August 18, 2023

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L8P 4Y5

RE: Preliminary Wetland Design
3054 Homestead Drive, 9166 and 9174 Airport Road, Hamilton, Ontario

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1. INTRODUCTION

GEI Consultants Ltd (GEI) was retained by Fengate Homestead Holdings LP (Fengate) to complete a Preliminary Wetland Design for 3054 Homestead Drive, 9166 and 9174 Airport Road, Hamilton, Ontario (herein referred to as the Subject Lands; **Figure 1**, **Appendix A**).

The Subject Lands are generally located north of Airport Road, west of Homestead Drive, east of John C. Munro Hamilton International Airport (herein referred to as the Airport Lands) and south of Dickenson Road. The Subject Lands fall within the Airport Employment Growth District (AEGD) Secondary Plan Area and are within the Twenty Mile Creek and Upper Welland River Subwatersheds.

1.1 Project Overview

The Subject Lands consist of a mixture of actively managed agricultural fields (soy), recently fallow fields and/or residential lands. Two headwater drainage features are identified within the Subject Lands: one drainage feature (referred to as HDF H1) flows west-east across the northern portion of the Subject Lands, while the second drainage feature (referred to as HDF H2) flows north along the eastern property boundary. The surrounding landscape is dominated by agricultural and commercial/industrial land-uses, including the Airport Lands immediately west of the property.

An Environmental Impact Study (EIS) was required to assess the potential impacts of the proposed development of the Subject Lands on natural heritage features and their associated functions. GEI prepared and submitted the first EIS submission in December 2021 to the City of Hamilton and the Niagara Peninsula Conservation Authority (NPCA). This technical brief has been prepared in support of the third submission of the EIS to address agency comments.

An industrial development consisting of a complex of warehouses is proposed within the Subject Lands. A total of four buildings and one 30 m wide roadway (Street A; also referred to as the internal East Cargo Road) are proposed (**Figure 1, Appendix A**). Several options for the development layout were explored by the consultant team to ensure that the identified natural heritage/hydrologic features were protected; however, this was not feasible given the site engineering requirements and the large industrial building footprints. Based on the site's constraints related to the alignment of Street A, there were grading conflicts associated with some of the natural heritage features within their existing location in proximity to the neighbouring

properties. Opportunities to retain and minimize grading impacts were explored; however, it was determined that maintaining these features in-place was not achievable. Thus, the proposed development layout considers ecological reconfiguration and compensation of the wetlands (GEI 2023a).

1.2 Purpose

This memo demonstrates the proposed wetland compensation approach based on the existing natural heritage features identified for removal. This memo explains the proposed compensation approach, design considerations and limitations, and restoration goals and objectives. This letter further expands on the concept plan outlined within Section 7.2 of the EIS. A preliminary planting plan, wildlife habitat features, fencing recommendations, and ecological monitoring parameters are intended to generate concept for review purposes.

In addition to providing an overview of the wetland compensation approach for the Subject Lands in support of the proposed development plan, an example of a wetland compensation project is provided to show how wetland compensation can be successful in restoring and enhancing ecological features and functions. While it is recognized that the City of Hamilton does not have any wetland compensation guidelines, the EIS has demonstrated through the mitigation hierarchy review that the existing wetlands could not be retained in place in a post-development scenario; thus, compensation is required to ensure that there is no loss in wetland area or functions within the Subject Lands.

2. EXISTING CONDITIONS

The Subject Lands occur on flat topography and consist predominantly of agricultural land. The surrounding landscape contains a mixture of land uses including residential, commercial/ industrial and agricultural. The surficial geology consisted of silty and clay substrates with minor evidence of sand and gravel (Soil-Mat 2022).

GEI completed ecological field investigations between 2021 and 2023, including Ecological Land Classification (ELC) and a tree inventory, to understand potential ecological constraints to development (GEI 2023a; GEI 2023b).

Vegetation communities were first identified on aerial imagery and then verified in the field. Vegetation community types were confirmed, sampled, and revised using the sampling protocol of the ELC for Southern Ontario (Lee at al. 1998).

A tree inventory was completed for individual trees as well as trees located within hedgerows and woodland vegetation communities. Trees with a diameter-at-breast-height (DBH) of 10 cm and greater within the Subject Lands were tagged and assessed. Trees within two woodlands were assessed but not tagged. Woodland trees were assigned a unique identifier for mapping and reference purposes. The locations for all inventoried trees on the Subject Lands were recorded in UTM coordinates using a sub-meter capable GPS unit (GEI 2023b).

2.1 Existing Wetland Vegetation Communities

Wetland vegetation communities occupy a total of 1.11 ha on the Subject Lands (GEI 2023a). A total of six individual wetlands were present on the Subject Lands. The following wetlands were identified within the Subject Lands:

- Four isolated Reed Canary Grass Mineral Meadow Marsh (MAM2-2) (0.42 ha);
- One linear Cattail Mineral Shallow Marsh with a complex of smaller areas characterized as Common Reed Mineral Shallow Marsh (MAS2-1/MAS1-12) (0.66 ha); and
- One isolated Silver Maple Mineral Deciduous Swamp (SWD3-2) (0.03 ha).

Wetland staking was completed with NPCA on August 6, 2021, and the staked linework is shown on **Figure 2, Appendix A**. No provincially rare vegetation communities were present on the Subject Lands (NHIC 2021). No locally rare vegetation communities were present on the Subject Lands (NPCA 2010). No calling amphibians were recorded within any wetland community. The wetlands do not support Species at Risk (SAR) or Significant Wildlife Habitat (SWH), nor do they provide linkage functions (GEI 2023a).

Representative photos of each wetland vegetation community type are provided in **Photolog 1, Appendix B**. The photolog depicts degraded wetland vegetation communities with the presence of invasive species and limited species diversity that offer limited ecological functions. Anthropogenic disturbances observed include extensive debris and trash, all-terrain vehicle (ATV) ruts, and remnant disturbance from an old farm crossing.

A total of five Category 1 invasive species, which are deemed the most invasive and can dominate a site to exclude all other species, were recorded within the following wetland communities (Urban Forest Associates 2002):

- Canada Thistle (*Cirsium arvense*) – occasional in MAM2-2;
- Purple Loosestrife (*Lythrum salicaria*) – occasional in MAS2- and rare MAM2-2;
- European Buckthorn (*Rhamnus cathartica*) – rare in MAM2-2;
- Manitoba Maple (*Acer negundo*) –rare in MAM2-2 and MAS2-1; and
- Common Reed (*Phragmites australis ssp. australis*) – Occasional in the overall MAS2-1/ MAS1-12, though where present this species is dominant.

In addition to this, Photo 4 (**Photolog 1**, **Appendix B**) shows contaminants that were documented within the MAS2-1/MAS1-12 vegetation community during the wetland feature staking with NPCA. These unknown contaminants were presumed to have come from the Airport Lands (upstream).

2.2 Inventoried Trees

A total of 444 trees were mapped and assessed during the tree inventory, of which two were dead. Of the 444 inventoried trees, 355 are subject to removal (including two dead trees) to accommodate site alteration and development (GEI 2023a; GEI 2023b). Inventoried trees identified for removal are shown on **Figure 2, Appendix A**.

Removal of all woodland/wooded communities within the Subject Lands is proposed (0.25 ha). The wooded communities are relatively small and isolated features within the landscape. They do not host SWH or SAR, rather they support common and secure bird species (GEI 2023a). No amphibian breeding was recorded within the Subject Lands and the wetlands provide contributing functions to downstream fish habitat (i.e., wetlands are indirect fish habitat).

3. PROPOSED COMPENSATION APPROACH

As discussed within Sections 5 and 6 of the EIS, direct removal of all existing wetland communities, totaling 1.11 ha, is proposed to accommodate site alteration and development. Most of the wetland removal is associated with the proposed building envelope; however, some removals are required to accommodate site grading associated with the construction of Street A (GEI 2023a). In addition, the removal of 355 inventoried trees (i.e., individual trees, hedgerows trees, and woodland trees) is also necessary.

3.1 Wetland Compensation

Ecological offsetting is a mitigation strategy that is often considered in an effort to achieve a net ecological benefit to projects, subject to the approval of the planning authority. In this case, ecological offsetting is proposed as a means to achieve additional ecological benefit by meeting the replication requirement (GEI 2023a).

The size of the wetland is proposed to be replicated at a 1:1 ratio on the Subject Lands in a different orientation and location, while increasing the overall biodiversity of the created wetland community. Although a gain in physical wetland area will not be provided, it is GEI's assessment that a gain in ecological function (increased wildlife function and habitat availability in comparison to the existing wetlands) will be provided (GEI 2023a).

3.2 Tree Compensation

It is recognized that trees provide a variety of functions (i.e., canopy cover, energy conservation, mental health benefits and wildlife habitat); thus, compensation of these trees will ensure that there is not a loss in these functions within the landscape (GEI 2023a). Compensation of these trees will be completed in accordance with the City of Hamilton's Tree Preservation Guidelines (2010). The City of Hamilton requires compensation of live private trees at a 1:1 ratio, therefore, a total of 353 trees are proposed to be planted to compensate for those being removed due to the proposed development (GEI 2023b).

4. PRELIMINARY WETLAND DESIGN

To address the wetland and tree compensation requirements on the Subject Lands, the EIS proposes to create a 1.11 ha wetland with a 10 m treed buffer zone (0.88 ha) along the eastern boundary of the Subject Lands (GEI 2023a).

4.1 Design Considerations and Limitations

The hydrogeological brief prepared by Soil-Mat (2022) suggests that the groundwater is expected to be present at depths of approximately 2 to 3 meters below the existing grade. It should be noted that the groundwater monitoring completed by Soil-Mat was conducted in the winter and late summer and is therefore not necessarily reflective of the spring high water levels on site. Therefore, seasonal fluctuations in the groundwater elevation should be anticipated, with the expectation that groundwater could be present less than 2 metres below the existing grade during the spring (Soil-Mat 2022). The report notes that subsurface soil conditions consist of clayey silt / silt deposits. These clayey soils would generally be characterized as cohesive material of low to medium plasticity and are expected to have a low permeability (Soil-Mat 2022). However, it was noted by Soil-Mat that sand seams were encountered in some locations on site which could result in higher than expected permeability. The in-situ hydraulic conductivity was not measured and therefore, was estimated based on the soils encountered. Due to the preliminary nature of the hydrogeological report prepared by Soil-Mat (2022), additional in-situ testing of hydrogeological conductivity and/or infiltration rates and seasonal monitoring of the groundwater table is needed to characterize local infiltration/recharge conditions and seasonality of the groundwater table. This will be completed at detailed design.

The created wetland is proposed to be fed by a conveyance swale and roof top drainage. Flows from the piped conveyance swale flow through the north end of the created wetland while roof top drainage is expected to be directed to the south end of the wetland. The wetland is expected to drain into the conveyance swale before connecting into an offsite wetland at the north end of the wetland based on the proposed grade. The Functional Servicing Report (FSR) proposes that roof top drainage from Building B would support the created wetland (Odan Detech 2023). A water availability assessment will be required during the detailed design phase to ensure that the wetland hydroperiod can be supported.

A water balance and water availability assessment will be required at detailed design to ensure that the hydroperiod of the created wetland can be maintained following development. A post-development grading plan will be required to complete these analyses and assess the separation of the created wetland from the groundwater table.

Recognizing that increased contributions of road salts during the winter months is inevitable due to site development and created wetland's the proximity of Street A, salt tolerant plants have been included to encourage the establishment of resilient wetland flora. This is illustrated within Section 4.3 (below).

The created wetland will be designed to support urbanized wildlife species that are accustomed to various levels of noise and light. The targeted fauna usage within the feature will generally be restricted to terrestrial species (e.g., insects, birds, small mammals) (GEI 2023a). Due to proximity to the Airport Lands, the created wetland will be designed to limit attraction of waterfowl congregations to the extent possible by reducing the number of open water areas (GEI 2023a). The created wetland design also aims to reduce the likelihood of the establishment of Common Reed from adjacent lands (GEI 2023a).

A formal restoration plan for the created wetland will be prepared following consultation with the City of Hamilton and NPCA. A monitoring program for the created wetland area is presented is Section 8.0 of the EIS (GEI 2023a).

4.2 Restoration Goals and Objectives

The restoration goal is to replicate the area and functions of the existing wetland (i.e., water storage, contribution of allochthonous materials) while increasing overall ecological functions (i.e., increased native flora, inclusion of pollinator habitat; GEI 2023a).
As noted in the EIS report, the ecological restoration objectives for the Subject Lands include:

- Replicate wetlands proposed for removal within the created wetland area at a 1:1 replication ratio (1.11 ha total area);
- Deter establishment of non-native/invasive plant species in the created wetland and associated buffer;
- Create floristically diverse and resilient vegetation communities that will support a variety of native fauna;
- Stabilize soils through the application of an annual cover crop seed mix applied in conjunction with native perennial seed mixes (along with other ESC measures, as necessary);
- Include nectaring plants and Milkweed species within groundcover planting areas to attract/support local insect populations including Monarch; and
- Provide wildlife habitat structures for a variety of wildlife (e.g., mammals, insects) to increase breeding, foraging and refugia opportunities.

The target vegetation community for the created wetland is a Mineral Shallow Marsh (MAS2) with Mineral Thicket Swamp (SWT2) inclusions. The target vegetation community for the 10 m treed buffer zone is Dry-Fresh Deciduous Forest (FOD4). The target vegetation communities were selected based on the existing vegetation communities and their associated species, as well as other compatible species, soil type, proposed hydrological conditions, proposed adjacent land use, intended wildlife habitat, and strategies to minimize the establishment of invasive species.

4.3 Preliminary Planting Plan

Surface Water Hydrology and Grading

The water storage capacity of the wetland will be refined at detailed design with a Water Availability Assessment. For the preliminary wetland design, the maximum depth of the created wetland is proposed to be 120 cm, which is above the expected groundwater level.

The majority of water input into the created wetland is expected to be from roof runoff, which will enter the wetland from the south and southeast sides of the created feature. A smaller quantity of water is proposed to flow through the northern wetland limit via a low flow conveyance swale. The low flow conveyance swale design will be refined at detailed design. Slow movement is the water is expected to occur from southeast to northwest. Given the gentle grades sloping from higher elevations (229.22 to 229.21 masl) along the southeaster to lower elevations (228.74 masl) along the west and (226.86 masl) at the northeast corner. During high water levels, the created wetland will be designed to overflow into the low flow conveyance swale and output into the existing drainage feature directly downstream.

Grading and Planting Layout

The wetland feature will be graded to have a varying topography to enhance aquatic species habitat diversity, minimize the opportunity for the establishment of invasive species, and deter waterfowl congregation. The following characteristics will be incorporated:

- Submerged mounds (10-30 cm deep) planted with shallow aquatic vegetation to increase surface area for shallow aquatic vegetation (irregular and narrow shaped);
- Dry mounds (0-10 cm deep) planted with shrubs to discourage establishment of Common Reed (irregular and narrow shaped); and
- A screen of densely planted cattails and wetland shrubs along the eastern limit (linear shaped nodes).

The 10 m treed buffer zone will wrap around the entire created wetland and will be graded to gently slope towards the created wetland. Surface runoff from the buffer zone is expected to be attenuated by woodland vegetation cover provided by planted woody and herbaceous vegetation.

All aquatic vegetation plantings will be clustered into nodes and arranged in a natural-appearing configuration with a diversity of species (i.e., no more than three to five individuals of the same species per node). All buffer zone trees and shrubs are to be planted a minimum of 3 m and 1 m on center, respectively.

Preliminary Species List

The edge of the created wetland will be planted with a dense, but naturalized row of wetland shrubs at the water's edge and a row of cattail within the first 30 cm of water. The remainder of the wetland will be vegetated with wetland shrubs, floating and emergent aquatic plugs, and a native wetland seed mix to create a woodland feature. A preliminary list of native wetland plants is provided in **Table 1**, below. Additional native species may be added or removed to the wetland planting plan at detailed design depending on the findings of the water availability assessment.

The 10 m treed buffer zone will be densely planted with compensation trees along with shrubs, a native woodland seed mix and a nurse crop mix. A preliminary list of native woodland plants is provided in **Table 2** (below). Additional native species will be added to the buffer planting plan at detailed design.

Table 1. Preliminary created wetland plant list

Species	Notes
Shrubs	
Buttonbush (*Cephalanthus occidentalis*)	Plant along wetland edge
Gray Dogwood (*Cornus racemosa*) *	
Red-osier Dogwood (*Cornus sericea*) *	Plant on dry mounds
Heart-leaved Willow (*Salix eriocephala*)	
Pussy Willow (Salix discolor)	
Bebb's Willow (*Salix bebbii*)	
Plugs	
Broad-leaved Cattail (*Typha latifolia)* *	Plant along wetland edge
Swamp Milkweed (*Asclepias incarnata*) **	Plant on dry mounds
Spotted Joe Pye Weed (*Eupatorium maculatum*) **	
Wild Blue Flag (*Iris versicolor*) **	
Common rush (*Juncus effusus*) ***	Plant on submerged mounds
Torrey's Rush (*Juncus torreyi*) ***	
Woolgrass (*Scirpus cyperinus*) ***	
Soft-stemmed Bulrush (*Schoenoplectus tabernaemontani*) *	
Fragrant Water-lily *(Nymphaea odorata)*	Plant 30-60 cm deep
Common Arrowhead (*Sagittaria latifolia*)	
Seed Mix	
1% Bebb's Sedge (*Carex bebbii*)	GEI Custom Meadow Marsh Seed Mix Plant in 0-30 cm of water Seeding should occur in the Fall to promote natural cold stratification.
1% Blue Lobelia (*Lobelia siphilitica)*	
14% Blue Vervain (*Verbena hastata)*	
2% Boneset (*Eupatorium perfoliatum)*	
5% Dark Green Bulrush (*Scirpus atrovirens)*	
25% Fox Sedge (*Carex vulpinoidea)*	
1% Grass Leaved Goldenrod (*Euthamia graminifolia)*	
10% Meadow/Open Field Sedge (*Carex granularis)*	
1% Purple Stemmed Aster (*Symphyotrichum puniceum)*	
5% Soft Rush (*Juncus effusus)*	
2% Spotted Joe Pye Weed (*Eupatorium maculatum)*	
1% Monkey Flower (*Mimulus ringens)*	
2% Stalk Grain Sedge (*Carex stipata)*	
2% Tall Manna Grass (*Glyceria grandis)*	
2% Woolgrass (*Scirpus cyperinus)*	
1% Swamp Milkweed (*Asclepias incarnata)*	
25% Fowl Bluegrass (*Poa palustris)*	
Cover Crop	
100% Annual Oats (*Avena sativa*)	Cover Crop to be added if seeding occurs in the Spring.

*Salt tolerant; **Nectaring plant; *** Pioneer aquatic species

Table 2. Preliminary 10 m treed buffer zone plant list

Species	Notes
Trees: 5% caliper; 95% whips or saplings	
Basswood (*Tilia americana*) *	Plant interspersed within buffer zone
Red Oak (*Quercus rubra*) *	
Shagbark Hickory (*Carya ovata*) *	
Eastern Hop-hornbeam (*Ostrya virginiana*)	
Silver Maple (*Acer saccharinum*)	Plant along wetland edge
Shrubs	
Pin Cherry (*Prunus pensylvanica*) *	Plant interspersed within buffer zone
Wild Red Raspberry (*Rubus idaeus sp. Strigosus*) *	
Bush-honeysuckle (*Diervilla lonicera*) *	
Witch-hazel (*Hammamelis virginiana*) *	
Dotted Hawthorn (*Crataegus punctata*)	
Seed Mix	
20% Virginia Wildrye (*Elymus virginicus var. virginicus)*	GEI Custom Partial Shade Seed Mix Applied October to November
10% Canada Wildrye (*Elymus canadensis)*	
10% Bottlebrush Grass (*Elymus hystix)*	
30%Little Bluestem (*Schizachyrium scoparium var. scoparium)*	
5% Fowl Bluegrass (*Poa palustris)*	
5% Limestone Meadow Sedge (*Carex granularis*)	
5% Aster species (*Symphyotrichum ericoides, S. cordifolium, Eurybia macrophylla)*	
5% Path Rush (*Carex tenuis)*	
5% Pennyslvania Sedge (*Carex pensylvanica)*	
2% Fowl Mannagrass (*Glyceria striata)*	
1% Canade Anemone (*Anemone canadensis)*	
1% Showy Tick-Trefoil (*Desmodium canadense)*	
1% Wild Columbine (*Aquilegia canadensis)*	
Cover Crop	
35% Canada Wild Rye (*Elymus canadensis*)	Cover Crop Mix
25% Annual Oats (*Avena sativa*)	
20% Creeping Bent Grass (*Agrostis stolonifera*)	
20% Red Fescue (*Festuca rubra*)	

*Salt tolerant

4.4 Wildlife Habitat Features

Specialized wildlife habitat structures will enhance ecological functionality within the created wetland. Bush piles and rock piles are proposed to be installed within the 10 m treed buffer zone. The structures should be spaced irregularly a minimum of 60 m apart (GEI 2023a).

4.5 Fencing

Fencing is proposed to be installed along the outer edge of the buffer zone as a deterrence measure to restrict waterfowl from accessing the water and to discourage human engagement/disturbance (GEI 2023a).

4.6 Ecological Monitoring

Construction monitoring will be conducted to ensure the effectiveness of measures and practices designed and implemented to manage impacts during to construction (e.g., maintenance of ESC measures, proper installation of plant, etc.; GEI 2023a).

Post-construction compliance monitoring will be conducted to demonstrate that measures are constructed as designed (i.e., created wetland area and associated buffer) (GEI 2023a).

Post-construction performance monitoring will be conducted to compare the functionality of the created wetland area against the initial baseline monitoring data collected in 2021. It is recommended that a five-year monitoring period from the basis of the post-construction performance monitoring plan. It is expected that monitoring will be conducted in years 1, 2, 3 and 5 within the created wetland area and ecological buffer zone and will commence one growing season after vegetation or other restoration measures are implemented. Performance monitoring surveys will include vegetation (ELC and canopy health), invasive plant species, and planted vegetation (growth rate, survivorship, performance, cover, and node coverage; GEI 2023a).

Adaptive management may be necessary to ensure that performance standards are achieved and to address any unanticipated impacts or deficiencies (i.e., additional vegetation plantings, invasive species management) (GEI 2023a).

Annual monitoring reports will be prepared for each year in which monitoring occurs (i.e., years 1, 2, 3 and 5) to summarize the findings. Annual monitoring reports will be limited to general observations, summary of restoration activities during the monitoring year, recommendations for modifications to the monitoring program, repair/rehabilitation work required, and system design modifications. Milestone reports will be prepared for monitoring rears 3 and 5. Milestone reports will include more detailed commentary on the integrity of the created wetland area and the 10 m treed buffer zone, any perceived trends in the data collected, general performance, as well as a summary of adaptive management approaches (GEI 2023a). Monitoring reports will be provided to the City and NPCA on or before March 1 of each year, covering the monitoring from the previous calendar year (GEI 2023a).

5. EXAMPLE OF A SUCCESSFUL WETLAND COMPENSATION PROJECT

GEI has completed numerous successful wetland restoration projects across Southern Ontario. The Sandalwood Wetland in Brampton is an example of a wetland compensation project which demonstrates that terrestrial, aquatic, hydrological, and hydrogeological features and functions can be re-created and enhanced. This project has since been highlighted by Society for Ecological Restoration (SER) Ontario Chapter and has won several awards including the International Making Cities Livable Award (2013), Brampton Urban Design Award (2012) for Best Overall Project – Mount Pleasant Village New Neighbourhood, and the Brampton Award of Merit (2012) for Healthy and Sustainable Development.

Photolog 2, Appendix B (Photo 1) depicts Racetrack Pond wetlands prior to removal. Detailed ecological studies (terrestrial and aquatic ecology, hydrology, hydrogeology) were completed for the Racetrack Ponds area between 2006 and 2011. GEI subsequently assisted with the design of the new wetland. **Photolog 2, Appendix B** (Photo 2, Photo 3, and Photo 4) depicts the new wetland, termed the Sandalwood Wetland, built east of the Racetrack Pond wetlands within the Natural Heritage System to compensate for the removal of the Racetrack Pond wetlands.

The Sandalwood Wetland was designed with full consideration for the existing wetland's features and functions as well as agency requests to maintain the natural topography and a specific outlet location. The Sandalwood Wetland replicated the wetland type and enhanced vegetation types, hydrological conditions, wildlife habitat, connectivity, regional and site biodiversity, hydrogeology, as well as aquatic communities/fish habitat. These wetlands were also considered contributing Redside Dace habitat.

Within five years of ecological monitoring, the Sandalwood Wetland was considered a successful wetland restoration project. The wetland was assessed by the Ministry of Natural Resources and Forestry (MNRF) and designated as a Provincially Significant Wetland, thus confirming that the created wetland provides significant ecological functions.

6. CONCLUSION

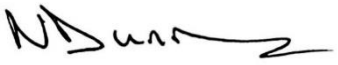
This preliminary wetland design provides wetland and tree compensation requirements as well as concept level details to create a 1.11 ha wetland with a 10 m treed buffer zone (0.88 ha) within the Subject Lands. The preliminary wetland design was prepared based on design considerations and limitation obtained from relevant environmental studies completed by the project team. Further studies, such as a water balance and water availability assessment, will be needed for detailed design.

The restoration goal for this project is to replicate the area and functions of the existing wetland while increasing overall ecological functions. The ecological restoration objectives for the created wetland and associated buffer include deterring the establishment of invasive plant species, create floristically diverse and resilient vegetation communities that will support a variety of native fauna, stabilize soils through the application of an annual cover crop seed mix applied in conjunction with native perennial seed mixes, include nectaring plants and Milkweed species within groundcover planting areas to attract/support local insect populations, and provide wildlife habitat structures for a variety of wildlife to increase breeding, foraging and refugia opportunities. As summarized above, these ecological restoration objectives will be met.

We trust that this preliminary wetland design demonstrates the vision and opportunities for the created wetland and associated buffer all while emphasizing the feasibility to create a successful wetland feature within a developed landscape.

If you have any questions, please contact one of the undersigned.

Yours truly,
GEI Consultants



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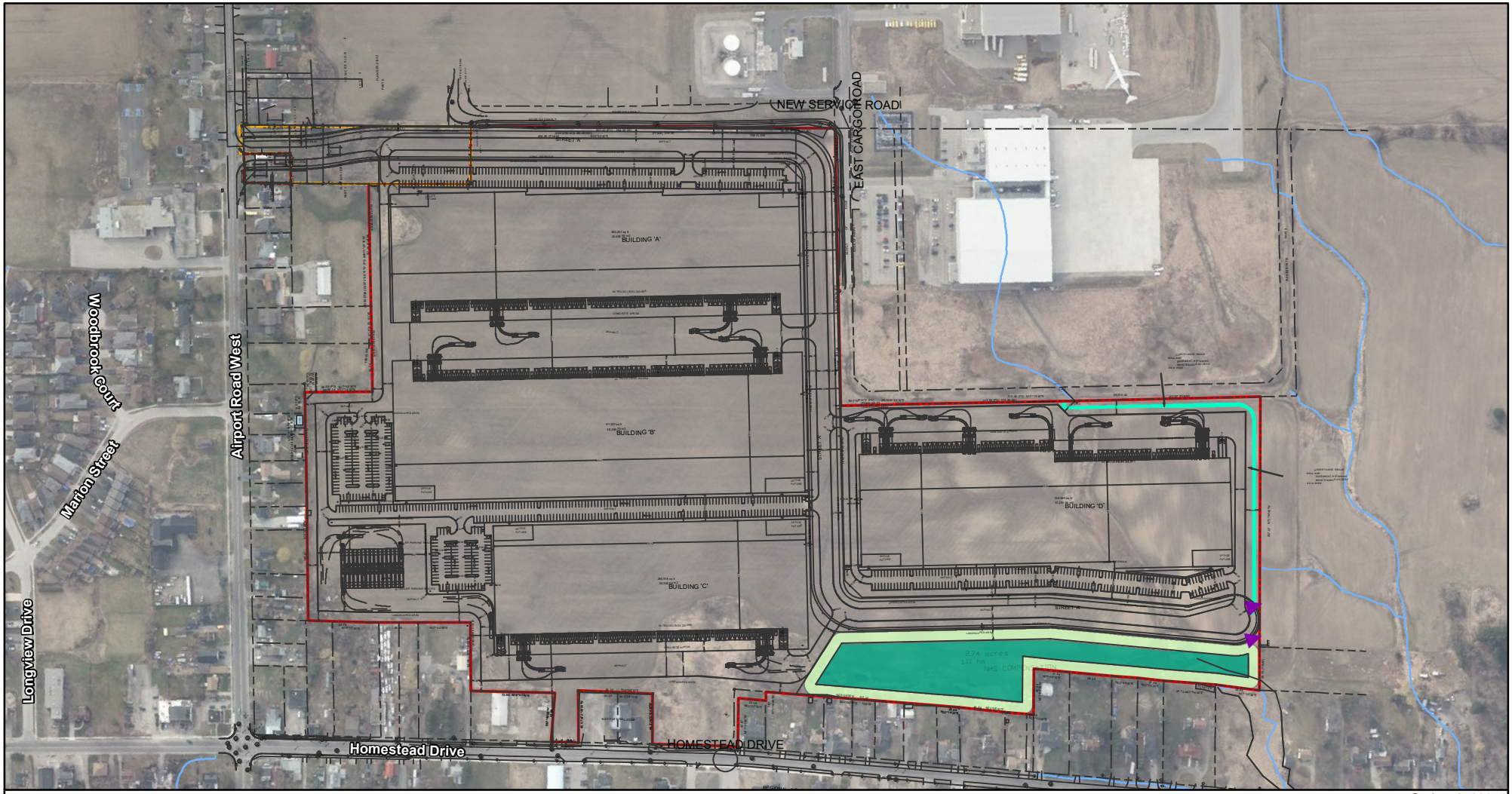
Appendix A

Figure 1: Subject Lands with Concept Plan

Figure 2: Existing Wetlands and Inventoried Trees



Project 2100017

NOTES:

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023; © Niagara Peninsula Conservation Authority, 2023.
3. Orthoimagery © First Base Solutions, 2023. Imagery taken in 2019.
4. Concept Plan:'413-21-Concept Plan-2023-07-04.dwg'

Legend

- 3054 Homestead Drive
- 9174 Airport Road
- 9166 Airport Road
- Watercourse (NPCA)
- Created Wetland Area (1.11 ha)
- Vegetated Buffer from Created Wetland Area (10 m)
- Conveyance Swale
- Culvert

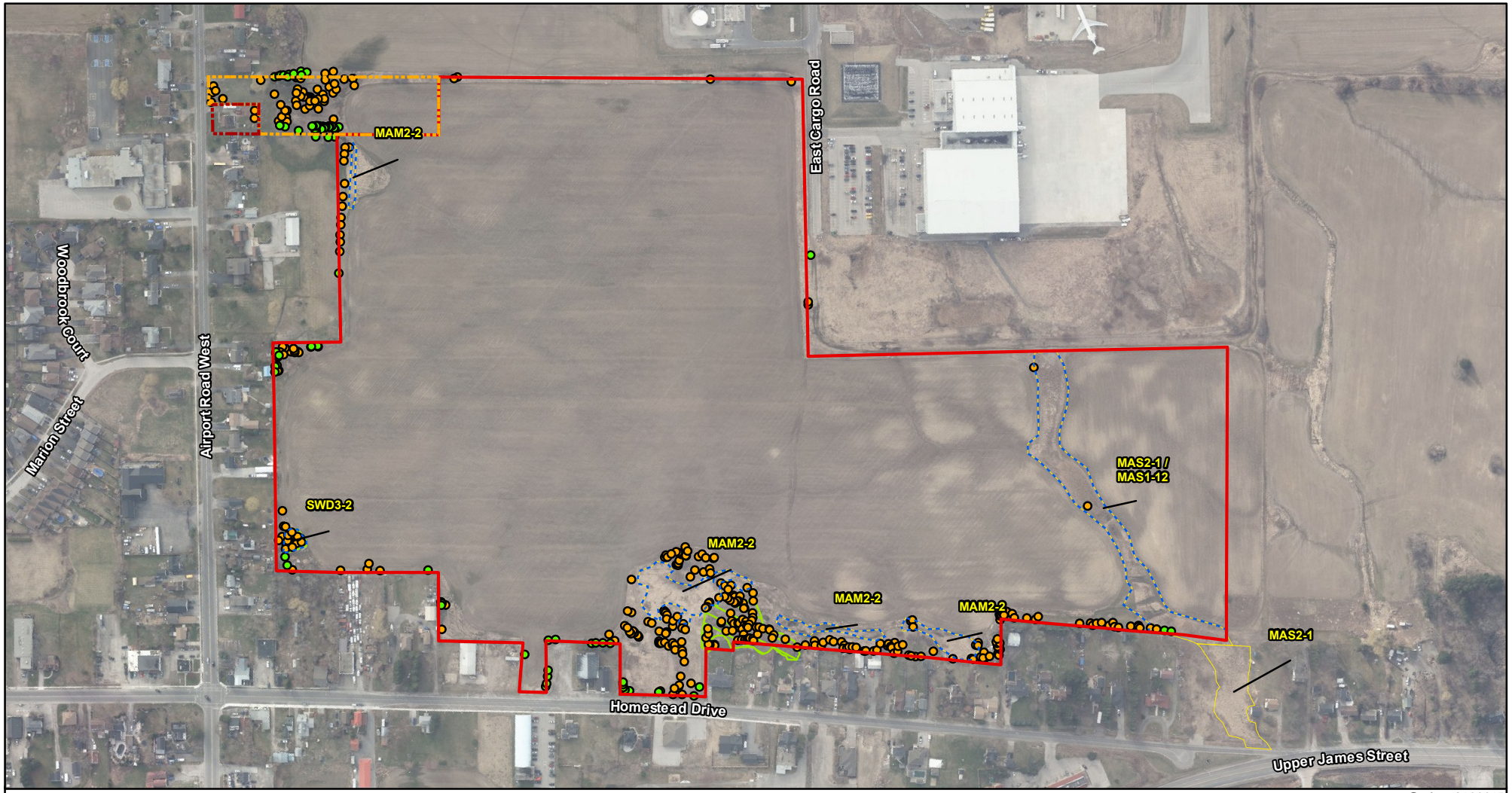
Homestead Environmental Impact Study
Preliminary Wetland Design
Fengate Asset Management

Figure 1
Subject Lands and Concept Plan

0 50 m
1:5,000

N

GEI Consultants



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Legend

- 3054 Homestead Drive
- 9174 Airport Road
- 9166 Airport Road
- Staked Wetland (August 6, 2021)
- Ecological Land Classification
- Woodland (per 2021 ELC)

Tree Inventory

- Preserve
- Removal

ELC Legend

MAM2-2, Reed-canary Grass Mineral Meadow Marsh
MAS2-1 / MASM1-12, Cattail Mineral Shallow Marsh/Common Reed Mineral Shallow Marsh
MAS2-1, Cattail Mineral Shallow Marsh
SWD3-2, Silver Maple Mineral Deciduous Swamp

Project 2100017

Homestead Environmental Impact Study
Preliminary Wetland Design
Fengate Asset Management

Figure 2
Existing Wetlands and Inventoried Trees

0 50 m
1:5,000

N

GEI Consultants

Appendix B

Photolog 1: Existing Wetland Vegetation Communities

Photolog 2: Example Wetland Compensation Project

Photolog 1: Existing Wetland Vegetation Communities

Photo 1. Reed Canary Grass Mineral Meadow Marsh (MAM2-2) near Airport Road West with an abundance of invasive Purple Loosestrife. Photo taken August 2023 (GEI).

Photo 2. Silver Maple Mineral Deciduous Swamp (SWD3-2) with debris and trash scattered throughout. Photo taken August 2023 (GEI).

Photo 3. Reed Canary Grass Mineral Meadow Marsh (MAM2-2) near Homestead Drive with debris and trash. Photo taken August 2023 (GEI).

Photo 4. Reed Canary Grass Mineral Meadow Marsh (MAM2-2) near Homestead Drive with more debris, trash, and disturbance from ATV tracks. Photo taken August 2023 (GEI).

Photo 5. Cattail Mineral Shallow Marsh with a complex of smaller areas characterized as Common Reed Mineral Shallow Marsh (MAS2-1/MAS1-12) showing presence of invasive Common Reed. Photo taken August 2023 (GEI).

Photo 6. Cattail Mineral Shallow Marsh with a complex of smaller areas characterized as Common Reed Mineral Shallow Marsh (MAS2-1/MAS1-12) showing remnant disturbance from an old farm crossing. Photo taken August 2023 (GEI).

Photo 7. Potential contaminants observed within flow being discharged from the Airport Lands. Photo taken within the MAS2-1/MAS1-12 during the August 2021 site visit with NPCA. Photo taken August 2021 (GEI).

Photo 8. Potential contaminants observed within flow being discharged from the Airport Lands. Photo taken within the MAS2-1/MAS1-12 during subsequent visit in August 2023. Photo taken August 2023 (GEI).

Photolog 2: Example Wetland Compensation Project

Photo 1. Racetrack Pond wetlands prior to removal. Orthophoto take Fall 2006 (City of Brampton)

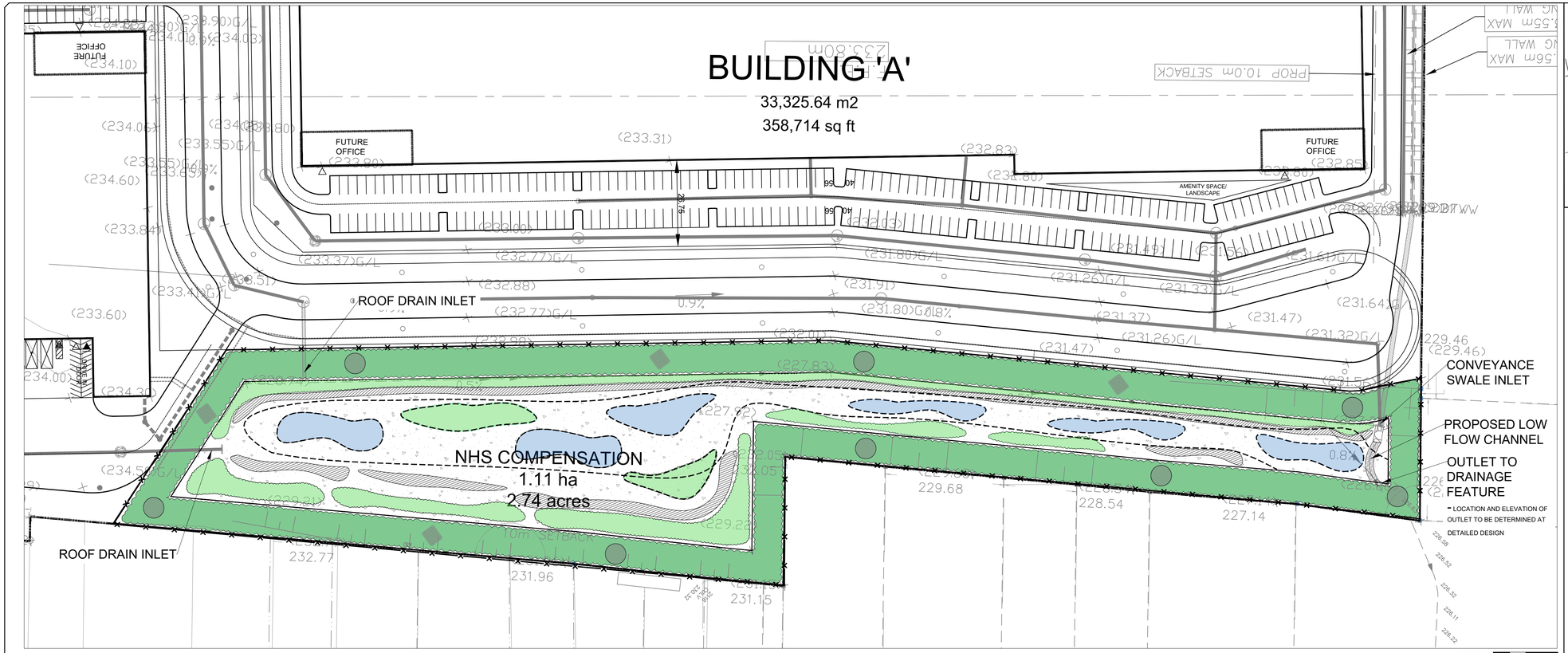
Photo 2. Photo monitoring station. Photo taken Summer 2015 (GEI)

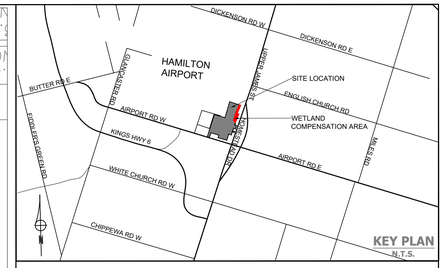
Photo 3. Created Sandalwood Wetland. Orthophoto taken Fall 2022 (City of Brampton)

Photo 4. Photo monitoring station. Photo taken Summer 2018 (GEI)

Appendix C

Drawing 1: Conceptual Wetland Compensation Design (WL-1)





LEGEND

- PROPOSED CONTOUR LINES
- PROPOSED 1.2M HIGH CHAIN LINK FENCE AT COMPENSATION AREA LIMIT
- PROPOSED UPLAND PLANTING/ COMPENSATION TREE PLANTING AREA* AND UPLAND SEED MIX
- PROPOSED SHRUB THICKET WETLAND PLANTINGS
- PROPOSED SHALLOW AQUATIC WETLAND PLANTINGS ON SUBMERGED DEPRESSIONS 10-30CM DEEP
- PROPOSED SHRUB THICKET WETLAND PLANTINGS ON ELEVATED MOUNDS 0-10CM HIGH
- PROPOSED CATTAIL PLANTINGS
- PROPOSED WETLAND SEED MIX
- BRUSH PILE HABITAT FEATURES
- ROCK PILE HABITAT FEATURES

UPLAND PLANT LIST

TREES: 5% Caliper, 95% Whips or Saplings					
KEY	SCIENTIFIC NAME	COMMON NAME	QUANTITY OF TREES 150 CM HEIGHT, 3 GALLON POTTED	QUANTITY OF TREES 40 MM CALIER	SPACING
Deciduous Trees					
AS	*Acer saccharinum*	Silver Maple	75	0	3-5m O.C.
CO	*Carya ovata*	Shagbark Hickory*	65	6	3-5m O.C.
OV	*Ostrya virginiana*	Eastern Hop-hornbeam	65	0	3-5m O.C.
QR	*Quercus rubra*	Red Oak *	65	5	3-5m O.C.
TA	*Tilia americana*	Basswood*	66	6	3-5m O.C.
Total			336	17	

Species	Notes
Shrubs	
Pin Cherry (*Prunus pensylvanica*) *	Plant interspersed within buffer zone
Wild Red Raspberry (*Rubus idaeus sp. Strigosus*) *	
Bush-honeysuckle (*Diervilla lonicera*) *	
Witch-hazel (*Hammamelis virginiana*) *	
Dotted Hawthorn (*Crataegus punctata*)	
Seed Mix	
20% Virginia Wildrye (*Elymus virginicus var. virginicus*)	GEI Custom Partial Shade Seed Mix Applied October to November
10% Canada Wildrye (*Elymus canadensis*)	
10% Bottlebrush Grass (*Elymus hystix*)	
30%Little Bluestem (*Schizachyrium scoparium var. scoparium*)	
5% Fowl Bluegrass (*Poa palustris*)	
5% Limestone Meadow Sedge (*Carex granularis*)	
5% Aster species (*Symphyotrichum ericoides, S. cordifolium, Eurybia macrophylla*)	
5% Path Rush (*Carex tenuis*)	
5% Pennyslvania Sedge (*Carex pensylvanica*)	
2% Fowl Mannagrass (*Glyceria striata*)	
1% Canade Anemone (*Anemone canadensis*)	
1% Showy Tick-Trefoil (*Desmodium canadense*)	
1% Wild Columbine (*Aquilegia canadensis*)	
Cover Crop	
35% Canada Wild Rye (*Elymus canadensis*)	Cover Crop Mix
25% Annual Oats (*Avena sativa*)	
20% Creeping Bent Grass (*Agrostis stolonifera*)	
20% Red Fescue (*Festuca rubra*)	

*SALT TOLERANT

UPLAND PLANTINGS:

- TREES AT 3-5M O.C. SHRUBS AT 1M O.C.
- 3 SHRUBS PLANTED FOR EVERY TREE

WETLAND PLANT LIST

Species	Notes
Shrubs	
Buttonbush (*Cephalanthus occidentalis*)	Plant along wetland edge
Gray Dogwood (*Cornus racemosa*) *	
Red-osier Dogwood (*Cornus sericea*) *	Plant on dry mounds
Heart-leaved Willow (*Salix eriocephala*)	
Pussy Willow (Salix discolor)	
Bebb's Willow (*Salix bebbii*)	
Plugs	
Broad-leaved Cattail (*Typha latifolia*) *	Plant along wetland edge
Swamp Milkweed (*Asclepias incarnata*) **	Plant on dry mounds
Spotted Joe Pye Weed (*Eupatorium maculatum*) **	
Wild Blue Flag (*Iris versicolor*) **	
Common rush (*Juncus effusus*) ***	Plant on submerged mounds
Torrey's Rush (*Juncus torreyi*) ***	
Woolgrass (*Scirpus cyperinus*) ***	
Soft-stemmed Bulrush (*Schoenoplectus tabernaemontani*) *	
Fragrant Water-lily (*Nymphaea odorata*)	Plant 30-60 cm deep
Common Arrowhead (*Sagittaria latifolia*)	
Seed Mix	
1% Bebb's Sedge (*Carex bebbii*)	GEI Custom Meadow Marsh Seed Mix Plant in 0-30 cm of water Seeding should occur in the Fall to promote natural cold stratification.
1% Blue Lobelia (*Lobelia siphilitica*)	
14% Blue Vervain (*Verbena hastata*)	
2% Boneset (*Eupatorium perfoliatum*)	
5% Dark Green Bulrush (*Scirpus atrovirens*)	
25% Fox Sedge (*Carex vulpinoidea*)	
1% Grass Leaved Goldenrod (*Euthamia graminifolia*)	
10% Meadow/Open Field Sedge (*Carex granularis*)	
1% Purple Stemmed Aster (*Symphyotrichum puniceum*)	
5% Soft Rush (*Juncus effusus*)	
2% Spotted Joe Pye Weed (*Eupatorium maculatum*)	
1% Monkey Flower (*Mimulus ringens*)	
2% Stalk Grain Sedge (*Carex stipata*)	
2% Tall Manna Grass (*Glyceria grandis*)	
2% Woolgrass (*Scirpus cyperinus*)	
1% Swamp Milkweed (*Asclepias incarnata*)	
25% Fowl Bluegrass (*Poa palustris*)	
Cover Crop	
100% Annual Oats (*Avena sativa*)	Cover Crop to be added if seeding occurs in the Spring.

*Salt tolerant; **Nectaring plant; *** Pioneer aquatic species

WETLAND PLANTINGS:

- SHRUBS AT 1M O.C.

WETLAND DESIGN IS CONCEPTUAL. GRADING TO BE REFINED DURING DETAILED DESIGN.

*353 TREES ARE REQUIRED TO COMPENSATE FOR REMOVALS AS PER GEI'S 2023 ARBORIST REPORT. REPORT TO BE UPDATED.

No.	REVISION	DATE	BY
5			
4			
3			
2			
1	ISSUED FOR REVIEW	2023/08/15	NC

FENGATE ASSET MANAGEMENT

NOT FOR CONSTRUCTION UNLESS SIGNED & DATED

GEI Consultants

3054 HOMESTEAD DR, 9166 AIRPORT RD & 9174 AIRPORT RD

CONCEPTUAL WETLAND COMPENSATION DESIGN

DESIGNED BY: NC	CHECKED BY: ND	PROJECT No.: 2100017	
DRAWN BY: NC	DATE: 15 August 2023	FIGURE No.: WL-1	