Wildfield Village Secondary Plan
Caledon
Local Subwatershed Study
Phase 2 Report
Analysis and Impact Assessment

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1.0 Introduction

Wildfield Village is located within the Region of Peel, in the Town of Caledon, within the Region's Urban Boundary. The Wildfield Village Secondary Plan Area was identified by the Region of Peel through their Settlement Area Boundary Expansion (SABE) Study as "New Community Area". The SABE Study informed the Region of Peel Official Plan, 2022, which designates the Secondary Plan Area as "2051 New Urban Area" In conformity, the Future Caledon Official Plan also designates the Secondary Plan Area as "2051 New Urban Area" and "New Community Area". These lands are intended to be developed for residential purposes including associated roads, infrastructure, utilities, institutions, retail, parks and open space.

1.1 Purpose

This Local Subwatershed Study (LSS) has been prepared by SCS Consulting Group Ltd. (SCS) and GEI Consultants Inc. (GEI) in support of the Secondary Plan for Wildfield Village. Per Town of Caledon correspondence (Cassie Schembri, Town of Caledon, March 28, 2024), the intent of the LSS is to "develop a sustainable development plan for the subject growth area in Caledon by protecting and enhancing the natural and human environments through the implementation of the direction, targets, criteria and guidance of the Region of Peel Scoped Subwatershed Study (SWS) prepared by Wood (2022). The LSS will confirm, refine and implement a Natural Heritage System (NHS) and the water resource management approach that will protect, rehabilitate, and enhance the natural and water-based environments within the Secondary Plan area, and the surrounding lands in the subwatershed."

This LSS has been prepared in accordance with the approved Terms of Reference dated August 23, 2024 (refer to **Appendix A1**). The LSS will address a range of environmental and servicing matters associated with the Wildfield Village Secondary Plan (WVSP) area, including the protection and management of surface water, groundwater, fluvial geomorphology, and terrestrial and aquatic resources. The LSS will also identify the NHS and municipal servicing needs, including stormwater management, sanitary and water servicing and site grading requirements.

The LSS serves to:

- Address the relevant natural features and functions identified in the Provincial Planning Statement (PPS; MMAH 2024), Region of Peel Official Plan, and Town of Caledon Official Plan;
- Provide the foundation for the layout of the Secondary Plan by defining and delineating elements such as the NHS, transportation and servicing networks, and the location of stormwater management (SWM) facilities;

- Follow the direction and guidance of the Region of Peel Scoped SWS (Wood., 2022) confirming targets and criteria based on site specific data obtained through the Secondary Plan level study; and,
- Define measures to protect and/or enhance the NHS.

The LSS will be completed in three phases as follows:

- Phase 1 – Characterization of Existing Conditions and Baseline Inventory
- Phase 2 - Analysis and Impact Assessment
- Phase 3 - Mitigation, Implementation, Monitoring and Adaptive Management

This report fulfills the requirements of the Phase 2 LSS. As the Secondary Plan process proceeds, this report will be amended to include future Phase 3, in addition to incorporating revisions to the Phase 1 and 2 reports to address agency comments. The purpose of the current Phase 2 report is to introduce the land use plan, and provide an assessment of the potential for impacts on natural heritage features and functions, as well as on groundwater and surface water that might result from the proposed development.

1.2 Study Area

The WVSP area is approximately 358.1 hectares (ha) in size, and is located in the Town of Caledon, and the Region of Peel. The WVSP area is bound by Centreville Creek Road to the west, Mayfield Road to the south, the planned Highway 413 Transportation Corridor to the north and the limits of the Greenbelt Plan to the east, with the West Humber River beyond that. Refer to **Figure 1.1** in **Appendix A2** for the location of the Secondary Plan area. The Natural Heritage Study Area (NHSA) consists of the WVSP area plus the 120 m adjacent lands to study and assess natural heritage features.

Figure 1.2 (**Appendix A2**) shows the ownership for the WVPS area with approximately 57% of the lands owned by parties participating in the LSS and the Secondary Plan process.

1.3 Land Use Plan

Per the Planning Justification and Housing Assessment Report (PJR) prepared by SGL Planning and Design (2024), the proposed Land Use Plan includes a mixed-use high-density Neighbourhood Centre and three Urban Corridors which are envisioned to develop with a mix of uses, mid-rise apartments, townhouses and neighbourhood-oriented uses. The majority of the WVSP area has been designated as Neighbourhood Area with various ground related housing types, parks, schools and other institutional uses planned. The Land Use Plan also protects for a preliminary Natural Heritage System (NHS), as described in Section 2.5 of the Phase 1 LSS (SCS and GEI, November 2024).

The proposed land use for the WVSP is provided here as **Figure 1.3** in **Appendix A2**. The Land Use Plan includes mixed use and residential development, collector roads, elementary schools, parks, environmental features and SWM facilities. Parks, schools and SWM facilities are shown as symbols on the proposed land use plan (**Figure 1.3, Appendix A2**). For additional land use information, refer to the PJR (SGL Planning, 2024). SWM facilities will be discussed in more detail in the Phase 3 LSS.

The process of developing the Land Use Plan was iterative with input from planners, engineers, ecologists and hydrogeologists. The plan reflects the Future Caledon Official Plan Town Structure and its identification of a Neighbourhood Centre, Urban Corridors, as well as a network of collector roads. The plan was established based on a comprehensive review and analysis of planning, transportation, servicing and SWM needs while protecting for natural features and hazards within the NHS. Refer to the PJR (SGL Planning, 2024) and the Wildfield Community Transportation Study (WCTS) prepared by BA Group (2024) for the planning and transportation analysis, respectively. The servicing needs are further detailed in Section 5.0 of this Phase 2 LSS, with the NHS previously established in Section 2.5 of the Phase 1 LSS (SCS and GEI, November 2024) and SWM needs to be discussed in the future Phase 3 LSS.

2.0 Natural Heritage Features and Hazards

This section of the Phase 2 LSS assesses the potential impacts on the natural heritage features and functions that could result from the implementation of the proposed land use plan (**Figure 1.3, Appendix A2**), as well as climate change.

Impacts from land use changes will be considered in two categories:

- **Direct**: impacts associated with the removal or modification of natural features as a result of land use changes.
- **Indirect**: associated with impacts to less visible functions or pathways that could cause negative impacts to natural heritage features over time.

An analysis of existing natural features in the Natural Heritage Study Area (NHSA) was completed as part of the Phase 1 LSS (SCS and GEI, November 2024), including an evaluation of their significance against criteria recommended in the Natural Heritage Reference Manual (NHRM; MNR 2010) and in the Significant Wildlife Habitat Criteria Schedules for Ecoregions 6E and 7E (MNRF 2015).

These analyses identified the following significant natural heritage features as present, on, or within 120 m, of the NHSA (**Figure 2.1, Appendix B1**):

- Significant Wetland;
- Significant Woodlands;
- Candidate Significant Valleyland;
- Fish Habitat;
- Habitat of endangered and threatened species (Redside Dace, Bobolink, Eastern Meadowlark and candidate SAR bat); and,
- Significant Wildlife Habitat including:
    - Seasonal Concentration Areas of Animals (Candidate Bat Maternity Colonies, Candidate Bald Eagle and Osprey Habitat and confirmed Turtle Overwintering Areas); and,
    - Species of Conservation Concern (Terrestrial Crayfish and Wood Thrush).

A Natural Heritage System (NHS) is made up of a diversity of ecological components; not all those natural features and associated ecological functions merit a significance designation at a provincial scale. However, there are features that merit consideration as important at a local scale. The Phase 1 LSS characterization identified the following additional natural heritage features and functions in the NHSA which are addressed in this Phase 2 impact assessment (**Figure 2.1, Appendix B1**):

- Unevaluated and Other Wetlands;
- Other Woodlands.

Section 2.5 of the Phase 1 LSS (SCS and GEI, November 2024) identifies a preliminary NHS for the NHSA, comprised of retained natural heritage features and appropriate compensation for proposed natural features removal.

2.1 Potential Terrestrial Impacts

2.1.1 Woodlands

Two significant woodlands occur in the NHSA. One is a Cultural Woodland (CUW1) located adjacent to a Silver Maple Deciduous Swamp (SWD3-2; significant wetland) in the south-central portion of the NHSA. The other woodland, a Forest (FO) and Cultural Woodland (CUW) is associated with the West Humber River valley east of The Gore Road (**Figure 2.1, Appendix B1**). The majority of this woodland is within the Greenbelt Plan Area.

The CUW1/SWD3-2 was designated as significant due to being greater than 0.5 ha in size, proximity (within 30 m) to the adjacent wetland community and having confirmed significant species (Wood Thrush [Special Concern]). This significant woodland will not be altered and will be protected by a 10 m buffer from the dripline; this buffer width has been demonstrated to provide adequate root protection for woodland communities (Carolinian Canada, 2003), and native plantings within these buffers will help insulate significant woodlands against potential impacts of land use changes. To protect roots and prevent negative impacts to tree health, any required site grading is recommended to be limited within the 10 m woodland buffer. Where grading cannot be avoided, additional mitigative measures such as tree protection hoarding, and timely restoration of impacted areas are recommended.

The other significant woodland (FO/CUW) occurs with the 120 m adjacent lands, in the south-east portion of the NHSA, and is associated with the valley surrounding the West Humber River. The FO/CUW was designated as significant due to being greater than 4 ha, proximity (within 30 m) to a watercourse and having candidate significant species and communities (bat maternity colonies, Bald Eagle and Osprey habitats). The West Humber River also provides occupied habitat for Redside Dace. Most of this woodland is located within the Greenbelt Plan Area where it is afforded a 30 m buffer; the majority of this buffer also falls within the Greenbelt Plan Area.

As noted previously, woodland features within the NHSA are being retained. Potential direct impacts to all retained woodland communities may include:

- Edge effects associated with the tree removal (e.g., sunscald, windthrow, increased light penetration); and,
- Impacts associated with site grading and machinery (e.g., tree root damage/loss; change in drainage to/from woodland, soil compaction, invasive species colonization, stress/dieback).

Indirect impacts because of disturbance within or immediately adjacent to the woodlands could include changes to drainage post-development (whereby overland flow contributions to woodland or its buffer are reduced or increased), noise and light disturbance, as well as the introduction of invasive and non-native plants along the disturbed margins of the development footprint.

Further design considerations to mitigate these direct and indirect impacts will be considered in site specific EIS work at the Draft Plan of Subdivision stage. These may include, but are not limited to the following:

- Tree protection fencing and Erosion and Sediment Control (ESC) measures should be installed adjacent to all retained trees at the edge of the buffer zone to mitigate against excessive disturbance caused by proposed vegetation removals, ground disturbance and dislodgement of sediment. This will also protect the integrity of the NHS and aide in preventing adverse effects from ground disturbance.
- Construction activities adjacent to the retained woodlands should be timed outside of the evening and early morning periods during the bat breeding seasons (March 15 to November 30). Some localized movement of wildlife out of these edge areas may still occur during the construction phase; however, refuge habitats exist within the broader landscape.
- New lighting should be directed away from woodlands to reduce impacts to wildlife. Fencing and other barriers should be considered to limit the effects of noise and light on wildlife, particularly adjacent to roadways.
- Construction equipment should be regularly cleaned to reduce the potential for transportation of invasive material within and outside of the site.
- To slow the spread of invasive species, such as Emerald Ash Borer (Agrilus planipennis) and American Beech scale insects (Cryptococcus fagisuga) and American Beech fungus (Neonectria faginata) (amongst others), all trees should be disposed of locally to reduce transportation to other local municipalities; and,
- Restore affected areas and naturalize adjacent buffers with native vegetation.

Provided recommended mitigation measures and buffers are put in place, no negative impacts to significant woodlands and other woodlands are predicted.

2.1.1.1 Climate Change Impacts to Woodlands

Woodlands face several climate stressors that threaten their health and ecosystem services. The increase in the frequency and intensity of extreme weather events can damage urban trees, reducing canopy cover and leading to a loss of critical ecosystem goods and services such as air purification, water regulation, and cooling. Higher average temperatures and more frequent hot days over 30°C contribute to increased tree mortality, resulting in decreased shade and protection from heat. Additionally, rising temperatures and altered precipitation patterns cause shifts in eco-regions, which create conditions favorable for invasive species to thrive, further compromising woodland health. These impacts collectively reduce the resilience of woodlands, diminishing their ability to mitigate climate change and support biodiversity.

The retention of all woodland features within the NHSA, combined with the implementation of buffers, enhances the overall climate resilience of these woodlands. The design considerations noted above also play a critical role in mitigating potential impacts. By safeguarding the structural integrity and ecological functions of woodlands, these strategies support the continued provision of vital ecosystem services, such as carbon storage, temperature regulation, and habitat for biodiversity. In turn, healthy, intact woodlands are better equipped to adapt to and mitigate the effects of climate change, enhancing overall climate resilience for the surrounding environment and communities.

2.1.2 Wetlands

2.1.2.1 Wetland Characterization and Evaluation

GEI assessed all wetlands with an area greater than 2 ha using the current Ontario Wetland Evaluation System (OWES) protocol (MNRF 2022) and determined that one wetland (wetland 8_9; SWD3-2 in the south-central portion of the NHSA; **Figure 2.1, Appendix B1**) met the criteria for significance. The OWES wetland evaluation reporting and mapping will be submitted to the Town under separate cover.

All other wetland communities are either too small (<2 ha) to meet the OWES size criteria or were evaluated as other wetlands (non-significant). The following other wetland communities are identified within the NHSA, and numbered on **Figure 2.1** (**Appendix B1**):

- Cattail Mineral Shallow Marsh-MAS2-1 (wetlands 2,3,5,6)
  - Locally rare plant species: Pennsylvania Smartweed (*Persicaria pensylvanic*a; R3), Peach-Leaved Willow (*Salix amygdaloides*; R6) and Eastern Mannagrass (G*lyceria septentrionalis var. septentrionalis*; R2)
  - No calling amphibians or low species abundances reported.
- Reed Canary Grass Mineral Meadow Marsh-MAM2-2 (wetland 4, 12, 13)
  - Locally rare plant species: Tall Beggarticks (*Bidens vulgata*; R1), Pennsylvania Smartweed, Common Bedstraw (*Galium aparine*; R4) and Peach-Leaved Willow
  - No calling amphibians or low species abundances reported.
- Reed Canary Grass Mineral Meadow Marsh/ Disturbed-MAM2-2/DIST (wetland 7)
  - Made up of common and secure (S5 and S4) vegetation species

    - No calling amphibians
- Mineral Meadow Marsh-MAM2 (wetland 14, 17)
    - Made up of common and secure (S5 and S4) vegetation species
    - No calling amphibians
- Reed Canary Grass Mineral Meadow Marsh/ Forb Mineral Meadow Marsh-MAM2-2/MAM2-10 (wetland 10_11)
    - Locally rare plant species: Tall Beggarticks, Pennsylvania Smartweed, Common Bedstraw, Peach-Leaved Willow and Sandbar Willow (Salix interior; R5)
    - No calling amphibians

Wetlands on non-participating lands consist of small (usually much smaller than 0.5 ha), secluded features in an agricultural and residential land use setting, generally comprised of Meadow Marsh and Shallow Marsh wetland types. These wetlands will need to be evaluated under OWES in future studies. For this LSS, these wetlands are anticipated to be removed, pending future studies.

2.1.2.2 Wetland Hydrology

GEI conducted pre-development wetland surface water and groundwater monitoring. The results indicate that the participating wetlands are primarily surface water driven features, although there is potential for seasonal interflow (shallow subsurface lateral flow) during the spring.

2.1.2.3 Groundwater Impacts on Wetlands

The dependence of retained wetlands 8_9, 10_11, 33 and 34 (**Figure 2.1, Appendix B1**) on groundwater baseflow is minimal. Subsurface investigation has revealed that soils of low hydraulic conductivity predominate across the NHSA, and groundwater monitoring has indicated that prevalent vertical gradients are downward (i.e., recharge gradients) and lateral gradients are generally low in magnitude, similar to topographic slopes. Notable instances of apparent upward vertical gradients were observed at monitoring well MW28S/D. Based on the stratigraphy encountered at that monitoring well, it appears that the shale bedrock underlying the till may exhibit artesian conditions in some locations, depending on ground elevation. However, the potential seepage contributions to surface water remain attenuated by the low hydraulic conductivity of the intervening soils, and of the low transmissivity of the shale itself.

In combination, these factors indicate that the potential groundwater seepage to features is generally low. Therefore, impacts to wetlands from an annual infiltration deficit would be anticipated to be minor. Regardless, to mitigate any impacts from an annual infiltration deficit, the sizing, configuration and location of potential LID infiltration practices are to be evaluated and developed as part of studies completed in support of future Draft Plan of Subdivision applications. Provided the LIDs are designed and implemented to achieve pre-development infiltration targets as part of the overall water balance (refer to **Section 3.2** below), the individual wetlands are predicted to generally achieve pre-development infiltration volumes. As such, it is anticipated that no indirect effects associated with groundwater contributions to the wetlands will occur if these mitigative measures are designed and implemented appropriately. Additional discussion on LID measures will be provided in the Phase 3 LSS as part of the overall SWM strategy for the WVSP area.

Changes to groundwater quality would be expected from human activities such as road salting, minor fuel and oil leaks, fertilizer application etc. Best management practices should be considered when applying salt, fertilizers etc. to minimize their application and limit changes to groundwater. Spills and leaks must be contained and remediated as soon as possible to limit damage to the environment. Provided that groundwater infiltration and best management practices can be achieved as predicted, no negative impacts to groundwater on local or significant wetlands are expected.

2.1.2.4 Surface Water Impacts on Wetlands

Wetlands in the NHSA are hydrologically supported by surface water inputs, such as direct precipitation, runoff, and interflow in the shallow weathered soils above the silt-clay till. Potential impacts to surface water contributions due to the proposed land use could include a degradation of surface water quality or change in water quantity contribution to support the health of the wetland systems. For example, the proposed development will result in increase in imperviousness across much of the NHSA and would also disrupt existing interflow patterns due to grading and the construction of services and building foundations (which may create alternate preferential flow paths). These effects would lead to an increase in peak storm flows and a general increase in overall runoff, which in turn may result in increased erosion.

Stormwater management design will therefore seek to mitigate erosion through the implementation of appropriate SWM facilities (to attenuate peak storm flows) and LID features (to mitigate changes to overall runoff or recharge). These goals are especially important to meet within the catchment areas of features that are to be retained (i.e., wetlands 8_9, and 33, 34, 10_11). Refer to **Section 4.3**, below, for the feature based water balance assessment for these wetlands.

The proposed development will also introduce sources of contaminants (e.g., road salt, oil and grease residues, heavy metals) from roadway runoff. To mitigate impacts of any quality concerns with surface water runoff into wetland features, end-of-pipe water quality treatment of stormwater runoff will be designed to provide 'Enhanced' protection of receiving waters that would contribute to wetland hydrology in accordance with Ministry of Environment (2003) requirements. Stormwater management design will also be required to provide appropriate water quantity retention through the implementation of LID measures. The SWM strategy for the WVSP area, encompassing quantity, quality and erosion control will be further detailed in the Phase 3 LSS.

Provided that surface water volume and quality contributions to the significant and other wetlands are managed as per anticipated stormwater management approaches and LID Best Management Practices, no negative impacts to wetlands associated with surface water runoff are expected.

2.1.2.5 Proposed Wetland Relocation and Removal and Compensation

Nine (9) other (non-significant) wetlands on participating lands are proposed for relocation or removal to accommodate the proposed land use plan (**Figure 1.3, Appendix A2**). No significant wetlands are proposed for removal.

The wetlands proposed for relocation or removal (wetlands 2, 3, 4, 5, 6, 7, 13, 14 and 17, shown on **Figure 2.1, Appendix B1**) consist of wetland vegetation communities that are regionally and locally common and all plant species within these wetlands are regionally and locally common except for five locally rare species: Peachleaf Willow and Pennsylvania Smartweed present in rare abundance within MAS2-1 and MAM2-2 communities (wetlands 2, 3, 4, 5, 6 and 13), Eastern Mannagrass present occasionally in MAS2-1 communities (wetlands 2, 3, 5 and 6), Tall Beggarticks and Common Bedstraw present in rare abundance in MAM2-2 communities (wetlands 4 and 13). Opportunities for plant salvage and transplant within the Wildfield Village NHS will be discussed in the Phase 3 LSS.

Amphibian breeding habitat was identified within MAS2-1 communities (Wetlands 2, 3) for Wood Frog (Lithobates sylvaticus) and Gray Treefrog (Dryophytes versicolor). Amphibian breeding habitat was also identified within the MAM2-2 communities (Wetland 4) for Wood Frog. All of these species are provincially ranked S5 (common and secure) or S4 (apparently common and secure). Species and abundances were not met to qualify as Significant Wildlife Habitat (SWH). Additionally, Terrestrial Crayfish (a species of conservation concern) was observed within wetland 3 (2 chimneys) and wetland 14 (10 chimneys), which are small in size (0.009 ha and 0.1 ha). It should be noted that greater than 80 Terrestrial Crayfish chimneys were observed in the significant wetland (SWD3-2; Wetland 8_9) which is expected to provide more suitable habitat and be a better representation of SWH compared to Wetlands 3 and 14. Therefore, due to the low number of chimney observations in comparison to the SWD3-2, and the small size and isolated nature of the wetlands surrounded by active agricultural land use, SWH is not reasonably warranted for Wetlands 3 and 14. No other wildlife habitat was identified in these wetlands.

The wetlands proposed for relocation or removal and compensation are surface water fed. Wetlands 2, 3, 4, 5, 6, 7 and 17 (0.49 ha) are anticipated to be relocated on-site within Wetland Relocation Area 1 (**Figure 2.2, Appendix B1**). The other two wetlands are located at the south end of the NHSA and are anticipated to be compensated with cash-in-lieu.

Wetlands on non-participating lands consist of small (usually much smaller than 0.5 ha), secluded features in an agricultural and residential land use setting, generally comprised of Meadow Marsh and Shallow Marsh wetland types. These wetlands are anticipated to be removed, pending future studies. Several of these wetlands are associated with headwater drainage features that may require on-site compensation. Conceptual Wetland Compensation Areas 2 and 3 are shown on **Figure 2.2 (Appendix B1)**.

By implementing the above wetland compensation, there are no negative impacts expected because of wetland relocation or removals. Additional details and a fulsome restoration and enhancement plan will be provided in the Phase 3 LSS.

2.1.2.6 Wetland Buffers

It is recommended that a 30 m buffer be maintained for significant wetlands to support their continued function and maintain water quality (TRCA, 2014; MNRF, 2012). The significant wetland (wetland 8_9; **Figure 2.1, Appendix B1**) in the NHSA is provided a 30 m buffer, noting that buffer adjustments may be examined at subsequent stages of development.

Additional retained wetlands within the NHSA (wetlands 10_11, 33, 34; **Figure 2.1, Appendix B1**) are considered other (non-significant) wetlands. These features consist of wetland vegetation communities that are regionally and locally common and all plant species within these wetlands are regionally and locally common except for five locally rare species: Peachleaf Willow and Pennsylvania Smartweed present in rare abundance within MAS2-1, MAM2-10 and MAM2-2 communities (wetlands 10_11, 34), Sandbar Willow present in rare abundance in MAM2-10 communities (wetland 10_11), Eastern Mannagrass present occasionally in MAS2-1 communities (wetland 34), Tall Beggarticks and Common Bedstraw present in rare abundance in MAM2-10 and MAM2-2 communities (wetlands 10_11). Opportunities for plant salvage and transplant within the WVSP NHS will be discussed in the Phase 3 LSS.

Amphibian breeding habitat was identified within Wetland 33 for American Toad (Anaxyrus americanus), Wood Frog and Green Frog (Lithobates clamitans) by listening from the edge of a participating property. Amphibian breeding habitat was identified within Wetland 34 for Wood Frog and Western Chorus Frog (Pseudacris triseriata). All of these species are provincially ranked S5 (common and secure) or S4 (apparently common and secure). However, species and abundances were not met to qualify as Significant Wildlife Habitat (SWH). Additionally, turtle over-wintering SWH was identified within Wetland 34. These other (non-significant) wetlands are afforded a 10 m buffer, as is generally recommended best practice (TRCA, 2014). Buffer adjustments may be examined at subsequent stages of development.

The buffers for significant and other wetlands are adequate considering there is generally no existing buffering for these features due to ongoing agricultural activities. The wetland buffers are proposed to be planted with native trees and shrubs which will provide enhanced protection to these wetlands. A 10 m buffer will also be applied to all Wetland Relocation and Compensation Areas (**Figure 2.2, Appendix B1**) Any required site grading and LID measures will be permitted within the new buffer. The application of the aforementioned wetland buffers is anticipated to both protect features by mitigating any adverse impacts to the features and enhance the existing NHS.

2.1.2.7 Climate Change Impacts to Wetlands

Climate stressors can also threaten wetland function and resilience. The increase in extreme weather events, such as heavy rainfall and flooding, can disrupt wetland hydrology, causing erosion, habitat degradation, and altering surface water contributions. Rising temperatures and altered precipitation patterns can lead to shifts in vegetation communities, favoring invasive species, which can outcompete native plants and reduce habitat quality. In the NHSA, wetlands are primarily supported by surface water inputs, such as direct precipitation, runoff, and interflow through shallow soils. Proposed development may increase impervious surfaces, disrupt existing interflow patterns, and impact surface water quality. To mitigate these impacts, stormwater management (SWM) facilities, erosion control, and LID features will be implemented to attenuate peak flows, maintain water quality, and support groundwater recharge. These design considerations will help maintain hydrological balance, prevent erosion, and ensure wetlands can continue to provide critical ecosystem services.

Wetlands are important for both mitigating climate change by sequestering carbon and reducing greenhouse gas emissions, and adapting to its impacts by providing flood protection, storm buffering, drought resilience, and habitat preservation. These multifunctional ecosystems play a crucial role in supporting environmental stability and community resilience in the face of climate change. By safeguarding the surface water and groundwater contributions to these wetlands, these strategies enhance climate resilience.

Wetland relocation and compensation can support wetland resilience to climate change by maintaining or enhancing the critical ecological functions these ecosystems provide. The proposed relocation of non-significant wetlands aims to allow wetland systems to continue to regulate water flow, reduce flood risks, and support biodiversity, which are essential in adapting to climate variability and increased extreme weather events. By incorporating wetland relocation within designated areas, opportunities exist to create habitats that are more resilient to climate stressors, such as flooding and drought.

2.1.3 Significant Wildlife Habitat

As identified in the Phase 1 LSS (SCS and GEI, November 2024), candidate and confirmed SWH features were identified within the NHSA. The majority of SWH will be protected with appropriate vegetated buffers and as such no impacts are anticipated. These include:

Within the Developable Area:

- Turtle Overwintering Area within MAS2-1 (wetland 34) will be protected by a 10 m vegetated buffer.
- Habitat for Species of Conservation Concern including Terrestrial Crayfish (within SWD3-2 [wetland 8_9], protected by a 30 m vegetated buffer), Wood Thrush (within SWD3-2/CUW1, protected by a 30 m wetland vegetated buffer and 10 m woodland vegetated buffer) and Barn Swallow (within barn structures along Centreville Creek Road, to be removed outside active breeding window and mitigated with Habitat Replacement Structures located in the NHS).

Within the Greenbelt Plan Area:

- Candidate Bat Maternity Colonies within the FOD/CUW associated with the Humber River valley will be protected by 30 m woodland buffers.
- Candidate Bald Eagle and Osprey Nesting, Foraging and Perching Habitat within the Humber River corridor will be protected by a 30 m woodland buffer.
- Candidate Seeps and Spring within the Humber River corridor will be protected by a 30 m buffer; and,
- Candidate Habitat for Species of Conservation Concern including Marsh Bird Breeding Habitat, Wood Thrush and Eastern Wood-Pewee (*Contopus virens*) within the Humber River corridor will be protected by 30 m woodland and wetland buffers.

Indirect impacts to terrestrial crayfish SWH (SWD3-2; wetland 8_9) could include a reduction in the water table from a decrease in groundwater discharge to this wetland feature. However, as noted in Section 2.1.2.3 dependance of the wetland on groundwater is minimal and therefore these indirect impacts are not anticipated based on site conditions.

Wetland SWD3-2 (wetland 8_9) is generally supported by surface water input such as precipitation, runoff and seasonal thaw. Wetland 8_9 is intended to be retained post-development. The lack of pronounced gullies in the areas upgradient of this feature indicates that runoff reaches this feature largely via sheet flow or by interflow through the weathered soils above the underlying silt-clay Halton till. To maintain its hydrological function, the stormwater management design should attempt to preserve this pre-development drainage pattern. The proposed SWM strategy will be discussed in the Phase 3 LSS.

Wetland SWD3-2 will be further protected by a 30 m Significant Wetland buffer. By vegetating this buffer, important foraging habitat can also be created which will be an improvement compared to the current agricultural land. The buffer will also provide protection to the wetland and SWH from sedimentation and surface water runoff. Provided that surface water volume contributions to SWD3-2 are managed as anticipated using stormwater management approaches and LID Best Management Practices, no negative impacts to Terrestrial Crayfish SWH are anticipated.

2.1.3.1 Climate Change Impacts to Significant Wildlife Habitat

The protection of SWH within the NHSA, supported by appropriate vegetated buffers, plays a crucial role in supporting climate resilience. By preserving habitats for species like turtles, Terrestrial Crayfish, and Wood Thrush, these measures help maintain biodiversity and ecosystem stability, which are essential for adaptive capacity in the face of climate change. The recommended buffers provide safeguards against disturbances, protecting SWH from sedimentation, runoff, and hydrological changes, impacts that may be exacerbated in the future under changing climate regimes. Vegetated buffers further enhance climate resilience by stabilizing soil, filtering pollutants, and creating additional foraging and nesting habitats, which can improve overall ecosystem health. Collectively, these strategies assist SWH in adapting to climate stressors, sustaining critical ecosystem services and supporting broader environmental resilience.

2.1.4 Candidate Significant Valleyland

A Candidate Significant Valleyland occurs for the valley surrounding the West Humber River. This feature is located inside the Greenbelt Plan Areaand is afforded the following buffers:

- Preliminary Long Term Stable Top of Slope + 15 m;
- Significant Woodlands + 30 m; and,
- Fish Habitat + 30 m.

As this feature is located within the Greenbelt Plan Area, no impacts to the Candidate Significant Valleyland are anticipated.

2.1.4.1 Climate Change Impacts to Candidate Significant Valleyland

Valleylands provide important climate adaptation and mitigation related ecosystem services that enhance environmental resilience. They help mitigate climate change by sequestering carbon in their vegetation and soils and maintaining biodiversity, which supports ecological stability. Valleylands also play a critical role in climate adaptation by mitigating floods through their natural floodplain functions, reducing erosion with stabilizing vegetation, and regulating water flow to maintain groundwater recharge. Their vegetation helps moderate temperatures and provides shade, reducing heat stress in surrounding areas. Valleylands also serve as ecological corridors, enabling wildlife to move and adapt to changing habitats. Additionally, they filter pollutants from surface runoff, maintaining water quality and protecting aquatic ecosystems. These combined functions make valleylands vital for supporting resilient communities and ecosystems in the face of climate change.

2.2 Potential Aquatic Impacts

2.2.1 Direct Fish Habitat

The Phase 1 LSS (SCS and GEI, November 2024) identified direct fish habitat for the West Humber River located in the southeast portion of the NHSA and is identified as occupied Redside Dace habitat. The river is characterized as intermediate riverine warmwater fish habitat (TRCA, 2005).

Headwater drainage feature H12AS1 (**Figure 2.1**, **Appendix B1**) was also identified as providing direct seasonal fish habitat, due to the observation of one Brook Stickleback in April 2024 in an isolated pool. This feature is ploughed through in the spring and had ephemeral flow in April 2024, but was dry in May 2024, and supports seasonal warmwater fish species. This HDF is proposed for removal, and compensation will aim to enhance fish habitat through the creation of wetland habitat that will be designed to provide a net ecological gain through thermal mitigation from shading, improved water quality due to settling of sedimentation, and provision of extended baseflow to downstream habitat. This is anticipated to improve fish habitat compared to existing conditions (degradation from agricultural activities such as ploughing through the feature, as well as the use of fertilizers resulting in pollution).

Despite fish community sampling surveys in May 2024, no fish were observed in watercourse H5S1/S2/S3 located in the southeast portion of the NHSA. The watercourse exhibited intermittent flow and was dry in August 2024. Due to the proximity and connection to the West Humber River and unobstructed passage under The Gore Road and Mayfield Road, it is acknowledged that this feature has potential to provide seasonal fish habitat.

As part of the NHS, the West Humber River and H5S1/S2/S3 will both be protected by a warm water fish habitat buffer (15 m, MNR 2010), intended to mitigate negative impacts to water quality from adjacent land uses. Buffers with native vegetation can also contribute to bank stability and thermal regulation. The West Humber River is located within the Greenbelt Plan Area and will be further protected by the buffers for adjacent features including the stable top of slope (15 m buffer), and significant woodland (30 m buffer).

Additional potential indirect effects on fish habitat downstream that could occur from the proposed development include:

- Impaired fish habitat and/or negative impacts on aquatic biota (e.g., fish and benthic invertebrates), including deteriorated health or mortality, due to erosion and sediment from site alteration and development;
- Mortality or health impacts due to accidental spills of toxic materials during or post-construction;
- Short-term dewatering may be required related to the construction of subsurface utilities;
- Alterations in watercourse water balance (e.g., timing and volume of flows) and associated negative impacts on fish habitat functions; and,
- Long-term impairment of watercourse quality (including chemical contaminants, suspended solids and temperature) due to surface runoff from the proposed development.

The following mitigative measures should be considered in subsequent development applications to prevent or minimize negative effects on fish and fish habitat:

- Establishment of erosion and sediment control (ESC) measures along the limit of the NHS that should be monitored during construction and where deficiencies are identified, ESC measures must be repaired immediately to prevent adverse impacts to receiving features;
- Preparation and implementation of a spill prevention and response plan to prevent or minimize the potential for spills of potentially toxic materials during construction;
- Groundwater mitigation measures, as discussed in **Section 3.2** below;
- Surface water quality and quantity impact mitigation measures, as discussed in Section 3.1.4 and 3.2.6; and,
- Considerations of fencing and/or thorny barrier plantings should also be contemplated in subsequent site plan designs to limit human disturbance.

Positive impacts to fish habitat are anticipated as a result of the creation of wetland habitat compared to existing conditions within actively managed agricultural fields.

2.2.1.1 Surface Water Impacts to Fish Habitat

Fish habitat within the NHSA was identified for H5S1/S2/S3. Surface water level measurements (i.e., staff gauge SG1 located at H5S2) and other field observations indicate that this feature is intermittent.

The increase in imperviousness due to development is expected to generally increase the quantity of runoff. The stormwater management design will need to attenuate flows to prevent excessive erosion or flooding in these areas. However, by attenuating flows while also accommodating a larger overall volume of runoff, there is potential that the duration of flows in these features may also increase relative to pre-development conditions. This would typically result in a benefit to fish habitat. Perennial streams, such as the West Humber River, would not be affected by these changes as they are already water-bearing year-round.

Potential impacts associated with the proposed development include erosion and sedimentation due to construction activities, and accidental spills during construction. A formal Erosion and Sediment Control (ESC) Plan, as well as a spill prevention and response plan, will be required to demonstrate that construction activities will not have negative impacts on downstream fish habitat.

Provided that surface water volume and quality contributions to the watercourses can be managed as anticipated utilizing stormwater management approaches and mitigation measures outlined above, negative impacts to fish habitat associated with surface water are not anticipated.

2.2.1.2 Groundwater Impacts to Fish Habitat

The potential for groundwater impacts to fish habitat is expected to be limited. This is because, for the identified fish habitat within the NHSA (H5S1/S2/S3), groundwater contributions are minor in comparison to surface water contributions due to the low hydraulic conductivity of the Halton Till soil materials.

The West Humber River, due to the depth of its incised channel potentially intersecting strata more conductive than the overlying silt-clay Halton Till, may receive larger volumes of groundwater discharge. However the rate of discharge is controlled by hydraulic gradients, which in turn are related to groundwater levels. The proposed development may generally result in a lowering of the water table due to reduced infiltration and also due to the construction of structures that induce drainage (e.g., services, foundation drains). The former effect (reduced infiltration) is not likely to be significant because the Halton Till is of such low hydraulic conductivity that the reduced infiltration will not likely result in a significant lowering of water levels. However, where deep structures (e.g., along the urban corridor, or trunk sewers and other infrastructure) may intersect higher conductivity materials at depth or may induce larger drawdowns (>2 to 3 m) due to long-term drainage, assessments should be conducted to determine whether mitigation measures are necessary (e.g., waterproof subsurface structures to avoid reliance on drainage; clay collars for linear infrastructure).

Changes to groundwater quality would be expected from human activities such as road salting, minor fuel and oil leaks, fertilizer application, etc. Best management practices should be considered when applying salt, fertilizers etc. to minimize their application and limit changes to groundwater. Spills and leaks must be contained and remediated as soon as possible to limit damage to the environment.

Provided that groundwater contributions to the watercourses can be managed as required, and through the implementation of mitigation measures outlined above, negative impacts to fish habitat associated with groundwater are not anticipated.

2.2.2 Indirect Fish Habitat

The HDFs within the NHSA were generally ephemeral and provide indirect fish habitat, except for H12AS1 which had ephemeral flow and provided direct fish habitat. It is important to acknowledge that as with any guidelines, the HDF Guidelines (CVC and TRCA 2014) are intended to have flexibility to best reflect additional considerations regarding the site-specific nature of features, such as impairment related to surrounding active agriculture (i.e., siltation due to ploughing up to the edge or through the feature and pollution due to fertilizers), compensation for wetlands, and compatibility with land uses. As such, there are situations where recommendations were made for an alternative management recommendation based on site-specific understanding of these additional factors. These HDFs are proposed for removal with replication of their functions expected to be achieved through LIDs or wetland compensation.

Within the NHSA, all of the HDFs have a Management Recommendation of Mitigation or interpreted Management Recommendation of Mitigation based on the anticipated ability to replicate HDFs and associated wetland, functions through the provision of baseflow and on-site compensation of wetland habitat.

As noted in the HDF Guidelines (CVC and TRCA 2014), Mitigation management allows for the replication of the function of the HDF to:

- Replicate functions by lot level conveyance measures (e.g., vegetated swales) connected to the preliminary natural heritage system, as feasible and/or LID stormwater options;
- Replicate on-site flow and outlet flows at the top end of the system to maintain feature functions; and,
- Specific implementation techniques to replicate functions should be determined at the MESP stage and may include LID measures.

The replication of HDF functions will assist in maintaining flow conditions. Compensation through wetland creation and enhancement will provide additional shading, improved water quality, and extended baseflows. Together, these measures help fish habitats remain resilient to climate change, maintaining their ecological functions and supporting aquatic biodiversity.

All HDFs designated as 'Mitigation' are anticipated to be removed and will have their functions replicated through SWM and LID infrastructure, as well as wetland compensation. Additional details on the SWM and LID measures will be provided as part of the Phase 3 LSS.

2.2.3 Climate Change Impacts to Fish Habitat

Climate change may impact direct and indirect fish habitats in the NHSA through increased water temperatures, altered flow patterns, and intensified extreme weather events, which can cause erosion, sedimentation, and habitat degradation. The increase in impervious surfaces due to development can further alter runoff patterns and reduce groundwater infiltration. The above noted proposed mitigative measures aim to minimize these impacts and enhance climate resilience. Protective buffers assist in regulating water temperature, improve water quality, and stabilize banks. ESC plans, spill prevention measures, and LID features will further reduce risks from construction activities, such as sedimentation and pollution, further supporting healthy fish habitat that is better able to withstand changing climate conditions. Both ESC plans and LID measures will be discussed further in the Phase 3 LSS.

2.3 Potential Impacts to Species at Risk

Each property will be responsible for preparing and submitted an Information Gathering Form to the MECP at the Draft Plan of Subdivision stage to demonstrate how direct and indirect impacts to Endangered and Threatened species will be mitigated. The following sections provide an overview of the potential impacts to Species at Risk resulting from the proposed WVSP.

2.3.1 Redside Dace

GEI is currently in discussions with MECP to understand if contributing habitat for Redside Dace is present in the NHSA. If contributing habitat is found to be present, the LSS will be updated accordingly.

The West Humber River located in the southeast portion of the NHSA provides occupied habitat for Redside Dace. As shown on **Figure 2.2, Appendix B1**, the West Humber River and its valley are protected within the NHS.

Potential impacts to Redside Dace occupied habitat could occur during construction as it relates to erosion or sedimentation being conveyed to downstream habitats, and/or accidental spills. Unmitigated, this could cause negative effects on Redside Dace habitat, mortality and health effects.

Recommended Mitigation/Management measures include ESC measures and providing setbacks to development. ESC measures will be used throughout construction, and spill prevention and response measures will be implemented to avoid negative effects due to accidental spills during construction. Regulated habitat for Redside Dace is the Meander belt plus 30 m surrounding the occupied reach. This area generally falls within the Greenbelt Plan Area. One area identified near the intersection of The Gore Road and Mayfield Road includes Redside Dace regulated habitat limits which extend beyond the

Greenbelt Plan Area. Any works within this area will need to adhere to MNRF's Guidance for Development Activities in Redside Dace Protected Habitat (MNRF, 2016).

Provided the above mitigation is carried out as recommended, no negative impacts to Redside Dace are anticipated.

2.3.2 Candidate SAR Bats

No bat SAR were identified with the NHSA participating ownerships during the acoustic monitoring. Habitat for bat SAR may be present within the well forested West Humber River valley in the south-east portion of the NHSA.

There is no setback requirement prescribed by MECP for SAR bats; however, the woodland features are within the Greenbelt Plan Area and will be protected by a minimum 30 m buffer.

While the features that may provide candidate SAR bat habitat are not anticipated to be altered, the following are best practices that should be followed to protect SAR bats within the NHSA:

- Any tree removals within the NHSA should be completed outside of the bat active window (approximately April 1 – September 30); and
- New lighting should be directed away from candidate SAR bat habitat to minimize disturbance.

Provided these mitigation measures are carried out as recommended, no negative impacts on candidate SAR bats are anticipated.

2.3.3 SAR Birds

Both Bobolink and Eastern Meadowlark are designated as Threatened on the SARO list and receive protection under the ESA (2007). Eastern Meadowlark and Bobolink were observed in suitable habitat (hayfields) located within the NHSA east of The Gore Road on non-participating lands. No suitable habitat for these species occurs on participating lands in the NHSA.

Impacts to Bobolink and Eastern Meadowlark will be addressed with MECP through their Information Gathering Form (IGF) process during the Draft Plan of Subdivision stage. Any proposed removal of this habitat will require permit registration with MECP under clause 17(2)(b) of the ESA accompanied by appropriate habitat compensation. Under O. Reg. 830/21 Part IV, Bobolink and Eastern Meadowlark may be exempt, with compensation options including cash-in-lieu payments to the Species at Risk Conservation Fund. Requirements for creating or enhancing habitat are outlined in Section 17. Following habitat creation or enhancement, the proponent must develop a

Bobolink and Eastern Meadowlark management plan in accordance with Section 16. Additionally, for five years, at least three annual surveys must be conducted to confirm the species' presence and assess fledgling success, as stipulated in Section 14.

Barn Swallow are Special Concern on the SARO List. Farm buildings which currently provide nesting habitat near Centreville Creek Road are proposed to be removed which will result in loss of breeding habitat for the species. Habitat removals will occur outside of the Barn Swallow active season (beginning of May to end of August) to avoid adverse impacts. Replacement habitat structures for Barn Swallow will be installed in the NHS.

Provided these mitigation measures are carried out as anticipated, no negative impacts to Eastern Meadowlark, Bobolink, or Barn Swallow are anticipated.

2.3.4 Candidate Rapids Clubtail

Rapids Clubtail (*Phanogomphus quadricolor*) was identified through background review and may be present along the West Humber River. This species prefers large streams and rivers with wooded shorelines and riffle and pool features.

The West Humber River and its valley are within the Greenbelt Plan Areaand well protected though the following buffers:

- Significant Woodlands +30 m; and;
- Candidate Significant Valleyland + 15 m from Long Term Stable Top of Slope.

Provided these mitigation measures are carried out as recommended, no negative impacts on potential Rapids Clubtail are anticipated.

2.4 Magnitude and Longevity of Impacts to the NHS

As part of the assessment of impacts on natural heritage features and functions, the magnitude (extent of an impact) and longevity (associated with duration of an impact) were also considered as it applies to each of the natural heritage features discussed above in Sections 2.1 through 2.3.

Overall, the magnitude of impacts on natural heritage features within the NHSA, including Wetlands, Woodlands, SWH, Fish Habitat (direct and indirect), Valleylands and SAR habitat has been assessed as minimal. With the implementation of recommended mitigation measures and compensation, there are no negative impacts predicted.

Similarly, the longevity of impacts will be mitigated through pre-construction, during-construction, and post-construction mitigation measures, appropriate monitoring, and adaptive management. This will be fully detailed within the Management and

Implementation Plan, and the Monitoring Plan, which are key deliverables of the Phase 3 LSS.

In general, it is anticipated that most impacts to features and their functions will be mitigated, resulting in a minimal impact, or else limited to construction phases with mitigation measures in place to minimize the longevity of these impacts.
Some examples of efforts to limit the magnitude and longevity of impacts due to land use change will include:

- Erosion and Sediment Controls – these should be established so that sediment is not entering wetland features or downstream watercourses. These measures are intended to prevent the release of debris, sediment or deleterious substances which could have long-term impacts on the aquatic ecosystem. Both magnitude and longevity of potential impacts are mitigated in this scenario; and,
- Wetland Ecohydrology Monitoring – as the proposed land use plan requires some wetland feature relocation and removal, mitigating the magnitude and longevity of the feature relocation and removal will be reliant on successful implementation of the proposed relocation and compensation. This will require developing a post-construction monitoring program that assesses the hydroperiods of the created wetlands, water volumes, and wetland vegetation establishment, and identifying adaptive management techniques to maintain the created wetlands.

The examples above are just a subset of methods of reducing magnitude and longevity impacts to natural heritage features and functions. By implementing the mitigative measures outlined in the previous sections and incorporating the implementation, management and adaptive management recommendations that will be detailed in the Phase 3 LSS, it is expected that the NHS will be a robust system with adequate protection and restoration to enhance the longevity of retained and compensated features and functions.

2.5 Mitigation, Compensation, and Restoration/Enhancement Opportunities

The preliminary NHS, conceptual compensation, restoration and ecological enhancements are founded upon a sound technical understanding of the extent and quality of natural heritage features and functions observed within the NHSA. The overall goal of the proposed NHS is to establish a healthy and diverse ecosystem that enhances and complements the native vegetation coverage and strengthens its ecological resilience.

The following environmental targets are being considered through this LSS to maintain, restore, and enhance existing conditions:

- Provide natural vegetative cover across the entire created NHS and all NHS buffers;
- Achieve an overall measurable net gain in native vegetation community type and species diversity (flora and fauna);
- Provide habitat for certain life stages of various bird and small and medium sized mammal species;
- Mitigate removal of wetlands by providing appropriate areas for wetland compensation and by increasing ecological functions within created wetland features;
- Map abundance of Category 1 invasive species (i.e., *Rhamnus cathartica, Phragmites australis ssp. australis*) within retained natural features;
- Invasive species management (risk) assessment to determine whether it is ecologically, socially, and economically viable to manage a given invasive species population;
- Where invasive species risk assessment identifies invasive management, for a given species, carry out invasive management as per Ontario Invasive Plant Council best management practices;
- Explore salvage and transplant of native species within removed features into created features and or retained feature buffers, where feasible; and,
- Consider best management practices for road crossings to support movement of amphibian, reptile, small and medium sized mammals under road crossings.

As discussed throughout Section 2.0, a key mitigation measure for the protection of features within the NHS are buffers or Vegetation Protection Zones (VPZs). These buffer recommendations are made based on established best practices, the form of the feature, functions, sensitivity, and location within the NHS, as well as the extent and nature of the proposed land use changes. These recommended buffers apply to both retained and compensation features within the NHSA.

To facilitate the NHS, some feature compensation will be required as described in **Section 2.5.1**, below. A high-level discussion of recommendations for these compensation areas is provided in the subsequent sections, and additional details will be provided in the Phase 3 LSS.

The proposed mitigation, compensation, and restoration/enhancement opportunities are anticipated to support climate change resilience by maintaining and enhancing ecosystem functions within the NHS. The creation of natural vegetative cover, wetland compensation, and invasive species management is expected to improve habitat quality, stabilize hydrological processes, and enhance biodiversity, making the system more adaptive to climate variability and extreme weather events. These efforts collectively promote a healthier, more robust natural heritage system capable of withstanding and adapting to the impacts of climate change.

2.5.1 Ecological Offsetting Policy Considerations

Ecological offsetting is a mitigation strategy that is often considered to achieve a net ecological benefit to projects, subject to the approval of the planning authority. This compensation strategy quantifies the loss of natural features to provide compensation through habitat re-creation or an alternative through a consultation process. Ecological offsetting approaches are typically applied as a last resort (after avoidance and mitigation have been considered). In this case, ecological offsetting is proposed to achieve additional ecological benefit by meeting and/or exceeding the replication requirement.

As per O. Reg. 41/24, the TRCA no longer has planning jurisdiction over natural heritage features and instead regulates natural hazard features only. This includes flood and erosion risks that relate to the alteration of rivers, streams, valleys, and wetlands, and consideration of the regulation and permitting requirements that will impact these features will be incorporated into the feature compensation design.

The Town of Caledon is responsible for administering the in-force Town of Caledon OP (2018) and the Region of Peel's OP (2022). The Town does not have any ecological offsetting guidance available. The Region of Peel OP notes the following policy considerations for ecological compensation in Section 2.14.30:

> "Support the appropriate use of ecosystem compensation guidelines by the local municipalities and other agencies in accordance with the policies of this Plan subject to federal and provincial policy requirements and provided that development or site alteration will not result in negative impacts to the natural features or ecological functions of the Greenlands System. Where ecosystem compensation is determined to be an acceptable mitigation option, it should be applied to achieve a no net loss and if possible, a net gain, in natural heritage feature area or function."

TRCA has also developed a 'Guideline for Determining Ecosystem Compensation' (TRCA, 2023) which highlights best practices for the compensation of features and their functions. This guiding document could be considered when finalizing compensation efforts during detailed design.

One of the main goals for ecological compensation will be to target a net gain for the Town's NHS. This concept is not fully defined within the Town of Caledon OP (2018); however, net gain should be measured at "relevant timescales" for the project, recognizing that actions to restore and offset actions may lead to short-term adverse effects before it is achieved (IUCN, 2021). The TRCA's compensation guidelines Section 1.3 also notes:

> "Compensation outcomes should strive to fully replace the same level of lost ecosystem structure and function in proximity to where the loss occurs and, where possible, achieve an overall gain."

The following sections outline high-level natural feature compensation considerations for the wetland and fish habitat removal, with details on how the principles of net ecological gain will be achieved by providing ecosystem structure and function. Natural feature compensation requirements should be further reviewed at later design stages.

More detailed restoration, and monitoring and adaptive management plans will be included in the Phase 3 LSS.

2.5.2 Wetland Relocation and Compensation

Wetland features within the proposed NHS (wetlands 8_9, 33, 34 and 10_11; **Figure 2.3**, **Appendix B1**) will be retained in-place and buffered with either a 10 m or 30 m buffer, as noted in Section 2.1.2.6. To facilitate the proposed land use plan, seven (7) other (non-significant) wetlands (wetlands 2, 3 ,4, 5, 6, 7 and 17) totaling 0.49 ha are proposed for on-site relocation. Two other small (< 0.5 ha) wetlands (non-significant) at the south end of the NHSA (wetlands 13 and 14) are proposed for removal and are anticipated to be compensated through cash in lieu.

Twelve small wetlands (wetlands 16, 21, 23, 26, 27, 28, 26, 39, 40, 41, A, B; **Figure 2.3**, **Appendix B1**; all are < 0.5 ha except for one wetland that is 0.6 ha) wetlands on non-participating properties totaling 1.9 ha are anticipated to be removed, pending future studies, as detailed in Section 2.1.2.5. Four conceptual wetland relocation or compensation areas are proposed (**Figure 2.2, Appendix B1**):

- Wetland Relocation Area 1 for the proposed relocation of Wetlands 2, 3, 4, 5, 6, 7, 17;
- Wetland Compensation Area 2 for the proposed removal of wetlands associated with HDF H4S1B;
- Wetland Compensation Area 3 for the proposed removal of wetlands associated with HDF H7S1 and H7S2; and,
- Wetland Compensation Area 4 for the proposed removal of HDF H12A1 which provides seasonal fish habitat.

The size of the compensation areas will be determined at a later stage; however, the aim is to provide a 1:1 compensation ratio or greater. Wetland compensation areas will be constructed in close proximity to removal locations, as is recommended for feature removal offsetting and compensation. It is anticipated that all four (4) compensation wetlands can be fed with sufficient volumes of clean water required to sustain a range of water depths and proposed wetland vegetation community types. This will be determined at subsequent stages of the planning process.

The goal of the wetland compensation design will be to achieve a net gain in overall function of the community compared to existing conditions in the NHSA. The wetland design is recommended to consider the inclusion of wildlife enhancements such as the creation of breeding amphibian habitat, fish habitat, and Terrestrial Crayfish habitat. Compensation areas will aim to provide an increase in native vegetation community types and species diversity through restoration plantings and will aim to improve the overall NHS proximity between retained and compensation features within the NHSA. This will support ecosystems' ability to adapt to climate variability, preserve biodiversity, and maintain essential ecosystem services.

2.5.3 Fish Habitat Removal and Compensation

Ephemeral HDF H12A1 provides seasonal fish habitat and is proposed for removal and compensation through the creation of wetland habitat. The reach length of H12A1 is approximately 500 m, and despite the observation of one Brook Stickleback, this feature provides low quality fish habitat due to being ploughed through in the spring, and ephemeral nature of the reach. The Phase 3 LSS will discuss potential sizing for the Fish Habitat Compensation Area 4.

The goal of the fish habitat compensation design will be to achieve a net gain in fish habitat through the creation of wetland habitat, which is expected to provide thermal mitigation from shading, improved water quality due to settling of sedimentation, and provision of extended baseflow to downstream habitat. This is anticipated to improve fish habitat compared to existing conditions (degradation from agricultural activities such as ploughing through the feature, as well as the use of fertilizers resulting in pollution).

More detailed information on design, water availability, vegetation community targets, and implementation for these compensation areas will be further described in the Phase 3 LSS.

2.6 Policy Conformity

One of the goals of the LSS is to address the proposed land use changes in the context of applicable planning policies and to clearly identify how requirements are met or exceeded. The following is a summary linking the conclusions of the above impact assessment to conformity with land use plans and applicable policies, including the PPS, provincial legislation, Regional and Local Municipal Official Plans, and federal legislation. This LSS addresses alignment, conformity and consistency with the following policies outlined in Section 2.6.1 through 2.6.7:

2.6.1 Fisheries Act, 1985

The Fisheries Act prohibits the death of fish by means other than fishing (subsection 34.4 (1)) and the harmful alteration, disruption or destruction of fish habitat (HADD; subsection 35. (1)). A HADD is defined under the Fisheries Act as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes" (DFO 2019).
The West Humber River, H5S1/S2/S3 and H12A1 provide direct fish habitat. The West Humber River and H5S1/S2/S3 are anticipated to be protected or enhanced, respectively. No negative impacts are expected to fish habitat as the West Humber River is protected in the Greenbelt with feature buffers (15 m for fish habitat, 30 m for significant woodlands, 15 m from stable top of slope). HDF H12A1 is proposed to be removed and compensated through wetland creation that is aimed to improve aquatic habitat conditions for fish species (Section 2.5.4).

Some HDFs that provide indirect fish habitat are proposed for removal. The functions of these features are anticipated to be replicated through the SWM strategy, as well as through wetland compensation areas. Any potential impacts to fish habitat are anticipated to be mitigated through the measures discussed in Section 2.5.4, in addition to in the Phase 3 LSS.

2.6.2 Migratory Birds Convention Act, 1994

The federal Migratory Birds Convention Act prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests. Tree removals should be undertaken outside of the core breeding period, which is approximately April 1 to August 31. In rare circumstances where this window cannot be avoided, a nest search is recommended, and a buffer will be marked off surrounding any active nests that must be maintained until activity in the nest has ceased. The Migratory Birds Convention Act applies at all times, even outside of the peak breeding period.

2.6.3 Federal Species at Risk Act (2002) and Provincial Endangered Species Act (2007)

Eastern Meadowlark and Bobolink were observed in suitable habitat (hayfields) located within the NHSA east of The Gore Road on non-participating lands. No suitable habitat for these species occurs on participating lands in the NHSA. Impacts and habitat removals, as needed, will occur through engagement of MECP and approved permits in accordance with section 17(2) of the ESA and O. Reg. 183/21.

Barn Swallow nesting habitat was identified within serval farm structures along Centreville Creek Road. Habitat will be removed outside the active breeding bird window and replaced with habitat structures.

Candidate SAR bat habitat may be present within the woodlands associated with the Humber River valley at the southern portion of the NHSA. The woodlands are located in the Greenbelt Plan Area and will be afforded a 30 m buffer.

Redside Dace occupied habitat is identified in the West Humber River located in the southeast portion of the NHSA. This habitat occurs within the Greenbelt Plan Area and is protected with a 15 m fish buffer and 15 m stable top of slope buffer.

For all future site-specific development, additional efforts may be required to demonstrate compliance with the Species at Risk Act and Endangered Species Act.

2.6.4 Provincial Planning Statement (PPS, 2024)

The Provincial Planning Statement (2024) is the guiding document providing policy direction on matters of Provincial interest related to land use and development. Section 3(5) of the Planning Act requires that all decisions that affect planning matters be consistent with the PPS, which is issued under the Act. The following PPS features were identified and considered in the NHSA: Significant Woodlands (Section 2.1.1), Significant Wetlands (Section 2.2.1), Significant Wildlife Habitat (Section 2.3.1), Direct and Indirect Fish Habitat (Sections 2.2.1 and 2.2.2, respectively) and Habitat for Threatened and Endangered Species (Section 2.3). As described in these sections, provided the recommended mitigation and compensation are achieved, with anticipated stormwater management, no negative impacts to these features are expected. The NHS is expected to meet the intent of the policies of the PPS.

2.6.5 Ontario Regulation 41/24: Prohibited Activities, Exemptions and Permits

O. Reg. 41/24 allows Conservation Authorities to implement Section 28 Conservation Authorities Act, 1990 (amended 2024), which states under Section 28(1) that:
28 (1) No person shall carry on the following activities, or permit another person to carry on the following activities, in the area of jurisdiction of an authority:

1. Activities to straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse or to change or interfere in any way with a wetland.
2. Development activities in areas that are within the authority's area of jurisdiction and are,
    i. hazardous lands,
    ii. wetlands,
    iii. river or stream valleys the limits of which shall be determined in accordance with the regulations,
    iv. areas that are adjacent or close to the shoreline of the Great Lakes-St. Lawrence River System or to an inland lake and that may be affected by flooding, erosion or dynamic beach hazards, such areas to be further determined or specified in accordance with the regulations, or v. other

areas in which development should be prohibited or regulated, as may be determined by the regulations. 2017, c. 23, Sched. 4, s. 25.

Pursuant to O. Reg. 41/24, any interference with or development in or on areas stated in the Conservation Authorities Act (e.g., hazardous lands, wetlands, river or stream valleys) requires permission from the Conservation Authority. The Conservation Authority may issue permits under Section 28.1 and may attach conditions on the permits per Section 9(1) of the Regulation.

The land use plan and post-development NHS will be in alignment with this regulation; no significant wetlands or watercourses will be impacted. Permits will be required from the Conservation Authority (TRCA) to facilitate the alteration and compensation of the regulated wetlands within the NHSA.

2.6.6 Region of Peel Official Plan (2022)

Region of Peel's OP (RPOP) outlines policies to guide growth and development in the Region. The Regional Greenlands System is based on natural heritage features and areas and the linkages among them.

As per Section 2.14 of the RPOP, development and site alteration is not permitted in Core Areas; however, refinements to the Greenlands System may be permitted through an approved development plan as per Section 2.14.10. Greenland System features are shown in Schedule C-1 ("Greenlands System") and Figure 7 ("Regional Greenlands System- Core Areas, Natural Areas and Corridors and Potential Natural Areas and Corridors").

In general, it would be expected that any impact shall be mitigated through restoration and enhancement or compensation.

Within the NHSA, the West Humber River and the downstream portion of one of its tributaries are identified as part of the Core Area of the Greenlands System as per Schedule C-2 ("Core Area of the Greenlands System"). This area is generally within the Greenbelt and will not be impacted. One small area extends beyond the Greenbelt on non-participating lands and appears to be associated with the Preliminary Long Term Stable Top of Slope (GEI) and will need to be further assessed as part of subsequent Draft Plan of Subdivision level studies for the non-participating lands.

These features have all been delineated and assessed by GEI through the LSS process. This LSS has evaluated the ecological form and functions of Core Areas, NACs, and PNACs and determined that all impacts will be mitigated through buffering, restoration and enhancement, or compensation as outlined in this report.

2.6.7 Caledon Official Plan (2018)

To implement new secondary plans, an official plan amendment (OPA) is required to the Town of Caledon Official Plan. Secondary plans require a subwatershed study or comprehensive environmental impact study and management plan prepared in accordance with an approved term of reference.
The subwatershed study should include a consideration of cumulative environmental impacts from existing and planned development and considerations that avoid or minimize impacts, strategies to meet environment targets and objectives to protect, improve, restore and enhance the natural environment system (Section 5.5.9.2).

This LSS has identified existing conditions within the NHSA and has evaluated the impacts of the proposed land use concept on the existing system while providing mitigative and enhancement opportunities to improve the overall NHS.

Within the NHSA, the following features of the Town of Caledon's Ecosystem Framework for Environmental Protection Areas (EPAs) were identified:

Natural Core Areas:

- Significant Woodlands (SWD3-2/CUW1 [south-central area], FOD/CUW [associated with the West Humber River valley]);
- Significant Wetland (SWD3-2);
- Candidate Habitats of Endangered Species (bat SAR associated with the West Humber River valley);
- Habitat of Endangered and Threatened Species (Bobolink and Eastern Meadowlark on non-participating lands east of The Gore Road);
- Fish Habitat:
  - The West Humber River; H12AS1; H5S1/S2/S3;
- Significant Wildlife Habitat:
  - Seasonal Concentration Areas of Animals (Candidate Bat Maternity Colonies within West Humber River corridor; Over-Wintering Turtle Habitat within wetland 34);
  - Specialized Wildlife Habitat (Candidate Seeps and Spring within West Humber River corridor; Candidate Bald Eagle and Osprey Nesting, Foraging and Perching Habitat within West Humber River corridor; and
  - Species of Conservation Concern (Terrestrial Crayfish within SWD3-2, Wood Thrush within SWD3-2/CUW1, Barn Swallows within farm structures along Centreville Creek Road, Candidate Marsh Bird Breeding Habitat within the West Humber River corridor and Candidate Wood Thrush and Eastern Wood-Pewee within the West Humber River Corridor).

Natural Corridors:

- Valley and Stream Corridor (The West Humber River).

Supporting Natural Systems:

- Other woodlands (CUW1 south of Mayfield Road); and
- All other wetlands.

Through this LSS, a fulsome impact assessment has been completed and determined that there are no negative impacts anticipated to the features listed above. Any impacts to features, including wetlands and seasonal fish habitat will be compensated for and enhanced in the post-development NHS.

2.7 Natural Hazards

Natural hazards, including both erosion and flood hazards, have been identified for the WVSP area as detailed in the Phase 1 LSS. Additional study will be required at the Draft Plan of Subdivision stage to confirm erosion hazards for non-participating lands. The preliminary NHS utilized in preparation of the proposed Land Use Plan (**Figure 1.3, Appendix A2**) encompasses these hazards, in addition to the associated development setbacks as outlined in Sections 2.3.4 and 2.3.7.1 of the Phase 1 LSS (SCS and GEI, November 2024).

Implementation of the proposed Land Use Plan (**Figure 1.3, Appendix A2**) will not require modification to any flood hazards as there are no proposed watercourse crossings or grading proposed within the floodplain. As outlined in Section 2.2.2, all HDFs designated as 'Mitigation' are anticipated to be removed and will have their functions replicated through SWM and LID infrastructure. As discussed and agreed upon by TRCA (P. Corresp. D. Chekol (TRCA) and A. Keeping (SCS) July 31, 2024), the flood storage associated with these HDFs does not need to be replicated under post-development conditions.

3.0 Groundwater

3.1 Geological and Hydrogeological Assessment

A summary of the Phase 1 report findings for groundwater and hydrogeology is provided below, in the form of the hydrogeological conceptual site model for the WVSP area. For full details on the WVSP area characterization, please refer to the Phase 1 LSS (SCS and GEI, November 2024).

Both the regional geologic mapping and the boreholes advanced across the WVSP area are consistent. The mapping indicates the site is located in a Till Plain to the south of the Oak Ridges Moraine. The WVSP area is dominated by uniformly encountered Halton Till. Locally, a cohesionless glacial till, likely the Newmarket Till unit, was encountered. The till units are underlain by shale bedrock of the Georgian Bay Formation. The geologic conditions are considered to be consistent across the WVSP area.

The overburden till units are composed of low permeability, silt dominated soils that limit infiltration and groundwater migration. The surficial Halton Till units were found to be consistent across the area with no specific areas of high infiltration (higher permeability) or groundwater migration observed. Deeper layers underlying the Halton Till (e.g., sand silt and Newmarket Till) may have somewhat higher hydraulic conductivity, but the interaction between the surface and these deeper layers is mitigated by the Halton Till which is appears to be continuous across the WVSP.

Based on the geologic conditions, the hydrogeologic conditions in the area are also considered to be consistent across the WVSP area and support limited infiltration and groundwater migration. The WVSP area has limited occurrence of surface water features, mainly consisting of small marsh (MA) and swamp (SW) wetland vegetation types and ephemeral and intermittent headwater drainage features extending across active agricultural fields. Refer to **Figures 3.1** and **3.2** in **Appendix C1** for an illustration of the natural features and borehole locations. Groundwater flow, albeit limited, is expected to be dominated by flow in the upper weathered till units and interflow. Lateral hydraulic gradients are expected to follow topography, with the resultant groundwater flow direction being towards the southeast and the West Humber River for the majority of the WVSP area. Groundwater and surface water flows in a limited area in the northwest corner of the WVSP area are expected to be westerly, towards the West Tributary of the West Humber River. Local upwards gradients are expected in the overburden in the vicinity of the surface drainage features.

Infiltration rates are expected to be consistent across the WVSP area and in the range from about 91 mm/year (agricultural land) to 78 mm/year (treed areas), based on both the TRCA models and the Thornthwaite and Mather methodology used specifically for the WVSP area. The low infiltration is typical of large glacial till plains.

Surface water features generally form “parallel” or “dendritic” drainage patterns and also indicate consistent geology over the WVSP area. Flows are expected to be predominantly fed by runoff, a high variability of flow (and typically higher peak flows) corresponding to intensity of precipitation events. Due to the predominance of the till soil, base flow contributions to surface water features are minimal, and the attenuation of runoff is limited mainly to the capacity of the thin layer (typically <1 m) of weathered soil overlying the till to accept infiltration and convey attenuated flows as interflow.

Consistent with the geology, the field investigation encountered no evidence of point source discharge or zones of significant groundwater discharge. Baseflow of surface water systems are likely based on accumulation of relatively low volume inputs through low hydraulic conductivity soils over the length of the surface water channels.

3.1.1 Dewatering Assessment

The Land Use Plan is described in Section 1.3. It includes urban corridors for mixed use development, a neighborhood area for residential development, collector roads, elementary schools, parks, environmental features and Stormwater Management (SWM) facilities.
However, detailed information (e.g., final grades, building footprints, road/servicing alignments etc.) is not currently available, so the following assumptions were made to assess potential short-term construction dewatering requirements and potential impacts:

- Site servicing could extend about 3 to 5 m below grade for storm or sanitary sewers. 100 m of trench is assumed to be dewatered at a time.
- Residential basements could extend about 3 m below grade. It is assumed that a typical residential block could be 50 m wide, 200 m long, and basement areas could cover 70% of each block.
- Deeper basements or multiple underground levels may occur within the urban corridors, requiring excavations extending as much as 6 to 7 m below grade. It is assumed these urban corridor blocks could be 100 m wide and 200 m long, and basement areas could cover 70% of each block.
- Perimeter and sub-floor drains for buildings are assumed to be about 0.3 m deeper for the permanent dewatering assessment.
- SWM facilities are assumed to extend about 3 to 4 m below grade with plan dimensions up to 200 m by 200 m in size.

The following data is taken from the Phase 1 LSS (SCS and GEI, November 2024) and was used in the preliminary dewatering assessments:

- Based on the subsurface conditions at the site as characterized through the LSS field investigation, the site is generally underlain by 5 to 6 m of low permeability clay and silt glacial till (Halton Till), followed by very dense silt and sand glacial till.

- Rising head tests measured hydraulic conductivity values of approximately $2.5x10^{-9}$ to $2x10^{-7}$ m/s in the Halton Till, and $3.6x10^{-7}$ to $2.6x10^{-5}$ m/s in the silt and sand glacial till. A hydraulic conductivity of $5x10^{-7}$ m/s was used to assess typical site conditions for the impact assessment.
- Seasonal high groundwater levels were as high as 0.2 m below existing grade. During summer and early fall (typical construction season), the groundwater table typically ranges from about 0.5 to 2.5 m below grade. A groundwater level of 0.5 m below ground surface was used in the dewatering assessment.

3.1.1.1 Construction Dewatering

For preliminary purposes, the short-term construction dewatering assessment is based on open cut excavations. To excavate under dry conditions, the groundwater level is anticipated to be lowered at least to a minimum of approximately 0.5 m below the proposed excavation depth. Additional dewatering capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. The values below are preliminary estimates to support the impact assessment, and detailed analysis for dewatering will be required in future phases of site development.

The Radius of Influence (ROI) for construction dewatering is estimated based on the empirical Sichardt Equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This equation is empirical and was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

It is noted that in steady state conditions, the radius of influence of pumping will extend until boundary flow conditions are reached and provide sufficient water inputs to the aquifer, such as surface water bodies, more productive aquifers, or, as may be the case with soils of low hydraulic conductivity, until a new equilibrium is formed with infiltration and runoff/interflow processes. As a result, the distance of influence calculated using Sichardt equation is used to provide a representative flow rate calculation, but it is not precise in determining the actual radius influenced by pumping.

The ROI of pumping (dewatering) for radial flow is calculated based on the Sichardt equation, which is described as follows:

$$R_0 = 3000\ (\mathrm{H} - \mathrm{h})\sqrt{\mathrm{K}}$$

Where:

K = Hydraulic Conductivity (m/s)
H = Static Saturated Head (m)
h = Dynamic Saturated Head (m)

R_0 = Radius of Influence (m)

Based on the Sichardt equation, the hydraulic conductivity of 5.0 x 10^{-7} m/s for the soils, and the expected drawdowns, the ROI is approximately 6.4 to 14.8 m from the excavation for radial flow. The ROIs and potential drawdowns are summarized in **Table 3.1 (Appendix C2)** with calculations provided in **Appendix C3**.

The ROI calculation is a conservative methodology and is calculated based on the assumption of active pumping during construction dewatering. It should be noted that most of the water will be pumped during the first stage of the construction period or when a rain event occurs.

The Equivalent Well Radius method was used to obtain a flow rate estimate for the proposed site servicing and is expressed as follows:

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_O / r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

Where:

Q	= Rate of pumping (m^3/s)
x	= Length of excavation (m)
L_0	= Length of influence (m) ($L_0 = \frac{R_0}{2}$)
K	= Hydraulic conductivity (m/s)
H	= Head beyond the influence of pumping (static groundwater elevation) (m)
h	= Head above base of aquifer at the excavation (m)
R_0	= Radius of influence (m)
r_s	= Equivalent well radius (m)

For the dewatering estimates related to the long, narrow excavations associated with site servicing, the entire equation above is used which accounts for linear flow along the length of the trench and radial flow at both ends of the trench. For dewatering flows associated with larger excavations with lower aspect ratios (i.e., shorter length relative to width), only the first term in the equation is used as these types of excavations can more adequately be represented by flow to an equivalent well: such excavations include those for residential blocks, urban blocks, or SWM facilities.

Based on the assumptions provided previously, the results of the dewatering rate estimates are summarized in **Table 3.2** (see **Appendix C2**), and additional estimation details are provided in **Appendix C3**.

The total construction dewatering flow rates include a factor of safety of 2.0 to account for seasonal fluctuations in the groundwater table and variation in hydrogeological properties beyond those encountered during the field investigation. A 10 mm rain event was included to account for a typical precipitation event that could occur during construction. The dewatering estimates could be more or less, depending on the actual area and depth excavated at a time for each location.

These preliminary estimates indicate that construction dewatering for a given construction project within the WVSP is likely to involve taking of groundwater less than 400,000 L/day and therefore a Permit To Take Water is not expected to be required. However, the taking of stormwater and groundwater combined may potentially be 50,000 L/day and so the construction dewatering activity is required to be registered to the Environmental Activity and Sector Registry and must be carried out in accordance with O.Reg. 63/16.

It is reiterated that the dewatering estimates are for the impact assessment only, additional detailed analysis must be carried out to support future work within the WVSP area.

3.1.1.2 Post Construction Dewatering and Basement Drainage

The Town of Caledon engineering standards do not specify a minimum clearance between basement slabs and the seasonal high groundwater table. Based on the groundwater monitoring data provided in the Phase 1 LSS (SCS and GEI, November 2024), seasonal high groundwater levels typically range from 0.6 to 0.2 m below existing grade. Unless more than 3 m of grade raise is undertaken at the site, most basements in the proposed development would extend below the seasonal high groundwater level, and in most cases below the prevailing groundwater table throughout the year. Similarly, subsurface infrastructure (e.g., watermains, sewers) have the potential to form preferential flow paths due to disturbance of soils along their length, potentially leading to groundwater drainage and lowering of the overburden water table.

Where basement levels and any perimeter subdrains are kept above the seasonal high groundwater level (with a typical clearance of at least 0.5 to 1.0 m to account for long-term yearly variations) or where basement levels are fully waterproofed (i.e. no drains) and designed to resist hydrostatic pressures, no permanent dewatering would be anticipated. Installation of sewers and watermains with trench plugs or clay collars can also limit long-term dewatering and groundwater drainage.

A preliminary assessment is completed below for potential permanent dewatering rates, should basement levels be constructed below the groundwater table. The following additional assumptions are made for the purposes of providing an assessment:

- For most of the residential development areas, low density development is anticipated (e.g., single-detached dwelling units, townhouses), but building dimensions are unknown. Lot sizes of 20 m wide by 30 m long were assumed for a typical detached residential dwelling.

- For larger buildings in the urban corridor, with potentially one or two underground levels, it is still assumed these urban corridor blocks could be 100 m wide and 200 m long, and basement areas could cover 70% of each block.
- Rainfall events are not included for permanent dewatering because there is no open excavation.

The ROI estimation for permanent dewatering from basement drains follows the same procedure discussed previously. Estimation details are provided in **Appendix C3**, and the ROIs and potential drawdowns are summarized in **Table 3.3** (**Appendix C2**) for different potential permanent dewatering locations. The ROI estimates indicate zones of influence extending generally less than 15 m from the proposed structures.

The estimates were carried out using the methodology previously discussed (see **Appendix C3**), and are summarized in **Table 3.4** (**Appendix C2**). For a single detached dwelling, the estimated drainage rates are up to 12,120 L/day, whereas for a larger building constructed in the urban corridor (e.g., apartment or mixed use building with below ground parking) estimated long term drainage rates may be up to 152,600 L/day. It is reiterated that the dewatering estimates are for the impact assessment only, and additional detailed analysis must be carried out to support future work within the WVSP area.

3.1.2 Regulatory Considerations for Water Taking

The volume of water entering the excavation during construction will be based on both groundwater infiltration and precipitation events. Based on O.Reg. 63/16, the following dewatering limits and requirements are as follows:

- Construction Dewatering less than 50,000 L/day: The taking of both groundwater and stormwater does not require a hydrogeological report, does not require registration on the Environmental Activity and Sector Registry (EASR), and does not require a Permit to Take Water (PTTW) from the MECP.
- Construction Dewatering greater than 50,000 L/day but with the groundwater portion being less than 400,000 L/day: The taking of groundwater and/or stormwater requires a hydrogeological report and registration on the EASR but does not require a PTTW from the MECP.
- Construction Dewatering involving the taking of groundwater exceeding 400,000 L/day: requires a hydrogeological report and requires a PTTW from the MECP.

Based on the above, it is expected that an EASR and/or a PTTW from the MECP will be required during construction. Dewatering activities where the radius / zone of influence overlap must be considered together for the total water taking rates. A Category 3 PTTW would be necessary where dewatering of work areas with overlapping zones of influence require a combined taking of groundwater in excess of 400,000 L/day on any given day.

Additional assessment may also be required per "TRCA Technical Guidelines for the Development of Environmental Management Plans for Dewatering," dated September 2013. During future development stages, an ecologist may need to be retained to review the ROIs and estimated water taking rates previously described, relative to the potential NHS on or near the WVSP area. A Natural Heritage Evaluation may be required, along with consultation with TRCA to determine if an Environmental Management Plan (EMP) is required for construction dewatering.

For permanent (long-term) dewatering, a PTTW is required where the water taking rates exceed 50,000 L/day. As each neighbourhood area residential unit / lot is expected to be a freehold property, the water taking rates can be assessed individually (i.e., on a lot-by-lot basis). Based on the estimates discussed above, a PTTW is not anticipated for the neighbourhood area residential lots. However, a PTTW may be needed for the urban corridor development requiring permanent foundation drainage of basements. The requirement for PTTW could be avoided by constructing the subsurface portions (e.g., basements, parking structures) as waterproofed structures and thereby avoiding reliance on drainage. Pre-consultation with MECP can also be considered to confirm the long-term dewatering approach and requirements. Approval from the Town and possibly the Toronto and Region Conservation Authority (TRCA) may also be necessary for this long-term dewatering approach.
These regulatory requirements must be assessed further during future development stages, once detailed site plans are available and additional field investigation is completed.

3.1.3 Potential Impacts to the Natural Environment

The potential impacts discussed below must be assessed in more detail and addressed during future phases of development. The West Humber River lies outside the anticipated zones of influence of dewatering, therefore impacts to the West Humber River from short term construction dewatering are not expected. Furthermore, the water taken during construction dewatering would likely be discharged to surface within the same catchment from which it was taken, therefore eventually being returned to the West Humber River.

Most surface water features in the WVSP area are fed by surface water and would not be impacted by dewatering. The features that are fed by groundwater have the potential to be impacted if the construction dewatering ROI intersects the feature and reduces baseflow or draws down the surface water. Future reports must investigate this further and provide recommendations for appropriate monitoring and mitigation plans to reduce or prevent the impacts. Should pumped groundwater be returned to the feature to offset potential dewatering impacts, the condition of the discharged water must be assessed to prevent other quality or quantity impacts to the feature such as temperature, groundwater chemistry, total suspended solids, volume of discharge (taking care not to disrupt the temporal hydroperiod), spill control, etc. Ecological communities with seasonal reliance on groundwater must be considered in impact assessments for any proposed dewatering activities. Erosion and sediment control methods must be incorporated into any dewatering plans to prevent quality impacts and reduce potential for erosion within the features.

Construction dewatering has the potential to locally lower the groundwater table, but the impact is likely minor due to the short-term nature of the construction dewatering. Any minor impacts could likely be offset by discharging the pumped groundwater back to the land surface and allowing for it to re-infiltrate.

Post-construction drainage of the basement levels across the WVSP area is expected to have an impact on the prevailing groundwater table by lowering it deeper below grade compared to the seasonal levels observed during Phase 1 LSS monitoring. If not mitigated, there are potential environmental impacts and long-term implications associated with lowering of the groundwater table. The stormwater management design, informed by the feature-based water balance for applicable features, would seek to maintain the water balance of the wetlands/features that are to be retained thus mitigating any impact. The details of basement designs and the mitigation (e.g., LID measures) will be determined through the Phase 3 LSS and subsequent design stages (e.g., draft plan, site plan).

Consultation between different technical experts such as natural heritage / ecology teams and hydrogeologists are recommended during future design stages to make sure the appropriate long-term groundwater conditions are understood and accounted for. For example, if constructed wetlands are designed using current groundwater levels, but drained basements are to be constructed that will lower the groundwater table, this must be understood and incorporated into / accounted for in the design and appropriate mitigation measures included as applicable. During future development stages, studies are required to assess the potential amount of drawdown, the spatial area of impact, and any potential environmental effects or impacts to the natural heritage system.

3.1.4 Potential Impacts to Future Storm Water Infrastructure

If any construction dewatering occurs after site servicing is completed and the groundwater is discharged into the storm sewer infrastructure instead of to the land surface, the water-taker will need to verify that the expected flows can be safely conveyed by the storm sewers and in accordance with all relevant criteria and by-laws. If not, an appropriate discharge plan will need to be prepared and implemented to limit potential impacts to receivers.

Where drained basements are constructed with an outlet to a storm sewer, there will be increased permanent flows to the sewers and SWM facilities. The designer will need to check if the increased permanent flows will impact the design or function of the infrastructure and accommodate the flows within the design accordingly. Similar considerations apply in the design of a “third pipe” system with a dedicated drain for foundation drainage (i.e., a weeping tile collector).

Service trenches typically contain granular bedding and granular backfill around the pipes. The granular material is more permeable compared to the clay and silt glacial till encountered at the WVSP area. This can create a French drain effect, where groundwater is drawn into the granular material and conveyed along the pipe alignments, potentially lowering the groundwater table or creating issues with internal soil erosion (also referred to as “piping”). The need for trench plugs, anti-seepage collars, or similar methods should be explored as part of future design stages.

3.1.5 Potential Impacts to Land Stability and Settlement

For construction dewatering and long-term drainage, settlement of the soil within the radius of influence must be calculated based on the increase in effective stress from reducing the pore water pressures. Settlement has the potential to damage buried utilities, building foundations, or cause subsidence in adjacent lands. The settlement must be assessed in reports during future development stages, and if concerns are noted, mitigation measures must be provided.
Another cause of significant dewatering related settlement is due to pumping of fines through the dewatering system (i.e., ground loss by internal soil erosion). Future reports supporting site development should provide recommendations on filtering techniques or other methods to ensure soil is not conveyed through the dewatering systems. Low-density dwellings (e.g., townhouses, single-detached units) with basements below seasonal high groundwater and relying on foundation drainage should consider the use of appropriate granular material as backfill around weeping tile and filter fabrics to limit internal soil erosion, which could lead to ground loss and clogging of drains.

3.2 Water Balance and Groundwater Recharge

3.2.1 Water Balance Components

A water balance is an accounting of the water resources within a given area. The water balance equates the precipitation (P) over a given area to the summation of the change in groundwater storage (ΔS), evapotranspiration/evaporation (ET), surface water runoff (R) and infiltration (I) using the following equation:

$$\mathrm{P} = \Delta S + I + ET + R$$

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (i.e., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). For example, runoff occurs at a higher percentage during periods of snowmelt when the ground is frozen or during intense rainfall events.

Precise measurement of the water balance components is difficult, and as such, approximations and simplifications are made to characterize the water balance of a property. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important inputs to the water balance calculations.

- **Precipitation (P):** For the purposes of approximating the annual precipitation at the WVSP area, the monthly rainfall between 1981 and 2010 was used based on Environment Canada historical weather data for the Woodbridge Ontario weather station (Climate ID 6159575, Latitude 43.78 N, Longitude - 79.6 W, Elevation 164 metres), which is located about 11.9 km southeast of the WVSP area.
- **Storage (ΔS):** Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero.
- **Evapotranspiration/Evaporation (PET):** The evapotranspiration and evaporation components vary based on the characteristics of the land surface cover (i.e., type of vegetation, soil moisture conditions, perviousness of surfaces, etc.). Potential evapotranspiration refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. Evaporation occurs from a hard surface (such as flat rooftops, asphalt, gravel parking areas, etc.).
- **Water Surplus (R + I):** The difference between the mean precipitation and evapotranspiration is referred to as the water surplus. The water surplus is divided into two parts: as surface or overland runoff (R) and the infiltration into the surficial soil (I). The infiltration is comprised of two end member components: one component that moves vertically downward to underlying aquifers (referred to as percolation, deep infiltration or net recharge) and a second component that moves laterally through the near surface soil profile or shallow soils as interflow that re-emerges locally to surface (i.e., as runoff) at some short distance and time following precipitation.

3.2.2 Regional Climate

The average temperature and precipitation data was taken from Environment Canada Woodbridge station 1981 to 2010. The annual information is presented below:

Average Temperature: T (°C)	7.6
Unadjusted Potential Evapotranspiration: U (mm)	510.1

Adjusted Potential Evapotranspiration - PET (mm)	604.0

It is noted that the above are average values, which are representative in a regional context. Seasonal and annual variations of these values are expected. The long-term groundwater recharge and discharge rates are determined by these average values.

3.2.3 Approach and Methodology

An annual water balance was calculated according to the methodology provided by Thornthwaithe and Mather (1957). This methodology involves monthly estimates of soil-moisture balance to determine the pre- and post-development infiltration volumes. The detailed water balance calculation is provided in **Appendix C4**, which is summarized in this and subsequent sections of the report. The following assumptions were used as part of the soil-moisture balance calculations:

- A soil moisture balance approach assumes that soils do not release water as potential recharge while a soil moisture deficit exists.
- During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Considering the nature of the near surface soils (clay and silt glacial till, encountered uniformly across the WVSP area), a soil moisture storage capacity of 75 mm was used for the WVSP area to account for the post-construction green spaces consisting mostly of grass lawns or parkland.
- Once the soil moisture deficit is overcome, the remaining excess water is considered to be available to enter the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

Monthly potential evapotranspiration calculations accounting for latitude, climate and the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions was calculated. The proportioning of water surplus into its components runoff (R) and infiltration (I) was estimated by the method provided by the Ministry of Environment SWM Planning and Design Manual (2003). That method involves the selection of an infiltration factor based on topography, soil type and land cover in the catchment area. This approach was used to obtain a corresponding infiltration factor for pre- and post-development conditions. To obtain the quantity of infiltration in a given scenario, the water surplus is multiplied by the appropriate infiltration factor. Runoff is then the difference between the water surplus and the infiltration computed above.

3.2.4 Pre and Post-Development Water Balance

The Phase 1 LSS (SCS and GEI, November 2024) included the detailed pre-development water balance calculations. The results are summarized below:

- The potential infiltration for the WVSP area ranged from about 91 mm/year (agricultural land) to 78 mm/year (treed areas).

- The calculations suggested that the total yearly target for infiltration across the WVSP area was 307,550 m^3/year.

For the post-development water balance, the developable area and overall percent imperviousness were calculated based on the proposed Land Use Plan (**Figure 1.3, Appendix A2**), and are summarized in **Table 3.5** (**Appendix C2**). Generally, the proportion of impervious land area is expected to increase to above 70% for all areas within the WVSP.

These values were incorporated into the post-development water balance model. The post-development model results are included in **Appendix C4** and are summarized in **Table 3.6** (**Appendix C2**) along with the pre-development model results for comparison.

Comparing the pre- to post-development conditions, the following is observed for the WVSP area based on the Land Use Plan:

- Runoff increases by 181% and infiltration decreases by 62%.

- The infiltration deficit is 192,151 m^3/year, meaning this volume would need to be infiltrated via enhanced recharge facilities, LID structures, or other mitigation measures each year to maintain the water balance.

3.2.5 Potential Impacts to the Natural Environment

Urban development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (e.g., roads, parking lots, driveways, rooftops). Impervious surfaces prevent infiltration of water into the underlying soils and the removal of the vegetation reduces the evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor (estimated to be 15% of precipitation) compared to the evapotranspiration component that occurs with vegetation in this area (up to two thirds of precipitation). So, the net effect of the urbanization of the site is that most of the precipitation that falls onto impervious surfaces increases the surplus water resulting in more direct runoff from developed areas and reduced natural infiltration.
In conjunction with increased runoff, there is a reduction in infiltration to the shallow groundwater system. A reduction in infiltration can potentially lead to a lowering of the local groundwater table and reduce the potential for this seasonal water table intersection and discharge into natural features on or off site.

The increases in surface water runoff that will occur with urban development and mitigation of the potential impacts to the local water table due to reduction of infiltration may be minimized by using appropriate stormwater management and using LID measures to promote infiltration, where possible.

The basic premise for LID is to try to minimize changes to runoff and infiltration. As outlined in the MOE SWMP Design Manual (2003) and Low Impact Development Stormwater Management Planning and Design Guide published by the Credit Valley Conservation (CVC) and TRCA (2010), there are a suite of techniques that may be considered to promote infiltration and reduce runoff.

The infiltration deficit is estimated at 192,151 m^3/year. LIDs or other methods to increase post-development infiltration and maintain the water balance as best as possible must be explored in future design phases. It is recognized that infiltration at the WVSP area may be challenging, based on the low infiltration rates and the high groundwater table measured as part of the Phase 1 LSS.

It is noted that the WVSP area is not within a Significant Groundwater Recharge Area (SGRA). The WVSP area is uniformly surfaced with clay and silt Halton Till, limiting the amount of deeper recharge and promoting runoff. Due to the presence of weathered soils at the surface, it is expected that a large proportion of moisture that initially infiltrates ultimately flows laterally across the upper surface of the Halton Till and emerges at drainage features as interflow. Vertical gradients across the WVSP were mainly hydrostatic to downward, indicating that recharge conditions prevail. Where upward gradients have been observed, they have mostly been temporary occurrence and generally not artesian (i.e., groundwater levels above ground surface). Due to the resistance to seepage provided by the Halton Till, the quantity of groundwater discharge occurring where or when these upward gradients may occur would be very limited.

Surface water features planned to be maintained on site include (**Figure 2.3**, **Appendix B1**):

- Feature 8_9 (SWD3-2, Silver Maple Mineral Deciduous Swamp)
- Feature 10_11 (MAM2-2, Reed Canary Grass Mineral Meadow Marsh and MAM2-10, Forb Mineral Meadow Marsh)
- Feature 33 (SA, Shallow Aquatic)
- Feature 34 (MAS2-1, Cattail Mineral Shallow Marsh, Mowed)

Based on the data available from the Phase 1 LSS, which included the staff gauges and nested monitoring wells to measure gradient, surface flow, and potential groundwater-surface water interaction, the hydrology of these features is considered to be dominated by surface water processes. If development induces reduced infiltration or the lowering of the groundwater table over time, impacts to the features are not expected as they do not primarily rely on groundwater discharge. However, the stormwater strategy will need to maintain the availability of runoff to these features post-development, ideally in a way that maintains the pre-development flow pattern (e.g., distributed flow versus point outlet) and peak flows.

Surface water features that are planned to be removed but compensated with constructed wetlands include (see **Figure 2.3 Appendix B1**):

- Wetlands 2, 3, 5 and 6 (MAS2-1)
- Wetlands 4, 7, and 17 (MAM2-2)

The hydrology of these features appears to be dominated by surface water processes rather than groundwater flow. The occurrence of water in these features is understood to be mainly due to the combination of topography, which focuses runoff and interflow from the surrounding areas into these depressions, and the Halton Till soils, which limits seepage outflows and allows for periods of prolonged water retention. Site-specific groundwater level data, both at the existing wetland locations and the proposed compensation area, should be considered when establishing grades for the constructed wetlands.

3.2.6 Groundwater and Surface Water Quality

Depending on land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, phosphorous, bacteria and viruses. For groundwater, generally except for the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater flow through the soils.

LID measures or end treatments such as oil/grit separators or wet ponds will also help to remove suspended solids and other contaminants in runoff prior to infiltration or conveying the flows off the site, especially when a treatment train approach is taken for stormwater management. The proposed SWM strategy for the WVSP area will be discussed in the Phase 3 LSS.

Runoff from residential developments (e.g., rooftops, landscaped areas) is typically considered “clean” and should be prioritized for infiltration where infiltration is required to maintain groundwater recharge. Infiltration-based practices could potentially be permitted for impervious areas such as roads and driveways for the low-density residential neighbourhood areas, but this must be confirmed during future design stages with the Town and TRCA. Infiltration of runoff from commercial areas may require pre-treatment prior to infiltration or may not be permitted for infiltration, to be determined in future design stages.

If only clean or pre-treated runoff will be infiltrated, the groundwater quality will not be degraded and will not impact the West Humber River, on-site surface water features being maintained or created, or other nearby environmental features.

3.3 Water Supply Wells

The potential impacts discussed below must be assessed in more detail and addressed during future phases of development.

As discussed previously in the Phase 1 LSS (SCS and GEI, November 2024), the WVSP area is not located within a Well Head Protection Area Zone A to D or Q1/Q2, Intake Protection Zone, Significant Groundwater Recharge Area, Oak Ridges Moraine, or the Niagara Escarpment.

Development in the WVSP area is not expected to impact the quality or quantity of groundwater taken from active municipal wells given that the radius of influence is estimated to be less than 15 m from the excavation for the worst-case short term and permanent dewatering scenario. The nearest active municipal wells are approximately 6.4 km east and or 9.4 km northwest of the WVSP area.

Since the WVSP is not within a WHPA Q2, impacts to municipal wells for groundwater quantity are not expected even if the water balance cannot be maintained due to lower permeability soils and a high groundwater table.

LID measures are expected to be implemented on site where possible. If only clean or pre-treated runoff will be infiltrated, the quality of groundwater available to nearby domestic wells is not likely to be impacted. The low-permeability silt and clay till deposit (Halton Till) across the WVSP area also limits the amount of water infiltrating deeper below grade as recharge and helps reduce the potential for contamination entering the deeper drinking water aquifers.

It is noted that areas within the north, central and southeastern portions of the WVSP area have been identified as Highly Vulnerable Aquifer (HVA) areas under the local source protection plan (CTC SPR, 2015, see Figure 3.3). An HVA is an aquifer that has the potential for increased risk of contamination due to its proximity to the ground surface or the presence of surrounding geological materials with high permeability. For instance, materials like sand and fractured bedrock are highly permeable and allow water to infiltrate from the surface into deeper strata, potentially impacting aquifers, whereas clay layers provide a natural barrier due to their low permeability and offer protection to underlying aquifers.

It is noted that the HVA mapping provided in the source protection plan was developed through desktop studies based on existing data (e.g., water well records, surficial geological mapping). However, site specific information helps to provide actual stratigraphic and hydrogeological conditions.

Typically, within the WVSP area the groundwater level is near surface which is contributing to portions of the WSVP area being classified as HVAs. Based on field investigation conducted within the WVSP area under Phase 1 of this study, the general stratigraphy in the areas mapped as HVAs are mainly clay and silt glacial till (Halton Till) which is considered relatively low permeability material and represents an aquitard setting. Consequently, the study area specific information indicates that the area would not be considered an HVA.

Regardless of whether these areas remain HVAs or not, the potential for contamination as a result of development activities must be considered as part of subsequent phases of development studies. For example, the risk associated with activities such as the application of handling and storage of road salt, fuel and snow must be evaluated in those future reports.

Any existing monitoring wells or domestic drinking water wells within the WVSP area that are no longer in use will need to be decommissioned per Ontario Regulation 903. This will prevent potential contamination from entering the deeper groundwater system through unused wells, especially for domestic wells screened within deeper drinking water aquifers.

A door-to-door private well survey was completed for the sixty-one (61) private wells identified within 500 m of the site in the Phase 1 LSS, but no responses were received.

MECP water well records mapped within 500 m of the WVSP area were reviewed to assess the general nature groundwater usage in the vicinity of the WVSP area. Within the well record search area, most water well records indicating a supply usage were for domestic purposes, with several livestock wells and one public well (associated with St. Patrick school located southwest of the intersection of The Gore Road and Mayfield Road). Approximately one-third of the supply wells were identified as bedrock wells, having an average depth of over 25 m, while the remainder were overburden wells, having an average depth of about 18 m, though some wells have been identified at depths less than 10 m. Overburden wells were noted to typically be screened in sand or sand and gravel deposits between 15.2 to 54.9 m below existing grade. Based on the well records with available stratigraphic information, the deeper sand and gravel units may potentially be part of the Oak Ridges Aquifer Complex (ORAC).

Within the well record search area, most of the supply wells identified as being overburden wells were relatively deep (i.e., over 15 mbgs), were located to the east side of the West Humber River, or were located within the proposed WVSP area. Deeper wells are less susceptible to changes in water level; wells located to the east side of the West Humber River, which is interpreted to act as a local groundwater divide, are not expected to be influenced due to the separation provided by the river; and wells located within the WVSP area would eventually be provided with municipal water service as part of the proposed development, indicating a lesser need for long-term reliance on those supply wells. These factors generally indicate that the proposed development generally has low potential to impact the water quantity available to overburden well users, except possibly with respect to deep structures (e.g., deep basements in the urban corridor, trunk sewers) if such structures would require or induce long-term dewatering.

Bedrock wells within the search area are generally relatively deep (most greater than 15 m) and as such are not likely to be impacted in terms of water quantity. However, water quality may be affected depending on proposed stormwater management details. The potential for water quality impacts should be assessed as part of detailed design to determine whether mitigation measures should be implemented, such as lined ponds or quality requirements for water to be infiltrated (e.g., whether it should be limited to "clean" sources such as rooftops and rear-yards, or whether other sources can be used based on the provision of pre-treatment).

As previously noted, relatively little recharge from the WVSP area is expected to reach the ORAC based on the general stratigraphy consisting of clay and silt to sandy silt glacial till (Halton Till) which is considered relatively low permeability material and represents an aquitard setting. Furthermore, the ORAC deposits (if any do exist) are expected to be local and potentially discontinuous as discussed in the Phase 1 LSS (SCS and GEI, November 2024). A reduction in groundwater quantity to nearby wells is expected to be minimal to negligible even if pre-development quantities of recharge cannot be maintained post-development.

Even if impacts to nearby domestic wells are not anticipated, future reports should include a contingency plan with measures to implement during construction in case private well owners issue complaints about potential well shortages or other interference with their well. This could include investigating the complaint, assessing ongoing data collected from site during construction, addressing the complaint, and providing a temporary supply of potable water until the groundwater levels recover or the complaint is addressed.

3.4 Climate Change Impacts Groundwater

Climate trends were discussed in the Humber River Watershed Plan (TRCA, 2008) and were based on an analysis of climate parameters between two climate periods (1961-1990 and 1981-2010). The findings as described in the Watershed Plan are:

- Air temperature is increasing (0.7 degrees Celsius on average between the two time periods).

- Very hot days above 30 degrees Celsius and 35 degrees Celsius have increased.
- Very cold days between -10 degrees Celsius and -20 degrees Celsius have decreased.
- Total annual precipitation generally increased in the watershed by 3.3%.
- The growing season is increasing.

Local projections published by the TRCA (*Taking Action on Climate Change in Toronto Region)* indicate that by 2100:

- Average annual precipitation may increase by between 2.9% and 31%
- Average annual temperature may increase by between 2.5°C and 8.5°C
- Storm intensity may increase with maximum single-day precipitation amounts increasing by between 60% and 102%.

There is potential for climate change to impact the natural environment in that increased precipitation and more intense storms will further affect the distribution of runoff and infiltration in the WVSP. Increased temperatures and evapotranspiration may result in more extensive or prolonged seasonal drying of soils and a wider range of groundwater level fluctuations. These changes may in turn affect ecological communities, particularly wetlands, which are sensitive to hydroperiod, consistency of soil moisture, and/or depth to groundwater.

Climate change may affect water availability at water wells in the vicinity of the WVSP in that increased temperatures and a shift in storm patterns toward more intense events may result in widespread reductions in net groundwater recharge. Increased temperatures and evapotranspiration may also result in increased water-taking by well users for irrigation or other purposes. As the proposed development will be municipally-serviced via the Lake-based municipal water supply system, the latter effect is not expected to be exacerbated by the proposed development. However, the former effect (i.e., reductions in groundwater recharge) may be exacerbated by the proposed development due to the increased impervious area that would be associated with the developed area. Most water wells in the area are low intensity uses (e.g., domestic) and on average have a substantial water column (average water column above bottom of well is approximately 11.2 m). Therefore, it is expected that the potential for water quantity impacts to nearby well users is limited, though some users may be more susceptible, such as those with shallow wells or with wells installed in poorly productive formations (e.g., shale; till) which require large drawdowns to produce sufficient flows. In terms of water quality, it is not expected that climate change will impact water quality available to local wells, except potentially insofar as it may affect the rates of application of road salt for winter road maintenance.

4.0 Surface Water

4.1 Hydrologic Assessment

4.1.1 Proposed Drainage

Under future development conditions, the proposed grading and drainage for the WVSP area will need to maintain existing drainage conditions as described in Section 4.1.1 of the Phase 1 LSS (SCS and GEI, November 2024). The proposed Land Use Plan, **Figure 1.3** (**Appendix A2**) provides collector road locations and general land use, with local road layout and lotting to be established later through the Draft Plan of Subdivision stage of the development process. In accordance with the approved TOR (**Appendix A1**), and further outlined in Section 5.1 below, preliminary grading completed in support of the Secondary Plan only includes centerline collector road grades and as such, does not include future conditions drainage areas.

For the purposes of identifying potential impacts of the proposed land use on water resources, and determining a SWM strategy to mitigate those impacts, it is therefore assumed that the existing drainage patterns will be maintained under future development conditions. Considering the existing drainage patterns, in addition to the location of existing culverts, land ownership, natural heritage features and the proposed Land Use Plan (**Figure 1.3, Appendix A2**), nine (9) separate storm outlets have been identified for the WVSP area, as shown on **Figure 4.1** (**Appendix D1**). The existing conditions drainage areas to each of these outlets have been delineated as shown on Figure 4.1 of the Phase 1 LSS (SCS and GEI, November 2024).

In determining the outlet locations and drainage areas, consideration was given to the location and sizing of future SWM facilities to mitigate surface water impacts. This included the following considerations:

- Ensuring feature-based water balance for receiving headwater drainage features (HDFs), where possible.
- Avoiding drainage area diversions between Humber River catchments and minimizing drainage area exchanges between subcatchments.
- Maintaining drainage areas to end-of-pipe SWM facilities to less than 65 ha. With drainage areas greater than this, capacity within the public right-of-way (ROW) for conveyance of major system flows becomes limited which then leads to capture of 100 year storm event flows and corresponding increases in storm sewer sizing.
- Minimizing the number of SWM facilities to reduce the Town of Caledon's long-term maintenance requirements.
- Utilizing existing culverts as outlets where feasible, taking into consideration existing grading constraints.

- Consideration of ownership, i.e. participating versus non-participating landowners, as it relates to phasing and construction of SWM facilities.
- Minimizing the amount of municipal infrastructure required for SWM facility outfalls while being cognizant of the location of these outfalls (i.e. public property within the existing municipal ROW versus private property).
- Consideration of the proposed Land Use Plan, specifically:
    - The location of parks and the potential to co-locate SWM facilities within parks.
    - Future Collector Road layout and maintenance access to SWM facilities.
    - Low density residential versus mixed use corridor land uses, as it relates to whether the SWM facility would be municipally or privately owned and operated.

Although future conditions grading and delineation of proposed conditions drainage areas have not been completed as part of this LSS, the proposed drainage strategy does include five (5) areas where it is proposed that drainage be modified to accommodate the future development of the WVSP area as outlined below and illustrated on **Figure 4.1** (**Appendix D1**).

- The combined drainage from subcatchments 36.11.1 and 36.11.2 will drain to Culvert #6 at Outlet 1.
    - Under existing conditions subcatchment 36.11.2, 8.14 ha in size, drains southwesterly to Culverts #7 and #8 discharging to the ditch on Mayfield Road. There are no features downstream of the WVSP area that would be impacted by diverting the proposed drainage to Outlet 1. Due to the small size of the drainage area and to minimize the number of SWM facilities, the drainage from Subcatchment 36.11.2 will be combined with drainage from Subcatchment 36.11.1 discharging to Outlet 1.
- The combined drainage from subcatchments 38.04.10, 38.04.11 and 38.04.12 will drain to Culvert #10 at Outlet 4.
    - Subcatchment 38.04.12 is approximately 9.24 ha and drains under existing conditions to the north ditch of Mayfield Road. To minimize municipal infrastructure for a storm outfall from this area, it is proposed to direct the flows to Culvert #10 at Outlet 4.
    - Based on ownership and to minimize the number of SWM facilities, it is proposed to combine the drainage from Catchment 38.04.11 with subcatchments 38.04.10 and 38.04.12. The potential impact of the diversion on the wetland and HDF downstream of Culvert #9 south of Mayfield Road is discussed further in Section 4.3 with mitigation of impacts to be discussed in the Phase 3 LSS.
    - Although Culvert #9 is larger than Culvert #10, the latter was chosen for Outlet 4 due to the existing elevation being approximately 2.67 m lower facilitating grading and earthworks cut/fill balance for the development.

- The combined drainage from Subcatchments 38.04.20 and 38.05.10 will drain to Culvert #11 at Outlet 5.
    - Subcatchment 38.05.10 is small in size, approximately 5.80 ha and drains under existing conditions to Culvert #12 which is only 350 mm diameter in size. Based on the size of the catchment and the culvert, it is proposed to divert the drainage from this subcatchment downstream to Culvert #11 which is a 1500 mm diameter CSP.
    - Refer to Section 4.3 for further discussion of the potential impacts of the diversion on the HDF downstream of Culvert #12 east of The Gore Road. Future mitigation, if required will be discussed in the Phase 3 LSS.
    - Consideration of maintaining a feature-based water balance for Tributary H5S1/S2/S3 will also need to be considered in the SWM facility outfall location for these subcatchments. Refer to Section 4.3 for further discussion.
- The combined drainage from Subcatchments 38.06.10 and 38.06.11 will drain to Culvert #14 at Outlet 6.
    - Subcatchment 38.06.10 drains to Culvert #13 (650 mm diameter) combining with flows from Subcatchment 38.06.11 immediately downstream of Culver #14 (1300 mm diameter) east of The Gore Road.
    - To minimize the number of SWM facilities, the drainage from both subcatchments will be combined and discharged to the larger culvert, Culvert #14, at Outlet 6.
- The combined drainage from Subcatchments 38.06.20 and 38.06.22 will drain to Culvert #15 at Outlet 7.
    - Subcatchment 38.06.22 is small in size, approximately 3.65 ha and drains under existing conditions to Culvert #16 which is only 600 mm diameter in size. Based on the size of the catchment and the culvert, it is proposed to divert the drainage from this subcatchment downstream to Culvert #15 which is a 1000 mm diameter CSP.
    - To minimize the number of SWM facilities, the drainage from both subcatchments will be combined and discharged to the larger culvert, Culvert #15, at Outlet 7.

It is proposed to maintain existing drainage patterns for all remaining subcatchments within the WVSP area (i.e. 36.10.1, 38.04.30, 38.06.21 and 38.06.30), as well as for all external subcatchments (i.e. 36.10.2, 36.10.3, 36.10.4 and 36.06). It is also noted that Subcatchment 36.11.3 sheet drains southwesterly under existing conditions towards the east Centreville Creek Road ditch. Flows are then conveyed southerly within the ditch, crossing the road at Culvert #5, joining with flows from Subcatchment 36.11.1 immediately downstream of Culvert #6. To maintain existing drainage patterns, taking into consideration the location of the proposed mid-block east-west collector road, as shown on the proposed Land Use Plan (**Figure 1.3, Appendix A2**), and property ownership (participating versus non-participating, as shown on **Figure 1.2**, **Appendix**

A2), it is proposed to maintain the drainage from Subcatchment 36.11.3 to the ditch at Outlet #2. However, it is noted that it would be possible to combine the drainage from Subcatchments 36.11.1, 36.11.2 and 36.11.3 discharging to Culvert #6 at Outlet #1. This would eliminate one SWM facility and the future trunk storm sewer required on Centreville Creek Road once the road is urbanized and the ditch removed (Outlet 2).

As noted in Section 4.1.1 of the Phase 1 LSS (SCS and GEI, November 2024), external drainage is conveyed into the WVSP area from the northern limit where future SWM ponds are proposed in support of the Future Highway 413. No other external drainage enters the WVSP area.

The proposed drainage strategy outlined above is based on the preferred Land Use Plan and the information available as part of this LSS. Post development drainage areas will be established through subsequent Draft Plan of Subdivision grading, servicing and SWM designs. Ultimately, the Draft Plan drainage strategy may differ from that presented in this LSS provided that the existing drainage patterns are maintained to the extent possible.

4.1.2 Hydrologic Modelling

In order to determine the hydrologic impact of the proposed Land Use Plan (**Figure 1.3, Appendix A2**) on surface water resources, the peak flow to each of the nine (9) outlets was determined utilizing the Visual Otthymo Version 6.2 hydrologic model. As noted in the Phase 1 LSS (SCS and GEI, November 2024), the most recent calibrated hydrologic model for the Humber River watershed was obtained from the TRCA in January 2024 and discretized to establish existing conditions quantity control targets for the Regional storm event. This same model has now been utilized to complete the proposed conditions hydrologic assessment of peak flows for this Phase 2 LSS.

For the proposed conditions model, percent imperviousness was determined for each catchment based on the land uses indicated on the proposed Land Use Plan (**Figure 1.3, Appendix A2**). The percent imperviousness for each catchment was calculated as a weighted Runoff Coefficient based on the Town of Caledon Development Standards Manual (Version 5, 2019) and then converted to imperviousness based on the formula I = 0.7 RC + 0.2. The percent imperviousness for each catchment are identified on **Figure 4.1 (Appendix D1)** and summarized in **Table 4.1 (Appendix D2)**.

As established in a meeting with TRCA on December 5, 2024, the Curve Number (CN) and Initial Abstraction (Ia) for pervious areas were updated in the hydrologic model to represent the proposed land use conditions for both AMCII and AMCIII conditions. Refer to **Appendix D3** for the model parameter summary sheets. It is noted that, as discussed at the meeting and per correspondence from TRCA, calibration of the WVSP hydrologic model is not required.

The five (5) subcatchments identified in Section 4.1.1 requiring modification for future development conditions were consolidated into drainage areas to each outlet in the hydrologic model (refer to **Figure 4.1**, **Appendix D1**). The percent imperviousness, CN and Ia values were then updated for each drainage area as provided in **Appendix D3**.

Using the updated hydrologic model, the 2 through 100 year and Regional storm events were simulated to determine the proposed conditions uncontrolled peak flows for each catchment. Refer to **Appendix D3** for the hydrologic model schematic, summary output for the catchments and a digital link to the hydrologic modelling files. The peak flows for each catchment under existing conditions have been summarized in **Table 4.2** (**Appendix D2**), with the uncontrolled total peak flow for each catchment summarized in **Table 4.3** (**Appendix D2**).

The proposed conditions peak flows for each catchment, as well as at downstream key flow nodes identified in the Phase 1 LSS (SCS and GEI, November 2024), were compared to the existing conditions flow rates established in the Phase 1 LSS (SCS and GEI, November 2024). As shown in **Tables 4.4** and **4.5** (**Appendix D2**), the proposed conditions uncontrolled peak flows for each outlet exceed the pre-development levels; therefore, stormwater management quantity controls for the 2 through 100 year and Regional storm events are required to mitigate downstream impacts.

4.1.3 Climate Change Impacts to Peak Flows

Further hydrologic assessment has been completed to evaluate the hydrologic impacts of the proposed land use under future climate change scenarios. The proposed conditions hydrologic model, outlined above in Section 4.1.2, was simulated utilizing the Statistically downscaled CMIP-6 climate data retrieved from Power Analytics and Visualization for Climate Science (PAVICS), as instructed by TRCA. Refer to **Appendix D4** for the climate change model outputs.

Based on the "Summary of Climate Projections for the Humber River Watershed and If-Then-So Analysis" prepared by the TRCA, for watershed components incorporating climate change analysis, the high emissions scenario (and 2050s future climate data) will be the priority for assessment. Therefore, the SSP5-8.5 rainfall data was used for this analysis. The expected peak flows under the climate change scenario are summarized in **Table 4.6** (**Appendix D2**) and are compared to the post-development conditions per the proposed WVSP land use in **Table 4.7** (**Appendix D2**). It was found that there is an increase of peak flows ranging from 7% in the lower storm events to 46% in the higher-level storm events.

Geomorphic Assessment

In natural systems, watercourses regularly see flows that entrain and transport sediment. This is part of the natural process that maintains natural channel form (TRCA 2012, CVC 2015). The erosion threshold represents the magnitude of flow at which bed and/or bank sediment within a reach is entrained. Specifically, the erosion threshold provides a depth, velocity, discharge, or shear stress at which sediment of a particular size (usually the median grain size) may potentially begin to move. This does not necessarily mean systemic erosion (i.e., widening or degradation of the channel); it simply indicates a flow which may potentially entrain sediment (CVC 2015).

Nine (9) outfalls are proposed to outlet to several tributaries of the West Humber River. The locations of these outfalls are presented in **Figure 4.2** (**Appendix D1**). These receiving tributaries were selected for further assessment, to assist in the development of a stormwater management plan for the WVSP area.

4.1.4 Detailed Geomorphic Assessments

Detailed geomorphic assessments were completed for the receiving tributaries of the West Humber River between November 12 and November 14, 2024, and consisted of the collection of a topographic survey of the site at a sufficient level of detail to allow the measurement of the longitudinal profile of the watercourse and cross-sectional geometry. Additionally, a Rapid Geomorphic Assessment (RGA) was performed on these reaches, to identify the dominant geomorphic process, to help identify whether the critical erosion threshold would be based on the bed or bank materials. Some reaches were situated within non-participating land and could not be assessed in person. As such, a LiDAR-derived digital terrain model (DTM) from the Geospatial Ontario Database (MNRF 2024) was used to extract the longitudinal profile and cross sections. This data was supplemented by visual observations from a windshield assessment.

Where possible, in-situ documentation of bankfull stage indicators was also undertaken, as well as riparian vegetation cover and general site conditions. The characteristics of bed and bank materials (e.g., composition, grain size, etc.) was also recorded. The Manning's roughness coefficient was estimated using a visual method, as outlined by Arcement & Schneider (1989). Cross-sectional measurements and bankfull dimensions, the estimate of Manning's roughness, and the gradient, were used to back-calculate bankfull hydraulics. The surveyed cross sections were entered into FlowMaster (hydraulics software) along with the estimated Manning's roughness, to obtain the relevant bankfull hydraulics. The results from the detailed geomorphic assessment are summarized below and in **Table 4.8** (**Appendix D2**). Reach delineation established for the Scoped Subwatershed Study for the Settlement Area Boundary Expansion (Wood Environmental and Infrastructure Solutions Inc., November 2022) were maintained for this assessment.

Reach WHT3(5)2-1

Overall, reach WHT3(5)2-1 had an average profile gradient of 1.4%. The channel displayed a low degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 0.90 m to 2.0 m, averaging 1.6 m. The average bankfull depth ranged between 0.11 m to 0.40 m, and averaged 0.35 m. The Manning's roughness was estimated to be 0.040. The back-calculated bankfull velocity was 1.0 m/s, which corresponded to an average bankfull discharge of 0.40 m^3/s. Based on a textural analysis, bed material in the reach was found to be represented by ordinary firm loam. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of wetland flora.

Reach WHT3(7)1-1

Overall, reach WHT3(7)1-1 had an average profile gradient of 0.60%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 3.2 m to 6.6 m, averaging 4.0 m. The average bankfull depth ranged between 0.33 m to 0.40 m, and averaged 0.34 m. The Manning's roughness was estimated to be 0.040. The back-calculated velocity was 0.67 m/s, which corresponded to an average bankfull discharge of 0.53 m^3/s. Based on a textural analysis, bed material in the reach was found to be represented by silt loam. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of some trees and shrubs, with grasses and non-woody herbaceous species.

Reach WHT2-1-2

As reach WHT2-1-2 flows through non-participating land, a field assessment could not be performed. Instead, a surface for the location was created using a LiDAR-derived DTM from the Geospatial Ontario Database (MNRF 2024). Overall, reach WHT2-1-2 had an average profile gradient of 1.4%. As a desktop analysis was performed, bankfull indicators could not be observed, and bankfull dimensions were not measured. Via observations from the road right of way, the Manning's roughness was estimated to be 0.040. Based on a visual assessment, bed material in the reach was estimated to be represented by ordinary firm loam. Riparian vegetation consisted mainly of grasses and herbaceous species.

Reach WHT2-4

Overall, reach WHT2-4 had an average profile gradient of 1.0%. The channel displayed a low degree of entrenchment in the upstream portion of the reach, becoming highly entrenched in the downstream portion. Bankfull channel widths within the surveyed sections ranged between 1.4 m to 3.6 m, averaging 2.7 m. The average bankfull depth ranged between 0.21 m to 0.53 m, and averaged 0.32 m. The Manning's roughness was estimated to be 0.035. The back-calculated velocity was 0.91 m/s, which corresponded to an average bankfull discharge of 0.56 m^3/s. Based on a textural analysis, bed material in the reach was found to be represented by silt loam. Bank materials consisted of cohesive clay. Riparian vegetation consisted of some trees and shrubs, with grasses and non-woody herbaceous species.

Reach WHT2(1)2-1

As reach WHT2(1)2-1 flows through non-participating land, a field assessment could not be performed. Instead, a surface for the location was created using a LiDAR-derived DTM from the Geospatial Ontario Database (MNRF 2024). Overall, reach WHT2(1)2-1 had an average profile gradient of 3.5%. As a desktop analysis was performed, bankfull indicators could not be observed, and bankfull dimensions were not measured. Via observations from the road right of way, the Manning's roughness was estimated to be 0.040. Based on a visual assessment, bed material in the reach was estimated to be represented by ordinary firm loam. Riparian vegetation consisted mainly of grasses and herbaceous species.

Reach WHT2(1)1-1b

As reach WHT2(1)1-1b flows through non-participating land, a field assessment could not be performed. Instead, a surface for the location was created using a LiDAR-derived DTM from the Geospatial Ontario Database (MNRF 2024). Overall, reach WHT2(1)1-1b had an average profile gradient of 1.8%. As a desktop analysis was performed, bankfull indicators could not be observed, and bankfull dimensions were not measured. Via observations from the road right of way, the Manning's roughness was estimated to be 0.040. Based on a visual assessment, bed material in the reach was estimated to be represented by ordinary firm loam. Riparian vegetation consisted mainly of grasses and herbaceous species.

Reach WHT2(1)1-1c

At the time of assessment, this reach presented as a drainage feature in an agricultural field, with no defined bed or banks. Material throughout the reach consisted of loose loam. No riparian vegetation existed within the vicinity of the feature. Downstream of The Gore Road, this reach was located within non-participating lands. A surface for this location was created using a LiDAR-derived DTM from the Geospatial Ontario Database (MNRF 2024). No defined channel could be discerned through this method as well.

Reach WHT2(1)1-1a

As reach WHT2(1)1-1a flows through non-participating land, a field assessment could not be performed. Instead, a surface for the location was created using a LiDAR-derived DTM from the Geospatial Ontario Database (MNRF 2024). Overall, reach WHT2(1)1-1a had an average profile gradient of 2.8%. As a desktop analysis was performed, bankfull indicators could not be observed, and bankfull dimensions were not measured. Via observations from the road right of way, the Manning's roughness was estimated to be 0.040. Based on a visual assessment, bed material in the reach was estimated to be represented by ordinary firm loam. Riparian vegetation consisted mainly of grasses and herbaceous species.

Reach WHT2

Overall, reach WHT2 had an average profile gradient of 0.20%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 8.9 m to 10 m, averaging 9.0 m. The average bankfull depth ranged between 1.3 m to 1.7 m, and averaged 1.6 m. The Manning's roughness was estimated to be 0.035. The back-calculated velocity was 1.4 m/s, which corresponded to an average bankfull discharge of 14.5 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). A veneer of fine material was found to cover bed substrate throughout the reach. This deposit of fine materials did not appear to be characteristic of the reach, and is likely to be aggrading due to the effect of backwatering, such as due to large wood debris. The D_{50} (median grain size) was determined to be 5 mm due to the presence of fine material, the D_{75} mm was 51 mm, and the D_{84} was 110 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of trees, shrubs, grasses, and other herbaceous species.

4.1.5 Erosion Thresholds

As noted previously, erosion and deposition are natural processes that occur within watercourses. Issues arise when changes in the watershed's hydrology result in an increase or decrease in the frequency of period of erosive events. The objective, therefore, is to minimize the risk of exacerbating existing rates of erosion in the watercourse in the post-development condition.

There are several approaches that may be applied to determine the erosion threshold for a reach. These require information regarding the mean channel slope, cross-sectional dimensions, assessment of roughness, and substrate information (e.g., grain size), as obtained from the detailed geomorphic assessment. The TRCA (2012) Stormwater Management Criteria document provides a brief list of methods and resources for estimating thresholds for a range of conditions. The CVC (2015) Fluvial Geomorphic Guidelines document similarly provides a similar list of methods and resources. These methods may be based on the critical shear stress or the critical velocity. These parameters refer to the shear stress or velocity, based on the sediment size or class, at which sediment is entrained. For the shear stress approaches, when the mean shear stress in the channel exceeds the critical shear stress, sediment entrainment can be expected to occur. Similarly, for the velocity approaches, sediment entrainment occurs when the mean velocity in the channel exceeds the critical velocity. Critical shear stress or velocity for a given grain size can be calculated using empirical methods (e.g., Neill, 1967; Miller et al., 1977; Komar, 1987, etc.), or by graphical analysis, by referring to a chart (e.g., Hjulstrom, 1935; Chow, 1959). Authors such as Fischenich (2001), Julien (1998), Chang (1988), etc., provide tables of compiled permissible shear stresses and velocities for a range of sediment sizes.

Of the assessed channels where bed substrate consists of gravel, the method outlined by Komar (1987) was used. Komar presents an empirical relationship based on a function of the grain size, applicable to gravel in the 1 – 500 cm range:

$$V_{cr} = 57\ D^{0.46}$$

where V_{cr} is the critical velocity at which sediment is entrained (in cm/s), and *D* is the particle diameter to be entrained (in cm).

For the assessed channels with material finer than gravel, Julien (1998) and Fischenich (2001) provide permissible velocities that correspond to bed or bank material type (e.g. silt loam, ordinary firm loam, shale).

The reference cross-sections obtained from the detailed geomorphic assessments are used in the analysis to determine the corresponding erosion threshold, whereby the depth of flow in the cross-section is increased iteratively until the mean velocity exceeds the permissible velocity of the sediment. The erosion threshold analysis and calculations are summarized below and in **Table 4.9 (Appendix D2).**

Reach WHT3(5)2-1 (ETL-1)

The Rapid Geomorphic Assessment (RGA) effort had identified that the reach was in regime. Slight evidence of aggradation was observed throughout the reach. As the substrate for this reach consisted of ordinary firm loam, a permissible velocity as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.14 m^3/s. This discharge represents a value that is approximately 37% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 23 N/m^2.

Reach WHT3(7)1-1 (ETL-3)

The Rapid Geomorphic Assessment (RGA) effort had identified that the reach was in regime, with slight evidence of aggradation. As the substrate for this reach consisted of silt loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.61 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.36 m^3/s. This discharge represents a value that is approximately 70% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 13 N/m^2.

Reach WHT2-1-2 (ETL-4)

Reach WHT2-1-2 was located on non-participating lands, and therefore, was assessed via a desktop analysis using LiDAR data. A substrate characterization was completed using a windshield assessment. The dominant substrate appeared to consist of ordinary firm loam. A permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.14 m^3/s. The average shear stress acting on the channel bed at this stage is approximately 23 N/m^2.

Reach WHT2-4 (ETL-5)

The Rapid Geomorphic Assessment (RGA) effort had identified that downcutting (i.e., vertical scour) was the dominant geomorphic process. Therefore, the erosion of the bed material was considered to be the critical erosion threshold. Additionally, due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials.

As the substrate for this reach consisted of silt loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.61 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.25 m^3/s. This discharge represents a value that is approximately 60% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 17 N/m^2.

Reach WHT2(1)2-1 (ETL-6)

Reach WHT2(1)2-1 was located on non-participating lands, and therefore, was assessed via a desktop analysis using LiDAR data. A substrate characterization was completed using a windshield assessment. The dominant substrate appeared to consist of ordinary firm loam. A permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.09 m^3/s. The average shear stress acting on the channel bed at this stage is approximately 27 N/m^2.

Reach WHT2(1)1-1b (ETL-7)

Reach WHT2(1)1-1b was located on non-participating lands, and therefore, was assessed via a desktop analysis using LiDAR data. A substrate characterization was completed using a windshield assessment. The dominant substrate appeared to consist of ordinary firm loam. A permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.40 m^3/s. The average shear stress acting on the channel bed at this stage is approximately 21 N/m^2.

Reach WHT2(1)1-1c (ETL-8)

No defined channel could be discerned for this reach within the Subject Lands, and through the LiDAR data downstream of the Subject Lands. Therefore, this reach was deemed to not be sensitive to erosion. In lieu of a detailed erosion assessment it is recommended that the minimum on-site retention requirements outlined within the TRCA (2012) Stormwater Management Criteria document be applied to the proposed outfall on this reach.

Reach WHT2(1)1-1a (ETL-9)

Reach WHT2(1)1-1a was located on non-participating lands, and therefore, was assessed via a desktop analysis using LiDAR data. A substrate characterization was completed using a windshield assessment. The dominant substrate appeared to consist of ordinary firm loam. A permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach, was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.19 m^3/s. The average shear stress acting on the channel bed at this stage is approximately 25 N/m^2.

Reach WHT2 (ETL-10)

It was noted during the field investigation that a veneer of sand and silt had been recently deposited on the surface. As this fresh deposit did not appear to be characteristic of the reach, the more representative particle size was deemed to be the coarser fraction, i.e., the D_{75} of 51 mm. The critical velocity for the bed materials in reach WHT2, based on the D_{75}, was calculated to be 1.2 m/s, using Komar's (1987) relationship. The corresponding discharge in the cross section at the point that sediment is entrained is 8.5 m^3/s. This discharge represents a value that is approximately 60% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 21 N/m^2. Due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials. Therefore, the most appropriate critical discharge for this reach was identified to be that of the bed materials (i.e., 8.5 m^3/s).

4.1.6 Erosion Exceedance Analysis

In order to understand the potential impacts of the proposed development plan on channel morphology, an impact assessment was undertaken with respect to the stormwater management plan for the site. As noted previously, in natural systems, watercourses regularly see flows that entrain and transport sediment. This is part of the natural process that maintains natural channel form (TRCA 2012, CVC 2015). The key to maintaining natural channel function is to match the frequency of exceedance or cumulative effective work in the post-development condition (TRCA 2012).

Pre- to post-development exceedance can be evaluated using several criteria. The simplest is the cumulative time of exceedance or the number of exceedances (TRCA 2012, CVC 2015). Although these provide a simple comparison, they do not provide information on the work or erosive force of flows once erosion thresholds are exceeded. To provide a more stringent assessment, an approach involving three analyses was performed, including the cumulative effective erosion index (velocity exceedance), cumulative effective discharge index, and the cumulative effective work index.

The cumulative effective velocity (*CEV*) is calculated as:

$$CEV = \sum (V - V_c)$$

The cumulative effective discharge (*CED*) is calculated as:

$$CED = \sum (Q - Q_c)$$

The cumulative effective shear stress (*CESS*) is calculated as:

$$CESS = \sum (\tau - \tau_c)$$

where V is the mean channel velocity, V_c is the critical (permissible) velocity, Q is the channel's discharge, Q_c is the critical discharge, τ is the instantaneous shear stress, and τ_c is the threshold shear stress.

The cumulative effective work index (W_i) describes the cumulative effective work or stream energy expended above the critical value. W_i is calculated as:

$$W_i = \sum (\tau - \tau_c) \mathrm{V}\, \Delta t$$

where Δt is the timestep used in the analysis.

The TRCA Stormwater Management Criteria (2012) document notes that the cumulative effective work index is the preferred method when assessing potential impacts, as the velocity will increase as flood stage increases, which means that the cumulative effective work parameter will be more sensitive to extreme floods.

To determine the potential erosion impacts associated with the proposed land use, an erosion exceedance analysis was completed. This included completing continuous simulation hydrological modelling to establish hydrographs for existing and proposed conditions at the erosion threshold locations identified in Section 4.2.2 and shown on **Figure 4.2 (Appendix D1)**. The event based Visual Otthymo hydrologic model created for the hydrologic assessment, as outlined in Section 4.1.2, was utilized in continuous simulation mode for the erosion exceedance analysis. Rainfall data was provided by TRCA which included twenty-two (22) years of precipitation data from May 1986 to December 2007 from Buttonville Airport Weather Station. Refer to **Appendix D5** for the model schematic, model parameter summary and hydrographs, for both existing and proposed conditions.

For the continuous modelling simulation, soil types have been assigned to each catchment based on the Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Soil Survey Complex. Similarly, the existing land cover for each catchment is noted as "Crops up to Shoulder Height" established based on aerial imagery of the WVSP area. Further to this, the land cover for each catchment in post-development conditions has been assigned as "Grass Land", as the pervious areas in post-development conditions will consist of grassed/landscaped areas (rear yards, boulevards etc.).

The existing and proposed conditions hydrographs resulting from the continuous simulation modelling at the twelve (12) erosion threshold locations were utilized to calculate cumulative time of exceedance, cumulative effective velocity, cumulative effective discharge, and cumulative effective work.

To complete the erosion exceedance analysis, a rating curve was created based on a representative cross section (identified through the detailed geomorphic assessment and erosion threshold work). The flow in each time step of the hydrographs was then related to the representative cross section. This was then used to calculate the cumulative exceedance for each hydraulic parameter (e.g., velocity, discharge, shear stress, effective work index) in relation to the threshold condition.

The cumulative exceedance analysis results for the pre-development condition were compared to the uncontrolled post-development scenario. The results are presented in **Table 4.10 (Appendix D2**). It should be noted that ETL-2 and ETL-8 were omitted from the analysis, as flows from ETL-2 is proposed to be routed to ETL-1, and ETL-8 outlets to reach WHT2(1)1-1c, which was an undefined feature lacking bed and banks.

The results indicate that the proposed uncontrolled condition post-development results in an increase in erosion potential throughout the reaches receiving flow from the Subject Lands. The increases vary for the different parameters, but the cumulative effective work index parameter represents the most important parameter to assess potential impacts. This varies between an increase of 39% for ETL-5 (reach WHT2-4) to 5521% for ETL-7 (reach WHT2(1)1-1b). It is anticipated that the increase in erosion potential can be mitigated through the implementation of stormwater management measures, LIDs, etc. which will be discussed in the Phase 3 LSS.

4.2 Feature Based Water Balance

4.2.1 Wetland Screening and Water Balance Risk Evaluation

The existing conditions catchment area was delineated for all wetlands within the WVSP area, in addition to those wetlands located outside of the WVSP area with catchment areas inside the WVSP area. Refer to **Figure 4.3** (**Appendix D1**) for the wetland ID, locations and drainage areas. An initial assessment of the wetland catchments and the potential impacts from the proposed land use plan was completed. Refer to **Table 4.11a (Appendix D2)** for a summary of the assessment.

A wetland water balance risk evaluation (TRCA 2017) was then completed for retained wetlands within the WVSP area (wetland numbers 8_9, 33, 34, and 10_11) and wetlands located outside of the WVSP area, with catchments inside the WVSP area (wetland numbers 22, 24, 25, 29, 30, 31, 32, 35, 37, 38 and 43). This corresponds to a total of fifteen (15) wetlands assessed as part of the Wetland Water Balance Risk Evaluation.

Wetlands on non-participating lands (wetland numbers 16, 21, 23, 26, 27, 28, 36, 39, 40, 41A and 41B) are anticipated to be removed, pending future studies, as they consist of small (usually much smaller than 0.5 ha), secluded features in an agricultural and residential land use setting, generally comprised of Meadow Marsh and Shallow Marsh wetland types. Wetlands proposed for removal and compensation or relocation (wetland numbers 2, 3, 4, 5, 6, 7, 12, 13, 14, and 17) were excluded from the wetland risk evaluation.

The wetland risk evaluation further compared pre-development conditions with post-development without mitigation conditions. The risk level (low, medium, high) was assessed based on the potential magnitude of hydrological change and sensitivity of the wetland. Where there was incomplete ecological data, due to site access, the precautionary principle was applied, and the wetland sensitivity was assessed as high.

The wetland water balance risk evaluation (**Table 4.11b, Appendix D2**) assessed eight (8) wetlands as high risk (wetlands 8_9, 33, 34; 24, 31, 35, 37 and 43), one wetland as medium risk (wetland 10_11) and six wetlands as low risk (wetlands 22, 25, 29, 30, 32, and 38).

Three (3) of the fifteen wetlands assessed, Wetlands 29, 30, and 32, are riparian wetlands located on the West Humber River, north of Mayfield Road. There is only 0.81 ha of drainage area from the WVSP contributing flows to these wetlands, representing less than 0.1% of the total wetland drainage area. Potential impacts to these three (3) wetlands are considered negligible and have therefore, not been evaluated further within the continuous modelling scenarios.

Implementation of the proposed land use plan, and associated servicing, grading and SWM, will result in an overall increase of runoff volume to eight (8) of the wetlands due to the increase of impervious surfaces draining to them. This includes Wetlands 22, 24, 25, 31, 35, 37, 38 and 43. No further analysis of these wetlands is required. The remaining four (4), Wetlands 8_9, 33, 34 and Wetland 10_11, require feature-based water balance assessment utilizing continuous simulation hydrologic modelling.

The post-development modelling for these wetlands, noting that Wetlands 8_9, and 33 and 34 are considered one wetland complex, was prepared in order to determine the overall reduction and impact of the reduction on runoff volumes. Mitigation for runoff volume reduction to these features will be discussed in the Phase 3 LSS.

4.2.2 Continuous Simulation Hydrologic Modelling

As outlined in Section 4.3.1 above, through the Wetland Screening and Water Balance Risk Evaluation, it was established that there would be risk for negative impacts to the form and/or function of four (4) retained wetlands within the WVSP area resulting from the proposed land use plan. Wetlands 8_9, 33 and 34, will potentially be impacted by redirection of drainage from the wetland to Outlet 4, as outlined in Section 4.1.1 above. Similarly, Wetland 10_11 will potentially be impacted by redirection of drainage to Outlet 5.

To quantify the potential impacts resulting from a decrease in runoff volumes to the feature, a continuous simulation hydrologic model was utilized to determine existing and future conditions average monthly, average annual and average seasonal (spring, summer, fall) runoff volumes to both wetlands. The time to peak was calculated for both wetlands using the Uplands Method. Refer to **Figure 4.3 (Appendix D1**) for the travel length and **Appendix D6** for the calculations. The remaining model parameters for each wetland drainage area, including Curve Number (CN), Initial Abstraction (Ia), percent imperviousness, soil types and land cover were obtained from the parent subcatchment in the erosion exceedance model.

The wetland model was then simulated in continuous mode utilizing the same twenty-two (22) years of precipitation data utilized in the erosion exceedance model, (May 1986 to December 2007 from Buttonville Airport Weather Station). Refer to **Appendix D6** for the model schematic, parameter sheets along with the total annual, monthly and seasonal runoff volumes. The total annual runoff volumes for Wetland complex 8_9, 33, 34 and Wetland 10_11 have been summarized in **Tables 4.12** and **4.13** (**Appendix D2**), illustrating a reduction annual runoff volumes of 43% and 98%, respectively. Mitigation of potential impacts is therefore required with clean water augmentation to the wetlands through the implementation of LID measures. The mitigation strategy will be discussed in the Phase 3 LSS.

In accordance with the approved LSS Terms of Reference (**Appendix A1**), and based on the amount of field data obtained to date (1 to 2 years) the wetland continuous simulation hydrologic model has not been calibrated at this time. Per Town correspondence and TRCA SWM Criteria, Appendix D (Water Balance for Protection of Natural Features), calibration will be required at the Draft Plan of Subdivision stage once additional data has been obtained.

4.2.3 Climate Change and Wetland Water Balance Risk Evaluation

Climate change is altering precipitation patterns, increasing temperatures, and intensifying extreme weather events. These changes can lead to periods of excessive flooding, prolonged drought, and shifts in groundwater recharge, impacting the hydrology and ecological function of wetlands. Increased impervious surfaces due to development can exacerbate these impacts by altering runoff patterns and reducing infiltration rates. As a result, wetlands may face hydrological imbalances that threaten their ability to support biodiversity, regulate water quality, and provide critical ecosystem services, like flood mitigation and carbon sequestration.

The wetland water balance risk evaluation provides a framework to address the above noted challenges. By categorizing wetlands into low, medium, and high-risk levels based on potential hydrological changes and sensitivity, appropriate hydrological modelling methods are applied to ensure a detailed understanding of each wetland's needs. The precautionary principle ensures that in cases of incomplete data, conservative assessments guide mitigation planning. The use of continuous hydrological models for medium and high-risk wetlands, including those with groundwater interactions, allows for the prediction of hydrological responses under various scenarios. Additionally, the integration of LID measures and adaptive stormwater management strategies can assist in maintaining natural hydrological functions post-development. This approach supports wetlands in continuing to adapt to climate variability, preserving their resilience and capacity to provide essential ecosystem services in a changing climate.

5.0 Grading and Municipal Servicing

5.1 Grading

Per the topographic survey provided in Appendix D2 of the Phase 1 LSS (SCS and GEI, November 2024), the WVSP area is generally comprised of rolling agricultural lands with a grade range of less than 1% to approximately 7%. The topographic elevations vary from approximately 249.0 m at the northwestern limit of WVSP area to approximately 220.0 m at the southeastern limit. The WVSP area is divided by a ridge running north to south. The lands to the west of the ridge slope west towards Centreville Creek Drive. The lands to the east of the ridge slope east towards the Gore Road. The rolling topography generates several distinct low points along Centreville Creek Road, the Gore Road, and Mayfield Road. Existing culverts are located at each of the distinct low points to convey stormwater runoff outside the limits of the WVSP area.

A preliminary grading concept showing centerline road grades based on the proposed Land Use Plan is provided on **Figure 5.1, Appendix E1**. Due to the relatively flat grades through portions of the study area, a minimum road grade of 0.5% has been utilized where necessary to achieve continuous overland drainage towards the anticipated low points of the WVSP development. The local road network will coincide with the collector road low points to provide a continuous overland flow path to the ultimate storm outfall locations. Where capture of the 100-year storm event is required, the proposed grading will allow for emergency flows to be directed overland to the ultimate storm outfall or adjacent arterial road right-of-way. The proposed grading concept generally matches the existing topography to the extent possible to minimize the cut and fill volumes.

Per the current Highway 413 preliminary concept mapping, two SWM facilities are anticipated at the north end of the WVSP area. The western SWM facility is anticipated to convey flows south into the WVSP area. The existing elevations to the east and west of the western SWM facility are significantly higher than the existing low point, therefore it is anticipated that emergency flows will be conveyed through the WVSP area from this facility. A continuous overland drainage route will be provided from the western SWM facility block through the WVSP area to convey emergency flows. The eastern SWM facility is anticipated to convey outflow east within the Highway 413 right-of-way and ultimately to the West Humber River, therefore no additional grading considerations are required. It is anticipated that some transition grading will be required within the MTO's 14m structural setback allowance to regulate the limit of development due to the steeper slopes adjacent to the western SWM facility block.

The design of Highway 413 is ongoing and therefore subject to change. The grading requirements along the MTO structural setback allowance and confirmation of the emergency overland flow accommodations will be provided as part of future draft plan applications for affected properties.

In general, proposed development within the WVSP area must be graded in a manner which will satisfy the following goals:

- Satisfy the Town of Caledon lot and road grading criteria including:
  - Minimum Road Grade: 0.75% (exceptions proposed as necessary as outlined above)
  - Maximum Road Grade: 6.0%
  - Minimum Lot Grade (split lots): 2%
  - Minimum Lot Grade (front draining lots): 3%
  - Maximum Lot Grade: 5%
  - Maximum slope between houses in any direction: 4:1
  - Provide a 0.6 m wide gently sloped area at 2.0% away from the house on at least one side of the building where side yard setbacks permits;
- Provide continuous road grades for overland flow conveyance;
- Minimize the need for retaining walls;
- Minimize the volume of earth to be moved and minimize cut/fill differential;
- Minimize the need for rear lot catchbasins; and
- Achieve the stormwater management objectives required for the proposed development.

A more detailed grading utilizing the criteria noted above will be provided at the Draft Plan of Subdivision application stage. The preliminary grading shown on **Figure 5.1, Appendix E1** will be used as the basis for grading within individual parcels. The collector road grading is subject to change at the Draft Plan of Subdivision application stage, as required, to balance the cut and fill volumes and minimize slopes and walls.

Grading is not anticipated to be required within the NHS for the implementation of infrastructure, trails, or roads. Transition grading may be required within buffers to satisfy the goals listed above. Any grading proposed within buffers will be confirmed as part of the future draft plan applications for affected properties.

5.2 Sanitary Sewer Servicing

5.2.1 Existing and Planned Sanitary Servicing

As noted in the Phase 1 LSS (SCS and GEI, November 2024), there are no existing sanitary sewers within the WVSP area or on the arterial roads immediately surrounding the WVSP area. An existing 1200 mm diameter sanitary sewer is located on The Gore Road approximately 615 m south of Mayfield Road. There is also an existing sanitary sewer (size to be confirmed) located on McVean Drive at the intersection with Countryside Drive approximately 1.25 km south of the WVSP area.

The planned sanitary servicing improvements in the Region of Peel and Town of Caledon have been determined through the Region of Peel Water and Wastewater Master Plan

(2020), Region of Peel Settlement Boundary Expansion (SABE) Water and Wastewater Servicing Analysis (2022), and ongoing coordination with Region of Peel staff. The WVSP Area is identified as Secondary Plan area G2 in the Town of Caledon Official Plan. Relevant figures from the Region documents and coordination noted above are provided in **Appendix E2**. Through the documents and discussions outlined above, it can be confirmed that the WVSP has been accounted for by the Region with regard to wastewater servicing through the extension of existing services.

The Region of Peel Water and Wastewater Master Plan (2020) identifies the servicing needs of future development to 2041. The Master Plan projects proposed in this document include watermain and sanitary sewer projects throughout the Region, including the planned growth areas in Caledon north of Mayfield Road and in west Bolton, but do not include the development area surrounding the anticipated Bolton GO station. Several wastewater projects are noted in the immediate vicinity of the WVSP including: T-085 (The Gore Road from current termination to Mayfield Road) and ST-256 (McVean Drive from current termination to Mayfield Road).

The Region of Peel SABE Water and Wastewater Servicing Analysis (2022) identifies the servicing needs of the anticipated growth areas in Caledon from 2041 to 2051 including the development area surrounding the anticipated Bolton GO Station. The analysis focused on conveyance infrastructure and did not include a summary of water treatment plant and wastewater treatment plant improvements required beyond those identified in the Region of Peel Master Plan (2020). The WVSP Area was identified as part of sanitary servicing area 3. No additional wastewater projects were noted in the immediate vicinity of the WVSP beyond those identified in the Region of Peel Water and Wastewater Master Plan (2020).

Draft DC Project Mapping (2024) was obtained from Region of Peel staff which illustrates preliminary sanitary projects to support the full buildout of the SABE including the WVSP. It should be noted that the projects and construction timing shown are preliminary only and subject to change. The Draft DC Mapping shows The Gore Road Trunk Sewer (T-085) extending north of Mayfield Road to King Street and the McVean Drive trunk sewer extending north of Mayfield Road on Centreville Creek Drive to immediately south of the planned Highway 413, refer to **Appendix E2.1**.

A first submission of the detailed design of project T-085 has been completed and reviewed by Region of Peel staff. The proposed 1200 mm diameter concrete sanitary sewer will extend north on The Gore Road from the current termination point approximately 80 m north of Beamish Court to immediately south of the planned Highway 413. The design drawings show individual plugs at the proposed maintenance hole structures to accept sanitary flows from the WVSP Area at the anticipated collector road locations and at the intersection with Mayfield Road. The latest version of the design drawings has been provided in **Appendix E2.2** for reference.

5.2.2 Proposed Sanitary Servicing

The Proposed Sanitary Drainage Plan (**Figure 5.2, Appendix E1**) shows local wastewater mains (i.e. sanitary trunk sewers) and drainage boundaries per the latest Region of Peel Draft DC Project Mapping (2024). The WVSP Area will be serviced via several connections to the future wastewater main on the Gore Road (project T-085) at each of the proposed collector road intersections. The internal alignment and location of the stubs for the proposed sanitary sewers are preliminary only and subject to change at the Draft Plan of Subdivision stage. No external drainage is proposed to be conveyed through the WVSP area in accordance with the latest Region of Peel Draft DC Project Mapping (2024).

The sanitary sewers within the WVSP Area are anticipated to have slopes ranging between 0.5% and 2% (typically). Preliminary grades and inverts are as illustrated on (**Figure 5.3, Appendix E1**). Slopes of less than 0.5% may be required for trunk sanitary sewers to limit the depth of trunk infrastructure while meeting minimum velocity criteria. The alignment and invert design of the trunk infrastructure is preliminary only and will be refined through the Draft Plan approval process to limit overall sewer depth.

The sanitary sewer system will be designed in accordance with the Region of Peel and MECP criteria, including but not limited to:
Residential Sanitary Generation Rate: 290 L/c/d,

- Commercial Sanitary Generation Rate: 270 L/emp/ha
- Population Density:
  - Single detached: 4.2 person/unit,
  - Semi-detached: 4.2 person/unit,
  - Townhouse: 3.4 person/unit,
  - Large Apartment (greater than 1 bedroom): 3.1 person/unit,
  - Small Apartment (less than or equal to 1 bedroom): 1.7 person/unit,
- Peaking Factor: Harmon (Max. 4.0),
- Infiltration Rate: 0.26 L/s/ha,
- Minimum Pipe Size: 200 mm diameter,
- Minimum Pipe Cover: 2.5 m below centerline road elevation,
- Minimum Actual Velocity: 0.75 m/s, and
- Maximum Velocity: 3.0 m/s.

A preliminary sanitary design sheet has been prepared based on the proposed Land Use Plan for the WVSP area and assumed land-use statistics. The sanitary design sheet is provided in **Appendix E3**. The WVSP Area sanitary drainage boundaries as defined by the limits of development in the Phase 1 Local Subwatershed Study will be refined through the Secondary Plan and Draft Plan approval process. Therefore, the populations and design flows are preliminary only and are subject to change.

5.3 Water Supply and Distribution

5.3.1 Existing and Planned Water Servicing

As noted in the Phase 1 LSS (SCS and GEI, November 2024), there are existing watermains on several arterial roads surrounding the WVSP area including: a 200 mm diameter watermain on Centreville Creek Road, Healey Road, and The Gore Road; and a 300 mm diameter watermain, 600 mm diameter watermain (Pressure Zone 5), and 750 mm diameter watermain (Pressure Zone 6) on Mayfield Road. The WVSP Area is located entirely within Pressure Zone 6 which has a serviceable elevation of 214.5 m to 259.1 m. The WVSP is located within the East Region of Peel transmission system. The system is fed from Lake Ontario and treated at the Arthur P. Kennedy Water Treatment Plant (HLP1C, HLP2C). Water storage and distribution for the WVSP area is provided by the Tullamore Reservoir (ES4) and Pumping Station (LLP5E, HLP6E) and the Bolton Elevated Tanks (BS6).

The planned water servicing improvements in the Region of Peel and Town of Caledon have been determined through the Region of Peel Water and Wastewater Master Plan (2020), and the Region of Peel Settlement Boundary Expansion (SABE) Water and Wastewater Servicing Analysis (2022). The WVSP Area is identified as Secondary Plan area G2 in the Town of Caledon Official Plan (OP, 2024). Relevant figures from the Region documents are provided in **Appendix E2.1**. Through the documents and discussions outlined above, it can be confirmed that the WVSP area has been accounted for by the Region with regard to water servicing through the extension of existing services and planned water servicing improvements.

The Region of Peel Water and Wastewater Master Plan (2020) identifies the servicing needs of future development to 2041. Several water projects are noted in the immediate vicinity of the Secondary Plan including: D-085 (Mayfield Road from Centreville Creek Road to the Gore Road), and D-184 (Centreville Creek Road from Mayfield Road to a mid-block connection). Per correspondence with Region of Peel staff, it is understood that project D-085 has been completed.

The Region of Peel SABE Water and Wastewater Servicing Analysis (2022) identifies the servicing needs of the anticipated growth areas in Caledon from 2041 to 2051 including the development area surrounding the anticipated Bolton GO Station. The WVSP Area was identified as part of water pressure subzone 6E. No additional water projects were noted in the immediate vicinity of the Secondary Plan beyond those identified in the Region of Peel Water and Wastewater Master Plan (2020).

Draft DC Project Mapping (2024) was obtained from Region of Peel staff which illustrates preliminary watermain projects to support the full buildout of the SABE including the Secondary Plan. It should be noted that the projects and construction timing shown are preliminary only and subject to change. The Draft DC Mapping shows a proposed 600 mm diameter distribution main extending north of Mayfield Road to Healey Road and a mid-block 400 mm diameter distribution main from Centreville Creek Drive to the Gore Road. A 400 mm diameter distribution main and 900 mm diameter transmission main are proposed on Healey Road however these projects are located outside of the WVSP Area.

A first submission of the detailed design of the distribution mains on Centreville Creek Road and the Gore Road has been completed by Schaeffers Consulting Engineers and reviewed by Region of Peel staff. The proposed 400 mm diameter PVC watermain on Centreville Creek Road will extend north from Mayfield Road to the future mid-block collector road. The proposed 600 mm diameter concrete pressure pipe watermain on the Gore Road will extend north from Mayfield Road to the future mid-block collector road. The design drawings show proposed chambers for future connections from the WVSP area at anticipated collector road intersection locations. The latest version of the design drawings has been provided in **Appendix E2.2** for reference.

5.3.2 Proposed Water Servicing

The Master Water Servicing Plan (**Figure 5.4, Appendix E1**) shows proposed local distribution mains and future Regional distribution and transmission mains per the latest Region of Peel DC Project Mapping (2024), and the approximate pressure zone boundaries. As noted above, the WVSP Area is located in Pressure Zone 6.

Servicing for the WVSP area will be provided by the distribution mains planned by the Region with connections to the existing distribution mains on Mayfield Road and the future distribution mains on Centreville Creek Road and The Gore Road.

The watermain system will be designed in accordance with the Region of Peel and MECP criteria including:

- Residential water usage rate: 280 L/c/d,
- Commercial water usage rate: 300 L/emp/ha,
- Population Density:
    - Single detached: 4.2 person/unit,
    - Semi-detached: 4.2 person/unit,
    - Townhouse: 3.4 person/unit,
    - Large Apartment (greater than 1 bedroom): 3.1 person/unit,
    - Small Apartment (less than or equal to 1 bedroom): 1.7 person/unit,
- Minimum Pipe Size: 150 mm diameter,
- Minimum Pipe Depth: 1.7 m, and
- Maximum Hydrant Spacing: 150 m.

Preliminary population estimates for the development blocks of the WVSP Area have been prepared based on the latest structure plan and assumed land-use statistics. The preliminary population estimates are provided in **Appendix E4** to be incorporated into the Region of Peel water model. The WVSP Area boundaries as defined by the limits of development in the Phase 1 Local Subwatershed Study will be refined through the Secondary Plan and Draft Plan approval process. Therefore, the populations are preliminary only and are subject to change.

The alignment of the proposed local distribution mains are within the future collector road rights-of-way only and therefore will not impact the NHS.