UNDULATION

TYPICAL BIOSWALE CROSS SECTION
N.T.S.



NOTES

1. SUBSTRATES TO BE COMPACTED TO 90% SPD TO PREVENT PIPING/FLOW-THROUGH.
2. FINE NATIVE MATERIAL TO BE ADDED TO SUBSTRATE MIX TO FILL INTERSTITIAL VOIDS, AS REQUIRED.
3. GRANULAR 'B' TO BE SOURCED FROM PIT-RUN MATERIAL AND ROUNDED IN NATURE. NO CRUSHED ROCK, LIMESTONE OR POST-CONSTRUCTION MATERIALS ARE TO BE USED WITHIN THE CHANNEL. MATERIAL TO BE REVIEWED BY THE DESIGNER OR REPRESENTATIVE PRIOR TO INSTALLATION.
4. SEED IS TO BE PLACED PRIOR TO THE INSTALLATION OF EROSION CONTROL BLANKET. SEED DWG DET-2 FOR SEED MIX SPECIFICATIONS.

ONLINE WETLAND CROSS SECTION
N.T.S.

LEGEND

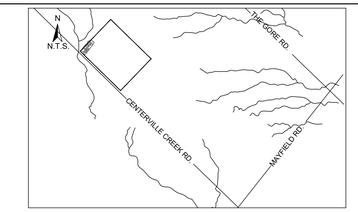
- SWALE (SEE DWG GEO-1)
- ONLINE WETLAND (SEE DWG GEO-1)
- OVERWINTER WETLAND POOL (55 mm BELOW FLOODPLAIN ELEVATION)
- POROUS WOODY DEBRIS JAM (SEE DWG DET-1)
- BERM (SEE DWG DET-1)
- PALLET TYPE WOOD PILE (SEE DWG DET-1)
- ROCK PILE (SEE DWG DET-1)
- RAPTOR POLE (SEE DWG DET-1)
- 100% BIODEGRADABLE EROSION CONTROL BLANKET AND LIVE STAKES (SEE DWG DET-2)
- BRUSH MATTRESS BANK TREATMENT (SEE DWG DET-2)
- PROPOSED WETLAND COMPENSATION AREA

Property Solmar

Depth From Flood elevation	Area	Unit
Habitat Area		
Shallow Wetland (0 to 0.30 m depth)	2623	m2
Deep Wetland (0.30 to 0.55 m depth)	1054	m2
Bioswale 0.35 to 0.55 m Depth (not in wetland)	251	m2
Wetmeadow	2848	m2
Total Wetland Area	**0.68**	**ha**
Summary		
Total Wetland to Compensate	0.56	ha
Total Swale Length	**462**	**m**

NOTES

1. SUBSTRATES TO BE COMPACTED TO 90% SPD TO PREVENT PIPING/FLOW-THROUGH.
2. FINE NATIVE MATERIAL TO BE ADDED TO SUBSTRATE MIX TO FILL INTERSTITIAL VOIDS, AS REQUIRED.
3. GRANULAR 'B' TO BE SOURCED FROM PIT-RUN MATERIAL AND ROUNDED IN NATURE. NO CRUSHED ROCK, LIMESTONE OR POST-CONSTRUCTION MATERIALS ARE TO BE USED WITHIN THE CHANNEL.
4. HYDRAULIC SIZING TO BE CONFIRMED AT DETAILED DESIGN
5. SEED IS TO BE PLACED PRIOR TO INSTALLATION OF EROSION CONTROL BLANKET. SEE DWG DET-2 FOR SEED MIX SPECIFICATION.



KEY MAP
N.T.S.

GENERAL NOTES

1. THE ACCOMPANYING CHANNEL REALIGNMENT TECHNICAL DESIGN BRIEF PREPARED BY GEO MORPHIX LTD. (2024) PROVIDES ADDITIONAL DESIGN DETAILS AND DIRECTION FOR IMPLEMENTATION AND IS TO BE REVIEWED IN CONJUNCTION WITH THIS DRAWING SET.
2. ALL CONTRACT DRAWINGS, SPECIFICATIONS AND APPLICABLE PERMITS MUST BE KEPT ON SITE DURING CONSTRUCTION FOR REFERENCE.
3. THE CONTRACTOR MUST NOTIFY THE DESIGNER AND CONTRACT ADMINISTRATOR OF THE INTENT TO COMMENCE WORK AT LEAST 48 HOURS IN ADVANCE.
4. THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES.
5. LAYOUT MUST BE REVIEWED AND APPROVED BY THE DESIGNER / DESIGNER REPRESENTATIVE, DESIGNATED ENGINEER, AND THE CONTRACT ADMINISTRATOR.
6. CONSTRUCTION OBSERVATION IS TO BE PERFORMED BY A CERTIFIED FLUVIAL GEOMORPHOLOGIST OR EXPERIENCED ENVIRONMENTAL INSPECTOR UNDER DIRECTION FROM THE DESIGNER.
7. ON-SITE SUPPORT FROM PROJECT ENGINEER (E.G., GEOTECHNICAL, HYDROGEOLOGICAL, AND/OR WATER RESOURCES ENGINEER) REQUIRED TO ASSESS AND ENSURE FAVOURABLE SURFICIAL AND SUBSURFACE CONDITIONS TO SUPPORT CHANNEL REALIGNMENT CONSTRUCTION.
8. BE ADVISED THAT THE LOCAL REGULATORY BODY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF, IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY OTHER FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.

TIMING OF WORKS

1. WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNR/DFO.
2. TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 31ST) AND THE BAT ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 30TH) TO COMPLY WITH THE FEDERAL MIGRATORY BIRDS CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR BATS.
3. THE WEATHER FORECAST SHOULD BE CONTINUALLY MONITORED TO ENSURE THAT WORKS ARE UNDERTAKEN ONLY DURING FAVOURABLE WEATHER CONDITIONS.
4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

SITE AND MATERIAL MANAGEMENT

1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STAGING/STORAGE AREA.
2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
3. STOCKPILES MUST BE LOCATED OUTSIDE THE ISOLATED WORK AREAS.
4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
6. ALL VEGETATION, ADJACENT TO THE WORK AREA, MUST BE PROTECTED AND DELINEATED WITH CONSTRUCTION FENCING OR TREE PROTECTION BARRIERS.
7. ALL GRADES IN THE AREA REGULATED BY THE CONSERVATION AUTHORITY MUST BE MAINTAINED OR MATCHED, UNLESS OTHERWISE AUTHORIZED IN THE APPLICABLE PERMIT.
8. AN AFTER-HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ONSITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.

EROSION AND SEDIMENT CONTROL

1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN-CISEC CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
3. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION, AND ANY REQUIRED REPAIRS OR REPLACEMENTS MUST BE COMPLETED WITHIN 24 HOURS AFTER THEY HAVE BEEN IDENTIFIED DURING THE MONITORING.
4. EROSION AND SEDIMENT CONTROLS MAY REQUIRE PERIODIC ADJUSTMENTS TO REFLECT CHANGING SITE CONDITIONS. THE CONTRACTOR WILL BE RESPONSIBLE FOR THESE ADJUSTMENTS TO ENSURE PROPER FUNCTION.
5. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN BEYOND MINOR ADJUSTMENTS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
6. ADDITIONAL EROSION AND SEDIMENT CONTROL SUPPLIES MUST BE KEPT ON SITE IN ORDER TO FACILITATE IMMEDIATE REPAIRS AND/OR UPGRADES AS NEEDED.
7. ALL TEMPORARY SEDIMENT CONTROLS MUST BE REMOVED AFTER THE CONTRACT ADMINISTRATOR DEEMS THE SITE TO BE STABLE.
8. THE PROJECT PROPONENT OR THEIR REPRESENTATIVE IS ULTIMATELY RESPONSIBLE FOR CONTROLLING SEDIMENT AND EROSION WITHIN THE CONSTRUCTION SITE FOR THE TOTAL PERIOD OF THE CONSTRUCTION.
9. IF EXCESSIVE SILTATION RESULTS FROM THE CONSTRUCTION ACTIVITIES, THE ONSITE SUPERVISOR/INSPECTOR AND/OR THE LOCAL REGULATORY BODY RESERVE THE RIGHT TO REQUEST ADDITIONAL ESC MEASURES WHICH WOULD BE INSTALLED PRIOR TO FURTHER CONSTRUCTION ACTIVITIES.

DELETERIOUS SUBSTANCE CONTROL/SPILL MANAGEMENT

1. PREVENT THE RELEASE OF SEDIMENT, SEDIMENT-LADEN WATER, RAW CONCRETE, CONCRETE LEACHATE OR ANY OTHER DELETERIOUS SUBSTANCES INTO ANY WATERBODY, RAVINE OR STORM SEWER SYSTEM.
2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ONSITE STAFF MUST BE TRAINED IN ITS USE.
5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-6060.

WORK AREA ISOLATION

1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUNDCOVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUNDCOVER.
4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.

2.0	28-08-2025	AS	SECOND CONCEPTUAL SUBMISSION TO CLIENT
1.0	29-01-2025	PV	FIRST CONCEPTUAL SUBMISSION TO CLIENT
	DATE	BY	REVISIONS

DESIGNED BY: PV | CHECKED BY: PV

DRAWN BY: SE | DATE: AUGUST 2025

PROFESSIONAL GEOSCIENTIST ONTARIO
PAUL V. VILLARD
PRACTISING MEMBER
0957
28-08-2025

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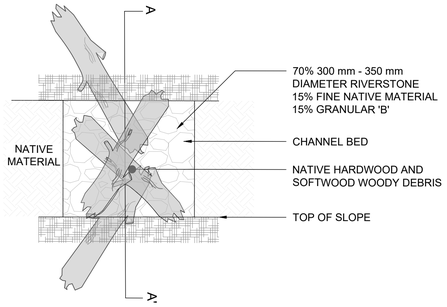
WILDFIELD VILLAGE, SOLMAR
CALEDON, ON

WEST HUMBER RIVER
CONCEPTUAL WETLAND REPLICATION
PLANFORM AND DETAILS

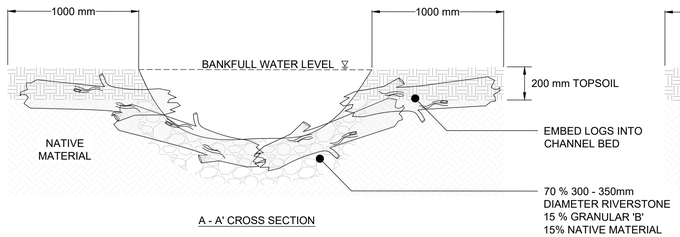
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SCALE: AS NOTED | SHEET 1 OF 3

SCALED FOR PLOT ON 'ARCH D'

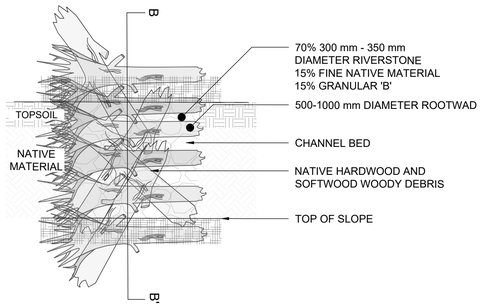


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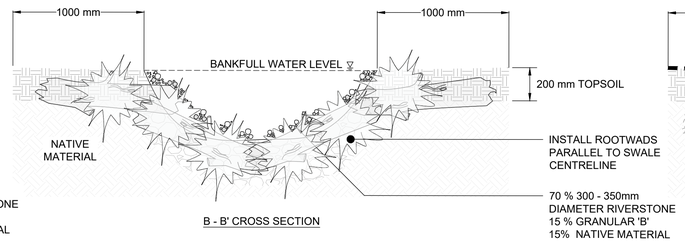


A - A' CROSS SECTION

STEP 1
1. LOGS AND WOODY DEBRIS TO BE NATIVE HARDWOOD AND SOFTWOOD SPECIES (LOCALLY SOURCED, IF POSSIBLE).
2. EXCAVATE CHANNEL AND EMBED LOGS AND STONE MIX INTO CHANNEL BED PERPENDICULAR TO FLOW.



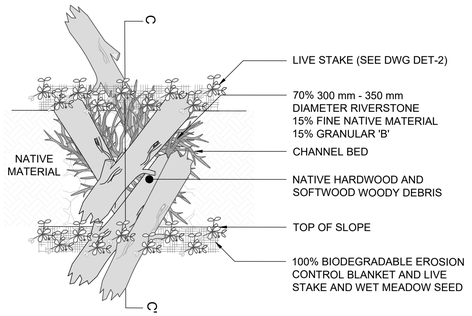
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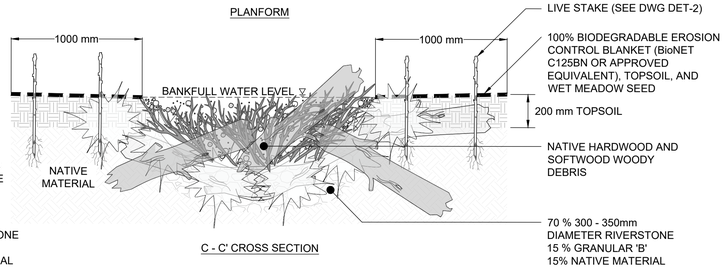
B - B' CROSS SECTION

STEP 2
1. PLACE 500-1000 mm DIAMETER ROOTWADS PARALLEL TO SWALE CENTERLINE WITH ROOT BALL UPSTREAM. DEBRIS TO BE NATIVE HARDWOOD AND SOFTWOOD SPECIES (LOCALLY SOURCED, IF POSSIBLE).
2. FILL VOIDS WITH STONE MIX AND COMPACT TO PREVENT FLOW THROUGH.

WOODY DEBRIS AND STONE PLUG
N.T.S.

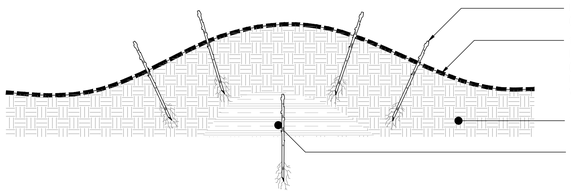


PLANFORM

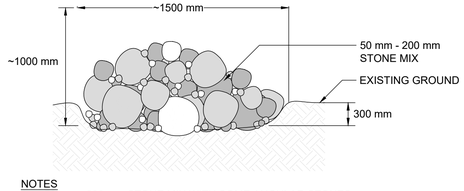


C - C' CROSS SECTION

STEP 3
1. PLACE SECOND STACKED LOGS PERPENDICULAR TO FLOW DIRECTION IN A WAY THAT PREVENTS FLOW THROUGH.
2. FILL VOIDS WITH STONE MIX AND COMPACT TO PREVENT FLOW THROUGH.
3. SEED WITH WET MEADOW SEED MIX, COVER WITH EROSION CONTROL BLANKET, AND HOLD IN PLACE WITH LIVE STAKES.

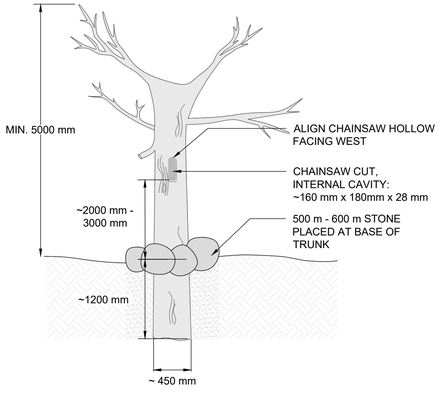


LIVE STAKE CLAY CORE BERM
N.T.S.



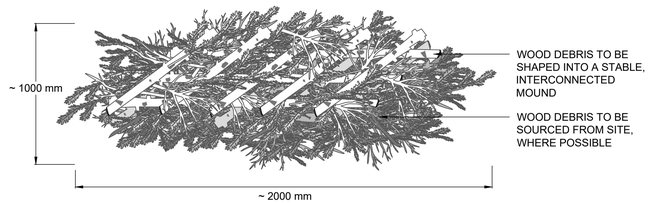
NOTES
1. 50 mm - 200 mm STONE MIX WITH SOME ANGULAR STONES.
2. THE STONE MIX SHOULD PROVIDE A VARIETY OF INTERSTITIAL SPACES.
3. PILES ARE AT LEAST 1500 mm IN DIAMETER AND ~1000 mm HIGH.
4. EMBED ROCK PILE 300 mm TO AVOID ROCKFALL.

ROCK PILE
N.T.S.



NOTES
1. CONSTRUCT WITH MATURE CONIFER TRUNKS WITH TWO OR MORE NATURAL BRANCHES.
2. AT LEAST 75% OF THE BARK SHOULD BE INTACT.
3. AUGER HOLE TO A DEPTH OF ~1000 m INSTALL TRUNK AND TAMP IN SAND AROUND BASE.
4. ~1000 m OF TRUNK IS TO BE BURIED.
5. PLACE 500 m - 600 m STONE AROUND BASE FOR ADDITIONAL SUPPORT.
6. IF ROOT WAD IS USED PLACE ROOT AT TOP.
7. LOGS SHOULD BE SOURCED ON SITE (WHERE POSSIBLE).

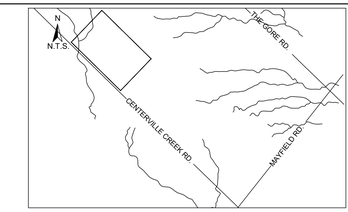
RAPTOR/VOLANT POLE
N.T.S.



NOTES
1. LARGEST AND HEAVIEST LOG MATERIAL SHOULD BE PLACED ON THE BASE OF THE BRUSH PILE. THE SMALLEST BRUSH MATERIAL SHOULD BE PLACED AT THE TOP.
2. LOGS SHOULD BE FORMED INTO A PALLET SHAPE.
3. HEIGHT OF BRUSH PILE IS NOT TO EXCEED 1000 mm.
4. A MIX OF HARDWOOD AND SOFTWOOD SHOULD BE USED.
5. PLANT WITH NATIVE FRUIT BEARING VINES.

PALLET TYPE WOOD PILE
N.T.S

SCALED FOR PLOT ON 'ARCH D'



KEY MAP
N.T.S.

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TIMING OF WORKS

1. WORKS SHALL BE COMPLETED DURING THE DESIGNATED IN-WATER WORKS WINDOW SET OUT BY MNR/DFO.
2. TREE CLEARING IS TO BE COMPLETED OUTSIDE THE BIRD NESTING SEASON (APRIL 1ST TO AUGUST 31ST) AND THE BAT ROOSTING WINDOW (APRIL 1ST TO SEPTEMBER 30TH) TO COMPLY WITH THE FEDERAL MIGRATORY BIRDS CONVENTION ACT AND THE PROVINCIAL ENDANGERED SPECIES ACT. ANY TREES THAT REQUIRE REMOVAL OUTSIDE OF THIS TIMING WINDOW MUST FIRST BE INSPECTED BY A QUALIFIED BIOLOGIST TO DETERMINE THE PRESENCE OF NESTING BIRDS OR BATS.
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4. COMPLETE THE WORKS WITH MINIMAL AVOIDABLE INTERRUPTIONS ONCE THEY COMMENCE.

SITE AND MATERIAL MANAGEMENT

1. ALL CONSTRUCTION EQUIPMENT AND MATERIALS (IMPORTED OR EXCAVATED) MUST BE STORED AT LEAST 30 m AWAY FROM ANY WATERBODY IN A STABLE AREA ABOVE THE ACTIVE FLOODPLAIN, OR IN A DESIGNATED STAGING/STORAGE AREA.
2. IN THE EVENT OF AN UNEXPECTED STORM, ALL UNFIXED ITEMS THAT HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW MUST BE MOVED A STABLE AREA ABOVE ACTIVE FLOODPLAIN.
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4. STABILIZE, TEMPORARILY OR PERMANENTLY, ANY DISTURBED AREAS AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW.
5. MINIMIZE THE AREA OF DISTURBANCE TO THE EXTENT POSSIBLE. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED USING APPROPRIATE EROSION CONTROL MEASURES AND AN APPROPRIATE SEED MIX AS NOTED WITHIN THE FINAL APPROVED RESTORATION PLAN.
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1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO START OF WORKS.
2. FOLLOWING INSTALLATION OF THE PROPOSED ESC MEASURES, A QUALIFIED AGENT OF THE PROPONENT (E.G. CAN-CISEC CERTIFIED MONITOR) WILL CONDUCT REGULAR SITE VISITS TO MONITOR ALL WORKS, PARTICULARLY THE CONDITION OF THE ESC MEASURES, DEWATERING, AND IN- OR NEAR-WATER WORKS. SHOULD CONCERNS ARISE, THE ENVIRONMENTAL MONITOR WILL CONTACT THE PROPONENT, THE CONSERVATION AUTHORITY, AND ANY OTHER APPROPRIATE PARTIES.
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2. ENSURE EQUIPMENT AND MACHINERY ARE IN GOOD OPERATING CONDITION (POWER WASHED), FREE OF LEAKS, EXCESS OIL, AND GREASE.
3. NO EQUIPMENT REFUELLING OR SERVICING SHOULD BE UNDERTAKEN WITHIN 30 m OF ANY WATERCOURSE OR SURFACE WATER DRAINAGE.
4. A SPILL CONTAINMENT KIT MUST BE READILY ACCESSIBLE ON SITE IN THE EVENT OF A RELEASE OF A DELETERIOUS SUBSTANCE TO THE ENVIRONMENT. ONSITE STAFF MUST BE TRAINED IN ITS USE.
5. THE CONTRACT ADMINISTRATOR MUST BE NOTIFIED IMMEDIATELY IN THE EVENT OF A SPILL OF DELETERIOUS SUBSTANCE. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1-800-268-6060.

WORK AREA ISOLATION

1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUNDCOVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUNDCOVER.
4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.

2.0	28-08-2025	AS	SECOND CONCEPTUAL SUBMISSION TO CLIENT
1.0	29-01-2025	PV	FIRST CONCEPTUAL SUBMISSION TO CLIENT
	DATE	BY	REVISIONS

DESIGNED BY: PV | CHECKED BY: PV

DRAWN BY: SE | DATE: AUGUST 2025

PROFESSIONAL GEOSCIENTIST ONTARIO
PAUL V. VILLARD
PRACTISING MEMBER
0957
28-08-2025

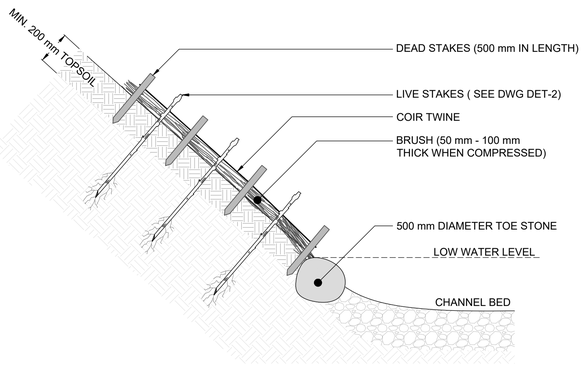
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T: 416.920.0926
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WILDFIELD VILLAGE, SOLMAR
CALEDON, ON

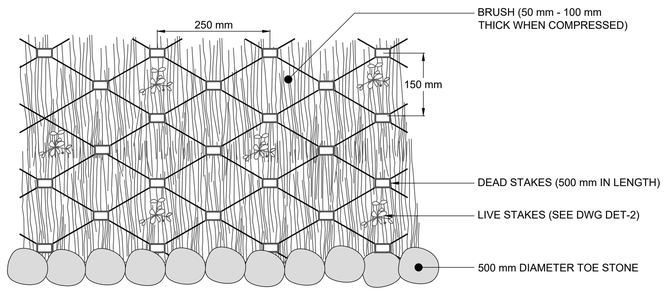
WEST HUMBER RIVER CONCEPTUAL WETLAND REPLICATION PLANFORM AND DETAILS

PROJECT No.: PN24105 | DRAWING No.: DET-1

SCALE: AS NOTED | SHEET 2 OF 3



CROSS SECTION



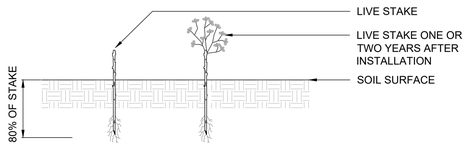
PLAN

NOTES
1. LIVE BRANCHES TO CONSIST OF WILLOW AND DOGWOOD SPECIES, APPROXIMATELY 1 m IN LENGTH AND 50 mm - 100 mm IN WIDTH.
2. BRANCHES TO BE KEPT IN MOIST AND COLD CONDITION UNTIL INSTALLATION.
3. BRUSH MATTRESS TO BE INSTALLED WHILE BRANCHES ARE DORMANT.
4. BRANCHES TO BE PLACED ON SLOPE WITH BUTT END TOWARDS VALLEY FLOOR AND PUSHED INTO SOIL.
5. BRANCHES MUST BE FLEXIBLE ENOUGH TO CONFORM TO THE SLOPE SURFACE IRREGULARITIES.
6. POUND DEAD STAKES TO HALF THEIR LENGTH INTO SOIL BETWEEN BRANCHES. TIE COIR TWINE AROUND DEAD STAKES AND TIGHTLY OVER BRANCHES. USE A CLOVE HITCH TO SECURE STAKES. POUND STAKES INTO SLOPE TO COMPRESS BRANCHES AGAINST GROUND.
7. TAMP LIVE STAKES BETWEEN DEAD STAKES.
8. FILL VOIDS BETWEEN BRANCHES OF THE BRUSH MATTRESS WITH SOIL TO PROMOTE ROOTING.

BRUSH MATTRESS
N.T.S.

EROSION CONTROL BLANKET SPECIFICATIONS

1. A BIODEGRADABLE EROSION CONTROL BLANKET (ECB) SHALL BE INSTALLED ON ALL DISTURBED NATURAL SURFACES FOLLOWING THE PLACEMENT OF TOPSOIL AND APPLICATION OF THE NATIVE SEED MIX.
2. THE ECB MUST BE CONSTRUCTED OF 100% WOVEN COCONUT FIBRE (E.G., COIR) OR STRAW MAT WITHIN A GEOJUTE NETTING (TOP AND BOTTOM) WITH BIODEGRADABLE THREAD. NON-BIODEGRADABLE MATERIAL INCLUDING POLYPROPELENE OR PLASTICS WITH A BIODEGRADABLE RATING ARE NOT ACCEPTABLE. THE MINIMUM WEIGHT OF THE ECB MUST BE 400 g/m^2 (12 oz./yd^2).
3. TO INSTALL, THE ECB MUST BE UNROLLED DOWNSLOPE OR IN DIRECTION OF WATER FLOW. ADJACENT ECBS SHOULD OVERLAP A MINIMUM OF 150 mm ALONG THE EDGES. AT THE END OF EACH ROLL, FOLD BACK 100 mm TO 200 mm OF THE ECB. OVERLAP THIS 100 mm TO 200 mm OVER THE START OF THE NEXT ROLL. SECURE THE TWO LAYERS TO THE GROUND SECURELY.
4. BIODEGRADABLE OR TAPERED WOODEN STAKES SHALL BE USED TO SECURE THE BLANKET. STAKES SHALL BE INSTALLED AT THE SPACING RECOMMENDED BY THE ECB MANUFACTURER TO PREVENT SURFACE RUNOFF FROM ERODING THE UNDERLYING SOIL.



UPSLOPE PLANTING

SCIENTIFIC NAME	COMMON NAME	QTY	CONDITION
CORNUS ALTERNIFOLIA	ALTERNATE-LEAF DOGWOOD	1760	1 m, LIVE STAKE
PHYSOCARPUS OPULIFOLIUS	COMMON NINEBARK	1760	1 m, LIVE STAKE
RHUS TYPHINA	STAGHORN SUMAC	1760	1 m, LIVE STAKE
VIBURNUM LENTAGO	NANNYBERRY	1760	1 m, LIVE STAKE

NOTES
1. QUANTITY TO BE DETERMINED BASED ON AREA OF DISTURBANCE TO BE RESTORED
2. LIVE STAKES SHOULD BE FROM AT MINIMUM 2-YEAR OLD STOCK.
3. LIVE STAKES ARE TO BE INSTALLED AT A DENSITY OF 3 STAKES PER SQUARE METRE.
4. LIVE STAKES SHOULD BE PRE-SOAKED (SUBMERGED IN WATER) FOR AT LEAST 24 HOURS AFTER HARVESTING AND IMMEDIATELY BEFORE INSTALLATION.
5. LIVE STAKES SHOULD NOT BE STORED FOR A PERIOD LONGER THAN 2 DAYS, UNLESS THEY ARE BEING SOAKED.
6. THE CONTRACTOR SHALL PROTECT PLANT MATERIALS FROM DRYING FROM THE TIME OF HARVEST UNTIL INSTALLED.
7. LIVE STAKES ARE TO BE A MINIMUM OF 25 mm IN DIAMETER AND CUT TO A LENGTH OF 1000 mm.
8. CUT ANGLE AT THE BOTTOM OF THE STAKE AND FLAT ON THE TOP.
9. TRIM ALL SIDE BRANCHES WHILE TAKING CARE NOT TO DAMAGE THE BARK.
10. INSTALL STAKES WITH BUDS POINTING UPWARDS AND THICKER STEM IN THE BED.
11. LIVE STAKES SHOULD BE INSTALLED USING A LARGE RUBBER MALLET.
12. 80% OF THE STAKE IS TO BE BELOW SURFACE.
13. TAMP THE LIVE STAKE INTO THE GROUND AT RIGHT ANGLE TO THE SURFACE.
14. IN COMPACT SOIL A PILOT HOLE SHOULD BE USED TO LIMIT DAMAGE TO THE STAKES.
15. IF USING A PILOT HOLE REPACK SOIL AROUND THE LIVE STAKE.
16. LIVE STAKES SHOULD STAND FIRM FROM THE SOIL FOLLOWING INSTALLATION.
17. ALL STAKES NOT PLANTED TO THE SPECIFICATIONS ABOVE WILL BE REPLACED AT THE CONTRACTOR'S EXPENSE.

LIVE STAKING
N.T.S.

TRCA - ONTARIO WET MEADOW

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE
ASCLEPIAS INCARNATA	SWAMP MILKWEED	2
BROMUS CILIATUS	FRINGED BROME	2
CAREX BEBBII	BEBB'S SEDGE	1
CAREX STIPATA	AWL-FRUITED SEDGE	1
CAREX VULPINOIDEA	FOX SEDGE	5
DOELLINGERIA UMBELLATA	FLAT-TOPPED ASTER	1
ELYMUS RIPARIUS	RIVERBANK RYE	10
ELYMUS VIRGINICUS	VIRGINIA WLID RYE	10
EUPATORIUM MACULATUM	JOE-PYE WEED	3
EUPATORIUM PERFOLIATUM	BONESET	2
GLYCERIA STRIATA	FOWL MANNA GRASS	3
JUNCUS ARTICULATUS	JOINTED RUSH	2
JUNCUS BALTICUS	BALTIC RUSH	1
JUNCUS EFFUSUS	SOFT RUSH	1
JUNCUS TENUIS	PATH RUSH	2
JUNCUS TORREYI	TORREY'S RUSH	1
LIATRIS SPICATA	DENSE BLAZING STAR	1
LOBELIA CARDINALIS	CARDINAL FLOWER	1
LOBELIA SIPHILITICA	BLUE LOBELIA	1
MIMULUS RINGENS	MONKEY FLOWER	1
MONARDA FISTULOSA	WILD BERGAMONT	3
OENOTHERA BIENNIS	EVENING PRIMROSE	2
PANICUM VIRIGATUM	SWITCH GRASS	10
PENSTEMON DIGITALIS	FOXGLOVE BEARDTONGUE	2
PHYSOSTEGIA VIRGINIANA SUBSP. VIRGINIANA	FALSE DRAGONHEAD OR OBEDIENT PLANT	2
RUDBECKIA HIRTA	BLACK EYED SUSAN	5
RUDBECKIA LACINIATA	GREEN CONEFLOWER	1
SCIRPUS ATROVIRENS	DARK GREEN BULRUSH	3
SCIRPUS CYPERINUS	WOOLGRASS BULRUSH	3
SOLIDAGO GRAMINIFOLIA	LANCE-LEAVED GOLDENROD	1
SORGHASTRUM NUTANS	INDIAN GRASS	7
SYMPHYOTRICHUM ERICOIDES	HEATH ASTER	2
SYMPHYOTRICHUM NOVAE-ANGLIAE	NEW ENGLAND ASTER	1
SYMPHYOTRICHUM PILOSUM	HAIRY ASTER	2
SYMPHYOTRICHUM PUNICEUM	SWAMP ASTER	2
VERBENA HASTATA	BLUE VERVAIN	3

NOTES:

1. APPLY SEED MIX AT A RATE OF 20 kg PER HECTARE.
2. SEEDING SHALL OVERLAP ADJACENT GROUND COVER BY 300 mm.
3. SIMULTANEOUSLY APPLY A NURSE CROP OF ANNUAL OATS (AVENA SATIVA) AT A RATE OF 30 kg PER HECTARE.
4. WATER SOIL AFTER SEED APPLICATION.

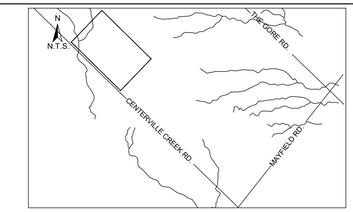
TRCA WET SLOPE MIX

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE
BROMUS CILIATUS	FRINGED BROME	5
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CAREX STIPATA	AWL-FRUITED SEDGE	1
CAREX VULPINOIDEA	FOX SEDGE	3
ELYMUS RIPARIUS	RIVERBANK RYE	20
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	25
JUNCUS TENUIS	PATH RUSH	3
JUNCUS TORREYI	TORREY'S RUSH	2
MONARDA FISTULOSA	WILD BERGAMONT	2
PANICUM VIRIGATUM	SWITCH GRASS	12
RUDBECKIA HIRTA	BLACK EYED SUSAN	3
SCIRPUS ATROVIRENS	DARK GREEN BULRUSH	5
SCIRPUS CYPERINUS	WOOLGRASS BULRUSH	5
SOLIDAGO GRAMINIFOLIA	LANCE-LEAVED GOLDENROD	1
SORGHASTRUM NUTANS	INDIAN GRASS	10
SYMPHYOTRICHUM NOVAE-ANGLIAE	NEW ENGLAND ASTER	2

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SCALED FOR PLOT ON 'ARCH D'



KEY MAP
N.T.S.

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WORK AREA ISOLATION

1. ALL WORK IN ISOLATED WORK AREAS MUST BE COMPLETED IN THE DRY. AN ADEQUATE NUMBER OF PUMPS MUST BE USED FOR UNWATERING.
2. CROSSING AN ACTIVE WATERCOURSE OR WETLAND BY EQUIPMENT, VEHICLES, PERSONNEL, ETC. IS NOT PERMITTED UNLESS APPROVED BY THE CONSERVATION AUTHORITY. ALL ACCESS TO WORK SITES SHALL BE FROM EITHER SIDES OF THE WATERCOURSE OR WETLAND.
3. THE UNWATERING DISCHARGE LOCATION MUST BE LOCATED AT LEAST 30 m FROM ANY WATERCOURSE OR WETLAND IN AN AREA WITH DENSE VEGETATIVE GROUNDCOVER, AND WHERE THE DISCHARGE CAN RETURN TO THE WATERBODY DOWNSTREAM OF THE WORK AREA OVER THE GROUNDCOVER.
4. FISH MUST BE REMOVED FROM THE WORK AREA ONCE ISOLATED. FISH SALVAGE MUST BE COMPLETED BY A QUALIFIED TECHNICIAN WITH A LICENSE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES.

2.0	28-08-2025	AS	SECOND CONCEPTUAL SUBMISSION TO CLIENT
1.0	29-01-2025	PV	FIRST CONCEPTUAL SUBMISSION TO CLIENT
	DATE	BY	REVISIONS

DESIGNED BY: PV | CHECKED BY: PV

DRAWN BY: SE | DATE: AUGUST 2025

PROFESSIONAL GEOSCIENTIST ONTARIO
PAUL V. VILLARD
PRACTISING MEMBER
0957
28-08-2025

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WILDFIELD VILLAGE, SOLMAR
CALEDON, ON

WEST HUMBER RIVER CONCEPTUAL WETLAND REPLICATION PLANFORM AND DETAILS

PROJECT No.: PN24105 | DRAWING No.: DET-2

SCALE: AS NOTED | SHEET 3 OF 3

Appendix C:
Wetland Water Availability Figures

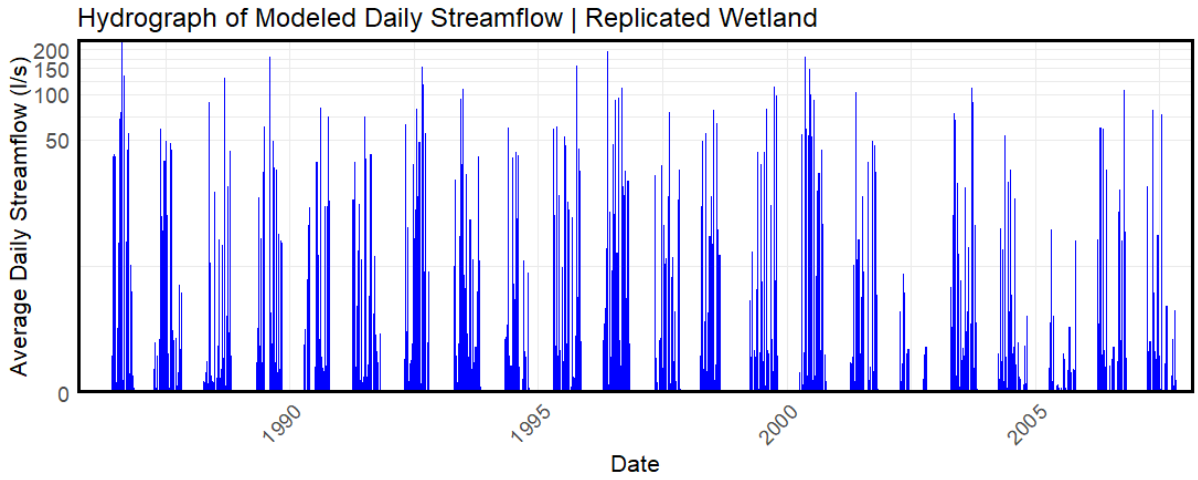


Figure 1. Average daily streamflow to the replicated wetland from 1986 to 2007.

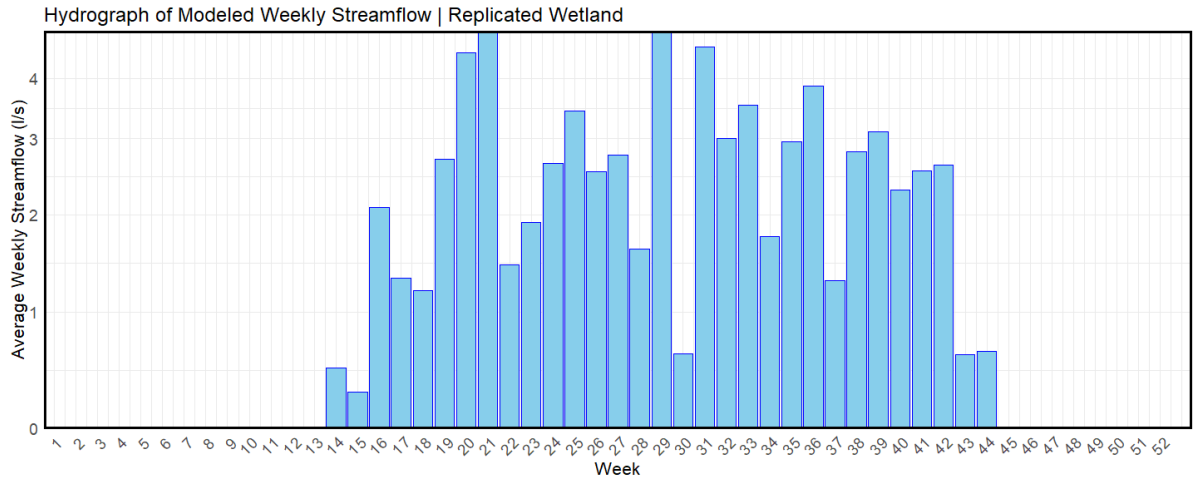


Figure 2. Average weekly streamflow to the replicated wetland.

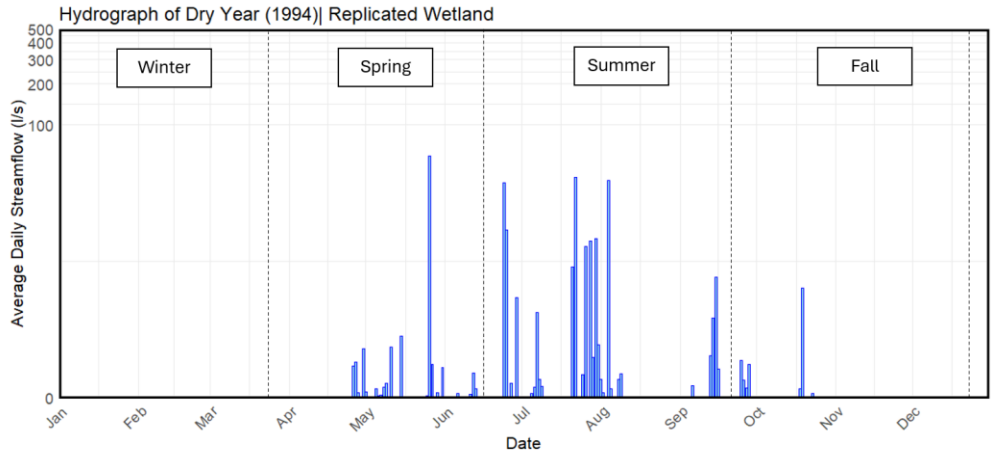


Figure 3. Average daily streamflow during a dry year (1994).

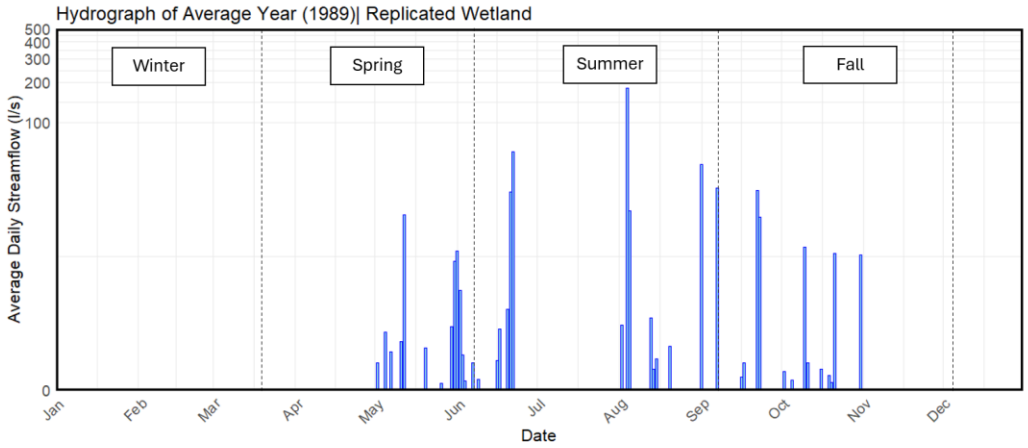


Figure 4. Average daily streamflow during an average year (1989).

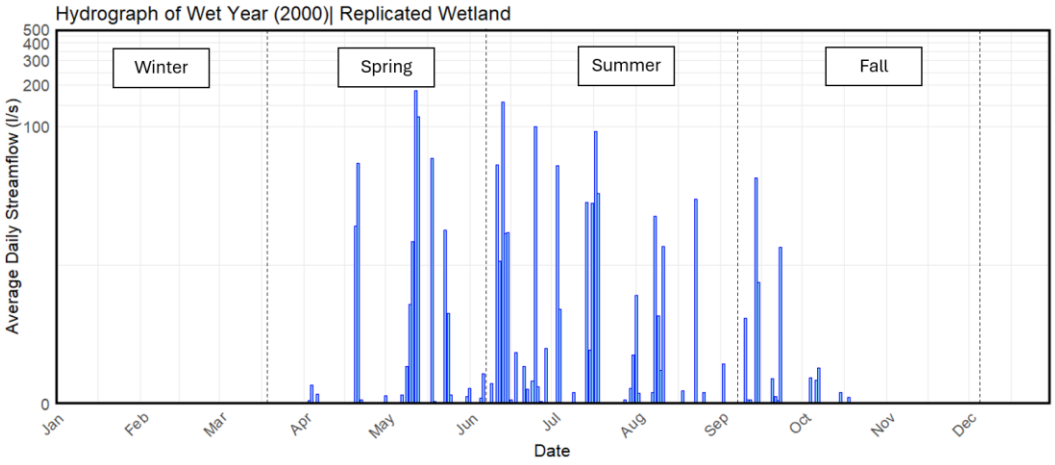


Figure 5. Average daily streamflow during a wet year (2000).