Emerald Creek Phase 3 – Headwater Drainage Features Assessment

FINAL REPORT

May 16, 2022

Prepared for:

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EMERALD CREEK PHASE 3 – HEADWATER DRAINAGE FEATURES ASSESSMENT

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(signature)

Josh Mansell, OCAD; Can-CISEC
Biologist

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by 8298025 Canada Inc. (the Client) to support their proposed development of the Emerald Creek Phase 3 subdivision (the Project; concept provided in **Appendix A**). Stantec's Environmental Services group (BC1609) was retained to complete a headwater drainage features assessment (HDFA) at 481 Tullamore Street, Ottawa, Ontario (the Site; 18T 452380E, 5013237N) (**Figure 1, Appendix B**) to evaluate and classify the unnamed tributaries to the Spratt Drain municipal drain (headwater drainage features) and to identify appropriate management recommendations for each section of the features anticipated to be impacted by the Project.

Due to historical land use (e.g., agriculture) as well as recent and on-going development observed within the general area (e.g., residential), the headwater drainage features within the Site have been channelized and were observed to be mapped differently by various agencies (**Figure 1, Appendix B**). Vegetation removal within the Site, associated with previous development activities, was observed to occur approximately 10 years prior using historical aerial imagery.

2.0 REGULATORY POLICY CONTEXT

The *Conservation Authorities Act* is the enabling legislation that provides the legal basis for the creation of conservation authorities ("CAs") in Ontario. Generally, the *Conservation Authorities Act* directs CAs to perform a number of critical functions regarding watershed planning and management including the prevention, elimination, or reduction of loss of life and property from flood hazards and erosion hazards, as well as the conservation and restoration of natural resources.

Section 25 of the *Conservation Authorities Act* defines a watercourse as "*an identifiable depression in the ground in which a flow of water regularly or continuously occurs*". Section 28 of the *Conservation Authorities Act* empowers CAs to make regulations in the area under its jurisdiction, including the prohibition, regulation or permitting for development if the control of flooding, erosion, or the conservation of land may be affected by the development.

Pursuant to *Ontario Regulation 174/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses,* prior permission is required from the Rideau Valley Conservation Authority (RVCA) for development within a floodplain, valleylands, wetland, or other hazardous land. Permission is also required from the RVCA for alteration to a river, creek, stream or watercourse or interference with the hydrological function of a wetland.

Through correspondence with the RVCA (Jennifer Lamoureux, Aquatic and Fish Habitat Biologist) on April 19, 2021, it was indicated to Stantec that a Standard Level Assessment was required to assess the headwater drainage features on, and immediately adjacent to, the Site. RVCA indicated that the following components related to a HDFA are required to support proposed physical and/or hydrological modifications to any headwater drainage features on, and immediately adjacent to, the Site:

- Applications to alter headwater drainage features shall be assessed in accordance with the document titled "*Evaluation, Classification and Management of Headwater Drainage Features Guideline*." (TRCA and CVC 2014)
- Applicants shall pre-consult with the Conservation Authority to ensure that the scope and timing of the HDFA is appropriate for the scale/type of the proposal, availability of information for the feature and the sensitivity of the feature.
- The evaluation of a headwater drainage feature shall include collecting information that may be available in a watershed or subwatershed plan, catchment reports, an environmental management plan, fisheries management plan etc.

3.0 METHODS

3.1 BACKGROUND DATA COLLECTION

As part of this HDFA at the proposed EOCC, existing conditions and potential natural heritage features (e.g., species at risk (SAR)) within the Study Area were initially identified by reviewing the following available background documents and related information sources:

- Ontario's Natural Heritage Information Centre (NHIC) – Make a Natural Heritage Area Map (NDMNRF 2021a)
- Land Information Ontario (LIO) (NDMNRF 2021b)
- Ministry of Agriculture, Food and Rural Affairs (OMAFRA) – AgMaps – Geographic Information Portal (OMAFRA 2020)
- Rideau Valley Conservation Authority (RVCA) GeoPortal (RVCA 2021)
- RVCA's Lower Rideau River Subwatershed Report 2012: Mosquito Creek Catchment (RVCA 2012)
- RVCA's City Stream Watch: Mosquito Creek 2015 Summary Report (RVCA 2015)
- City of Ottawa Official Plan (2013; including all consolidations)
- Fisheries and Oceans Canada (DFO) Aquatic Species at Risk Mapping (DFO 2021)
- Satellite imagery (Google Earth Pro 2021)

3.2 FIELD DATA COLLECTION

Collection methods in this HDFA followed the guidance provided in the Toronto Region Conservation Authority and the Credit Valley Conservation's *Evaluation, Classification and Management of Headwaters Drainage Features Guidelines* (the Guidelines) (TRCA and CVC 2014). These guidelines use standardized survey methods and a tiered study design to determine the risk of functional impairment to a headwater drainage feature through land development.

As outlined in the Guidelines, this HDFA was completed using the following steps:

1. **Evaluation** (consultation with the RVCA, collect background data, collect field data)
2. **Classification** (classify the functions of each headwater drainage feature with respect to hydrology, riparian vegetation, fish and fish habitat and terrestrial habitat)
3. **Management Recommendations** (provide management options recommendations for headwater drainage features based on the classification of each)

Standard field data collection for this HDFA followed the field procedures outlined in the Ontario Stream Assessment Protocol's module *Assessing Headwater Drainage Features, Section 4, Module 10* (S4:M10) (Stanfield 2013). Spate conditions were observed within the headwater drainage features during the initial assessment (#1) in early May. The headwater drainage features were observed to exhibit base flow conditions during the subsequent assessments (#2 and #3) in May and July, respectively.

See **Table 3.1** for survey dates and environmental conditions observed during Stantec's HDFA within the Study Area.

Table 3.1 Dates and Environmental Conditions of Stantec's HDFA within the Study Area

Purpose of Investigation	Date	Start/End Time (24 hour)	Weather Conditions	Biologist
• Headwater Drainage Feature Assessment #1 • General/SWH/SAR Wildlife Habitat Assessment • Fish and Fish Habitat Assessment	May 6, 2021	1000 – 1400	Temperature: 8 – 10°C Wind (Beaufort scale): 0 Cloud Cover: 30% Precipitation: None 24/hr. Precipitation: None	Josh Mansell & Brennan Obermayer
• Headwater Drainage Feature Assessment #2 • General/SWH/SAR Wildlife Habitat Assessment	May 27, 2021	0930 – 1330	Temperature: 8 – 13°C Wind (Beaufort scale): 1 Cloud Cover: 0% Precipitation: None 24/hr. Precipitation: None	Josh Mansell
• Headwater Drainage Feature Assessment #2 • General/SWH/SAR Wildlife Habitat Assessment	July 30, 2021	0800 – 1230	Temperature: 14 – 18°C Wind (Beaufort scale): 1 Cloud Cover: 50% Precipitation: None 24/hr. Precipitation: None	Josh Mansell

As recorded at the Ottawa International Airport, approximately five kilometres (km) north of the Study Area, the following monthly rainfall amounts overlapping with the headwater drainage feature assessments were observed (ECCC 2021):

- April 2021 – 59.2 mm
- June 2021 – 99.1 mm
- July 2021 – 104.1 mm

4.0 HEADWATER DRAINAGE FEATURE ASSESSMENT

4.1 BACKGROUND DATA COLLECTION

The headwater drainage features on, and immediately adjacent to, the Site were all observed to be either wetland features, engineered swales and historically channelized features. There are no specific fisheries data available for the headwater drainage features, however, the Site is located within the Mosquito Creek subwatershed in the Lower Rideau watershed, as identified in the City of Ottawa's Official Plan (2013). As such, the RVCA's *Lower Rideau River Subwatershed Report 2012: Mosquito Creek Catchment* (RVCA 2012) and *City Stream Watch: Mosquito Creek 2015 Summary Report* (RVCA 2015) were used to collect data and both resources have identified the thermal regime of Mosquito Creek as ranging between cool- and warmwater.

The Ministry of Agriculture, Food and Rural Affairs (OMAFRA) AgMaps (2020) identifies the Spratt Drain municipal drain, immediately downstream of the Site, as a DFO Class C drain which typically support a non-sensitive, spring spawning fish community. Additionally, the Ministry of Northern Development, Mines, Natural Resources and Forestry's (NDMNRF) Kemptville District indirectly identifies the Spratt Drain municipal drain as having a restricted in-water activity window from March 15 to June 30 in any given year to protect spring spawning (warmwater) species (NDMNRF 2013).

DFO's Aquatic Species at Risk Mapping (2021) does not identify the headwater drainage features on, and immediately adjacent to, the Site, Spratt Drain municipal drain or Mosquito Creek as Critical Habitat or as potential habitat for aquatic species protected under the SARA.

4.2 EVALUATION

Data collected during the HDFA are used to classify the features proposed to be impacted by the Project and provide appropriate management recommendations. The assessment evaluates the contribution of sediment, nutrients and flow to downstream reaches, as well as the use of these features by fish and wildlife; specifically, SAR.

The Guidelines define headwater drainage features as "*non-permanently flowing drainage features that may not have defined bed or banks; they are first-order and zero-order intermittent and ephemeral channels, swales and connected headwater wetlands, but do not include rills or furrows*". Through correspondence with the RVCA and review of background data, Stantec confirmed the presence of the headwater drainage features on, and immediately adjacent to, the Site and then applied the Strahler method (Strahler 1957) to determine stream order of the headwater drainage feature.

The 3.23-hectare Site, which is bisected by a proposed extension of Tullamore Street, has been predominantly cleared of woody vegetation which has been graded and levelled with fill. Areas that have been recently filled and graded are dominated by pioneer meadow species including wild carrot (*Daucus carota*) and white sweet-clover (*Melilotus albus*) (**Photos 1 – 6, Appendix C**). There is a small area (~500 m^2) in the northeast corner of the Site that was not filled and graded which is dominated by wetland

vegetation, predominantly *Carex* spp. and broad-leaved cattail (*Typha latifolia*) (**Photos 41 – 44, Appendix C**). An approximate 30 m strip of deciduous forest remains along both the northern and southern boundaries of the Site adjacent to the mapped headwater drainage features.

As shown on NHIC (NDMNRF 2021a) and LIO (NDMNRF 2021b), an unevaluated wetland pocket is shown as occurring along the whole eastern boundary of the Site and is shown as being associated with woodlands. The web-based geoOttawa Unevaluated Wetlands 2011 layers shows a larger contiguous unevaluated wetland polygon in the northern section of the Site, which also encompasses the NHIC and LIO mapped wetland.

Based on the Guidelines definition of a headwater drainage feature, a total of two headwater drainage features, separated into eleven distinct reaches, were observed within, or immediately adjacent to, the Site (**Figure 2, Appendix A**).

Fish community sampling within the two headwater drainage features did not occur as part of Stantec's HDFA as low water conditions were observed during the late May and July assessment periods. Fish were not observed within any of the headwater drainage features assessed by Stantec as part of this HDFA.

4.3 CLASSIFICATION

During Stantec's 2021 HDFA, reaches were delineated within each headwater drainage feature observed within the Site that are anticipated to be impacted by the Project. The classification of each reach was assessed by collecting data on the following parameters, as defined by the Guidelines:

1. Hydrology
2. Riparian
3. Fish and Fish Habitat
4. Terrestrial Habitat

The classification of fish and fish habitat was accomplished by completing a fish and fish habitat assessment on May 6, 2021. Existing conditions and parameter classifications of each reach is summarized below in **Table 4.1**. Photographic records of each reach within each headwater drainage feature are provided in **Appendix C** and HDFA field notes are provided in **Appendix D**.

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF1-R1-S1	82	–	✓	–	–	–	–	2.0	3.0	Y	16	Y	N	n/a	N	N	n/a	N	–	–	–	✓	✓	–	–	–	–	✓	–	–	–	✓	This channelized section is located south of the proposed Tullamore Street extension and flows south. It is not connected to ECk3-HDF1-R1-S2 via a culvert under Tullamore Street and is currently receiving flows from the existing roadside ditch south of Tullamore Street and ECk3-HDF1-R2-S1 during periods of high precipitation. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is mapped by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) and OMAFRA (2020) and is also shown as a Ditch by geoOttawa (2020) (**Photos 7 – 11, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF1-R1-S2	75	–	–	–	–	–	✓	14	n/a	Y	20	N	N	n/a	N	N	n/a	N	✓	–	–	✓	–	✓	–	✓	–	–	✓	–	–	–	This isolated, wetland section is located north of the proposed Tullamore Street extension and flows south. The feature is located within the limits of the geoOttawa (2020) mapped unevaluated wetland. It is not connected to ECk3-HDF1-R1-S1 via a culvert under Tullamore Street and is currently receiving flows from ECk3-HDF1-R1-S3 and the unevaluated wetland north of the feature. This feature does not have a defined channel and was observed to be hydrologically connected to the unevaluated wetland, therefore, the amount of water in the feature is directly related to the seasonal water level of the wetland. The feature is not considered to provide fish habitat. This section of the HDF is mapped by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) and OMAFRA (2020) but is not shown by geoOttawa (2020) (**Photos 12 – 17, 19, 22 Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF1-R1-S3	50	–	–	–	–	–	✓	n/a	n/a	Y	10	N	N	n/a	N	N	n/a	N	–	–	–	–	–	✓	✓	✓	–	–	✓	–	–	–	This isolated, wetland section is located along the northern boundary of the Site and contributes to flows in ECk3-HDF1-R1-S2. The feature is located within the limits of the geoOttawa (2020) mapped unevaluated wetland. This feature does not have a defined channel and was observed to be hydrologically connected to the unevaluated wetland, therefore, the amount of water in the feature is directly related to the seasonal water level of the wetland. The feature is not considered to provide fish habitat. This section of the HDF is mapped by geoOttawa (2020) as a Watercourse and is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) and OMAFRA (2020). geoOttawa (2020) shows this feature as connecting directly with ECk3-HDF2-R1-S2, however, this connection was not observed by Stantec during this HDFA (**Photos 17 – 23, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF1-R2-S1	215	–	✓	–	–	–	–	1.0	0.1	Y	90	Y	N	n/a	N	N	n/a	N	–	–	–	✓	✓	–	–	–	–	✓	–	–	–	✓	This channelized feature observed along the southern boundary of the Site provides flows from the western area of the Site into ECk3-HDF1-R1-S1. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020) and is shown as a Ditch in geoOttawa (2020) (**Photos 24 – 27, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF2-R1-S1	0	–	✓	–	–	–	–	n/a	n/a	Y	n/a	Y	N	n/a	N	N	n/a	N	–	–	–	–	–	✓	✓	–	–	✓	–	–	–	✓	This channelized feature, located west of the Site, was observed to receive all flows from all four reaches within ECk3-HDF2 and is shown by geoOttawa (2020) as a Ditch and Watercourse that directs flows into the Spratt Drain municipal drain ~650 m west of the Site. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020). Access to this feature was not provided and was observed from the Site boundary only. As such, no data sheets for this section are provided (**Photo 28, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF2-R1-S2	100	–	✓	–	–	–	–	1.25	0.2	Y	90	Y	N	n/a	N	N	n/a	N	–	–	–	–	–	✓	✓	–	–	✓	–	–	–	✓	This small, channelized feature, shown as a Ditch and Watercourse by geoOttawa (2020), is located within the boundary of the unevaluated wetlands shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021), OMAFRA (2020) and geoOttawa (2020) and is directly connected to ECk3- HDF2-R1-S1. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020). geoOttawa (2020) shows this feature as connecting directly with ECk3-HDF1-R1-S3, however, this connection was not observed by Stantec during this HDFA (**Photos 30 – 31, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF2-R2-S1	0	–	✓	–	–	–	–	n/a	n/a	Y	n/a	Y	N	n/a	N	N	n/a	N	–	–	–	–	–	✓	✓	–	–	✓	–	–	–	✓	This medium, channelized feature, shown as a Ditch by geoOttawa (2020), is located within the boundary of the unevaluated wetlands shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021), OMAFRA (2020) and geoOttawa (2020) and flows into ECk3- HDF2-R1-S1. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020). Access to this feature was not provided and was observed from the Site boundary only. As such, no data sheets for this section are provided (**Photo 28, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF2-R3-S1	100	–	✓	–	–	–	–	1.25	0.2	Y	90	Y	N	n/a	N	N	n/a	N	–	–	–	–	–	✓	✓	–	–	✓	–	–	–	✓	This small, channelized feature, shown as a Ditch and Watercourse by geoOttawa (2020), is located within the boundary of the unevaluated wetlands shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021), OMAFRA (2020) and geoOttawa (2020) and flows into ECk3- HDF2-R3-S1. This feature runs parallel to ECk3-HDF2-R1-S2 and are ~10 m apart from each other. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is not shown by any available mapping (**Photos 32 – 33, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF2-R4-S1	75	–	✓	–	–	–	–	1.25	0.8	Y	15	Y	N	n/a	N	N	n/a	N	–	–	–	–	✓	✓	✓	–	–	✓	–	–	–	✓	This medium, channelized feature, shown as a Ditch by geoOttawa (2020), is located along the western boundary of the Site. Located along the boundary of unevaluated wetlands shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021), OMAFRA (2020) and geoOttawa (2020), the feature flows into ECk3-HDF2-R1-S1. The feature was observed to provide seasonal hydrology to downstream areas and may provide seasonal fish habitat, provided barriers to fish are not present further downstream. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020) (**Photo 34 – 36, Appendix C**).

Table 4.1 Headwater Drainage Features Characteristics and Classifications within the Site

Headwater Drainage Feature Reach	Length Assessed (m)	Feature Type						Channel Dimensions		Early May 2021 Hydrology			Late May 2021 Hydrology			July 2021 Hydrology			Riparian Vegetation							Terrestrial Habitat			Fish Habitat				Headwater Drainage Feature Description
		Defined Natural Channel	Channelized	No Defined Feature	Swale	Tiled Drainage	Wetland	Feature Width (m)	Bankfull Depth (m)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	Water Present (Y/N)	Depth (mm)	Flow (Y/N)	None	Lawn	Cropped Land	Meadow	Scrubland	Forest	Wetland	Breeding Amphib. Wetlands	General Amphib. Habitat	Movement Corridors	No Habitat	Year Round	Seasonal	Contributing	
ECk3-HDF2-R4-S2	40	–	–	–	✓	–	–	2.0	1.0	Y	20	N	N	n/a	N	N	n/a	N	–	–	–	–	✓	–	–	–	–	✓	–	–	–	✓	This ill-defined section of ECk3-HDF2-R4, mapped as a Ditch by geoOttawa (2020), is located within the Trans-Northern Pipelines Inc. right-of-way that is dominated by wet meadow species. The feature was observed to provide seasonal hydrology to downstream areas and is not considered to provide fish habitat. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020) (**Photo 37 – 40, Appendix C**).
ECk3-HDF2-R4-S3	0	–	–	–	✓	–	–	n/a	n/a	N	n/a	N	N	n/a	N	N	n/a	N	–	–	–	–	–	✓	–	–	–	✓	–	–	–	✓	This small, channelized section of ECk3-HDF2-R4, mapped as a Ditch by geoOttawa (2020), is located within a deciduous woodland that was observed from the southern Site boudnary. The feature was observed to provide seasonal hydrology to downstream areas and is not considered to provide fish habitat. This section of the HDF is not shown by the NHIC (NDMNRF 2021a), LIO (NDMNRF 2021b), RVCA (2021) or OMAFRA (2020).

4.4 MANAGEMENT RECOMMENDATIONS

This section compiles the information collected during Stantec's 2021 reach characteristic and evaluation phase to classify hydrological, riparian, fish and fish habitat and terrestrial components to recommend management decisions for each feature or reach. As outlined in the Guidelines, management recommendations are based on flow characteristics and functions contributing to aquatic and terrestrial habitats (**Table 4.1**). The classification and management recommendation of each reach within the Site are summarized below in **Table 4.2** and shown on **Figure 3, Appendix A**.

Table 4.2 Headwater Drainage Feature Classifications and Management Recommendations

Headwater Drainage Feature Reach	Step 1		Step 2	Step 3	Step 4	Management Recommendation
	Hydrology	Modifiers	Riparian	Fish Habitat	Terrestrial	
ECk3-HDF1-R1-S1	Contributing	None observed	Important	Contributing	Contributing	Protection
ECk3-HDF1-R1-S2	Valued	None observed	Important	None	Important	Protection
ECk3-HDF1-R1-S3	Valued	None observed	Important	None	Important	Protection
ECk3-HDF1-R2-S1	Contributing	None observed	Important	Contributing	Contributing	Protection
ECk3-HDF2-R1-S1*	Contributing	None observed	Important	Contributing	Valued	Conservation
ECk3-HDF2-R1-S2	Contributing	None observed	Important	Contributing	Valued	Conservation
ECk3-HDF2-R2-S1*	Contributing	None observed	Important	Contributing	Valued	Conservation
ECk3-HDF2-R3-S1	Contributing	None observed	Important	Contributing	Valued	Conservation
ECk3-HDF2-R4-S1	Contributing	None observed	Important	Contributing	Contributing	Conservation
ECk3-HDF2-R4-S2	Contributing	Pipeline RoW Maintenance	Valued	Contributing	Contributing	Conservation
ECk3-HDF2-R4-S3	Contributing	None observed	Important	Contributing	Contributing	Conservation

***** Denotes access to the feature was not provided. Classifications and management recommendations are estimated based on Stantec observations.

According to the Guidelines, all of the headwater drainage feature reaches on, and immediately adjacent to, the Site are considered to receive Protection or Conservation as a management recommendation.

Based on the concept provided for the Project (**Appendix A**), direct impacts (e.g., re-routing, stormwater inputs) to the assessed headwater drainage features are not anticipated, therefore, all of the assessed values associated with each reach are anticipated to remain functional.

Management recommendations for the Protection and Conservation of the functions of each reach should be considered and implemented through the subsequent design stages of the Project. One of the primary considerations to retain the function of all headwater drainage features on the Site should be to maintain downstream flows to the Spratt Creek municipal drain.

Where **Table 4.2** recommends Protection of a reach, the following measures from the Guidelines should be considered and incorporated into the design of the Project:

- Protect and/or enhance the existing feature including the riparian vegetation surrounding the feature
- Maintain hydroperiod
- If necessary, use natural channel design techniques to restore and enhance habitat features; realignment not generally permitted
- Design and locate stormwater management system to avoid impacts (e.g., sediment, temperature increases) to the feature

Where **Table 4.2** recommends Conservation of a reach, the following measures from the Guidelines should be considered and incorporated into the design of the Project:

- Maintain, relocate and/or enhance feature including the riparian vegetation surrounding the feature
- If upstream catchment area is proposed to be removed for development, restore lost functions through enhanced lot level controls (i.e., increase infiltration using permeable pavers), as feasible
- Maintain or replace flows using mitigation measures
- Maintain or replace external flows
- Use natural channel design techniques to maintain or enhance overall productivity of the reach

5.0 SUMMARY

As part of this HDFA to to support 8298025 Canada Inc.'s proposed development of the Emerald Creek Phase 3 subdivision, two headwater drainage features, separated into eleven (11) reaches, were observed within Site. Management recommendations for each of the four reaches are based on flow characteristics and functions contributing to aquatic and terrestrial habitats (**Table 4.2**).

Based on the concept provided for the Project (**Appendix A**), direct impacts (e.g., re-routing, stormwater inputs) to the assessed headwater drainage features are not anticipated, therefore, all of the assessed values associated with each reach are anticipated to remain functional. Additionally, the Client is considering installing a corrugated steel culvert under Tullamore Street that will re-connect ECk3-HDF1-R1-S2 and ECk3-HDF1-R1-S1 which will allow flows and nutrients downstream to the Spratt Municipal Drain and may allow potential fish passage to upstream habitats.

6.0 REFERENCES

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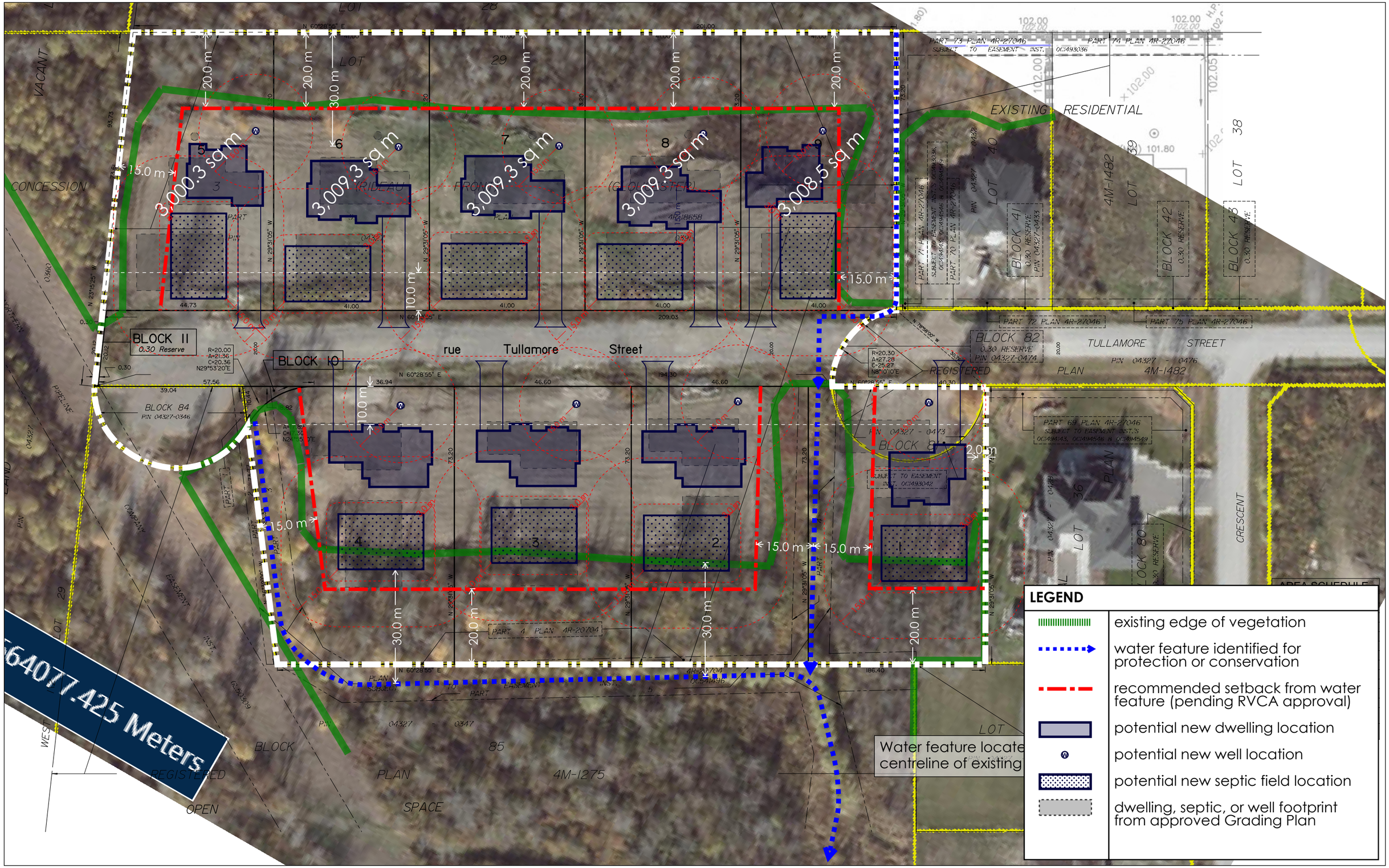
APPENDIX A:
Emerald Creek Phase 3 Subdivision Concept


3,000.3 sq m
3,009.3 sq m
3,009.3 sq m
3,009.3 sq m
3,008.5 sq m
5
6
7
8
9
4
3
2
1
20.0 m
30.0 m
15.0 m
10.0 m
2.0 m
BLOCK 11
0.30 Reserve
BLOCK 10
rue Tullamore Street
TULLAMORE STREET
BLOCK 82
0.30 RESERVE
BLOCK 84
BLOCK 41
BLOCK 42
BLOCK 43
EXISTING RESIDENTIAL
4M-1482
4M-1275
CONCESSION
VACANT
CRESCENT
PLAN
SPACE
OPEN
Water feature locate
centreline of existing
64077.425 Meters
LEGEND
existing edge of vegetation
water feature identified for protection or conservation
recommended setback from water feature (pending RVCA approval)
potential new dwelling location
potential new well location
potential new septic field location
dwelling, septic, or well footprint from approved Grading Plan

APPENDIX B:
Figures

Stantec

Legend
- Site Boundary (Approximate)
- Study Area
- Flow Direction
- Hydro Line
- Watercourses (LIO)
- Watercourses (City of Ottawa)
- 1 km UTM Grid
- Lot
- Wetland, Not Evaluated (LIO)
- Wooded Area

0 50 100 m

1:2,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Watercourse (City of Ottawa): City of Ottawa, 2021.
4.Aerial Imagery: City of Ottawa, 2021. Imagery Date, 2019.

Project Location
City of Ottawa

160410325 REV4
Prepared by KB on 2022-04-26
Technical Review by DH on 2021-11-10

Client/Project
8298025 CANADA INC. - EMERALD CREEK PHASE 3 - HEADWATER DRAINAGE FEATURE ASSESSMENT

Figure No.
1

Title
Background Natural Heritage and Surface Water Features

\\ca0004-ppfss04\work group\01609\active\ Other PCs Active\604 - Ottawa\160410325\03 data\gis cad\gis\mxds\Ecosystems\report figures\HDFA\160410325 Fig01 StudyArea EmeraldCreek Phase3.mxd Revised: 2022-04-26 By: bakaur

Stantec

Legend

- Site Boundary (Approximate)
- Study Area
- Hydro Line
- Culvert
- Earthern Berm
- Reach
- Reach Break
- Watercourses (City of Ottawa)
- Watercourses (LIO)
- 1 km UTM Grid
- Lot
- Wetland, Not Evaluated
- Wooded Area

0 50 100 m

1:2,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
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4. Aerial Imagery: City of Ottawa, 2021. Imagery Date, 2019.

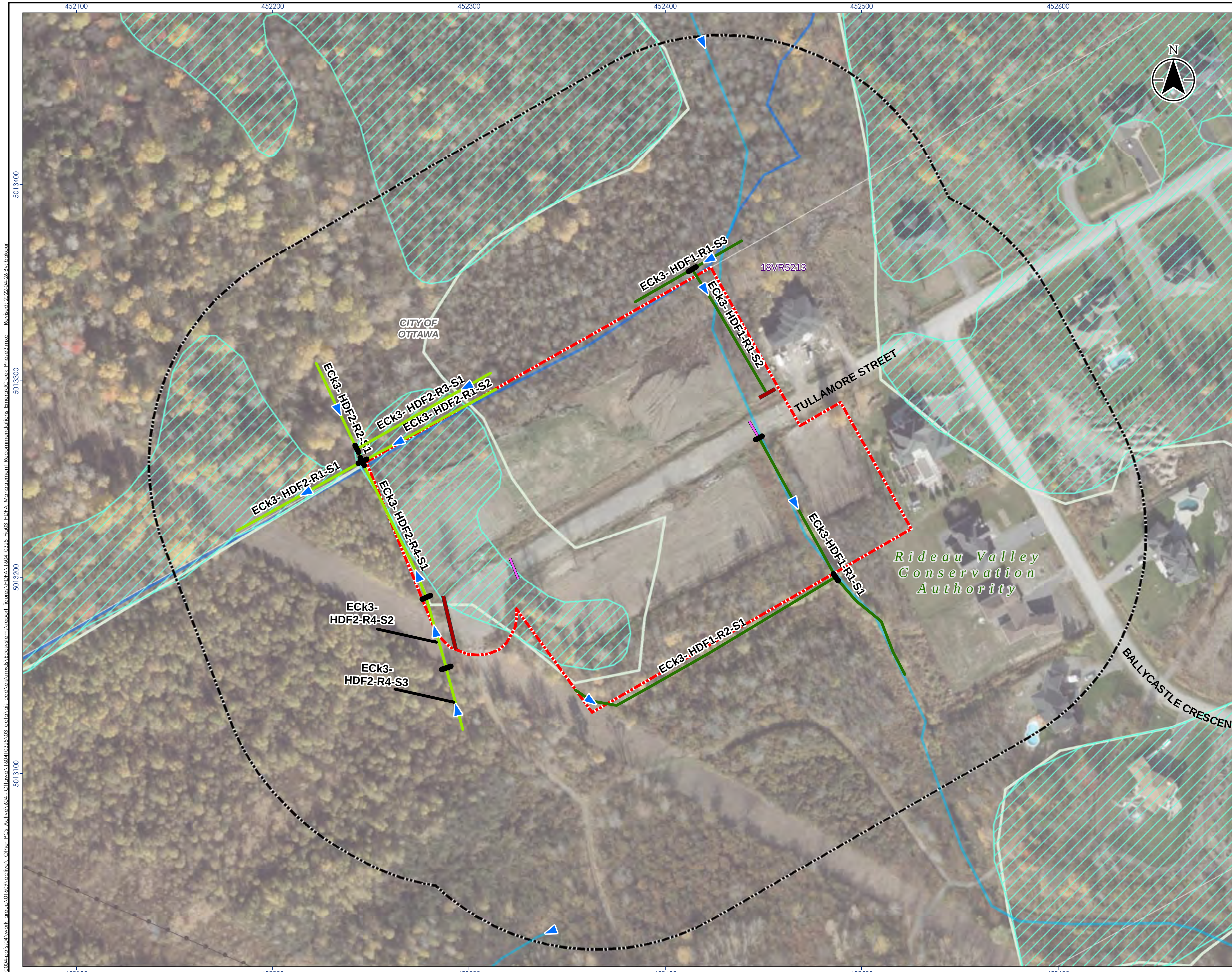
Project Location
City of Ottawa

160410325 REV4
Prepared by KB on 2022-04-26
Technical Review by DH on 2021-11-12

Client/Project
8298025 CANADA INC. - EMERALD CREEK PHASE 3 - HEADWATER DRAINAGE FEATURE ASSESSMENT

Figure No.
2

Title
Surface Water and Headwater Drainage Features



Stantec

Legend

- Site Boundary (Approximate)
- Study Area
- Flow Direction
- Hydro Line
- Culvert
- Earthern Berm
- Reach Break
- Watercourses (City of Ottawa)
- Watercourses (LIO)
- 1 km UTM Grid
- Lot
- Wetland, Not Evaluated
- Wooded Area

Management Recommendations

- Protection
- Conservation

0 50 100 m

1:2,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Watercourse (City of Ottawa): City of Ottawa, 2021
4. Aerial Imagery: City of Ottawa, 2021. Imagery Date, 2019.

Project Location
City of Ottawa

163410325 REV4
Prepared by KB on 2022-04-26
Technical Review by DH on 2021-11-12

Client/Project
8298025 CANADA INC. - EMERALD CREEK PHASE 3
HEADWATER DRAINAGE FEATURE ASSESSMENT

Figure No.
3

Title
Headwater Drainage Feature Management Recommendations

APPENDIX C:
Photographic Record of Site Conditions

Photo 1: Existing conditions within the Site along the Tullamore Street extension (May 27). Looking west from the eastern Site boundary.

Photo 2: Existing conditions observed within the existing Emerald Creek subdivision along Tullamore Street immediately east of the Site (May 6).

Photo 3: Existing conditions within the previously cleared areas of the Site north of Tullamore Street (May 6). Looking east.

Photo 4: Existing conditions within the previously cleared areas of the Site south of Tullamore Street (May 27). Looking north.

Photo 5: Existing conditions within the previously cleared areas of the Site south of Tullamore Street (July 30). Looking west.

Photo 6: Existing conditions within the Site along the Tullamore Street extension (July 30). Looking east from the western Site boundary.

Photo 7: Existing conditions of ECk3-HDF1-R1-S1 looking south from the Tullamore Street extension (May 6).

Photo 8: Existing conditions observed within the middle of ECk3-HDF1-R1-S1 (May 6). Looking south and downstream.

Photo 9: Existing conditions of ECk3-HDF1-R1-S1 looking south from the Tullamore Street extension (May 27).

Photo 10: Existing conditions observed within the middle of ECk3-HDF1-R1-S1 (May 27). Looking south and downstream.

Photo 11: Existing conditions of ECk3-HDF1-R1-S1 looking south from the Tullamore Street extension (July 30).

Photo 12: Looking towards ECk3-HDF1-R1-S2 north from the Tullamore Street extension (May 27). Note earthen berm (red line) isolates this reach from ECk3-HDF1-R1-S1 south of Tullamore Street.

Photo 13: Existing conditions observed within the middle of ECk3-HDF1-R1-S2 (May 6). Looking north and upstream.

Photo 14: Existing conditions observed within the middle of ECk3-HDF1-R1-S2 (May 27). Looking north and upstream.

Photo 15: Water and substrate conditions observed within ECk3-HDF1-R1-S2 (May 27).

Photo 16: Existing conditions observed within the middle of ECk3-HDF1-R1-S2 (July 30). Looking north and upstream.

Photo 17: Existing conditions at the confluence of ECk3-HDF1-R1-S2 and ECk3-HDF1-R1-S3 (May 6). Looking east.

Photo 18: Existing conditions observed within the middle of ECk3-HDF1-R1-S3 west of ECk3-HDF1-R1-S2 (May 6). Looking west and upstream.

Photo 19: Existing conditions at the confluence of ECk3-HDF1-R1-S2 and ECk3-HDF1-R1-S3 (May 27). Looking northeast.

Photo 20: Existing conditions observed within the middle of ECk3-HDF1-R1-S3 west of ECk3-HDF1-R1-S2 (May 27). Looking west and upstream.

Photo 21: Water and substrate conditions observed within ECk3-HDF1-R1-S3 (May 27).

Photo 22: Existing conditions at the confluence of ECk3-HDF1-R1-S2 and ECk3-HDF1-R1-S3 (July 30). Looking northeast.

Photo 23: Existing conditions observed within the middle of ECk3-HDF1-R1-S3 west of ECk3-HDF1-R1-S2 (May 27). Looking west and upstream.

Photo 24: Existing conditions of ECk3-HDF1-R2-S1 south of the Tullamore Street extension (May 6). Looking south and downstream.

Photo 25: Existing conditions observed within the middle of ECk3-HDF1-R2-S1 (May 6). Looking west and upstream.

Photo 26: Existing conditions observed within the middle of ECk3-HDF1-R2-S1 (May 27). Looking east and downstream.

Photo 27: Existing conditions observed within the middle of ECk3-HDF1-R2-S1 (July 30). Looking east and downstream.

Photo 28: Existing conditions observed within ECk3-HDF2-R1-S1 along the western boundary of the Site (May 27). Looking west and downstream.

Photo 29: Existing conditions observed at the confluence of ECk3-HDF2-R2-S1 and ECk3-HDF2-R3-S1 (May 27) at the northwest corner of the Site. Looking north and upstream.

Photo 30: Existing conditions observed within the middle of ECk3-HDF2-R1-S2 (May 6). Looking east and upstream.

Photo 31: Existing conditions observed within the middle of ECk3-HDF2-R1-S2 (May 6). Looking east and upstream.

Photo 32: Existing conditions observed within the middle of ECk3-HDF2-R3-S1 (May 6). Looking east and upstream.

Photo 33: Existing conditions observed within the middle of ECk3-HDF2-R3-S1 (May 27). Looking east and upstream.

Photo 34: Existing conditions observed within the middle of ECk3-HDF2-R4-S1 (May 6). Looking south and upstream.

Photo 35: Existing conditions observed within the middle of ECk3-HDF2-R4-S1 (May 27). Looking south and upstream.

Photo 36: Existing conditions observed within the middle of ECk3-HDF2-R4-S1 (July 30). Looking north and downstream.

Photo 37: Existing conditions of the ECk3-HDF2-R4-S2 (May 6) within the Trans-Northern Pipelines Inc. right-of-way. Looking northwest.

Photo 38: Existing conditions observed within the middle of ECk3-HDF2-R4-S2 (May 6). Looking northwest and downstream.

Photo 39: Existing conditions observed within the middle of ECk3-HDF2-R4-S2 (May 27). Looking northwest and downstream.

Photo 40: Existing conditions observed within the middle of ECk3-HDF2-R4-S2 (July 30). Looking northwest and downstream.

Photo 41: Existing conditions observed within the northeast corner of the Site that has not been filled and graded within the limits of the geoOttawa unevaluated wetland (May 6). Looking north towards ECk3-HDF1-R1-S3.

Photo 42: Existing conditions observed within the northeast corner of the Site that has not been filled and graded within the limits of the geoOttawa unevaluated wetland (May 6). Looking northeast towards ECk3-HDF1-R1-S2.

Photo 43: Existing conditions observed within the northeast corner of the Site that has not been filled and graded within the limits of the geoOttawa unevaluated wetland (May 27). Looking northeast towards ECk3-HDF1-R1-S2.

Photo 44: Existing conditions observed within the northeast corner of the Site that has not been filled and graded within the limits of the geoOttawa unevaluated wetland (July 30). Looking northeast towards ECk3-HDF1-R1-S2.

APPENDIX D:
Field Data Sheets

ECk3-HDF1-R1-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: 160410305 Recorder/Crew: J. Marsell B. Oberholtz

Stream Name: SMD - WC3 - A Stream Code: South MD WC Site Code: SMD-WC3-A

Site Limits: Upstream 18T WP# 452446E 5013064N Field Assessment: [x] Sample 1 Unconnected HDF:

Downstream WP# 452486E 5013199N [ ] Sample 2 [ ] Not connected

Direction of Assessment [x] Upstream [x] Downstream [ ] Sample 3 to downstream network

Flow Influence [ ] Freshet (1) [x] Spate (2) [ ] Baseflow (3)

Flow Condition [ ] Dry (1) [x] Standing Water (2) [ ] Interstitial Flow (3) [ ] Minimal Flow (4) [ ] Substantial Flow (5)

Feature Type [ ] Defined Natural Channel (1) [x] Channelized or Constrained (2) [ ] Multi-thread (3) [ ] No Defined Feature (4) [ ] Tiled Feature (5) [ ] Wetland (6) [ ] Swale (7) [ ] Roadside Ditch (8) [ ] Pond (9)

Feature Vegetation [ ] None (1) [ ] Lawn (2) [ ] Cropped (3) [ ] Meadow (4) [x] Scrubland (5) [ ] Wetland(6) [ ] Forest (7)

Riparian Vegetation

		None (1)	Lawn (2)	Cropped (3)	Meadow (4)	Scrubland (5)	Wetland (6)	Forest (7)
0 - 1.5 m	Left Bank	[ ]	[ ]	[ ]	[ ]	[x]	[ ]	[ ]
	Right Bank	[ ]	[ ]	[ ]	[ ]	[x]	[ ]	[ ]
1.5 - 10 m	Left Bank	[ ]	[ ]	[ ]	[ ]	[x]	[ ]	[ ]
	Right Bank	[ ]	[ ]	[ ]	[ ]	[x]	[ ]	[ ]
10 - 30 m	Left Bank	[ ]	[ ]	[ ]	[ ]	[x]	[ ]	[ ]
	Right Bank	[ ]	[ ]	[ ]	[ ]	[x]	[ ]	[ ]

Channel Gradient (S4.M7) [x] Visual (1) [ ] Clinometer (2) [ ] Laser Level (3) [ ] Survey Level (4) [ ] Other (5) [ ] LiDAR (6)

Distance (m): NA / / / Elevation (cm): ND / / / Gradient (%): 0 (Low)

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	[ ]	[x]	[ ]	[ ]	[ ]	[ ]	[ ]
Sub-Dominant Substrate (S2.M3)	[x]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Feature Roughness [ ] < 10% Minimal (1) [ ] 10 - 40% Moderate (2) [ ] 40 - 60% High (3) [x] > 60% Extreme (4)

Width Measurement [ ] Can't Measure (1) [ ] Bankfull (2) [ ] Mean Width (3) [ ] Estimated (4) [ ] GIS (5) [x] Measure/GIS (6)

Channel Dimensions Feature Width (m): 2.0 Bankfull Depth (mm) 160

Entrenchment NA Total: [x] > 40 m [ ] < 40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method [ ] Perched Culvert (1) [ ] Hydraulic Head (2) [ ] Distance by Time (3) [x] Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
2	No flow 160	NA	—	—	—

Sediment Transport

Adjacent [x] None (1) [ ] Rill (2) [ ] Rill and Gully (3) [ ] Gully (4) [ ] Outlet Scour (5) [x] Sheet Erosion (6) [ ] Instream Bank Erosion (7) [ ] Other (8)

Feature [x] None (1) [ ] Rill (2) [ ] Rill and Gully (3) [ ] Gully (4) [ ] Outlet Scour (5) [ ] Sheet Erosion (6) [ ] Instream Bank Erosion (7) [ ] Other (8)

Sediment Deposition NA Measures (mm): / / / / /

[x] None (1) [ ] Minimal: < 5 mm (2) [ ] Moderate: 5-30 mm (3) [ ] Substantial: 31-80 mm (4) [ ] Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: May 6/2021 Project #: 16CH10305 Field Assessment: ■ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Estimates or Measurements WP# Perched Height (mm): ~ 0 Jumping Height (mm): ~ 0

WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☒ ~~Watercress~~ ☐ Seepage ☐ Bubbling ■ Stained ☐ Other: ________

Fish Collection ■ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description
				Historically connected to SMD-WCL-A
				↳ earth berm blocks flow.
				↳ see location information on
				SMD-WCL-A data sheet.

Additional Notes:
- staining
- upstream is dry (approx 100m)
- barrier present (rock, berm) on collector

Site Break Trigger ■ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation ☐ Other: Comments ________

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R1-S2

Unconstrained Headwater Drainage Feature Assessment

Date: May 6/2021 Project #: 160410985 Recorder/Crew: J. Marsell B. Cremer

Stream Name: ~~SMD WC1 A~~ Stream Code: Small MD WC Site Code: SMD-WC1-A

Site Limits: Crgle Earth. Upstream n/a. WP# 452405E 5433356N Field Assessment: ■ Sample 1 Unconnected HDF:

Downstream 1BT WP# 452450E 5432914N ☐ Sample 2 ■ Not connected

Direction of Assessment: ■ Upstream ☒ Downstream ☐ Sample 3 to downstream network

Flow Influence ☒ Freshet (1) → ■ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ■ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☒ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ■ Wetland(6) ☒ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	■ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	■ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	■ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	■ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	■ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	■ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ■ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): 0 0 0 Elevation (cm): 0 0 0 Gradient (%): 0

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	■	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	■	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ■ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ■ Estimated (4) ☐ GIS (5) ☒ Measure/GIS (6)

Channel Dimensions Feature Width (m): 14 Bankfull Depth (mm) N/A

Entrenchment Total: ■ > 40 m ☐ < 40 m Left Bank NA m Right Bank N/A m Total width ~~N/A~~ 14 m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
* No Flow. 14	20/20/20	N/A	N/A	N/A	N/A

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): / / / / /

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

May 6/2021 16041C325 Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements:	WP#	Perched Height (mm):	Jumping Height (mm):
	WP#	Perched Height (mm):	Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☒ Stained ☐ Other:

Fish Collection ☐ Absent ☐ Present Comment: None observed

WP#	Photo #	Code	Category	Description
				Earthen barrier placed at D/S section
				along Tullamore Street. SMD-WC1-A is not
				connected to D/S features. Permanent fish
				barrier.
				18T 452450E 501324N
				Pics - 2950 - 53.

Additional Notes: tadpoles, lefr 3 gr f: observed, RUBL, NOWA, ~~fish observed~~
Corner (northeast) of site has marsh-like habitat w/ cattail.

Site Break Trigger ☐ Feature Type ☒ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation
☐ Other: Comments ______

Point Data Category
Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3)
No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R1-S3

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: 1661-10325 Recorder/Crew: J. Mansell B. Obermeyer

Stream Name: SMD-WC1-B Stream Code: Sprott MD WC Site Code: SMD-WC1-B

Site Limits: Google Earth Upstream WP# 452385E 5033339N Field Assessment: ☒ Sample 1 ☐ Sample 2 ☐ Sample 3 Unconnected HDF: ☐ Not connected to downstream network

Downstream 18T WP# 452410E 5033356N

Direction of Assessment: ☒ Upstream ☒ Downstream

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☒ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☒ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☒ Wetland(6) ☒ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☒ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): 0 0 0 Elevation (cm): 0 0 0 Gradient (%): 0

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☒	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☒	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☒ > 60% Extreme (4)

Width Measurement ☒ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions NA Feature Width (m): n/a Bankfull Depth (mm) n/a.

Entrenchment NA Total: ☒ > 40 m ☐ < 40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method NA ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1	2	3	Hydraulic head (mm) 1	2	3	Volume (L) 1	2	3	Distance (m) 1	2	3	Time (s) 1	2	3
* No Flow	5	10	15	–			–			–			–		

Sediment Transport

Adjacent ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): – – – – –

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: May 6/2021 Project #: 160410225 Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators: ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☒ Stained ☐ Other: _____

Fish Collection: ☐ Absent ☐ Present Comment: None observed.

WP#	Photo #	Code	Category	Description
				See banner data for SMD-WCL-A.

Additional Notes: Potential Turtle habitat behind house (1m deep x 15m x 35m) water disappears as heading west.

Site Break ☒ Feature Type ☒ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments * Mature deciduous wetland - not mapped LIO

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

* Wetland mapped by GeoOttawa.

POINT DATA KEY:

A	Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B	Seepage area - measure or estimate length of bank where seepage occurs
C	Watercress - estimate total surface area occupied
D	Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E	Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F	Beaver dam - measure perched height and jumping height
G	Manmade dam - measure perched height and jumping height
H	Other barrier to fish movement
I	Potential contamination source (storm sewer outlet or industrial discharge pipe).
J	Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K	Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L	Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M	Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N	Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O	Fish observed during non-fish sampling activities
P	Potential nutrient source
Q	Dredging of channel
R	Offline pond
S	Other

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: 160410305 Recorder/Crew: J Mansell B Ackerman

Stream Name: SMD-WC3-B Stream Code: Spring MD Site Code: SMD-WC3-B

Site Limits: Upstream 1ST WP# 452354E 5031940N Field Assessment: [x] Sample 1 Unconnected HDF:

Downstream WP# 452486E 5031991N [ ] Sample 2 [ ] Not connected

Direction of Assessment: [x] Upstream (Downstream) [ ] Sample 3 to downstream network

Flow Influence [ ] Freshet (1) [x] Spate (2) [ ] Baseflow (3)

Flow Condition [ ] Dry (1) [ ] Interstitial Flow (3) [ ] Substantial Flow (5)
[x] Standing Water (2) [ ] Minimal Flow (4)

Feature Type [ ] Defined Natural Channel (1) [ ] No Defined Feature (4) [ ] Swale (7)
[x] Channelized or Constrained (2) [ ] Tiled Feature (5) [ ] Roadside Ditch (8)
[ ] Multi-thread (3) [ ] Wetland (6) [ ] Pond (9)

Feature Vegetation [ ] None (1) [ ] Lawn (2) [ ] Cropped (3) [ ] Meadow (4) [x] Scrubland (5) [ ] Wetland(6) [ ] Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	[ ] None (1)	[ ] Lawn (2)	[ ] Cropped (3)	[ ] Meadow (4)	[x] Scrubland (5)	[ ] Wetland (6)	[ ] Forest (7)
	Right Bank	[ ] None (1)	[ ] Lawn (2)	[ ] Cropped (3)	[ ] Meadow (4)	[x] Scrubland (5)	[ ] Wetland (6)	[ ] Forest (7)
1.5 - 10 m	Left Bank	[ ] None (1)	[ ] Lawn (2)	[ ] Cropped (3)	[ ] Meadow (4)	[x] Scrubland (5)	[ ] Wetland (6)	[ ] Forest (7)
	Right Bank	[ ] None (1)	[ ] Lawn (2)	[ ] Cropped (3)	[ ] Meadow (4)	[x] Scrubland (5)	[ ] Wetland (6)	[ ] Forest (7)
10 - 30 m	Left Bank	[ ] None (1)	[ ] Lawn (2)	[ ] Cropped (3)	[x] Meadow (4)	[ ] Scrubland (5)	[ ] Wetland (6)	[ ] Forest (7)
	Right Bank	[ ] None (1)	[ ] Lawn (2)	[ ] Cropped (3)	[x] Meadow (4)	[ ] Scrubland (5)	[ ] Wetland (6)	[ ] Forest (7)

Channel Gradient (S4.M7) [x] Visual (1) [ ] Clinometer (2) [ ] Laser Level (3) [ ] Survey Level (4) [ ] Other (5) [ ] LiDAR (6)

Distance (m): NA / / / Elevation (cm): NA / / / Gradient (%): 0 Low.

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	[ ]	[x]	[ ]	[ ]	[ ]	[ ]	[ ]
Sub-Dominant Substrate (S2.M3)	[x]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Feature Roughness [ ] < 10% Minimal (1) [ ] 10 - 40% Moderate (2) [ ] 40 - 60% High (3) [x] > 60% Extreme (4)

Width Measurement [ ] Can't Measure (1) [ ] Bankfull (2) [ ] Mean Width (3) [ ] Estimated (4) [ ] GIS (5) [x] Measure/GIS (6)

Channel Dimensions Feature Width (m): 1.0 Bankfull Depth (mm) 90

Entrenchment NA Total: [x] > 40 m [ ] < 40 m Left Bank / m Right Bank / m Total width / m

Surface Flow Method [ ] Perched Culvert (1) [ ] Hydraulic Head (2) [ ] Distance by Time (3) [x] Estimated (4)

Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mm)	Volume (L)	Distance (m)	Time (s)
* No flow	90	NA			

Sediment Transport

Adjacent [ ] None (1) [ ] Rill (2) [ ] Rill and Gully (3) [ ] Gully (4) [ ] Outlet Scour (5)
[x] Sheet Erosion (6) [ ] Instream Bank Erosion (7) [ ] Other (8)

Feature [x] None (1) [ ] Rill (2) [ ] Rill and Gully (3) [ ] Gully (4) [ ] Outlet Scour (5)
[ ] Sheet Erosion (6) [ ] Instream Bank Erosion (7) [ ] Other (8)

Sediment Deposition NO Measures (mm):

[x] None (1) [ ] Minimal: < 5 mm (2) [ ] Moderate: 5-30 mm (3) [ ] Substantial: 31-80 mm (4) [ ] Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: May 6/2021 Site ID: 16041095 Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements WP# Perched Height (mm): Jumping Height (mm):

WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☒ Stained ☐ Other: ____________

Fish Collection ☒ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description
				Rock berm/ fish barrier @
				18T 452456E 5031811N

Additional Notes: /

Site Break Trigger ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

☐ Other: Comments ____________

Point Data Category	Ongoing and Active (1)	Historic Evidence (2)	Reported but No Evidence (3)
	No Evidence (4)	Unknown (5)	

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D *Outlet* (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E *Inlet* (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R1-S2

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: [illegible] Recorder/Crew: J Mansell B. Obermeyer

Stream Name: SMD-WC2-A Stream Code: Spratt MD WC Site Code: SMD-WC2-AA

Site Limits: Upstream IBT WP# 452313E 5093296N Field Assessment: ☒ Sample 1 Unconnected HDF:

Downstream WP# 452245E 5093259N ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☒ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☒ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☒ Swale (7)
☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☒ Wetland(6) ☒ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☒ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☒ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): NA n/a Elevation (cm): NA n/a Gradient (%): Low Lch.

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☒	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☒	☐	☒	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☒ 10 - 40% Moderate (2) ☒ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☒ Measure/GIS (6)

Channel Dimensions Feature Width (m): 1.25 Bankfull Depth (mm) NA - 90

Entrenchment NA Total: ☒ > 40 m ☐ < 40 m Left Bank ✓ m Right Bank ✓ m Total width ✓ m

Surface Flow Method ☐ Perched Culvert (1) ☒ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1.25	90			NA	2		NA			NA			NA		

Sediment Transport

Adjacent ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☒ Other (8)

Sediment Deposition Measures (mm): ✓ ✓ ✓ ✓ ✓

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

* SMD-WC2-AC not sampled
↳ no access

* SMD-WC2-A not sampled.
↳ no access

Unconstrained Headwater Drainage Feature Assessment

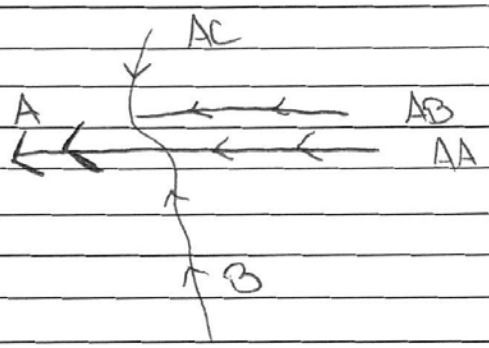
Date: May 6/2021 Project #: 160460335 Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm): None observed.
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☒ Watercress ☐ Seepage ☐ Bubbling ☒ Stained ☐ Other: _____
Fish Collection ☐ Absent ☐ Present Comment: None observed.

WP#	Photo #	Code	Category	Description



Additional Notes: 2nd Feature 10-15m north is identicle both flow into WC2-A. Named Smp-WC2-AB

Site Break ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation
Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) | Historic Evidence (2) | Reported but No Evidence (3) | No Evidence (4) | Unknown (5)

POINT DATA KEY:

A	Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B	Seepage area - measure or estimate length of bank where seepage occurs
C	Watercress - estimate total surface area occupied
D	Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E	Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F	Beaver dam - measure perched height and jumping height
G	Manmade dam - measure perched height and jumping height
H	Other barrier to fish movement
I	Potential contamination source (storm sewer outlet or industrial discharge pipe).
J	Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K	Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L	Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M	Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N	Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O	Fish observed during non-fish sampling activities
P	Potential nutrient source
Q	Dredging of channel
R	Offline pond
S	Other

ECk3-HDF2-R3-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: 1Company25 Recorder/Crew: J. Marsell B. Obermeyer
Stream Name: SMD - WC2 - AB Stream Code: Sprott MD WC Site Code: SMD - WC2 - AB.
Site Limits: Upstream 18T WP# 453746E 5039030N Field Assessment: ☒ Sample 1 ☐ Sample 2 ☐ Sample 3
Downstream WP# 453240E 5038951N
Unconnected HDF: ☐ Not connected to downstream network
Direction of Assessment: ☐ Upstream ☒ Downstream

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Standing Water (2) ☐ Interstitial Flow (3) ☒ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☐ Wetland (6) ☒ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☒ Wetland(6) ☐ Forest (7)

Riparian Vegetation

		None (1)	Lawn (2)	Cropped (3)	Meadow (4)	Scrubland (5)	Wetland (6)	Forest (7)
0 - 1.5 m	Left Bank	☐	☐	☐	☐	☐	☒	☐
	Right Bank	☐	☐	☐	☐	☐	☒	☐
1.5 - 10 m	Left Bank	☐	☐	☐	☐	☐	☒	☐
	Right Bank	☐	☐	☐	☐	☐	☒	☐
10 - 30 m	Left Bank	☐	☐	☐	☐	☐	☒	☐
	Right Bank	☐	☐	☐	☐	☐	☒	☐

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): / / / Elevation (cm): / / / Gradient (%): low.

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☒	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☒	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☒ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☒ Measure/GIS (6)

Channel Dimensions Feature Width (m): 1.95 Bankfull Depth (mm) 80

Entrenchment Total: ☒ > 40 m ☐ < 40 m Left Bank / m Right Bank / m Total width / m

Surface Flow Method ☐ Perched Culvert (1) ☒ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1	2	3	Hydraulic head (mm) 1	2	3	Volume (L) 1	2	3	Distance (m) 1	2	3	Time (s) 1	2	3
1.95	15	15	15	1	2	0		/			/			/	

Sediment Transport

Adjacent ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☒ Other (8)

Sediment Deposition Measures (mm): / / / / /

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: May 6 2021 Feature #: 16CA410305 Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):

None observed. WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☒ Watercress ☐ Seepage ☐ Bubbling ☒ Stained ☐ Other: ____________

Fish Collection ☐ Absent ☐ Present Comment: None observed.

WP#	Photo #	Code	Category	Description
				Connected to SMD-WCD-AC.
				↳ no access
				Parallel + identical to SMD-WC-AA.

Additional Notes:

Site Break Trigger ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation ☐ Other: Comments ✓ ____________

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R4-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: 160410825 Recorder/Crew: J Mansell B. Obermeyer

Stream Name: SMD-WC2-B Stream Code: Spath M D CW Site Code: SMD-WC2-B

Site Limits: Upstream 1ST WP# 452178E 5031891N Field Assessment: ☒ Sample 1 Unconnected HDF:

Downstream WP# 452245E 5031925N. ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☒ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☒ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☒ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☒ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☒ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☒ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☒ Forest (7)
10 - 30 m	Left Bank	☒ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☒ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): NA / / / Elevation (cm): NA / / / Gradient (%): Low

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☒	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☒	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☒ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☒ Measure/GIS (6)

Channel Dimensions Feature Width (m): 2.0 Bankfull Depth (mm) 300

Entrenchment Total: NA ☒ > 40 m ☐ < 40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
2 *No Flow	270	NA	NA	NA	NA

Sediment Transport

Adjacent ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition NA Measures (mm): / / / / /

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: May 6/2021 Feature: 16GHWD05 Field Assessment: ■ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP#   Perched Height (mm):   Jumping Height (mm):   None observed.
WP#   Perched Height (mm):   Jumping Height (mm):

Groundwater Indicators: ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ■ Stained ☐ Other: ________

Fish Collection: ☐ Absent ☐ Present Comment: None observed.

WP#	Photo #	Code	Category	Description
				Connects to both
				SMD-WC3A
				SMD-WC3 AA — 90°
				SMD-WCD-AC. — confluence.

Additional Notes: watercress

Site Break Trigger: ■ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation
☐ Other: Comments ________

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R4-S2

Unconstrained Headwater Drainage Feature Assessment

Date: May 6, 2021 Project #: 160410305 Recorder/Crew: J. Mansell B. Clemencyer

Stream Name: SMD-WC2-C Stream Code: Spratt MD WC Site Code: SMD-WC2-B1

Site Limits: Upstream 1BT WP# 459286E 5493153N Field Assessment: ☒ Sample 1 Unconnected HDF:

Downstream WP# 459278E 5493169N ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☒ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☒ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☒ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☒ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☒ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☒Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☒ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☒ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☒ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☒ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): NA / / / Elevation (cm): / / / Gradient (%): 6

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☒	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☒	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☒ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☒ Measure/GIS (6)

Channel Dimensions Feature Width (m): 2.0 m Bankfull Depth (mm) NA

Entrenchment NA Total: ☒ > 40 m ☐ < 40 m Left Bank / m Right Bank / m Total width / m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☒ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
2 * No flow	5	NA	NA	NA	NA

Sediment Transport

Adjacent ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition NA Measures (mm): / / / / /

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: May 6/21 Creek #: Veg10395 Field Assessment: ☒ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm): * No water
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators: ☒ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection: ☒ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description
				* SMD-WC2-B3 not surveyed
				- no access

Additional Notes: Within TVPI ROW
- managed for vegetation
- recently cleared.

Site Break Trigger: ☒ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A	Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B	Seepage area - measure or estimate length of bank where seepage occurs
C	Watercress - estimate total surface area occupied
D	Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E	Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F	Beaver dam - measure perched height and jumping height
G	Manmade dam - measure perched height and jumping height
H	Other barrier to fish movement
I	Potential contamination source (storm sewer outlet or industrial discharge pipe).
J	Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K	Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L	Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M	Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N	Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O	Fish observed during non-fish sampling activities
P	Potential nutrient source
Q	Dredging of channel
R	Offline pond
S	Other

ECk3-HDF1-R1-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160410305 Recorder/Crew: J. Morell

Stream Name: _____ Stream Code: _____ Site Code: SMD-UC3-A

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ■ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ■ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☐Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	**Wetted Depth (mm)**			**Hydraulic head (mm)**			**Volume (L)**			**Distance (m)**			**Time (s)**		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a															

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: No water obs.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R1-S2

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160410325 Recorder/Crew: J Mansell

Stream Name: _____ Stream Code: _____ Site Code: SMD-WC1-A

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ■ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ■ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a															

Sediment Transport

Adjacent Feature
■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature
■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: * No Water observed
Hydric Soils throughout

Site Break Trigger ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - *indicated by rip-rap*, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O *Fish observed during* non-fish sampling activities
P Potential nutrient source
Q *Dredging of* channel
R Offline pond
S Other

ECk3-HDF1-R1-S3

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160416325 Recorder/Crew:

Stream Name: Stream Code: Site Code: SMD-WC1-B

Site Limits: Upstream WP# Field Assessment: ☐ Sample 1 Unconnected HDF:
Downstream WP# ■ Sample 2 ☐ Not connected
Direction of Assessment: ■ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
■ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): Elevation (cm): Gradient (%):

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): Bankfull Depth (mm)

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank m Right Bank m Total width m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a															

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm):
■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm) Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: * No H_2O observed
* Hydric soils throughout

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R2-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160410305 Recorder/Crew: J. Morell

Stream Name: _____ Stream Code: _____ Site Code: SMD-WC3-B

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ■ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)			**Wetted Depth (mm)**			**Hydraulic head (mm)**			**Volume (L)**			**Distance (m)**			**Time (s)**		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a.																	

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: * No Water

Site Break Trigger ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R1-S2

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160416325 Recorder/Crew: J. Mansell

Stream Name: Stream Code: Site Code: SMO-WC2-AA

Site Limits: Upstream WP# Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# ■ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ■ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☐Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐Visual (1) ☐Clinometer (2) ☐Laser Level (3) ☐Survey Level (4) ☐Other (5) ☐LiDAR (6)

Distance (m): ____ ____ ____ Elevation (cm): ____ ____ ____ Gradient (%): ____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): ____ Bankfull Depth (cm): ____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a															

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: No H_2O observed
Hydric Soils throughout.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R3-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 1604-10925 Recorder/Crew: J. Mansell

Stream Name: ______ Stream Code: ______ Site Code: SMD-WC2-AB

Site Limits: Upstream WP# ______ Downstream WP# ______

Field Assessment: ☐ Sample 1 ☒ Sample 2 ☐ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Direction of Assessment: ☐ Upstream ☒ Downstream

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☒ Baseflow (3)

Flow Condition ☒ Dry (1) ☐ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☐ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): ____ ____ ____ Elevation (cm): ____ ____ ____ Gradient (%) ____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): ______ Bankfull Depth (mm) ______

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank ____ m Right Bank ____ m Total width ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	**Wetted Depth (mm)**			**Hydraulic head (mm)**			**Volume (L)**			**Distance (m)**			**Time (s)**		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a															

Sediment Transport

Adjacent: ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature: ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): ____ ____ ____ ____ ____

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: No inlet observed
Hydric soils observed.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R4-S1

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160410325 Recorder/Crew: J Mansell

Stream Name: ______ Stream Code: ______ Site Code: SMD - WC2 - B

Site Limits: Upstream WP# ______ Downstream WP# ______

Field Assessment: ☐ Sample 1 ☒ Sample 2 ☐ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Direction of Assessment: ☒ Upstream ☐ Downstream

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☒ Baseflow (3)

Flow Condition ☒ Dry (1) ☐ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☐ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): ______ Elevation (cm): ______ Gradient (%): ______

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): ______ Bankfull Depth (mm) ______

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank ______ m Right Bank ______ m Total width ______ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	**Wetted Depth (mm)**	**Hydraulic head (mm)**	**Volume (L)**	**Distance (m)**	**Time (s)**
	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
n/a					

Sediment Transport

Adjacent ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☒ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): ______ ______ ______ ______ ______

☒ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: No water
Hydric soils observed

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R4-S2

Unconstrained Headwater Drainage Feature Assessment

Date: May 27/2021 Project #: 160410305 Recorder/Crew: J. Mansell

Stream Name: _____ Stream Code: _____ Site Code: SMD-WC2-B1

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ■ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm): _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a.															

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/21 Project #: 160410325 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes:
* No H2O
* Dry

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation
Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R1-S1

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/2021 Project #: 160416225 Recorder/Crew: J. Mazell

Stream Name: _____ Stream Code: _____ Site Code: SMD-UC3-A

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ■ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a														

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☐ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes: No water

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R1-S2

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/2021 Project #: 160410925 Recorder/Crew: J. Morrell

Stream Name: _____ Stream Code: _____ Site Code: SMD-WC1-A

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ■ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☐Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐Visual (1) ☐Clinometer (2) ☐Laser Level (3) ☐Survey Level (4) ☐Other (5) ☐LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm) : _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a.														

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/21 Project #: _____ Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ☒ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description
				* No H2O observed
				* Hydric Soils + vegetation throughout

Additional Notes:

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R1-S3

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/2021 Project #: 1604110995 Recorder/Crew: J. Maxell

Stream Name: _____ Stream Code: _____ Site Code: SMD-WC1-B

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ■ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☐Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐Visual (1) ☐Clinometer (2) ☐Laser Level (3) ☐Survey Level (4) ☐Other (5) ☐LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	**Wetted Depth (mm)**			**Hydraulic head (mm)**			**Volume (L)**			**Distance (m)**			**Time (s)**		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a														

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 9th 21 Project #: 160416595 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm) Jumping Height (mm)
WP# Perched Height (mm) Jumping Height (mm)

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes:
* No H2O observed
* Hydric soils + vegetation.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation
Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF1-R2-S1

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/2021 Project #: 18C4162925 Recorder/Crew: J. Mansell

Stream Name: ______ Stream Code: ______ Site Code: SMD-WCB-B

Site Limits: Upstream WP# ______ Downstream WP# ______

Field Assessment: ☐ Sample 1 ☐ Sample 2 ■ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Direction of Assessment: ■ Upstream ☐ Downstream

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☐ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☒ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): ______ Elevation (cm): ______ Gradient (%): ______

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☒ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): ______ Bankfull Depth (mm): ______

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank ______ m Right Bank ______ m Total width ______ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm) 1 2 3	Hydraulic head (mm) 1 2 3	Volume (L) 1 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
n/c	n/a				

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/21 Project #: 160410325 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes:

* No H_2O
* Hydric soils + vegetation.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R1-S2

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/2021 Project #: 160410325 Recorder/Crew: J Mansell

Stream Name: _____ Stream Code: _____ Site Code: SMD-UC2-AA

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ■ Downstream ■ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☐Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐Visual (1) ☐Clinometer (2) ☐Laser Level (3) ☐Survey Level (4) ☐Other (5) ☐LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm): _____ _____ _____ Gradient (%): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a														

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a _____ _____ _____ _____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/21 Project #: 16041005 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm) Jumping Height (mm)

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes:

* No H2O observed
* Hydric soils + vegetation.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R3-S1

Unconstrained Headwater Drainage Feature Assessment

Date: Jul 30/2021 Project #: 16CH10325 Recorder/Crew: J Mansell

Stream Name: Stream Code: Site Code: SMD-WC2-AB

Site Limits: Upstream WP# Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ☐ Downstream ■ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐None (1)	☐Lawn (2)	☐Cropped (3)	☐Meadow (4)	☐Scrubland (5)	☐Wetland (6)	☐Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	■ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): Elevation (cm): Gradient (%):

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	■	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): Bankfull Depth (mm)

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank m Right Bank m Total width m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a														

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/21 Project #: KCCH0225 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm)
WP# Perched Height (mm): Jumping Height (mm)

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment

WP#	Photo #	Code	Category	Description

Additional Notes:
* No H2O observed.
* Hydric soils + vegetation

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R4-S1

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/2021 Project #: 160416925 Recorder/Crew: J. Mansell

Stream Name: Stream Code: Site Code: SMD-WC2-B

Site Limits: Upstream WP# Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# ☐ Sample 2 ☐ Not connected

Direction of Assessment: ■ Upstream ☐ Downstream ■ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): Elevation (cm): Gradient (%):

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): Bankfull Depth (mm):

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank m Right Bank m Total width m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a														

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: July 30/21 Project #: 160416295 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm):
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment

WP#	Photo #	Code	Category	Description

Additional Notes:

* No H2O observed.
* Hydric soils + vegetation.

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation

Trigger ☐ Other: Comments _____

Point Data Category Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other

ECk3-HDF2-R4-S2

Unconstrained Headwater Drainage Feature Assessment

Date: July 30 2021 Project #: 160410995 Recorder/Crew: J Mazell

Stream Name: Stream Code: Site Code: SMD-UC2-B1

Site Limits: Upstream WP#: Downstream WP#:

Direction of Assessment: ■ Upstream ☐ Downstream

Field Assessment: ☐ Sample 1 ☐ Sample 2 ■ Sample 3

Unconnected HDF: ☐ Not connected to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ■ Baseflow (3)

Flow Condition ■ Dry (1) ☐ Standing Water (2) ☐ Interstitial Flow (3) ☐ Minimal Flow (4) ☐ Substantial Flow (5)

Feature Type ☐ Defined Natural Channel (1) ☐ Channelized or Constrained (2) ☐ Multi-thread (3) ☐ No Defined Feature (4) ☐ Tiled Feature (5) ☐ Wetland (6) ☐ Swale (7) ☐ Roadside Ditch (8) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): ____ ____ ____ Elevation (cm): ____ ____ ____ Gradient (%): ____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (2-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): ____ Bankfull Depth (mm): ____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank: ____ m Right Bank: ____ m Total width: ____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
n/a	n/a																

Sediment Transport

Adjacent ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ■ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5) ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): n/a ____ ____ ____ ____

■ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Unconstrained Headwater Drainage Feature Assessment

Date: 3/4/2021 Project #: 16041625 Field Assessment: ☐ Sample # 1 ☐ Sample # 2 ■ Sample # 3

POINT FEATURE DATA

Fish Barrier Measurements: WP# Perched Height (mm): Jumping Height (mm)
WP# Perched Height (mm): Jumping Height (mm):

Groundwater Indicators ☐ None ☐ Watercress ☐ Seepage ☐ Bubbling ☐ Stained ☐ Other: _____

Fish Collection ☐ Absent ☐ Present Comment:

WP#	Photo #	Code	Category	Description

Additional Notes:
* No H2O
* Dry soil

Site Break ☐ Feature Type ☐ Feature Modifier ☐ Flow Conditions ☐ Feature Vegetation ☐ Riparian Vegetation
Trigger ☐ Other: Comments _____

Point Data Category: Ongoing and Active (1) Historic Evidence (2) Reported but No Evidence (3) No Evidence (4) Unknown (5)

POINT DATA KEY:

A Spring/upwelling - estimate <0.5 l/sec or >0.5 l/sec; measure temp
B Seepage area - measure or estimate length of bank where seepage occurs
C Watercress - estimate total surface area occupied
D Outlet (tile or other) - record flow status as per feature flow. Estimate volume <0.5 l/sec or >0.5 l/sec. Measure temperature.
E Inlet (tile or other) - record flow status as per feature flow. Estimate volume to be <0.5 l/sec or >0.5 l/sec.
F Beaver dam - measure perched height and jumping height
G Manmade dam - measure perched height and jumping height
H Other barrier to fish movement
I Potential contamination source (storm sewer outlet or industrial discharge pipe).
J Channel hardening - indicated by rip-rap, armour stone, or gabion baskets.
K Culvert - note type, size and whether or not perched. If perched record perched height and jumping height.
L Flow transition point D/S - flow condition changes from dry to standing water, independent of segment break
M Flow transition point M/S- flow condition changes from minimal to substantial surface flow, independent of segment break
N Flow transition point D-S/IF- flow condition changes from dry/standing water to interstitial flow, independent of segment break
O Fish observed during non-fish sampling activities
P Potential nutrient source
Q Dredging of channel
R Offline pond
S Other