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September 1, 2022

Tribal Partners Canada Inc.
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Attention: Michelle Lamothe

Re: Headwater Drainage Feature Assessments
12668 Dixie Road & 12892 Dixie Road
Town of Caledon, ON
GEO Morphix Project No. PN21015

GEO Morphix Ltd. was retained to complete headwater drainage feature assessments (HDFA) at 12668 and 12892 Dixie Road in the Town of Caledon, Ontario. A headwater drainage feature (HDF) is referred to as, *"non-permanently flowing drainage features that may not have defined bed or banks; they are first-order or zero-order intermittent and ephemeral channels, swales and connected headwater wetlands, but do not include rills or furrows"* (TRCA/CVC, 2014). HDFs are important sources of food, sediment, water, nutrients, and organic matter for reaches downstream (TRCA/CVC, 2014).

Initial headwater drainage feature (HDF) observations were completed by WSP Canada Inc. (WSP) during the completion of the Comprehensive Environmental Impact Statement and Management Plan (CEISMP) for 12892 Dixie Road in December 2020. The initial observations were supplemented with site visits in September and October 2020. Two of the HDFs that WSP observed, reaches **HDF 4** and **HDF 5a** on the subject property, received management recommendations of *no management*. The third feature, **HDF 5b**, received a recommendation of *mitigation*. WSP also recommended that updated HDF assessments be completed in 2021. GEO Morphix completed updated field assessments during the 2021 field season following the Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC) HDF Guidelines: *Evaluation, Classification and Management of Headwater Drainage Feature Guidelines* (2014).

As part of the headwater drainage feature assessment, we completed the following activities:

- Background review and desktop assessment of existing site conditions, including a review of site topography and drainage, as well as stream reach delineation
- Review of existing reach delineation and HDF observations previously completed by WSP (2020)
- Field reconnaissance to examine existing conditions on site and verify the findings of the desktop assessment and reach delineation exercise, including headwater drainage feature assessments following the TRCA and CVC protocol (2014)

Background Review and Reach Delineation

A review of background materials was conducted to characterize the landscape based on previous reports, studies, mapping, and records of existing site conditions (topography, geology, drainage, etc.).

The drainage features on site are part of the overall Humber River watershed and are situated within the jurisdictional area of the Toronto and Region Conservation Authority (TRCA). The Humber River watershed originates in the Oak Ridges Moraine, outlets to Lake Ontario, and encompasses approximately 911 square kilometers (TRCA, 2021). The West Humber River specifically originates in Caledon (South Slope) and flows over 45 km (crossing Peel Plain) in Brampton prior to its confluence with the Main Humber River in Toronto (TRCA, 2021). The small drainage features on site are associated with the West Humber River subwatershed.

Several tributaries traverse the subject property at 12668 and 12892 Dixie Road, flowing in a southeasterly direction and crossing Dixie Road along the eastern boundary of the property. Reach delineation was previously completed by WSP (2020) but has been updated and confirmed through this assessment.

Reaches are homogeneous segments of channel used in geomorphological investigations. Reaches are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This method allows for a meaningful characterization of a watercourse as the aggregate of reaches, or an understanding of a particular reach, for example, as it relates to a proposed activity.

Reaches are typically delineated based on changes in the following:

- Channel planform
- Channel gradient
- Physiography
- Land cover (land use or vegetation)
- Flow, due to tributary inputs
- Soil type and surficial geology
- Historical channel modifications

Reach delineation follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997), and the Toronto and Region Conservation Authority (2004) as well as others.

On the 12668 and 12892 Dixie Road properties several stream layers were reviewed to identify drainage features on site, which included those available through TRCA, Peel Region, MNRF, and delineated drainage features by WSP. All reaches/HDFs are graphically defined in **Appendix A**. Although a preliminary desktop reach delineation was completed, field verification was completed to confirm the existing drainage network on site. Field observations are outlined below.

Headwater Drainage Feature Field Assessments

Headwater drainage feature (HDF) assessments were completed on the property in 2021 following the Toronto and Region Conservation Authority's (TRCA) and Credit Valley Conservation's (CVC) *Evaluation, Classification, and Management of Headwater Drainage Features Guidelines* (2014). This approach includes three (3) separate site visits to assess the aquatic, hydrologic, terrestrial, and geomorphic attributes of each headwater reach. A photographic record of site conditions is included in **Appendix B**, for reference.

Several HDFs were delineated throughout the property. The various HDF reaches are shown in **Appendix A**. In accordance with TRCA/CVC guidelines, the first HDF site visit was completed on March 30, 2021, during spring freshet conditions; the second site visit was completed on May 26, 2021, following a period of 48 consecutive hours without rainfall; and the third site visit was completed on September 2, 2021, following a period of 72 consecutive hours without rainfall. If a feature was dry during a round of observations, then the feature was not observed during the following visit. A summary of HDF characteristics is provided in **Table 1**.

Table 1. Summary of HDF Reach Characteristics and Field Observations

HDF Reach	Notes/Observations
HDF 8a-3	Vegetated swale feature through wetland-type vegetation; standing water during Round 1 site visit; dry during subsequent site visits; riparian area dominated by cropped agricultural land use and adjacent residential grass lawn; limited habitat and channel form; bankfull channel observed in several locations, but intermittently defined
HDF 8a-4	Vegetated swale feature through wetland-type vegetation; standing water during Round 1 site visit; dry during subsequent site visits; riparian area dominated by cropped agricultural land use and adjacent residential grass lawn; limited habitat and channel form; bankfull channel observed in several locations, but intermittently defined
HDF 9b	Multiple flow paths observed through dense central woodlot feature on property; standing water during Round 1 site visit; no water observed in subsequent site visits; well developed, forested riparian area; no defined channels or bed/bank form
HDF 8a-5	Reaches delineated through desktop assessment only; no defined features observed on site during any HDF assessment site visit; reaches included on mapping for information purposes only, but suggest that they be removed from any future review/assessments
HDF 9c	
HDF 1a	
HDF 1b	
HDF 2a	
HDF 2b	
HDF 3	

We have assigned a management classification to each of the headwater drainage features observed based on the approach outlined by TRCA and CVC (2014). The HDF assessment technique evaluates and classifies various attributes and functions of HDFs. A management recommendation is then selected based on a combined evaluation of all attributes, specifically with regards to hydrological regime, riparian conditions, as well as aquatic and terrestrial habitat (TRCA and CVC, 2014).

Each of the classifications come with specific management requirements which are:

- *Protection* – Important functions: protect and/or enhance the existing feature and its riparian zone and groundwater discharge or wetland in-situ
- *Conservation* – Valued functions: maintain, relocate, and/or enhance drainage feature and its riparian zone corridor
- *Mitigation* – Contributing functions: replicate or enhance functions through enhanced lot level conveyance measures for downstream connection
- *No Management Required* – Limited functions: no feature and/or functions associated with the feature are present on the ground and/or there is no downstream connection

A management classification for each of the observed HDFs is outlined in **Table 2**.

Table 2. Summary of HDF Classifications and Management Recommendations

HDF Reach	Hydrology	Riparian*	Fish Habitat*	Terrestrial Habitat*	Management Recommendation**
HDF 8a-3	Limited	Contributing	Contributing	Limited	Mitigation
HDF 8a-4	Limited	Contributing	Contributing	Limited	Mitigation
HDF 9b	Valued	Important	Contributing	Contributing	Conservation
HDF8a-5 **HDF9c** **HDF1a** **HDF1b** **HDF2a** **HDF2b** **HDF3**	No features observed on site. No Management Required.				

** Riparian, Fish Habitat, and Terrestrial Habitat classifications may be subject to refinement based on results of site-specific ecological investigations*
*** Management Recommendation based on outcome of TRCA/CVC (2014) flow chart for classification. Subject to refinement depending on results of site-specific ecological investigations.*

Note that for several of the reaches documented in the desktop mapping exercise, there was no discernible feature observed on site. We have recommended "No Management Required" for those features, which includes **Reach HDF 8a-5**, **HDF 9c**, **HDF 1a**, **HDF 1b**, **HDF 2a**, **HDF 2b**, and **HDF 3**.

The HDF management classification assigned to **Reach HDF 8a-3** and **HDF 8a-4** is "Mitigation", and the management classification assigned to **Reach HDF 9b** is "Conservation". It should be noted that **HDF 9b** is situated within the central woodlot feature on the property. Based on our understanding of existing ecological data for the site, it is anticipated that the woodlot will be maintained in the future condition. As such, **HDF 9b** will likely remain protected in situ by virtue of its location within the existing woodlot.

We are also aware of potential wetland classifications along the **HDF 8a** tributary. **Reach HDF 8a-3** and **HDF 8a-4** have been classified as "Mitigation", which would indicate that these features could potentially be removed if their functions are maintained in the future condition. However, if there is any level of wetland feature that requires maintenance on site, then the associated HDF would likely remain in situ by virtue of its location within the potential wetland extent. Ultimately, the status of any woodlot or wetland features on site should be assessed and reviewed by a qualified ecologist/biologist.

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

Respectfully submitted,

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

Kat Woodrow, M.Sc.
Manager of Watershed Studies

Appendix A
Study Area Mapping

Legend

- Reach Break and Label (Reach 8a)
- Watercourse
- Contour (0.5 m)
- Subject Land Boundary
- Waterbody

HDF Management Classification

- No Management Required
- Mitigation
- Protection
- Conservation

12892 Dixie Road

2021 Headwater Drainage Feature (HDF) Assessment

Caledon, Ontario

GEO MORPHIX™

0 50 100

Metres

Imagery: Town of Caledon, 2021. Watercourse: Region of Peel, 2020 / TRCA 2021.
Subject Land Boundary, and 0.5 m Contour: R. Avis Surveying Inc., 2020.
Reach Break and Label: GEO Morphix Ltd., 2021/2023.
HDF: WSP, 2021 / GEO Morphix Ltd., 2021
Waterbody: MNRF, 2021.Printed: December 2023. PN21015. Drawn By: M.O., K.W.

Appendix B
Photographic Record

Photo 1 West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 1a: Site Visit 1	
	Photograph taken looking upstream. **HDF 1a** was not observed in situ.
Photo 2 West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 1b: Site Visit 1	
	Photograph taken looking downstream of **HDF 1b**. The area was dry, and no defined feature was observed.

Photo 3
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 2a: Site Visit 1

Photograph taken looking upstream. **HDF 2a** was not observed in situ.

Photo 4
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 2b: Site Visit 1

Photograph taken looking downstream of **HDF 2b**. The area was dry, and no defined feature was observed.

Photo 5 West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 3: Site Visit 1	
	Photograph taken looking downstream, **HDF 3** was not observed in situ.
Photo 6 West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 8a-2: Site Visit 1	
	HDF 8a-2 is located on a non-participating property. Photograph taken from property line, facing downstream. Photograph for information purposes only.

Photo 7
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 8a-3: Site Visit 1

HDF 8a-3 with standing water during Round 1 site observation. No defined channel. Looking downstream toward non-participating property.

Photo 8
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 8a-3: Site Visit 2

HDF 8a-3 was observed to be dry at the time of the second round of observations. The feature type is a swale.

Photo 9
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 8a-4: Site Visit 1

HDF 8a-4 facing upstream during Round 1 site visit. Standing water observed only. No defined, single channel present.

Photo 10
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 8a-4: Site Visit 2

HDF 8a-4 was observed to be dry at the time of the second round of observations. Swale feature with no defined, single channel.

Photo 11 West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 8a-5: Site Visit 1	
	HDF 8a-5 was not observed in situ.
Photo 12 West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 9b: Site Visit 1	
	Photograph taken at downstream extent of **HDF 9b**, facing downstream looking at property line. Standing water observed during Round 1 site visit.

Photo 13
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 9b: Site Visit 2

Photograph taken at a similar location to Photo 12. No standing water was observed during the second-round observations. No single, defined channel present.

Photo 14
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 9b: Site Visit 3

Photograph taken during the third-round of observations. No standing water was observed throughout the multi-threaded feature. Channels are poorly defined.

Photo 15
West Humber River Headwater Drainage Feature, 12892 Dixie Road, HDF 9c: Site Visit 1

Photograph taken from northern boundary of existing woodlot on site. No feature was observed in situ.