February 14, 2025

CBM Aggregates, a division of St. Marys Cement Inc. (Canada) 55 Industrial Street, Toronto, ON M4G 3W9

- Attn: David Hanratty (VCNA) Director of Land, Resource & Environment
- Re: Fluvial Geomorphic Assessment at Credit River and Tributary System in Caledon, Ontario Proposed CBM Caledon Pit/Quarry Project GEO Morphix Ltd. Project No. PN24061 – Report Version 1.0

1.0 INTRODUCTION

GEO Morphix Ltd. (GEO Morphix) was retained by CBM Aggregates, a division of St. Marys Cement Inc. (Canada) (CBM), to conduct technical services to support the regulatory approvals for the Caledon Pit/Quarry licence application (the Project). The technical services involved the completion of a fluvial geomorphic assessment in the receiving surface water environment of the proposed Caledon Pit/Quarry, specific to the tributary and mainstem channel system of the Credit River near Charleston Side Road.

The purpose of this report is to present the methods and results of the fluvial geomorphic study at the subject channels of the Credit River and tributary system. A summary of the study objectives and reporting structure is presented immediately below. A description of the methods and results of the assessment follows.

Project Overview and Study Objectives

With reference to Figure 1, the proposed conditions for the Project include the discharge of pumped water from the planned pit/quarry operations (i.e., surplus water that is not managed directly at the site – estimated to be 18 L/s on an average annual basis as described in WSP [2023]) to a location on the southeast side of the Osprey Valley Golf Course (OVGC). The surplus water will, in turn, be directed to one or more of the storage ponds at the OVGC, and, depending on the time of year and available storage capacity, relied on for irrigation purposes or returned to the receiving environment. This considers that, under existing conditions, permitted water takings at OVGC (primarily obtained/pumped from the Credit River at a location immediately north of Pond 3 – East and used mainly for golf course irrigation), coupled with local runoff and groundwater inputs, are managed through the on-site pond system, noting the following, relevant drainage conditions and water management practices:

- The network of ponds in the central portion of the site are relied on to convey the managed water from generally north to south (i.e., water is directed in series from Pond 3 East through to Pond 4 South), with the understanding that water above and beyond the storage capacity of the ponds is allowed to passively drain to an unnamed tributary of the Credit River (described herein as "Tributary 4") at a location immediately downgradient of Pump House A (i.e., surplus water from Pond 4 South collects at a wet well structure at the pumphouse, and, under overflow/bypass conditions, drains to Tributary 4 via a culvert).
- The ponds at the far east side of the site (described herein as the "East Ponds") have no connection to the existing water management network/infrastructure in the central part of the site and serve to capture and convey local runoff to the Credit River by way of a small outlet channel (also an unnamed tributary of the Credit River and described herein as the "East Ponds Outlet Channel"), recognizing that water from the ponds drain to the outlet channel via a culvert, as well as through other surface and subsurface flow paths (i.e., flows have been shown to overtop the outlet berm and also enter the downstream channel through subsurface pathways in the berm).

It also considers that, based on site observations and discussions with CBM to date, the proposed conditions for the Project include two conveyance path alternatives to direct the discharge waters from the Caledon Pit/Quarry to the Credit River:

- 1. Tributary 4 via the network of ponds and related water management infrastructure (existing or planned) in the central portion of the OVGC site.
- 2. The East Ponds and associated East Ponds Outlet Channel on the east side of the OVGC site via the installation of new water management infrastructure at the golf course facility (to direct water to the East Ponds from the central part of the site).

The regulatory review of the licence application for the Project has been ongoing in recent years. As part of this review process, the Credit Valley Conservation Authority (CVC) has communicated concerns that the proposed discharge activities from the Caledon Pit/Quarry have the potential to increase rates of erosion-sedimentation at the mainstem channel of the Credit River and/or channels of the contributing tributaries.

Based on the above, GEO Morphix was tasked to complete a fluvial geomorphic study at the subject channels of the Credit River and tributary system (specifically Tributary 4 and the East Ponds Outlet Channel, given that each feature was identified as a potential conveyance path alternative) to assess the potential for Project-related effects on characteristic erosion-sedimentation processes, and, where appropriate, to identify suitable mitigation measures. The results of the geomorphic assessment will be used to address the comments from CVC, and, as part of this, to inform the discharge capacity and control requirements at the subject receiving channels, as well as to comment on the preferred conveyance path alternative.

Reporting Structure

The remaining part of this report has been organized into three main sections. The methods and results are described in Section 2.0 and Section 3.0, respectively, while a summary and discussion are outlined in Section 4.0.

2.0 METHODS

As illustrated on Figure 2, the fluvial geomorphic studies were conducted at the following locations of the Credit River and tributary system:

- Unnamed tributary of the Credit River that is described herein as Tributary 4.
- Unnamed tributary of the Credit River that is described herein as the East Ponds Outlet Channel.
- Credit River from a location approximately 100 m upstream of the confluence with Tributary 4 to a location approximately 100 m downstream of the confluence with the East Ponds Outlet Channel.

The studies included the completion of an existing conditions assessment, as well as an erosion threshold assessment. The methodology for these studies is detailed below.

Existing Conditions Assessment

The existing conditions assessment involved the completion of desktop- and field-based studies to characterize the past and present channel morphology (including erosion-sedimentation patterns and associated bed and bank stability) in the subject receiving environment. Each component of the existing conditions assessment is outlined below.

The desktop analyses comprised a review of available study reports and data records for the site to assist in the general characterization of channel and watershed conditions at the subject watercourses, as well as to guide or inform the field studies (e.g., selection of representative channel units for the detailed geomorphic assessment) and the erosion threshold assessment. The relevant materials for the desktop review included the following:

- Mapping and imagery for the subject watersheds (i.e., soils and geological information, LiDAR and other topographic mapping, and historical and recent aerial photographs/imagery) that were obtained through publicly available sources.
- Flow estimates (e.g., average monthly flows, return period flow rates, etc.) for the subject channels that were obtained from WSP.
- Past environmental studies and reporting for the Project that were obtained from WSP.

The field studies involved the completion of rapid and detailed geomorphic assessments between July 23 and July 25, 2024, as well as other cursory level, visual inspections on June 17 and July 18, 2024 (to support the planning and implementation of the detailed field work, and, in the case of the July 18 visit, to observe high flow conditions at the subject channels following the major rainfall event on July 16). The specific field activities included the following at each of the subject channels:

- Completion of a Rapid Geomorphic Assessment (MOE, 2003) and Rapid Stream Assessment Technique (Galli, 1996) to evaluate channel stability and stream 'health', respectively.
- Completion of rapid-based habitat sketch maps and related observation logs in accordance with Newson and Newson (2000) to document the presence of, or variations to, channel bedform features (e.g., riffles and/or nick points, etc.), meander bend patterns/sequences, areas of active channel and valley slope erosion, channel substrate types and flow patterns, woody debris and other instream structures, and riparian vegetation.
- Detailed measurements of channel geometry and hydraulics, including bankfull width and depth, side and channel slope, channel entrenchment heights, pool and riffle flow depths, vegetation rooting depths, and flow velocity, noting that the various measurements of channel geometry were obtained through the completion of a targeted topographic survey (using RTK GPS survey equipment) at several representative channel cross-sections and profile units, while the flow velocity measurements were obtained via the floating ball method at a similar set of locations.
- Detailed characterization of bed and bank materials via the completion of a modified Wolman (1954) pebble count technique at the identified cross-section locations, supplemented, where needed, with the sampling of the fine-grained component of the substrate and subsequent testing of this material at an accredited laboratory for grain size distribution (i.e., bed and bank materials were sampled at discrete locations using an Ekman dredge sampler, and, in turn, the samples were issued to the laboratory for physical analysis).

Following the completion of the field investigations, the full set of field data was compiled and summarized to facilitate the characterization of existing channel conditions and associated controls on channel morphology at the watercourse network, and, as part of this, to develop several detailed desktop analyses. The topographic survey data, in particular, was used, in combination with other key measurements and standard coefficients, to estimate bankfull flow characteristics (e.g., discharge, average velocity, stream power, tractive force, and flow competency) at the subject channels. The same information was relied on to derive erosion thresholds for the receiving environment (described in the section below).

Erosion Threshold Assessment

The erosion thresholds for the subject channels (i.e., flow rates that would be expected to maintain physical stability at the subject channels) were quantified, in the form of a "critical discharge", based on the observed substrate (bed and bank) materials and channel geometry. The derivation of the critical discharge estimates involved the calculation of flow velocity, U, and shear stress, t, values under a range of flow rates and associated depths for a representative cross section, and, in turn, the comparison of these values against the assumed threshold for the bed and bank materials (i.e., the theoretical flow velocity or shear stress that would be expected to result in entrainment and transport of sediment based on Julien [1998], Fischenich [2001], Chow [1959], and others). The results of the comparison were then used to determine the point at which a given flow condition at the channel (using velocity and shear stress as the proxy) was shown to "exceed" the threshold of the substrate.

The flow velocity estimates were determined using a Manning's approach; mathematically represented as:

$$U = \frac{1}{n} d^{2/3} S^{1/2}$$
 [Eq. 1]

where, *d* is depth of water, *S* is channel slope, and *n* is the Manning's roughness.

The shear stress estimates were determined using the depth-slope product; mathematically represented as:

$$t = d\rho g S_{bed}$$

[Eq. 2]

where *t* is shear stress, d is the water depth, ρ is water density, g is acceleration due to gravity, and S_{bed} is the channel bed slope.

The erosion thresholds for the subject channels were determined for both bed and bank materials, noting the following:

- The lower of the two erosion threshold values was adopted at a given location to maintain a conservative and limiting estimate.
- The erosion threshold estimates at the banks were scaled by a factor of 0.75 in accordance with Chow (1959) to account for the inferred reduction in shear stress and velocity at the channel margins.

For added context to assess the potential for Project-related effects on characteristic erosionsedimentation processes at the subject channels, the erosion threshold estimates were compared against the characteristic flow conditions for the local surface water system. The flow information for each of the watercourses were provided by WSP and included estimates of mean, minimum, and maximum monthly flow rates, as well as flood flow conditions under the 2-year, 5-year, and 10-year return period events, with the understanding that the flow estimates at each of the subject channels were derived by pro-rating flow records (i.e., daily discharge data) from local Water Survey of Canada stream gauge stations.

3.0 RESULTS

Existing Conditions Assessment

The detailed results from the existing conditions assessment at the subject channels are presented in Appendices A, B, and C. This includes the documented records of observed channel morphology in Appendix A (photographs) and Appendix B (field measurements and sketches), as well as a detailed summary of the characteristic geomorphology and hydrotechnical conditions in Appendix C.

With reference to Photographs 1 through 4 (embedded below), the key findings from the existing conditions assessment are listed below for each of the subject channels:

- The observed channel morphology at the **Credit River** (from approximately 100 m upstream of the confluence with Tributary 4 to a location approximately 100 m downstream of the confluence with the East Ponds Outlet Channel) demonstrated mostly alluvial controls and included the following attributes:
 - Channel features were well-defined (i.e., incised channel with prominent bed and banks) with low to moderate entrenchment relative to the surrounding terrain;
 - Channel planform was characterized by a moderate, irregular meander pattern with partial valley confinement;
 - Bed form included alternating riffle-pool sequences (or run and pool features) for the bulk of the surveyed section;
 - Channel gradient was minor (<0.5%) for the majority of the surveyed section;
 - Channel geometry was broad and largely trapezoidal with:

- average bankfull widths ranging from 14.19 m to 14.70 m;
- average bankfull depths varying from 0.66 m to 1.02 m; and
- bank angles ranging from 15 to 90°.
- Erosion and/or depositional features at the channel included undercutting of banks (on the order of 0.10 m to 0.82 m) for the majority of the surveyed section, as well as discrete instances of leaning trees and valley wall contact;
- Instream controls included instances of woody debris (of moderate densities);
- Bank materials were composed of mostly fine-grained sediment (i.e., silty/sandy clay with instances of small to large cobbles), while bed materials comprised sands (ranging from very fine to very coarse sand) and small to large cobbles;
- Surface flows were generally low to moderate (i.e., water levels were below bankfull albeit notably higher during the site visit on July 18 that followed the major rainfall event) and exhibited a visible surface current; and
- Riparian zone spanned more than 10 channel widths and consisted of a continuous cover of mature and well-established vegetation (including trees and shrubs).
- The observed channel morphology at the **East Ponds Outlet Channel** (a short, section of channel approximately 33 m in length) showed mostly alluvial controls and included the following attributes:
 - Channel features were well-defined with moderate entrenchment relative to the surrounding terrain;
 - Channel planform was straight and confined;
 - Bed form was mostly flat;
 - Channel gradient was low (<1.0%);
 - Channel geometry was narrow and mostly trapezoidal with:
 - average bankfull widths of 2.53 m;
 - average bankfull depths of 0.31 m; and
 - bank angles of 40 to 70°.
 - Erosion and/or depositional features at the channel included:
 - A knickpoint at the upstream extent of the channel (located immediately downstream from the berm at the East Ponds where flows were conveyed from the upstream pond to the downstream channel via a degraded, 0.3 m diameter culvert, as well as by way of throughflow and overflow at the berm itself [as observed both in June and July, 2024]);
 - Undercutting of the banks on both sides of the channel for approximately 60% of the surveyed length; and
 - A small, vegetated island (sand deposit) immediately upstream of the confluence with the Credit River (likely indicative of backwater effects / dispositional influences from the mainstem channel).
 - Instream controls included some woody debris and vegetation encroachment;
 - Bank materials were composed of silt and fine to medium sand with small to large cobbles, while bed materials consisted of medium to very coarse sand with cobbles;
 - Surface flows were generally low at the channel; and
 - Riparian zone spanned between 4 and 10 channel widths and consisted of a dense cover of mature cedar trees.
- The observed channel morphology at **Tributary 4** (section that extends from the golf course limits near Pumphouse A to the confluence with the Credit River) demonstrated alluvial and wetland controls and included the following attributes:
 - Channel features were largely ill-defined (i.e., absence of discernible bed and/or banks) except for at the downstream-most extent of the watercourse (~ 75 m length of channel) that supported incised conditions;
 - Channel planform (or primary flow path of the watercourse) was characterized by a moderate and irregular meandering pattern;
 - Bed form (where present) was mostly flat;
 - Channel or valley gradient was low (<1.0%);
 - Channel geometry (where present) was narrow and mostly trapezoidal with:
 - average bankfull widths of 2.89 m;
 - average bankfull depths of 0.20 m; and

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- bank angles of 15 to 45°.
- Erosion and depositional features were mostly absent;
- Instream controls included moderate to high density woody debris, heavy vegetation 0 encroachment, and rooted emergent aquatic vegetation;
- Bank materials (where present) were composed of clays with silts and sands (ranging 0 from very fine to coarse sand) and occasional gravels, while bed materials consisted of fine to medium sand with small to large cobbles;
- Surface flows were largely discontinuous (the watercourse was characterized by dry 0 channel conditions and/or a series of mostly isolated ponded features at the time of the field visits in June and July, 2024) except for at the downstream-most extent of the watercourse that supported flowing conditions (albeit nominal in magnitude); and
- Riparian zone spanned over 10 channel widths and comprised a dense cover of trees, 0 shrubs, and low-lying vegetation.



Photograph 01: Credit River near confluence with Tributary 4 (June 2024).



Photograph 02: East Ponds Outlet Channel near confluence point with Credit River (June 2024).





Photograph 03: Tributary 4 at a location Photograph 04: Tributary 4 near confluence downgradient of the OVGC access road (June 2024).

point with Credit River (June 2024).

A summary of the key characteristics at the subject channels is provided in Table 1 and includes fieldsurveyed (or -inferred) channel dimensions and conditions, desktop-based hydraulic and catchment area calculations, and pebble count derived grain sizes.

Table 1. Summary	of Observed	and Derived	Geomorphic and	Hydrotechnical	Conditions at
Subject Channels					

Geomorphic and		Subject Ch	annel			
Hydrotechnical Parameters at Selected Cross-	Tributaries of	Credit River	Mainstem of Credit River (3) Credit River at East Ponds Outlet Channel Credit River a Tributary 4 15,051 14,759 0.38 0.30 14,19 14,70			
Section Location	East Ponds Outlet Channel ⁽²⁾	Tributary 4 ⁽³⁾	Credit River at East Ponds Outlet Channel	Credit River at Tributary 4		
Catchment Area (ha) ⁽¹⁾	16	229	15,051	14,759		
Surveyed Channel Gradient (%)	0.71	0.96	0.38	0.30		
Surveyed Bankfull Width (m)	2.53	2.89	14.19	14.70		
Surveyed Bankfull Depth (m)	0.31	0.20	1.02	0.66		
Bed material – Calculated D ₅₀ (mm) ⁽⁴⁾	10.8	<2mm	26.2	27.9		
Bank material – Observed	Silty sand with small to large cobbles	Silty clay with fine to medium sand	Silty/sandy clay with small to large cobbles	Silty/sandy clay		
Inferred Manning's n	0.045	0.045	0.045	0.045		
Field Measured Flow (m³/s) ⁽⁵⁾	0.021	No Flow (Standing)	0.547	0.450		
Calculated Bankfull Discharge (m ³ /s)	0.41	0.44	14.75	8.95		
Calculated Bankfull Velocity (m/s)	0.71	0.75	1.02	0.92		

(1) Catchment areas at the subject channels were estimated based on the Ontario Watershed Information Tool (OWIT), noting that the estimated catchment area for Tributary 4 does not account for the seasonal/intermittent drainage from the irrigation ponds at OVGC.

(2) Calculated hydraulic conditions at East Ponds Outlet Channel (as well as the surveyed channel gradient) were estimated based on the channel length located downstream of the knick point and berm.

(3) Surveyed channel dimensions and calculated hydraulic conditions at Tributary 4 were estimated at the location that included discernible bed and banks (i.e., incised channel at the downstream-most extent of the watercourse).

(4) The full suite of available pebble count results on a reach-specific scale were used to generate the reported bed material values for each of the subject channels (i.e., calculated D₅₀ values). The laboratory-based grain size results were used, for descriptive purposes, to provide a more fulsome characterization of the fine-grained component of the sampled substrate (or, in case of sites/samples dominated by fines, relied on to infill for the calculated D₅₀ values where pebble count analyses were not possible or practical).

(5) Field measured flows were obtained from July 23 to July 25, 2024.

Erosion Threshold Assessment

The results of the erosion threshold assessment are presented in Tables 2 and 3. This includes the estimated erosion thresholds for each of the subject channels (Table 2), as well as a comparison of the threshold values with the characteristic flow conditions to provide a means of assessing the channel capacity to accommodate added flow contributions from the Project or other (Table 3).

Geomorphic and				Subject (Channel				
Hydraulic Parameters at Selected	Tri	butaries c	of Credit R	iver	Ma	ainstem o	f Credit R	iver	
Section Location	East Outlet (Ponds Channel	Tribu	tary 4	Credit I East I Outlet	River at Ponds Channel	Credit Tribu	River at Itary 4	
	Bed	Bank	Bed	Bank	Bed	Bank	Bed	Bank	
Critical Velocity or Shear Stress	0.45 m/s	0.34 m/s	0.46 m/s	7.18 N/m²	0.76 m/s	0.53 m/s	0.76 m/s	7.18 N/m²	
Critical Discharge (m³/s)	0.100	0.100	0.134	0.149	3.859	3.153	3.668	2.284	
Erosion Threshold (m³/s)	0.1	100	0.134		3.1	153	2.284		
Notes on Critical Discharge Estimates	Critical vel 0.34 m/s a m/s were b Julien (199 "medium s "firm sandy respectivel which correct to a critica of 0.100 m For the put maintainin conservative estimates, observed of the channe as a minor component the bed an were not c in the eros threshold calculation	ocities of and 0.45 based on 08) for and" and y loam", y; each of esponded I discharge ³ /s. rposes of g ve the obbles at el (present t at both d banks) onsidered ion s.	Critical vela 0.46 m/s a was based Fischenich a "fine to r sand" and a critical di 0.134 m ³ /s Critical she 7.18 N/m ² banks was Chow (195 "fairly com clays" and a critical di 0.149 m ³ /s For the pur maintainin conservativ estimates, observed o the channe (present as component locations) considered erosion thr calculation	ocity of the bed on (2001) for nedium resulted in ischarge of 5. ear stress of at the based on 19) for pact sandy resulted in ischarge of 5. rposes of g ve the cobbles at el bed s a minor t at most were not in the reshold s.	Critical ve 0.76 m/s a was based Fischenich for "small and result critical dis 3.859 m ³ / Critical ve 0.53 m/s a banks was Julien (19) "sandy-loa and result critical dis 3.153 m ³ / For the pu maintainir conservati estimates, observed the chann (present of variable b not consid the erosio threshold calculation	locity of at the bed l on (2001) cobbles" ed in a charge of s. locity of at the based on 98) for amy clay" ed in a charge of s. urposes of ng ive , the cobbles at el banks on a asis) were lered in n	Critical ve 0.76 m/s a was based Fischenich "small cob correspond critical dis 3.668 m ³ / Critical sha 7.18 N/m ² banks was Chow (199 "fairly com clays"; con to a critica of 2.284 m For the pu maintainin conservati estimates, observed o the channe (present o basis) wer considered erosion th calculation	locity of at the bed l on (2001) for bles"; ding to a charge of s. ear stress of a the based on 59) for npact sandy rresponding al discharge n ³ /s. rposes of g ve the cobbles at el banks in a variable re not d in the reshold is.	

Table 2. Summary of Erosion Threshold Results at Subject Channels

Table 3.	Comparison	of	Erosion	Threshold	Results	with	Characteristic	Flow	Conditions	at
Subject (Channels									

Characteristic Flow Rate	Existing Flow at Channel (m³/s)	Proportion of Flow at Channel Relative to Critical Discharge (%)	Proportion of Flow at Channel Relative to Critical Discharge (m ³ /s)	
	East Ponds Outlet Ch	annel (ET 0.100 m ³ /s)		
Field-Measured Flow	0.021	21%	-0.079	
Min Monthly Flow	0.001	1%	-0.099	
Max Monthly Flow	0.004	4%	-0.096	
2-Year Flow	0.068	68%	-0.032	
5-Year Flow	0.127	127%	+0.027	
10-Year Flow	0.157	157%	+0.057	
	Tributary 4 (I	ET 0.134 m³/s)		
Field-Measured Flow	No Flow (Standing)	N/A	N/A	
Min Monthly Flow	0.014	10%	-0.12	
Max Monthly Flow	0.052	39%	-0.082	
2-Year Flow	0.525	392%	+0.39	
5-Year Flow	0.914	682%	+0.78	
10-Year Flow	1.196	893%	+1.06	
Credit	River at East Ponds O	utlet Channel (ET 3.153	m³/s)	
Field-Measured Flow	0.547	17%	-2.61	
Min Monthly Flow	0.939	30%	-2.21	
Max Monthly Flow	3.410	108%	+0.26	
2-Year Flow	11.405	362%	+8.25	
5-Year Flow	21.362	672%	+18.21	
10-Year Flow	29.469	935%	+26.32	
	Credit River at Tribu	tary 4 (ET 2.284m ³ /s)		
Field-Measured Flow	0.450	18%	-1.83	
Min Monthly Flow	0.921	40%	-1.36	
Max Monthly Flow	3.343	146%	+1.06	
2-Year Flow	11.236	492%	+8.95	
5-Year Flow	21.046	921%	+18.76	
10-Year Flow	29.033	1,271%	+26.75	

The key findings from the comparison of the erosion threshold estimates with the characteristic flow conditions are presented below:

• **Mainstem of Credit River** – The characteristic flow rates at the mainstem of the Credit River were shown to be lower than the estimated erosion thresholds for flow rates up to and including the minimum monthly flows (at both areas of interest at the river – downstream of each of the



confluence points with the subject tributary channels). This suggests that, under existing conditions, channel stability at the Credit River can be maintained under low to moderate flows, but sediment entrainment and transport is inferred under seasonally higher flow rates (e.g., spring freshet) and larger flood flow conditions. To that end, the capacity of the channel to accommodate additional flow volumes from the Project or other would be expected to align to this same flow regime. However, for added context, it is important to point out that the preliminary estimates of average annual pump rates from the Project (i.e., 18 L/s as described in WSP [2023]) represent less than 1% of the maximum monthly flow and 2-year flood event at the Credit River, meaning that, even under high flow events, the supplementary flows (assuming some or all would passively drain from OVGC to the receiving environment) would serve to provide little to no added risk of heightened rates of channel erosion.

• **Tributaries of Credit River** – The characteristic flow rates at the East Ponds Outlet Channel and Tributary 4 were shown to be lower than the estimated erosion thresholds for flow rates up to and including the maximum monthly flows, and, in the case of the East Ponds Outlet Channel, the 2-year flow event. This suggests that, under existing conditions, channel stability at the subject tributaries of the Credit River can be maintained under a wide range of low to high flow conditions, and, because of this, the capacity of the respective channels to accommodate additional discharge volumes during similar types of flow periods would be expected to follow suit. Similar to the identified comparisons for the mainstem of the Credit River, the estimated average annual pump rate from the Project represents less than 3% and 2% of the respective 2-year event and 5-year event at Tributary 4, meaning that, under larger flood flow events, the supplementary flows would be equally inconsequential from the standpoint of added erosion risks. In contrast, for the East Ponds Outlet Channel, the estimated average annual pump rate from supproximately 26% and 14% of the respective 2-year event and 5-year event.

4.0 SUMMARY OF RESULTS AND DISCUSSION

Based on a review of the results from the fluvial geomorphology study at subject channels of the Credit River and tributary system, Project-related effects on the characteristic erosion-sedimentation processes in the receiving environment are expected to be negligible. This considers that the subject channels were shown to be relatively stable under existing conditions, noting some evidence of active erosion processes (widening and degradation) at the East Ponds Outlet. It also considers that, based on the derived erosion thresholds and the preliminary estimates of average annual pump rates from the Project, the subject channels include sufficient capacity to accommodate an increase in flows (while still maintaining channel stability) under a relatively wide range of runoff conditions.

Further to the above, the results review suggested that Tributary 4 would serve as the preferred conveyance path to direct the discharge waters from the Caledon Pit/Quarry to the Credit River (via the OVGC). This was based on the following inferences and observations:

- The existing irrigation infrastructure/network at the OVGC site, coupled with the associated
 passive drainage processes, could be relied on to manage the discharge waters from the
 proposed Caledon Pit/Quarry (through a new or amended PTTW), with the understanding that,
 given the expected water demands at the golf facility, the storage and taking practices at the
 irrigation ponds could serve to reduce the actual quantity of water directed to the Credit River
 (i.e., some or all of the pumped water could be re-purposed for irrigation depending on the time
 of year), and, as part of that, further limit any added risk of increased rates, however negligible,
 of downstream erosion-sedimentation processes.
- Channel stability at Tributary 4 was shown to be especially prominent, with specific consideration
 of the low gradient of the channel and associated wetland influences, the dense/heavy
 vegetation cover at the banks and overbank zone, the strong connection to the floodplain, and
 the absence of erosion and depositional features.
- The estimated erosion threshold at Tributary 4 was shown to be slightly higher than the associated value at the East Ponds Outlet Channel.

Of note, the East Ponds Outlet Channel could still serve as a potentially viable option to receive and convey supplementary flows from the Caledon Pit/Quarry and OVGC (given that the channel was shown to support relatively stable conditions [albeit with some evidence of active erosion] and demonstrated a suitable level of capacity to accommodate additional flows). However, the implementation of this alternative would likely require alterations to one or both of the outlet structure/berm and channel to improve the physical stability and drainage capacity of the outlet area and the installation of new water management infrastructure at the OVGC (to direct water to the East Ponds from the central or other part of the site).

Staying on the topic of potential mitigation requirements and assuming that pump rates from the Project remain generally in line with the preliminary estimates from WSP (2023), there is no evidence to suggest that channel protection measures would be required at Tributary 4, or, for that matter, the Credit River, to accommodate the additional flow inputs. However, in the interest of maintaining channel stability in the receiving environment, and as part of this, appropriately managing the discharge of pumped water to OVGC, the implementation of the following general mitigation plan is recommended at the Tributary 4 and Credit River system:

- During typical/normal flow conditions (i.e., periods of low to moderate flow rates), the total flows at Tributary 4 and the Credit River (including any supplementary flows that are allowed to passively drain from the OVGC site) should be maintained at or below the erosion threshold limits for the subject channels; and
- During comparatively higher flow events (when flow rates could theoretically exceed the
 estimated critical discharge limit), the total flows at Tributary 4 and the Credit River (including,
 again, any supplementary flows that are allowed to passively drain from the OVGC site) should
 be maintained within 5% of the estimated flow rates under existing conditions, recognizing that
 this upper bound (of 5%) is expected to be well within the range of natural variation for a given
 flow event.

CLOSURE

We trust that the content of this technical memorandum meets your current requirements. However, should you have any questions or comments, please direct them to the undersigned.

Respectfully submitted,

nin Smit

Karine Smith, M.Sc. Environmental Scientist

Jan Franssen, Ph.D Senior Watershed Scientist



Andrew Forbes, M.Sc., P.Geo. Associate Director, Technical Lead





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Figures





Appendix A Reach Photographs



















Appendix B Field Sheets



General Site Characteristics Project Number: 24061

Date:		2024-07-24	Stream:	East Poods Trib
Time:		11:15	Reach:	East Ponds Outlet Channel
Weath	er:	22° CLOUPY	Location:	OUGE
Field S	Staff:	EF MK	Watershed/Subwatershed:	CREDIT RIVER
Featur	es	Monitoring	Site Sketch 7 /) \	Compass
	es Reach break Station location Cross-section Flow direction Riffle Pool Sediment bar Eroded bank/slope Undercut bank Bank stabilization Leaning tree Fence Culvert/outfall Swamp/wetland Grasses Tree Instream log/tree Woody debris	Monitoring Long-profile Image: Ima	CULLERF (0-30 m) CULLERF (0-30 m) CULLERF (0-30 m) CULLERF CUL	KNICK KNICK POINT V (0.75m) V X XSI V XSI
****	Beaver dam			m in in
Flow				La xsz Sta
H1 H2 H3 H4 H5 H6 H7 H8	Standing water H1/ Scarcely perceptible Smooth surface flow Upwelling Rippled Unbroken standing wav Chute	A Back water flow ave e	a a a a wis orted co (Primerut SAN	CEPPR CONOFY
Substr	ate	Dissipates below free fail	ant	- Xm
S1 S2 S3 S4 S5	Silt Sand Gravel Small cobble Large cobble	S6Small boulderS7Large boulderS8BimodalS9Bedrock/till	G SAND	
Other	Benchmark	ED Erector als	V' LIAK (
BM BS DS WDJ VWC	Benchmark Backsight Downstream Woody debris jam Valley wall contact	EP Erosion pin RB Rebar US Upstream TR Terrace FC Flood chute	COBBLE LRIFPLE CREDIT RIVER	
BOS	Bottom of slope	FP Flood plain	Photos:	
TOS	Top of slope	KP Knick point I	Notes: CULVERT = 0.30 m	
			KNICK = D.75 M	

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Detailed Assessment Long Profile (Level) Project Code: 24061

Date:		2024-07	- 24		Reach:		East Ponds Outlet Channel		
Time:		11:15			Location:		DVGC		
Weather		22° CLOU	Yau		Watershed	/Subwatershed:	CREDIT RIVER		
Field Sta	ff:	EF MK			Rain in las	t 24 hours:	None Yes: Amount mm		
Тор	Middle	Bottom	Angle	Water	XS	Notes	Survey Direction		
1002	0865	0740	252	0740			🔀 Upstream to Downstream		
0980	0343	OTIS	252	0746			Downstream to Upstream		
0982	0852	0723	251.5	0786			Cross-sections		
1025	0900	0772	251	0802			No. of Cross-sections Surveyed: $_$		
1042	0918	0792	251	0879			Monitoring Cross-sections: 🖾 No 🗆 Yes		
1085	0960	0838	252	0945			XS ID://		
1610	1488	1365	252	1396			Erosion Pin Installed: 🔁 No 🗆 Yes		
1606	1487	1370	252	1381			XS ID://		
1589	1579	1363	252	1392			Velocity & Sediment Transport		
1597	1490	1382	252	1403			□ Velocity <u>∂-1125</u> m/s Method:		
1610	1510	1408	252.5	1409	XSI		\Box Dischargem ³ /s		
1596	1500	1402	253	1410			Sed. Transport (Table 21): Suspended		
1602	1510	1422	252.5	1418			□ Sliding □ Rolling □ Saltation		
1638	1551	1466	252	1422			Percentage of Bed Active: %		
1631	1552	. 1476	250	1415			Valley Type (Table 2)		
1592	1522	1452	250	1419	ic		Confined Deartially Dunconfined		
1589	1325	1462	249	1424			Channel Zone (Table 4)		
1597	1541	1486	249	1442.			Headwater Transfer Deposition		
1596	1546	1496	249	1415	X52		Land Use (Table 1)		
1601	1559	1515	248.5	1434			FORESTED		
1599	1565	1529	246	1425			Vegetation		
1588	1560	1530	249	1432			Aquatic Vegetation:		
1566	1566	1546	243	1428			Coverage of Reach:%		
1587	1576	1554	242	1432			🗆 In Stream 🗇 Margins 🗆 On Bank		
1596	1582	1569	2.36	1438	XS3		Riparian Vegetation: 🗆 No 🖾 Yes		
1535	1576	156B	222	1932			Extent of Riparian Cover:		
1609	1605	1600	182.5	1429			🛛 🗆 Fragment 🗆 None 🖓 Continuous		
1623	1612	1602	121	1442			Riparian Cover (channel widths):		
1648	1623	1618	118	1432			□ 1-4		
1625	1595	5 1562	132	1431			Age Class of Riparian Vegetation:		
ļ							Immature Established Mature		
							□ (<5 yrs) □ (5-30 yrs) ☑ (>30 yrs)		
		_					Extent of Encroachment:		
	·						□ None □ Minimal □ Moderate		
							D Extreme		
							Density of Woody Debris:		
							□ Low 2 Moderate □ High		
							Blockage(s) in Channel:		
							□ Infrastructure □ Dam □ LWD		

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Detailed Cross-Section Characteristics

Project Number: 24-061

Date:	2024-07-24	Cross-section:	×5 1
Time:	2:00	Reach:	East Ponds Outlet Channel
Weather:	22° SUNNY	Location:	OVGC
Field Staff:	EF MK	Watershed/Subwatershed:	CREDIT RIVER

1.15 1991 1.6 P(H) Image: Second Seco	X	Y	NOTE			Notes	Cross-se	ctior	nal Morpholog	y (Table 22)		
2. • 0.140 0 2	1.75	1991	LB PIN			J		🗆 Ri	iffle 🗆 Pool	🗆 Run 🕅 🕅	ther	
2.15 2182 Image: Constraint of the con	2,0	2140					Substrate	e Sa	mple:			
2.4 3.5 2.4 3.5 3.5 2.4 3.5 3	2.15	2282					🗆 Be	d 🗆	Bank 🗆 Subpa	vement 🗆 Wate	r 🗆 None	
1.65 1.40 Image: Constraint of the second sec	2.4	2482					Pebble C	ount	Measuremen	ts A/B/C Axes	(cm):	
1.9 2188 1 1.2 3.5 3.5 3.6 1.1 1.2 3.5 3.5 3.6 1.1 1	2.65	2640					A B	С	ABC	A B C	AB	С
3.1 2980 1.1 9.9 <td< td=""><td>2.9</td><td>2788</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>1,2</td><td>3</td><td>SAN</td><td>D</td></td<>	2.9	2788					1		1,2	3	SAN	D
9. 25 30.91 0.9 5.3 4.0 3. 5 32.31 BK 3.15 3.5 4.6 3. 95 55.32. 1.4 1.2 1.4 1.2 4.10 3.617 2.3 1.4 1.2 1.4 9.95 55.32. 1.4 1.2 1.4 1.2 4.10 3.617 2.3 1.4 1.2 1.4 1.2 4.10 3.617 3.612.3 5.713 1.0.5 1.4 4.10 3.617.3 1.1 4.3 1.2 1.4 1	3.1	2980					1.9		Ч	4.6		******
3.5 3231 BF 3.75 3384	3.35	3091					0.9		5.3	Ч		
3.75 3384	3.5	3231	BF				3 2.2	0.5	2.9.2.2.1.4	4 2.4 0.6		
3.95 \$\$\$32 1.4 3 1.2 4.10 3617 2.3 2.3 2.3 4.25 3730 30.5 2.4 3.8 2.3 3.8 3.8 2.3 3.13 3.5	3.75	3384					1-1		3.5	4 6		******
4-(0) 3617 1 4-25 3656 106 4-4(5) 3730 0.5 4-4(5) 3730 0.5 4-65 3743 0.5 4-65 3743 0.7 4-65 3743 0.7 4-7 1 1.7 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 4-7 1.4 2.4 5.1 3.132 1.4 5.65 32.48 3076 5.7 3076 16 6.1 3132 105 6.24 3076 105 6.3 2.92 105 6.4	3.95	3532	t				1.4	1	3	1.2		
4. 25 3656 WE 4. 38 0.3 3.8 2.3 2.7 3 0.5 4. 45 2730 0 0.8 2.4 2.9 0.5 4. 95 3749 0 0.8 2.4 2.9 0.8 2.4 2.9 4. 95 3749 0 0.8 2.4 2.9 0.8	4-10	3617					0.9		3	2.3		
4.45 3730	4.25	3656	WE				4 3.8	0.3	5.8 3.8 2.3	3.7 3 0.5	1]
4.65 3743 1 4.3 1.1 4.9 3749 2 Particle Shape: □ Platy □ Very Angular 4.95 3746 2 Stub-angular □ Angular □ Rounded 5.12 3670 WE 2 Sub-angular □ Angular □ Rounded 5.20 3516 2 2 Sub-angular □ Angular □ Rounded 5.4 3428 3 Sub-angular □ Angular □ Rounded 5.65 32.50 348 Sorting (Table 20): □ Well 25 Moderate □ Poor □ Very poor 5.85 32.50 3137 □ Obsv (2 Not Obsv □ Not Visible - Reason:	4.45	3730			- 54.55		0.8		2,4	2.9		
4.8 3749	4.65	3743					1		4.3	1.1	V	
4.95 3746 Pi Sub-angular Rounded 5.12 3670 WE Sub-Rounded Well Rounded 5.20 3516 Sub-Rounded Well Rounded 5.4 3428 Sub-angular Rounded 5.65 3348 Sub-angular Rounded 5.65 3250 Sediment Transport Sorting (Table 20): Well Poor 6.1 3132 Obsv proor Supparement: (Pebble ABC axis guide) 6.4 3076 Supparement: (Pebble ABC axis guide) 6.95 2952 Obsv proor Supparement: % Velocity Supparement: % % 9 Velocity Supparement: % 9 Velocity % % 9 Velocity % % 9 Supparement: % % 9 Supparement: % % 9 Well CS Not Obsv Not Visible - Reason: % 16 9 Supparement: % % 16 9 Measured </td <td>4.8</td> <td>3749</td> <td></td> <td>2</td> <td></td> <td></td> <td>Particle S</td> <td>Shap</td> <td>e: 🗆 Platy</td> <td>Very Ang</td> <td>ular</td> <td>2</td>	4.8	3749		2			Particle S	Shap	e: 🗆 Platy	Very Ang	ular	2
5.12 3670 WE Image: Solution of the second s	4.95	3746					🖄 Sub-an	gular	r 🗆 Angular	□ Rounded	K	1
S. 20 35.16	5.12	3670	WE				🖄 Sub-Ro	unde	ed 🗆 Well Rour	nded /	X	//
S. 4 3428 Subpavement:	5.20	3516					Embededr	ness:	10_%	6	× J	
5.65 3348 Sorting (Table 20): Well @S Moderate Poor Very poor 5.85 32 SO Sediment Transport 6.1 3132 Obsv @ Not Obsv D Not Visible - Reason: 6.4 3076 If Observed (Table 21): 6.95 C952 Suspended D Sliding D Rolling D Saltation Percentage of Bed Active: % Velocity Measured 0.1S2 m/s Method: K8 Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Percentage of Bed Active: Image: Suspended D Sliding D Saltation Pistance D Saltation Image: Suspended D Sliding D Saltation S	5.4	3428					Subpaver	nent:		[Peb	ble ABC axis	quide]
Sediment Transport 6.1 3132 6.4 3076 6.95 C952 1 100sv @ Not Obsv @ Not Visible - Reason: 16.95 C952 1 100sv @ Not Obsv @ Not Visible - Reason: 16.95 C952 1 100sv @ Not Obsv @ Not Visible - Reason: 16.95 C952 1 100sv @ Not Obsv @ Not Visible - Reason: 16.95 C952 1 100sv @ Not Obsv @ Not Visible - Reason: 16.95 C952 1 100sv @ Not Visible - Reason: 1700sv @ Not Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Obsv @ Not Visible - Reason: 100sv @ Not Visible - Reason: 160sv @ Not	5.65	3348	A PROPERTY A				Sorting (7	Table	20): 🗆 Well 🖄	Moderate 🗆 Po	or 🗆 Very	poor
6.1 3132 □ □ 00sv @ Not Obsv □ Not Visible - Reason: □ 6.4 3076 □ □ If Observed (Table 21): □ Suspended □ Sliding □ Saltation 6.95 0952 □ □ Suspended □ Sliding □ Rolling □ Saltation 0 □ □ □ Welocity % □ □ □ □ □ % □ □ □ □ % Velocity □ □ □ □ □ % □ □ □ □ □ % □ □ □ □ □ % □ □ □ □ □ 10 □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	5.85	37.50	the second second				Sediment	t Tra	insport	and the second second	art sine	11
6.4 3076 If Observed (Table 21): 6.95 2952 Suspended □ Sliding □ Rolling □ Saltation Percentage of Bed Active: % Velocity Measured ().152 m/s Method: <u>\scitcestarted</u> Image: Strateging in the strateging in	6.1	3132					D Obsv 🖉	Not	Obsv 🗆 Not Vis	sible - Reason:		
6.95 USS2 Suspended Sliding Rolling Saltation Percentage of Bed Active: % Welocity Reasured 0.152 m/s Method: ME Suspended Sliding Rolling Saltation Percentage of Bed Active: % Welocity Reasured Mrs String Suspended Suspended Sliding Rolling Saltation Distance 1.0 m Time 6.41 s V 0.146 m/s Distance 1.0 m Time 6.41 s V 0.156 m/s Distance 1.0 m Time 6.41 s V 0.156 m/s Distance 1.0 m Time 6.41 s V 0.156 m/s Distance 1.0 1.0 Measured m³/s XS ID:	6.4	3076	multi I		_	an burnet	If Observ	ved (Table 21):			
Image: Sector of Bed Active: % Image: Sector o	6.95	2952	Critical Control of Co				□ Suspen	ded	□ Sliding □	Rolling 🗆 Salta	ation	- N
Velocity Measured 0.152 m/s Method: MB Measured 0.152 m/s Method: MS Measured 0.155 m Measured 0.155 m<			501. I I I I I				Percentag	e of l	Bed Active:		%	210
Image: Second state in the second s							Velocity				C. West	8 M 9
Image: state state stateImage: state state state stateImage: state state state state stateImage: state states							A Measure	ed _C).152_m/s M	ethod: WB		
							🗆 Estimat	ed	m/s X	SID: XSI		
Image: Second state in the second							Distance _	1.	om Time	6.83 s V	0,146	m/s
							Distance _	(.)	om Time	6.44 sv	0.155	m/s
Image: Discharge				-			Distance _	1-1	m_Time_	6-41 sv	0.156	m/s
	in the second						Discharge	e	Smith			
Image: Second state of the second							Estimate	ed _	m³/s Me	ethod:		
							□ Measure	ed	m³/s	KS ID:		
Depth m Width m V ₆₀ m/s Depth m Width m V ₆₀ m/s Use V ₆₀ if Depth 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m							Depth		m Width	M V ₆₀		m/s
Depth m Width m V ₆₀ m/s Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m							Depth		_m_Width	m V ₆₀		m/s
Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m							Depth	/	_m Width	m V ₆₀		m/s
							Use V6	o if De	epth < 0.75 m an	d V ₂₀ / V ₈₀ if Dept	n > 0.75 m	

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GEO





Detailed Cross-Section Characteristics Project Number: 2406

Date:	2024-07-24	Cross-section:	XS 2
Time:	1:15	Reach:	East Ponds Outlet Channel
Weather:	22° CLOUPY	Location:	ovac
Field Staff:	EP MK	Watershed/Subwatershed:	CREDIT RIVER

1.175 1445 LB	X	7	NOTE		Notes	Cross-sectional Morphology (Table 22)
2.0 12.32 Substrate Sample: 2.35 13.9 6 Bed Bed Bubstrate Sample: 2.35 1722 Bed Bed Substrate Sample: 2.35 1722 Image: Substrate Sample: Image: Substrate Sample: None 2.35 1722 Image: Substrate Sample: Image: Substrate Sample: None 2.35 1722 Image: Substrate Sample: Image: Substrate Sample: None 3.35 2214 Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: 4.0 2.512 Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: 4.1.2 2.648 Strate Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: 4.1.4 2630 Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: 5.45 31.12 Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: 5.45 31.12 Image: Substrate Sample: Image: Substrate Sample: Image: Substrate Sample: 5.45 31.14 S	1.75	1045	LB PIN			🗆 Riffle 🗆 Pool 🗆 Run 🖄 Other
2.15 13 9 6 Image: constraint of the second s	2.0	1232				Substrate Sample:
2. 15 1522 Pebble Count Measurements A/B/C Axes (cm): 2. 15 1722 A B C A A A C A A C C C C A A A A A A A A A A A A A A A A<	2.25	1396				🗆 Bed 🔲 Bank 🗆 Subpavement 🗆 Water 🗆 None
2.75 $1/22$ Image: constraint of the second s	2.5	1522				Pebble Count Measurements A/B/C Axes (cm):
S. 0 1907 1 2 4.3 SAND 3. 5 2069 2 1 2.3 SAND SAND 3. 5 2200 1.1 3.2 2 1 1.3 3.5 SAND SAND SAND 1.1 3.2 2 1.1 2.3 SAND SAND <td>2.75</td> <td>1722</td> <td></td> <td></td> <td></td> <td>A B C A B C A B C A B C</td>	2.75	1722				A B C A B C A B C A B C
3. 25 2069 2.3 1.1 2.3 1.1 2.3 3. 75 2300 1.1 3.2 2.1 1.1 3.2 2.1 4. 2572 0.5 7 4 1.1 3.3 4.3 4. 12 2648 8 7 4 1.1 3.3 4.3 4. 12 2672 0.5 7 4 1.1 3 1.1 3 4. 13 366 1.1 3.3 4.3 1.2 2.10.10.8 1.1 3 4. 13 366 1.1 3.4 1.2 2.2.10.10.8 1.1 3 4. 13 360 5.1 1.3 1.4 3 1.1 3 5. 45 3160 5.1 1.2 1.4 1.8 1.2 1.10.8 1.1 3 5. 45 3160 5.1 1.2 1.4 1.2 1.6 1.2 1.6 1.2 1.6 1.2 1.6 1.2 1.6 1.2 1.6 1.6 1.6 1.6 1.6 1	3.0	1907				1 3 H.3 SAND
3.5 2214 1.7 3.2 2.2 2.300 4.0 4.512 0.4512 0.5611 $11.8616.5$ 11.133 4.2 2.646 BC 1.133 4.33 4.33 4.33 4.42572 0.56772 1.133 4.33 4.334 3.3443 4.3343 4.425672 1.1333 4.3344 5.1316 5.1316 5.1316 5.1316 5.1316 5.1316 7.44 1.874 5.43172 3.1566 9.41326 9.6526 9.66566 $9.6656666666666666666666666666666666666$	3.25	2069				2 1 2.3
$3.7 \le 2300$ II 17.21.1 5.4 5.317 II 18.16.5 4.0 4.512 0.6 7.44 $4.1,4$ 2872 1.1 3.3 4.3 $4.1,4$ 2872 1.1 3.3 4.3 $4.1,4$ 2806 1.1 3.3 4.3 $4.1,4$ 2806 1.1 3.3 4.3 $4.1,4$ 2806 1.1 3.3 4.3 $4.1,3$ 3.66 1.1 $2.21/2.110.8$ 1.1 5.6 3172 2.47 1.8 $2.21/2.110.8$ 5.6 3172 8006 9.6 9.6 9.6 5.6 3172 8006 9.6 9.6 9.6 5.6 3172 8006 9.6 9.6 9.6 9.6 9.6 5.6 3172 8006 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 9.6 <td>3.5</td> <td>2214</td> <td></td> <td></td> <td></td> <td>1.1 3.2 2</td>	3.5	2214				1.1 3.2 2
$4, 0$ $4 \le 12$ $4, 12$ 2646 $4, 12$ 2672 $4, 12$ 2672 $4, 13$ 3.3 $4, 14$ 2672 $4, 11$ 2666 $4, 11$ 2666 $4, 11$ 3.3 $4, 11$ 3.3 $4, 11$ 3.3 $4, 11$ 3.3 $4, 11$ 3.665 $5, 6$ 3172 $5, 6$ 3172 $5, 6$ 3172 $5, 6$ 3172 $6, 53$ 3146 $6, 15$ 3146 $6, 15$ 3146 $6, 15$ 3146 $6, 53$ 3024 $6, 55$ 20236 $6, 55$ 2024 $6, 55$ 2024 $6, 55$ 2024 $6, 52$ 2174 16 0.048 m/s Method: $1/6$ $7.5 < 2.470$ 2.56 $7.6 < 2.470$ $7.6 < 2.470$ $7.6 < 2.470$ $7.6 < 5.7$	3.75	2300				11 7.21.1 5.4 5.3 1 11 8 65
4, 2 2.648 $8C$ $4, 4, 2672$ 1.1 3.7 4.3 $4, 14$ 2672 1.1 3.7 4.3 $4, 14$ 2672 1.1 3.7 4.3 $4, 13$ 2606 471 3066 412.82 112.12 3167 5.1 3156 5.1 2.7 1.8 $2.2.7$ 1.8 5.43 3166 96 974 964 964 964 5.6 3172 966 980 980 980 980 5.6 3172 986 980 980 980 980 5.6 3172 980 980 980 980 980 5.6 3172 980 980 980 980 980 980 980 980 980 980 980 980 980 990 990 990 990 990 990 990 990 990 990 990 990	4.0	2512				0.6 7 4
$4, \mu$ 2872 113 $3, \mu$ $4, \mu$ 3006 $4, 113$ 3006 $4, 11$ 3068 113 123 $2, 2, 12, 10, 8$ $5, -1, 3156$ 56 $5, -1356$ 56 $7, 3$ 10 $0, 9$ $5, -2, 3156$ 56 56 $7, 3$ 10 $0, 9$ $5, -43172$ $22, 9$ 123 900 900 $5, -53172$ 56 56 900 900 900 $5, -43172$ 900 900 900 900 900 $5, -53172$ 900 900 900 900 900 900 $5, -53024$ 9000 9000 9000 9000 9	4.2	2648	BE			.1 33 42
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S. (a)S112Image: S112S. (a)S114Embeddeness: 30° G. (b)S015WESorting (Table 20):Well & Moderate \Box Poor \Box Very poorG. (b)S024Sorting (Table 20):Well & Moderate \Box Poor \Box Very poorG. (b)Sorting (Table 20):Well & Moderate \Box Poor \Box Very poorG. (b)Sorting (Table 20):Well & Moderate \Box Poor \Box Very poorG. (b)Sorting (Table 20):Well & Moderate \Box Poor \Box Very poorG. (b)Sorting (Table 20):Well & Moderate \Box Poor \Box Very poorG. (b)Sorting (Table 21):Sorting (Table 21):K. (b)Suspended \Box Sliding \Box Rolling \Box Saltation7. (c)Percentage of Bed Active:7. (c)Sorting (Table 21):Measured O.OH& m/s Method:MB1. (c)Measured \Box OH& m/s Method:Measured O.OH& m/s Method:MBDistance \Box Sorting (Table 20):B. (c)IBQSorting (Table 20):Distance \Box Measured O.OH& m/s Method:M/sB. (c)Sorting (Table 20):B. (c)Sorting (Table 20):Measured \Box ModerateMeasured \Box ModerateModerateMeasuredMass (Masseries)MeasuredMasseriesMeasuredMisseriesModerateMisseriesModerateMisseriesMeasuredMisseriesMisseriesMisseriesMisseriesMisseriesMisseriesMisseries	2.10	2177				Image: Sub-Rounded □ Well Rounded
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SolutionSolutionPreble ABC axis guide]b.4 3675 WESorting (Table 20): Well & Moderate Poor Very poor6.5 3024 Sediment Transport6.55 2836 MODsv Not Obsv Not Visible - Reason:b.65 2749 MODserved (Table 21):b.8 2636 BpcMODserved (Table 21):c.8 2636 BpcMODserved (Table 21):c.8 2636 BpcMODserved (Table 21):c.7 22362 Measured O.OH8 m/s Method: MB7.65 2749 Measured O.OH8 m/s Method: MB7.65 2668 State O.OH8 m/s Method: MB7.65 1952 Distance O.S m Time 9.64 s V 0.052 m/s8.35 1800 Distance O.S m Time 10.88 s V 0.043 m/s8.35 1800 Distance 0.5 m Time 10.48 s V 0.043 m/s9.0 1542 Measured m^3/s Method:9.0 1542 Measured m^3/s Method:9.0 1542 Measured m^3/s Method:9.15 1465 Pepth m Width m V60 m/s9.25 1465 Pepth Mith m V60 m/s9.41 1342 Pepth Night m V60 m/s9.5 16 Depth 0.75 m and V_{20}/V_{80} if Depth > 0.75 m	615	3105				Subnavement:
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Sediment Transport 6.55 2836 6.65 27149 6.65 27149 6.8 2636 8.2636 8_{E} 7.65 2470 7.65 2470 7.65 2470 7.65 2361 7.65 2362 7.65 2362 7.65 2058 7.65 2058 7.65 2058 7.65 2058 7.65 2058 7.65 2058 7.65 2058 7.65 2058 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.65 1052 7.75 1052 8.35 1300 8.35 1200 8.5 1720 9.5 10525 9.5 10562 9.5 10562 9.5 10562 9.5 10562 9.5 100043 9.5 100043 9.5 100043 9.5 100043 9.5 100043 9.5 100043 9.5 100043 9.5 100043 9.5 100043	6 5	2013	ME			Sorting (Table 20): Well & Moderate Poor Very poor
G.SS2656 \blacksquare 6.852749 \blacksquare 6.862636 \blacksquare 7.952470 \blacksquare 7.952470 \blacksquare 7.952470 \blacksquare 7.952470 \blacksquare 7.952362 \blacksquare 7.952068 \blacksquare 7.652068 \blacksquare 7.652068 \blacksquare 7.652068 \blacksquare 7.851889 \blacksquare 8.351800 \blacksquare 8.351800 \blacksquare 8.351720 \blacksquare 9.01542 \blacksquare 9.01542 \blacksquare 9.1542 \blacksquare 9.15465 \blacksquare 9.15465 \blacksquare 9.1645 \blacksquare 9.1645 \blacksquare 9.1757 \blacksquare 9.1757 \blacksquare 9.1645 \blacksquare 9.1757 \blacksquare 9.1757 \blacksquare 9.1757 \blacksquare 9.1757 \blacksquare 9.17577 \blacksquare <t< td=""><td>0.5</td><td>2021</td><td></td><td></td><td></td><td>Sediment Transport</td></t<>	0.5	2021				Sediment Transport
6.805 $C144$ If Observed (Table 21): 6.8 2636 Bc $@$ Suspended \Box Sliding \Box Rolling \Box Saltation 7.95 2.470 \square \square Suspended \Box Sliding \Box Rolling \Box Saltation 7.95 2.470 \square \square Suspended \Box Sliding \Box Rolling \Box Saltation 7.95 2.470 \square \square Suspended \Box Sliding \Box Rolling \Box Saltation 7.95 2.470 \square \square Measured $\bigcirc .048$ m/s Method: \square 7.95 7.668 \square \square Suspended \Box Sliding \Box Rolling \Box Saltation 7.65 $C^{0}68$ \square \square Measured $\bigcirc .048$ m/s XS ID: \square S \square S 7.85 1822 \square \square Sitance $\bigcirc .5$ m Time $\square .64$ s V $\bigcirc .052$ m/s 8.35 1800 \square \square Sitance $\bigcirc .5$ m Time $\square .64$ s V $\bigcirc .043$ m/s 8.35 1720 \square \square Sitance $\bigcirc .5$ m Time $\square .444$ s V $\bigcirc .043$ m/s 8.5 1720 \square \square Sitance $_\5$ m Time $_\4465$ 9.0 1542 \square \square Measured $_\375$ X St ID: $\575$ m 9.25 1465 \square \square Measured $_\375$ X St ID: $\575$ m 9.41 13.92 \square \square m Width $_$ m V60 $_$ m/s \square \square \square m Width $_$ m V60 $_$ m/s \square \square \square m Width $_$ m V60 $_$ m/s	0.55	2656				🛛 Obsv 🗆 Not Obsv 🗆 Not Visible - Reason:
6.6 2636 $6c$ C	6.65	2199				If Observed (Table 21):
7.25 24(0 9ercentage of Bed Active: 1.0 % 7.25 2362 9ercentage of Bed Active: 1.0 % 7.25 2362 9ercentage of Bed Active: 1.0 % 7.45 2256 9ercentage of Bed Active: 1.0 % 7.65 2056 9ercentage of Bed Active: 1.0 % 7.65 1689 9ercentage of Bed Active: 1.0 % 9.15 1689 9ercentage of Bed Active: 1.0 % 8.35 1890 9ercentage of Bed Active: 1.0 % 8.35 1720 9ercentage of Service of Bergeto 1.0 9ercentage of Service	6.0	2 1170	BE			Suspended Sliding Rolling Saltation
Velocity 7.45 22,56 7.65 20,68 7.65 1952 7.65 1952 8.35 1800 8.35 1800 8.35 1800 8.35 1800 9.0 1542 9.25 1465 9.41 13.92 9.41 13.92 9.5 19.542 9.65 1465 9.64 5 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 19.70 9.75 13.75 9.75 10.75 9.75 10.75 9.75<	7.05	2410	-			Percentage of Bed Active:%
1.95 2256 Image: Second state in the ima	7.15	2362		an an an an		Velocity
7.65 $COGB$ m/s XS ID: $XS L$ 7.65 1952 m/s M/s 8.15 1889 m/s M/s 8.35 1800 m/s M/s 8.35 1800 m/s M/s 8.35 1800 m/s M/s 8.35 1720 m/s M/s 8.5 1720 m/s M/s 8.5 1720 m/s M/s 8.5 1720 m/s M/s 9.0 1542 m/s M/s 9.25 1465 m/s M/s 9.41 13.92 m/s M/s 9.41 13.92 m/s	1.45	2650				☑ Measured <u>0.048</u> m/s Method: <u>WB</u>
T.85 IMS2 Distance 0.5 m Time 9.64 s V 0.062 m/s B.15 1889 Distance 0.5 m Time 10.88 s V 0.048 m/s B.35 1800 Distance 0.5 m Time 10.88 s V 0.048 m/s B.35 1720 Distance 0.5 m Time 11.44 s V 0.043 m/s B.35 1720 Discharge Discharge<	7.65	1000				□ Estimatedm/s XS ID: <u>XS /</u>
6.15 1889 Distance 0.5 m Time 10.88 s V 0.048 m/s 8.35 1800 Distance 0.5 m Time 11.44 s V 0.043 m/s 8.5 1720 Distance 0.5 m Time 11.44 s V 0.043 m/s 8.5 1720 Distance 0.5 m Time 11.44 s V 0.043 m/s 9.0 1542 Discharge	7.85	1952				Distance 0.0 m Time 9.64 s V 6.052 m/s
8.35 1800 Distance 0.5 m Time 11.44 s v 0.043 m/s 8.5 1720 Distance 0.5 m Time 11.44 s v 0.043 m/s 8.5 1720 Distance 0.5 m Time 11.44 s v 0.043 m/s 8.5 1720 Distance 0.5 m Time 11.44 s v 0.043 m/s 9.0 1542 Distance 0.75 m Width m m m/s 9.0 1542 Distance m³/s XS ID: Depth m/s Depth m/s 9.41 13.92 Distance m Width m V60 m/s Depth m Width m V60 m/s Depth m/s Use V60 if Depth < 0.75 m and V20 / V80 if Depth > 0.75 m Use V60 if Depth < 0.75 m and V20 / V80 if Depth > 0.75 m	0.15	1889				Distancem Times Vm/s
8.5 1120 Discharge 8.75 V625 Image: Discharge 9.0 1542 Image: Discharge 9.25 1465 Image: Discharge 9.41 13.92 Image: Discharge Image: Discharge Image: Discharge V60 Image: Discharge Image: Discharge Image: Discharge Imag	8.35	1800		100		Distance 0. 5 m Time <u>11.44</u> s V <u>0.043</u> m/s
8.15 V62.5 Image: Constraint of the second sec	8.5	1720	N			Discharge
9.0 1542 Image: Measured interview Image: Measured interview m^3/s XS ID: 9.25 1465 Image: Measured interview Image: Measured interview Image: Measured interview 9.41 13.92 Image: Measured interview Image: Measured interview Image: Measured interview 9.41 13.92 Image: Measured interview Image: Measured interview Image: Measured interview 13.92 Image: Measured interview Image: Measured interview Image: Measured interview Image: Measured interview 13.92 Image: Measured interview Image: Measured interview Image: Measured interview Image: Measured interview 9.41 13.92 Image: Measured interview Image: Measured interview </td <td>8.75</td> <td>1625</td> <td></td> <td></td> <td></td> <td>Estimatedm³/s Method:</td>	8.75	1625				Estimatedm ³ /s Method:
9.25 1465 Depthm Widthm V_{60}m/s 9.41 13.92 Depthm Widthm V_{60}m/s Depthm Widthm V_{60}m/s Depthm Widthm V_{60}m/s Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m	9.0	1542				Measuredm ³ /s XS ID:
9.41 13 a'L Depthm Widthm V_{60}m/s Depthm Widthm V_{60}m/s Depthm Widthm V_{60}m/s Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m	9.25	1465				Depthm Widthm V ₆₀ m/s
Depth m Width m V ₆₀ m/s Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m	9.47	1392				Depthm Widthm V ₆₀ m/s
Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m						Depthm Widthm V ₆₀ m/s
						Use V_{60} if Depth < 0.75 m and V_{20} / V_{80} if Depth > 0.75 m

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Detailed Cross-Section Characteristics

Project Number: 24061

Date:	2024-07-24	Cross-section:	XS 3
Time:	12:30	Reach:	East Ponds Outlet Channel
Weather:	220 CLOUDY	Location:	OVGA
Field Staff:	EPMK	Watershed/Subwatershed:	CREDIT RIVER

X	Y	NOTE			Notes	Cross-sectional Morphology (Table 22)					
1.75	1286	LB PIN				🗆 Riffle 🗆 Pool 🗆 Run 🕅 Other					
2.0	1375					Substrate Sample:					
2.25	1612					🗆 Bed 🗆 Bank 🗆 Subpavement 🗆 Water 🗆 None					
2.5	1732					Pebble Count Measurements A/B/C Axes (cm):					
2.75	1869					ABCABCABCAB					
3.0	2123	BE	-			6.3 8.3					
3.1	2295					5 5					
229	2498					5.1					
3 2	2511					ASI2 HIZZ SAND					
3 42	2587	WE				7					
3 65	2002					e 2					
2 9	2204					<u> </u>					
105	2708					7 10 10					
1.00	2740										
1.5	2770		-			6-4					
7.55	2150			-							
1.8	2136			-		Particle Shape: Delaty Very Angular					
5.05	1702					Sub-Bounded Well Download					
5.3	2122										
2.55	2600	WE		1000		Embededness: <u>10</u> %					
5.65	2425	BF				Subpavement: [Pebble ABC axis guid					
5.15	2288	<u> (1943)</u>	Carlos Carlos			Sorting (Table 20): □ Well □ Moderate ☑ Poor □ Very po					
5-85	2083			-	and Second and	Sediment Transport					
6.0	2002			-		Obsv 🖾 Not Obsv 🗆 Not Visible - Reason:					
6.25	1900					If Observed (Table 21):					
5.4	1793			-		□ Suspended □ Sliding □ Rolling □ Saltation					
5-7	1662					Percentage of Bed Active:%					
6.9	1565					Velocity					
7.1	1436					Measured 0.025 m/s Method: WB					
1.34	1329	RB Pin				□ Estimatedm/s XS ID: XS 3					
						Distance 0.50 m Time 20.25 s V 0.025 m/s					
						Distancem Times Vm/s					
						Distancem Times Vm/s					
						Discharge					
						Estimated m ³ /s Method:					
						Measured M3/s XS ID:					
						Depthm WidthWo no m/s					
			All Street			Depth m Width m/s					
				-		Depth m Width m Vco m/s					
						m/s					
						lise Van if Depth < 0.75 m and V (V) (CD) (V)					

Page _____ of _____

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GEO

General Site Characteristics

Project Number: 240

Date:		20-	01- 07 03		Stream:	Talte
Time:	Name of the second s	1000	16		Reach:	I I I I I I I I I I I I I I I I I I I
Weath		10:	15		Leasting and a second s	IRIB 4
weatr		20	nny 25°C		Location:	OVGC
Field	Staff:	121	EF		Watershed/Subwatershed:	CREDIT RIVER
Featur	es	Monito	ring	Site	Sketch	Compass
	Reach break	-0-0-0-	_ong-profile	1	0(1/5 2)	\frown
<u> </u>	Station location		Monumented XS	A	- 1240 KKK	()
x	Cross-section	0	Monumented photo			
	Flow direction	1 '	Monumented photo		7 XXA	\smile
	Riffle	V	direction			VCC
\square	Pool		Sediment sampling		C) XXX	Δ30 ()
CC	Sediment bar		Erosion pins		we stand	\sim
/////////	Eroded bank/slope	<u>ð</u> 9	Scour chains		///	
	Undercut bank	Additio	nal Symbols		\mathcal{O}	
KXXXXX	Bank stabilization	IV	InstreamVea		War/	
	Leaning tree		Us s s J	r	\sim \sim \sim	
XX	Fence				V HMP C	
	Culvert/outfall				XS5	
	Swamp/wetland				W.	
WWW	Grasses				The Stat	\bigcirc
	Tree				lin	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
	Instream log/tree				101	
* * *	woody debris			6	H	
A A A A A A A A A A A A A A A A A A A	Beaver dam			1 c		
Elour T	vegetated island				XS4	\sim
FIOW I	Standing water H1	A Back	untan		1/22/44	
H2	Scarcely percentible	A Dack V	valer		10 ABA	1
H3	Smooth surface flow	now			· (C)	(
H4	Upwelling					~
H5	Rippled				1311	XS3
H6	Unbroken standing v	ave			WDI _ CAIL	\sim
H7	Broken standing way	e				-C
H8	Chute			100	- BLE	2 2
Н9	Free fall H9/	A Dissip	ates below free fall			8
Substr	ate					4
S1	Silt	S6	Small boulder		7.1	$(\Lambda XS2 ())$
S2	Sand	S7	Large boulder		A) V	VEUC
\$3	Gravel	S8	Bimodal		100 P	Att WN, 0.27
S 4	Small cobble	S9	Bedrock/till		470	()
S 5	Large cobble				XS1 (33-54/	\mathcal{L}
Other					S AND A	
BM	Benchmark	EP	Erosion pin		the s	XP 20015
BS	Backsight	RB	Rebar		0.35 US-SLHIALV	
DS	Downstream	US	Upstream		+ exproots sil 1	V.1/
WDJ	woody debris jam	TR	Terrace		w	
VWC	valley wall contact	FC	Flood chute		CREDIT	IVER
BOS	Bottom of slope	FP	Flood plain	Photo	os:	
TOS	Top of slope	KP	Knick point	Notes	: Intermittent analyse	only flow that accure
					pooring	and the vectors

Version #4 Last edited: 21/02/2023

Senior staff sign-off (if required): _____ Checked by: ____

leted by: _____ Page _____ of ___

Detailed Assessment Long Profile (Level) Project Code: 24061

	Time: Weather:		2029-1	J 1- 65		Reach:		Trib 4
			11:15			Location	1:	OVGC
			Sunny ?	25°C		Watersh	ed/Subwatershed:	CREDIT RIVER
	Field Sta	ff:	JV EF			Rain in I	ast 24 hours:	🗆 None 🗆 Yes: Amount mm
	Тор	Middle	Bottom	Angle	Water	XS	Notes	Survey Direction
	1989	1914	1843	128	1690			Upstream to Downstream
	2001	1937	1855	127	1605			⊠ Downstream to Upstream
	1957		18411	129.5	1585	1		Cross-sections
	1873		1768	131	1590			No. of Cross-sections Surveyed:
1	1743		1653	133	1595			Monitoring Cross-sections: 🗹 No 🗆 Yes
	1805	1767	1735	131	1590			XS ID: //
	1739	1708	1677	128	1595			Erosion Pin Installed: No Ves
	1691	1667	1643	122	1590			XS ID://
	1647	1628	1610	114	1590			Velocity & Sediment Transport
	1572	1556	1547	85	1534	XSI	1BF 1230 RBF922	Velocity 0.256 m/s Method:
	1504	1488	1474	46	1470			Dischargem ³ /s
	1638	1614	1592	24	1468			Sed. Transport (Table 21): Suspende
	1585	1555	ISZS	13	1465	XSZ	LBF 1113 RBF 1224	Sliding Rolling Saltation
	1541	1505	1468	S.	1428			Percentage of Bed Active: %
	1690	1649	1587	И	1425			Valley Type (Table 2)
	1572	1512	1451	6	1426			□ Confined □ Partially ☑ Unconfine
	1556	1488	1489	Ч	1412			Channel Zone (Table 4)
	1736	1664	1590	358	1444			Headwater Transfer Depositio
	1726	1648	1569	353	1400			Land Use (Table 1)
	14161	1374	1286	352	1349			Forested
	1401	1311	1222	347	1275	N		Vegetation
	1442	1352	1262	341	1295		9	Aquatic Vegetation: (ogter conerce
	2425	2349	2371	83	2775			Coverage of Reach: SO %
	2419	2349	2282	86	7235			☑ In Stream □ Margins □ On Bank
	2350	2290	2229	88	2232			Riparian Vegetation: No XI Yes
	2330	2275	2223	89	2222			Extent of Riparian Cover:
	2268	8055	2159	85	2175	X53	LBF 1950 RBF 1800	Fragment None Continuou
	2301	2264		79	2175			Riparian Cover (channel widths):
	2342	2303	2268	72	2175	XSH	LBF 1938 RBF 1780	□ 1-4 □ 4-10 ☑ >10
L	2186	2158	2133	46	2135			Age Class of Riparian Vegetation
	2147	2125	2105	31	2079			Immature Established Mature
	2181	2150	2123	F	2095			□ (<5 yrs) □ (5-30 vrs) 🕅 (>30 vrs
	2225	2195	2165	328	2097			Extent of Encroachment:
	2015	2067	2029	306	2052			□ None □ Minimal □ Moderate
	2147	2101	2058	302				Heavy D Extreme
L	2125	2075	2025	289	2012			Density of Woody Debris:
	2159	2098	2038	282	2009	X55	LBF 1992 RBF	□ Low □ Moderate Ø High
	2130	2063	1995	273	1970		10.90	Blockage(s) in Channel:
2	2080	2005	1925	771	1052			

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TPI TPI + lm

Page ____ of ____
Detailed Assessment Long Profile (Level) Project Code

Date:		2024-0-	1-23		Reach:		Trib 4
Time:		11:15			Location	1:	OVEC
Weather	:	Sunny 2	S°C		Watersh	ed/Subwatershed:	CP
Field Sta	iff:	JV EF			Rain in I	ast 24 hours:	None Yes: Amount mm
Тор	Middle	Bottom	Angle	Water	XS	Notes	Survey Direction
PSIS		1976	78	1969		still a point	Upstream to Downstream
2104	20411		79	1969			Downstream to Upstream
2128	5705	2019	88	1968			Cross-sections
2103		1999	92	1955			No. of Cross-sections Surveyed:
2098	2053	20105	93	1955			Monitoring Cross-sections: No D Yes
2115	2080	2046	89	1960			XS ID: / /
2090	2059	2030	TT	1954			Erosion Pin Installed: N No D Yes
1946	1976	1906	58	1875			XS ID: / /
2130	2116	2101	30	10/80	\$2.56	No.	Velocity & Sediment Transport
2074	1968	1000	0	1000	XSL	LBF RSF	Velocity a Sedment Transport
7019	1997	1075	325	19/20	100	0151 1751	Discharge m3/-
1565	1070	1204	Jar	1000		And	Sed Transport (Table 24)
1700	1657	ILIS	100	~		not a point	
7177	2127	2007	120	laan		Ч	
2024	7001	10:2	2	1970			Percentage of Bed Active: %
2001	2011	1002	2111	1000			Valley Type (Table 2)
2097	2050	1983	346	1944			□ Confined □ Partially □ Unconfir
2020	1004	CORS	335	14.18			Channel Zone (Table 4)
2020	7999		200	1010			🗆 Headwater 🗆 Transfer 🗆 Depositi
2061	1202	1001	281	1963	-		Land Use (Table 1)
2000	1946	1894	282	1000			
1999	1934	1873	287	1892			Vegetation
000	1995	1875	292	1892			Aquatic Vegetation:
2050	1945	1890	289	1875			Coverage of Reach:%
1955	1884	1793	287	1835			🗆 In Stream 🗆 Margins 🗆 On Bank
							Riparian Vegetation: 🗆 No 🗆 Yes
							Extent of Riparian Cover:
				4			🗆 Fragment 🗆 None 🗆 Continuo
							Riparian Cover (channel widths):
							□ 1-4 □ 4-10 □ >10
			_				Age Class of Riparian Vegetation:
					-		Immature Established Mature
							□ (<5 yrs) □ (5-30 yrs) □ (>30 y
							Extent of Encroachment:
	10 million - 10 mi						□ None □ Minimal □ Moderat
							□ Heavy □ Evtreme
							Density of Woody Debrie
							Blockage(s) in Channel

GEO MORPHIX

Detailed Cross-Section Characteristics Project Number: 24061

Date:	2024-07-23	Cross-section:	X51
Time:	2:42	Reach:	TRIB 4
Weather:	260 SUNNY	Location:	OVGC
Field Staff:	EP JU	Watershed/Subwatershed:	CREPIT RIVER

X	Y	NOTE		Notes	Cross-sectio	nal Morphol	ogy (Ta	ble 22)		
1.75	1950	LB	- ministration		(28' F	Riffle 🗆 Poo	DI 🗆 F	tun 🗆 C	ther	and a state of
2.)	1995				Substrate Sa	ample:				
2.4	2065				🗆 Bed 🗆	🛛 Bank 🗆 Sub	paveme	nt 🗆 Wate	r 🗆 None	e
2.59	2115	BF			Pebble Coun	t Measurem	ents A/	B/C Axes	(cm):	
2.8	2185				ABC	AB	CA	BC	AB	c
2.9	2210				3	21	5117	KAND	27	1 *
3.1	2255				1.8	46		100000	0.4	
3.25	2330				4 8			1	0.2	
3.3	2335				3.42.31.4	2.7 2.2	13	8 46	5.6 4.1	63.4
3.5	2392				3.4	2,0		1	1.6	
3.6	2405	WE			3.7	40			2.4	
3.9	2423				0.9	3.2		••••••	1.9	
4	2428				31.81	28241	2 14	0.404	61 31	22
4.2	2412				3.2	26	1.1.1.1.1.1	The set	<u></u>	0; 9
4.4	2391				3	3.7	·»	·····	→	
4.7	2398				Particle Shar	pe: 🗆 Platy		Very Ang	ular	~
4.86	2427				Sub-angula	ir 🗆 Angula	r _	Rounded		1
5.1	2440				Sub-Round	ed 🗆 Well Ro	ounded	/	8	//
5.3	2445				Embededness	. 30 %		L	XX	/
5.65	2417				Subpavement	: / i		(Dob	C C	
5.8	2402				Sorting (Table	e 20): 🕅 Well	□ Mode	rate 🗆 Por	or 🗆 Verv	
6	2385	wents a			Sediment Tra	ansport				, ,
6.2	2415	and the second	1.5		D Obsy M Not		Visible -	Peacon		
6.5	2456				If Observed	(Table 21):	VISIDIC	Redson	-	10.00
6.8	2399	WE			□ Suspended	□ Sliding	Rolling	□ Salta	ition	
1.0	2345			and the state of the second	Percentage of	Bed Active:		,	%	
1.3	2318		1.0		Velocity			- Sementing and	1180 - 60	Mah
7.6	2249				Measured (7.156 m/s	Method	WB		1.
7.8	2229				Estimated	m/s	XS ID:	XSI		
7.9	2195				Distance 1.1	D m Tim	e 5.7	3 sv	2510	m/s
7.15	2041				Distance	0 m Tim	e 6.6	T _s v	0150	m/s
1.35	1882		1100		Distance)	0 m Tim	e 6.9	0 s V	0.145	m/s
1.45	1820				Discharge	Terry and				
B.7	1753				□ Estimated	m³/s	Method		14.50 (0.116)	2211-
9.15	1708				□ Measured		-XS ID			
9.5	1688				Depth	m Width		m-Vso		m/s
9.8	1679				Depth	_m Width		m V ₆₀		m/s
10.32	16.63	RB			Depth	m Width			······	m/s
					Use Veo if D	enth < 0.75 m	and Vee /	Ves if Denth	> 0.75	
				 		-p 0.7.5 m	unu v20/	vao ii Depth	- 0.75 m	C

Last edited: 21/02/2023



GEO MORPHIX

Detailed Cross-Section Characteristics

Project Number: 24061

Date:	2024-01-23	Cross-section:	×s 2
Time:	3:25	Reach:	TRIB 4
Weather:	26° SUMNY	Location:	OVGL
Field Staff:	EP IV	Watershed/Subwatershed:	CREDIT RIVER

X	Y	NOTE			N	lotes	Cros	ss-se	ectio	nal N	lorp	ho	log	y (1	Tab	le	22)			
1.75	2080	LB								liffle	ø	Po	ol		RL	ın			ther		
2.2	2122						Sub	strat	te Sa	mple	9:									2	
2.27	2195	BF							ed 🗆	Ban	k 🗆	Su	bpa	ven	nen	t		/ate	r 🗆	Non	e
2.5	2345						Peb	ble (Coun	t Me	asur	em	nen	ts A	/B	1	C A	xes	(cm	ı):	
2.78	2499						A	B	С	A	B	1	с	A	i	B	1	c	A	B	
2.96	2570	WE					SAN	0			1.2		7		0	, «	5	-	50	Per	,
3.12	2639										1.1				2		5			1	
3.3	2650										0.4				1	2				t	
3.5	267 S									3.6	13.1	117	2.0	4	1	3	11	7			1
3.8	2655						1				6				3		Н			·+	
4.06	2648										 1 h				2		6			-+	
4.4	2665										2			202	0	1	3				
4.6	2622	11						1	D	6.4	146	Ti	4	3	31	3	12	2		rt-	
4.9	2583							1			.1	1011			0	9	-1			i	
5.1	2565						14	/			.5				1.	9				· 🎶	
5.4	2560						Part	icle	Shap	e: 🗆	Plat	y		-		Ve	rv /	Ana	ılar		-
5.6	2550						M St	ub-ar	Igula	r 🗆	Ang	ula	ır			Rc	ound	ded	~		/
5.8	2468							ub-Ro	ounde	ed 🗆	Wel	I/R	oun	ded				/		2	//
6.0	2454						Emb	eded	ness	7	5	0/0						L	A	X	/
6.1	2450						Subp	aver	nent	·								6	~	~	
6.3	2480	a loue to					Sorti	ng (*	Table	20):	ΠV	Vel		Mo	lera	ate	X	Ped	or 🗆	Vor	s guia
6.5	2590		(birdet)		1		Sedi	men	t Tra	inspo	ort							100		ver	y por
6.7	2578	ent of	417					sv 🕅	Not	Ohs		Not	Vie	ible	- 0	201			-	1.15	
6.9	2580					1.11.11.11	If O	bser	ved (Table	21)	:		DIC	- 1	100	3501	·			
1.1	2543	-m2 m-	ing			(Ispen	ded		lidin	a		Rolli	na	ſ		alta	tion		
7.15	25.90	1.00	1.544	-		0.251	Perce	entag	e of	Bed A	Activ	e:	्यतः ।						cion	0/0	
7.5	2560		TRUCT TO			Constant of the	Velo	city			(9)	-						1	m	70	ninini
7.6	2503						🗆 Me	asur	ed		m	1/5	Me	tho	d ·	~	100	5	LOW	1	Page 1
7.75	2380	BF					Es	timat	ed		6	1/5	X								
7.9	2332						Dista	nce			The .	Tim	ne				c	v			m/c
8	2320				1		Dista	nce		/	m ·	Tim	ne –				_3	v –	100	-	_m/s
8.3	2342						Dista	nce -		/	•	Tim	ne –				_3	v –			_m/s
8.6	2277						Disc	hara	e								_3	v			_111/S
8.8	2250	101					DEst	timat	ed		m ³	1/5	Me	thou	1.		-	-	19-24		-
9	2230							asure	ed			3/0	v	S TI	·· -		-	/	_		
9.2	2150						Dept	n		m	Widt	h		<u> </u>	-	m	V			-	mle
9.4	2010			1			Dept	n			Widt	h		-		m	Ve	- 00			m/s
9.6	1940						Dept	7	~	m	Widt	h –	-			 m	Ve		-		m/s
995	1290	RR					- Speci				ut		-			-m	ve	- 00		-	m/s

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Date:	2024-07-23	Cross-section:	xs 3
Time:	4:10	Reach:	TRIBH
Weather:	Sugar 26°C	Location:	OVGC
Field Staff:	JJEF	Watershed/Subwatershed:	CP

X	Y					Notes	Cros	ss-s	ectio	nal l	Mo	rph	olo	gy	(Ta	ble	22)				
1.75	1977	LB								Riffle			Pool			lun	Ø	LOth	ner		
2.1	1895						Sub	stra	te Sa	mpl	e:										
2.4	1932					-			ed [Bar	nk		ubp	av	eme	nt [] Wa	ater		lone	e
2.6	1883						Peb	ble	Coun	t Me	as	ure	me	nts	A/	B/0	CAX	es (cm)):	
2.75	1785					will rear an interve	A	В	C	A	ł	в	С		A	в	10		A	В	i c
2.87	1860					_	5.1	× 1	Find	55		1		+				+			
3.03	2030							11	San	Ĭ		+		-†-							
3.2	2045							• • • • • •				V		-†-							
3.4	2050	BF					3	71	1.1	7.4	17	5	2	- 12	173	1.1	100	3 2	7	17	1117
3.62	2062							1	iiii.					-1-				1		12.1	1.1.1.
3.72	1220			-				·				·}		-†-				• • • • •			
3.85	2320	ME										+		-†-						-+	
3.9	1385			-			1.6	0.6	06	24	17	9	1.1		R	0.	sia	< 1		1 2	117
4.1	2364		1				1.01		1.010	5.7	.i	1	111	42			10	(1	et li
43	7802		-								;	ļ		-+-		÷		·		-t	
4.5	2346			-			Part	icle	Shar	1e. [latu		-	-	1 Vo	my A			-	
4.7	2296			-			S S	ub-a	ngula	r r		nou	lar					ngui ed		/	2
49	7770							ub-R	ound	ed 🗆	n v	/ell	Rou	nd	ed _		unu	-u/	B	/	11
5.1	1725			-			Emb	odor	Inocc	. 0	10		0/-					V	A	Σ	/
22	1203			-			Subr	bave	ment	: <u> </u>	20		70					E	\leq	×	
< <	2112		-	-			Sorti	ing (Table	201		1 14/					- [F	Pebble	ABC	axis	guide
5.65	2047	1	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-			Sedi	mor	Table	20)	-			1 1*	oue	rate		POOR		very	/ poo
578	1954	oC		-			- Seul	h	-	ansh						0.00	161			2400	
59	IBan	DF						bsor	⊴ Not	(Tabl	V L		ot V	isit	le -	Rea	ason	:	-	-	
61	1842	und in 11						ISDA	nded			ling		D	llin		7.0-	lbab:			
64	1837	144. C					Perce	anta	nueu no of	Pod		inig inig		R	mini	9 1	_ Sa	itati	on		
68	1196			-		1.1.1.1.1.1.	Valo	cita	ge or	beu ,	ACI	ive	-	-	1	-		-		%	
7.0	1732		1.110.00	-				acu	rod			-	-	let		-	F	5	01)	-
1.3	1663			-				tima	tod			_m/		ret			00	>1	100	-	
7.7	1480	VR.		-			Diete	nna	Leu _				5)	15	D: .	-				10.1	
779	HUUS	RR		-			Dista	nce			_n	y r	ime	-	-		_s \		-		m/s
1-1-1	1172	LPD		-			Dista	ince		/	∠m	n Ti	ime				_s \	'			.m/s
							Dista	ince		1	_n	n Ti	me			-	_s \	/	- 10-		m/s
				-			Disc	narg	je		15				11.5	-			te fas		16/15
				-			Est	tima	ted _		1	m ³ /	s M	etł	od:	-		-	-	-	
10000							I Me	asur	red			_m ³	/s	XS	ID:	-			1.00	-	1.000
							Dept	n		_m	W	idth				_m	V60)			m/s
				-	anna an ta		Dept	n	11 - 14 -	m	W	idth				_m	V60)		r	m/s
							Dept	h	-	m	W	idth	÷	-	-	_m	V60			r	m/s
							1 1	Ico V	16 D	anth	- 0					10 5	10.00	164		1	

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GEO

MORPHIX~



Project Number:

Date:	2024-07-23	Cross-section:	XS 4	
Time:	4:45	Reach:	TRIB 4	
Weather:	Sunny 26°C	Location:	avec.	
Field Staff:	JVEE	Watershed/Subwatershed:	CV	

×	4				Notes	Cross-sectional Morphology (Table 22)	a week of the second second
1.75	1802					🗆 Riffle 🖾 Pool 🗆 Run 🗆 Other	
2.1	1839					Substrate Sample:	111-
2.2	1890	BF				🗆 Bed 🗆 Bank 🗆 Subpavement 🗆 Water 🗆 Non	e
2.4	1998					Pebble Count Measurements A/B/C Axes (cm):	
2.46	1999					ABCABCABCAB	i c
2.8	2038					2 24 24 5.5	and
3.0	1083					1 0.5 0.1	·····
3.3	2110					14 7 12	
3.5	2043					3 2416 4526 24 44 2412	
3.7	2104					0.9 40 12	
3,8	7172	INE	-				
3.9	12170	04-		-		1 0 0 0 0	
41	1205					2812 010 11112 11 8712 913	
474	1773			-		5.012412.14.13 1.6 5.6 2.8 1.1	
424	9758		-				
4 5	1220		-		in the second	0.6	-
1-2	1250					Very Angular	2
4.0	2155	5	00	-		Sub-Bounded - Well Develot	1
2.01	(1)					Sub-Rounded Well Rounded	//
S.2	2158			-		Embededness: <u>25</u> %	
5-7	2005			-		Subpavement: [Pebble ABC axi	s guide]
3.6	1902	0	-	-	and the second second	Sorting (Table 20): Well Moderate Poor Ver	y poor
5.8	1784	BF	1.00	-		Sediment Transport	12 640
6.1	1119	A Show	101			Obsv 🖾 Not Obsv 🗆 Not Visible - Reason:	
6,9	1648	0.0		-		If Observed (Table 21):	
6.65	1689	KB				□ Suspended □ Sliding □ Rolling □ Saltation	
				-		Percentage of Bed Active: %	
						Velocity	1-11-21
						\Box Measured/m/s Method: <u>NO_FLow</u>	
				1		Estimatedm/s XS ID:	
						Distancem Times V	m/s
						Distancem Times V	m/s
Include 1						Distance m Time s V	m/s
112.1.1						Discharge	
			and well			Estimated m ³ /s Method:	
					1	□ Measured m ³ /s XS ID:	
						Depthm Widthm Vso	m/s
						Depthm Width m Vso	m/s
						Depth m Width Veo	m/s
						Use Veo if Depth ≤ 0.75 m and Veo / Veo if Depth ≈ 0.75	
				1			a .

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ank Charac	teristics		Projec	ct Number:	C4061		
Date:	2074-07-23		Cre	oss-section:	XSU		-
lime:	4:45		Re	ach:	TRIBY		
Weather:	SUDDY 26°C		Lo	cation:	OV GC		
Field Staff:	JV EF		Wa	atershed/Subwatersh	ied: CZ		
Sketch (Viewed	Downstream) Include: m	neasurements, bar	nk slope, ev	vidence of geomorphic processe	es/adjustments, geomorp	hic/bedform units, vegeta	tion type &
Ben	Left Bank	Logis			Right	Bank	
	and the second	V \		V UNXXX	11		
	LOAR	COBBLE	20 All	Privite PREPLE	5>		
Lef	LOAR Materials	COBRLE	200	PINS PEPCE	Right	t Bank Materials	
Lef Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Depsity: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	Image: Constraint of the second state of the second sta	m ° m % m kg/cm ² kg/cm ²	R 0 ### **** **** **** **** **** 8	Features Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence Grasses Leaning tree Tree Woody Debris Sediment sample Erosion pin Scour/bed chain	Right Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	t Bank Materials Gravel Small Cobble Large Cobble Small Boulder Large Boulder 0-57 20 0-20 15 K / Taken at representative X Yes No	- m - % - m - % - m - m - kg/cm S5kg/cm
Lef Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used: Additional No	t Bank Materials Gravel Gravel Small Cobble Small Cobble Small Boulder Large Boulder Large Boulder A.48 35 0.20 15 X I Taken at representative XS5 Yes □ No tes	m ° m % m kg/cm ² kg/cm ²		Features Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence Grasses Leaning tree Tree Woody Debris Sediment sample Erosion pin Scour/bed chain	Right Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	t Bank Materials Gravel Small Cobble Small Cobble Large Cobble Small Boulder Large Boulder 0-57 20 0-20 15 K / Taken at representative X Yes D No	- m - % - m - % - m - m - kg/cm S5kg/cm
Lef Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used: Additional No	t Bank Materials Gravel Gravel Small Cobble Small Cobble Small Boulder Large Cobble Small Boulder Large Boulder A.4& 35 0.20 15 X I Taken at representative XS5 Yes I No tes	m o m o m % m kg/cm ² kg/cm ²		Features Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence Grasses Leaning tree Tree Woody Debris Sediment sample Erosion pin Scour/bed chain	Right Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	t Bank Materials Gravel Small Cobble Small Cobble Small Boulder Large Boulder 0-51 20 0-20 15 K / Taken at representative X Yes No	- m - % - m - % - m - % S5kg/cm
Lef Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used: Additional No	t Bank Materials Gravel Small Cobble Large Cobble Small Boulder Large Boulder 0.48 35 0.20 15 X 1 Taken at representative XS5 Yes D No	m ° m % m kg/cm ² kg/cm ²	R 0 ### **** **** **** **** **** **** 8	Features Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence Grasses Leaning tree Tree Woody Debris Sediment sample Erosion pin Scour/bed chain	Right Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	t Bank Materials Gravel Small Cobble Small Cobble Small Boulder Large Boulder Large Boulder 0-57 20 0-20 15 K / Taken at representative X Yes D No	- m - % - m - % - m - kg/cm S5kg/cm
Lef Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used: Additional No	t Bank Materials	m ° m % m kg/cm² kg/cm²	R 0 ##### **** **** **** **** 8	Features Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence Grasses Leaning tree Tree Woody Debris Sediment sample Erosion pin Scour/bed chain	Right Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	t Bank Materials Gravel Small Cobble Small Cobble Small Boulder Large Boulder Large Boulder C-57 C-20 IS K / Taken at representative X Yes No	- m - % - m - % - m - kg/cm S5kg/cm
Lef Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used: Additional No	t Bank Materials Gravel Small Cobble Small Cobble Small Boulder Carge Boulder Carge Boulder Small B	m ° m % m kg/cm ² kg/cm ²	R	Features Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence Grasses Leaning tree Tree Woody Debris Sediment sample Erosion pin Scour/bed chain	Right Bedrock Till Clay Silt Sand Bank Height: Bank Angle: Root Depth: Root Density: Undercut: Erosion Pin: Torvane: Penetrometer: Foot Used:	t Bank Materials Gravel Small Cobble Small Cobble Small Boulder Large Boulder 0-371 20 0-29 15 K / Taken at representative X Yes No	- m - % - m - % - m - % S5kg/cn

Detaile	d Cross	-Section	Charao	cteristic	s Pr	oject Number	PNI24061	in the second second	MORPHIX					
Date:		7074	-07-	24	Cross-see	tion:	1255							
Time:		9:18			Reach:	All the second s	TEL 4							
Weather	r:	Suppy	7700		Location:	PURCE THE	DVCC	DVGC						
Field Sta	aff:	MVE	C	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	Watershe	d/Subwatershed	CR							
		L LIM, C				,								
X	Y				Notes	Cross-section	nal Morpholog	y (Table 22)						
1.75	175G						iffle 🗆 Pool	□ Run -1≤ C	Other					
2.10	1805					Substrate Sa	mple:							
2.50	1842					🗆 Bed 🗆	Bank 🗆 Subpa	avement 🗆 Wate	er 🗆 None					
2.80	1898-					Pebble Count	Measuremen	ts A/B/C Axes	(cm):					
3.20	1997	BF				ABC	ABC	ABC	ABC					
3.40	2008					Fines								
3.50	2065													
3.60	2088			1					·/					
3.80	2065	UF					·····							
3.90	2176							·····›//						
4,00	7149		1.1.1					/						
4.13	2065	WE						/						
4.25	1998						·····	·/···						
4 40	1960					ii	ll	·····						
4.70	1935				-									
4.90	1024		1.			Particle Shan								
5.70	1901	Rr							ular					
5.40	1828	UF		-		□ Sub-Rounde			18/1					
5.70	1812					Embododnosou		//////////////////////////////////////	A					
600	1780			-		Subpavement:	%	K	- C					
GIR	1228		-			Sorting (Table	20)	[Pebl	ble ABC axis guide]					
0.10	1770					Sorting (Table	20): 🗆 Well 🗋	Moderate D Poo	or Very poor					
1					-	Sediment Tra	nsport	APPENDER AL	di Cagorat					
						Obsv 🖄 Not	Obsv 🗆 Not Vís	sible - Reason:						
						If Observed (Table 21):		2					
	1000	100		1				Rolling 🗆 Salta	tion					
		and the second				Percentage of E	Bed Active:		%					
						Velocity			- uniter sulfag					
						□ Measured	m/s Me	ethod:						
						Estimated	m/s XS	5 ID:	Dan V					
						Distance	m Time _	s V _	m/s					
			-		-	Distance	m Time _	s V	m/s					
		-				Distance	m Time _	s V _	m/s					
						Discharge	THURSDAY		Per unan de la					
						□ Estimated	m³/s Me	thod:						
						□ Measured	m³/s X	S ID:	- Louis and					
			*1			Depth	_m Width	m V ₆₀	m/s					
						Depth	_m Width	m V ₆₀	m/s					
					1996	Depth	_m Width	m V ₆₀	m/s					
						Use V60 if De	pth < 0.75 m and	V20 / Veo if Depth	> 0.75 m					

* a 2

Version #3 Last edited: 21/02/2023

Senior staff sign-off (if required): _____ Checked by: ____KS__ Completed by:

Page

_ of





Project Number: 24061

Date:	2024-07-24	Cross-section:	1000
Time:	9:52 AM	Reach:	700
Weather:	2055 4001S	Location:	OVEC
Field Staff:	MKEF	Watershed/Subwatershed:	C7

X	Y				Notes	Cross-sectional Morphology (Table 22)
1:75	1031					□ Riffle □ Pool □ Run ☑ Other
2.20	1083					Substrate Sample: Com a
2.50	1683					Bed Bank C Subnavement Water None
2.78	1182	BF				Pebble Count Measurements A/B/C Avec (cm)
3.00	1295					A B C A B C A B C A B C A D C
3.15	131 B					Find A, D, C A, B, C A, B, C
3.30	1311	WE				
3.50	1340					
3.60	1400	t,u≓				
3.75	1474					
3.90	1521					
4.10	1549					
430	1538					······································
4.50	1510					
460	1980	INP				
4.75	1321	000		<u>en en e</u>		
URR	1288	125				Particle Shape: Platy Very Angular
510	1257	15F				Sub-angular Angular Rounded
5 25	1742					Sub-Rounded U well Rounded
E UE	1212					Embededness:%
5.10	1120					Subpavement: [Pebble ABC axis guide]
500	11 70					Sorting (Table 20): Well Moderate Poor Very poor
0.79	14)	0				Sediment Transport
						🗆 Obsv 🖄 Not Obsv 🗆 Not Visible - Reason:
					1	If Observed (Table 21):
					0	□ Suspended □ Sliding □ Rolling □ Saltation
						Percentage of Bed Active:%
				_		Velocity
			. A.			□ Measuredm/s Method:Magnan
						Estimatedm/s XS ID:
- Statesta				_		Distancem Times Vm/s
	1-1				100 C	Distancem Times Vm/s
						Distancem Times Vm/s
						Discharge
-			12			Estimatedm ³ /s Method:
			1.1			Measuredm ³ /s XS ID:
						Depthm Widthm V ₆₀ m/s
						Depthm Widthm V ₆₀ m/s
						Depthm Widthm V ₆₀ m/s
						Use Vso if Depth ≤ 0.75 m and Vso / Vso if Depth ≥ 0.75

ato	2021. 07-211	Cross-section:	XSb
atei	Q.52 Reach:		TRIRY
leather	7:30	Location:	OV GC
iold Staff	NAV CC	Watershed/Subwatersh	hed: CP
ketch (Viewed	Downstream) Include: measurements.	bank slope, evidence of geomorphic process	ses/adjustments, geomorphic/bedform units, vegetation type 8
cation, bed & bank	materials, approx. water level, evidence of e	erosion, stratification in bank sediments, soil h	horizons, bankfull Indicators, woody debris, roots, etc.
Cedor maist h well - d	dominant wet, holoing	COLES /	Houndary woody debris
Feri	nswewelweed, honlochs likely near grandwater e	ele saturated bed/banks 10W compaction/coho	S, esion
Fen	ns, rurelweed, henlachs likely near grandwater e	ele Saturated Bed/bank IGW compaction/cohi	S, on a second s
Feri	ns, evelweed, henlochs likely near grandwater e	Ele Saturated Bed/banks IGW compaction/coho	S, on Right Bank Materials
Fern Le Bedrock	ns i evelweed, henlachs likely near grandwater e st Bank Materials	Features R Station location Monumented XS	S Image: Sign of the second secon
Fern Le Bedrock	eft Bank Materials	Features R Station location Monumented XS Monumented photo	S S S S S S S S S S S S S S S S S S S
Een Bedrock Till Clay	erelweed, henlachs I'kely near grandwater e eft Bank Materials Gravel Small Cobble Large Cobble	Features Features Features Station location Monumented XS Monumented photo Undercut bank	Sitt Sitt Sitt Small Boulder
Een Bedrock Till Clay Silt	Sjewelweed, henlochs IKCly Near grandwater e St Bank Materials Gravel Small Cobble Large Cobble Small Boulder	Features R Station location Monumented XS Monumented photo Undercut bank HHHH Eroded bank/slope	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder
Fern ■ Bedrock ■ Till ■ Clay ■ Silt ■ Sand Bank Height	eft Bank Materials Gravel Gravel Small Cobble Large Cobble Small Boulder Large Boulder C. 46 m	Features R Station location Monumented XS Monumented photo Undercut bank HIIIII EXXXXX Bank stabilization	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: M
Een Bedrock □ Till S Clay Silt □ Sand Bank Height Bank Angle	eft Bank Materials Gravel Gravel Small Cobble Large Cobble Small Boulder Large Boulder Cobble Small Boulder Cobble Small Boulder Cobble Cobble Small Boulder Cobble Cob	Features R Station location Monumented XS Monumented photo Undercut bank HIIIII EXXXXX Norumented bank/slope Bank stabilization K	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height:
Een Een Een Een Een Een Een Een	eft Bank Materials Gravel Gravel Small Cobble Large Cobble Large Boulder Large Boulder 20 0.20 m	Features R Station location Monumented XS Monumented photo Undercut bank ###### Eroded bank/slope Bank stabilization *-*-* Fence WWW	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: 0.40 m Bank Angle: 25 ° Root Depth: 0.20 m
Fern ■ Bedrock ■ Till ■ Clay ■ Silt ■ Sand Bank Height Bank Angle Root Depth Boot Depsity	eft Bank Materials Gravel Gravel Small Cobble Gravel Small Boulder Large Boulder C. 46 m C. 46 c c c c c c c c c c c c c	Features R Station location Monumented XS Monumented photo Undercut bank HIIII Eroded bank/slope Bank stabilization X	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: 0.40 M 0.20 Root Depth: 0.20 Root Density: 15
Fern Ee Bedrock □ Till □ Clay □ Silt □ Sand Bank Height Bank Angle Root Depth Root Density Undercut	eft Bank Materials Gravel Gravel Gravel Small Cobble Gravel Small Boulder Large Boulder Cobble Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Mathematicals Small Cobble Small Boulder Large Boulder Mathematicals Mathemat	Features R Station location Monumented XS Monumented photo Undercut bank ##### Eroded bank/slope Bank stabilization *-*-* Fence VVV Grasses Leaning tree Tree	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 0.40 m Bank Angle: 25 ° Root Depth: 0.20 m Root Density: 15 % Undercut: 0.40 m
Een Een Een Een Een Een Een Een	eft Bank Materials Gravel Gravel Gravel Gravel Gravel Small Cobble Large Cobble Gravel Materials Mat	Features ICW Compaction / Coho ICW Compaction / Coho ICW Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope EXXXX Bank stabilization *-*-× Fence VVV Grasses Leaning tree Tree X × × Woody Debris	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: 0.40 m Root Depth: 0.20 m Root Density: 15 % Undercut: 0 m Erosion Pin: N/O m
Een Een Een Een Een Een Een Een	eft Bank Materials Gravel Gravel Gravel Small Cobble Large Cobble Small Boulder Large Boulder Constant Cons	Peatures R Station location Monumented XS Monumented photo Undercut bank HHHH Eroded bank/slope Bank stabilization *-*** Fence VVV Grasses Leaning tree Tree Vody Debris Sediment sample	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 0.40 Mot Depth: 0.20 Root Depth: 15 Mot Density: 15 Erosion Pin: M)O Torvane: Taken at
Fern □ Bedrock □ Till □ Clay □ Silt □ Sand Bank Height Bank Angle Root Depth Root Density Undercut Erosion Pin Torvane Penetrometer	Signal weed, hen locks IKely near grandwater e Gravel Small Cobble Large Cobble Small Boulder Large Boulder	Pie Saturated Sed/bank ICW Compaction / Coho ICW Compaction / Coho ICW Compaction / Coho ICW Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence VVV Grasses Leaning tree Tree X ** Woody Debris Sediment sample Erosion pin	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: 0.40 Mot Depth: 0.20 Root Depth: 15 Penetrometer: Taken at kg/c Penetrometer: representative XS5 kg/c
Een Een Bedrock Till Clay Silt Sand Bank Height Bank Angle Root Depth Root Density Undercut Erosion Pin Torvane Penetrometer	eft Bank Materials Gravel Gravel Gravel Small Cobble Large Cobble Small Boulder Large Boulder 20 15 0 15 % 0 m 15 % 0 m 15 %	Pie Saturated Sed/bank IGW Compaction / Coho IGW Compaction / Coho IGW Compaction / Coho IGW Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence VVV Grasses Leaning tree Tree VVV Sediment sample Erosion pin Scour/bed chain	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 0.40 Materials m Bank Angle: 25 Root Depth: 0.20 m Root Density: 15 % Undercut: 0 m Erosion Pin: N)0 m Torvane: Taken at kg/c Penetrometer: representative XS5 kg/c Foot Used: Yes No
Een Een Een Een Een Een Een Een	eft Bank Materials Gravel Gravel Gravel Small Cobble Gravel Small Boulder Large Cobble Small Boulder Large Boulder C.46 m 20 ° 15 % 0 m 15 % 15 15 15 15 15 15 % 15 % 15 % 15 15 15 15 15 15 15 15 15 15 15	Peet Saturated Bed/bank ICW Compaction / Cohe ICW Compaction / Cohe ICW Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence VVV Grasses Leaning tree Tree X Woody Debris Sediment sample Erosion pin 8 Scour/bed chain	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 940 Materials ° Root Depth: 0.20 More Density: 15 More Density: 15 Torvane: Taken at Kg/c Penetrometer: representative XS5 kg/c Foot Used: Yes
Een Een Een Een Een Een Een Een	and weed, hen locks I'kely near grandwater grandwater and water and water grandwater and water and cobble black black and cobble black bl	Perform Features R Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence VVV Grasses Leaning tree Tree VVV Stediment sample Erosion pin Scour/bed chain	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: 90 Root Depth: 15 Root Density: 15 Erosion Pin: MD Torvane: Taken at Kg/c Foot Used: Yes<
Een □ Bedrock □ Till □ Clay □ Silt □ Sand Bank Height Bank Angle Root Density Undercut Erosion Pin Torvane Penetrometer Foot Used Additional N	eft Bank Materials Gravel Gravel Gravel Small Cobble Small Boulder Large Boulder Large Boulder 20 15 0 15 % 0 m 15 % 15 15 % 15 15 % 15 15	Performance Features Image: Station location Monumented XS Image: Station location Monumented photo Image: Station location Monumented XS Image: Station location Monumented photo Image: Station location Monumented XS Image: Station location Monumented photo Image: Station location Monumented photo Image: Station location Fence Image: Station location Station location Image: Station location Fence Image: Station location Fence Image: Station location Station location Image: Station location <td< td=""><td>Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 0.20 Root Depth: 0.20 More Density: 15 Undercut: 0 Torvane: Taken at Kg/c representative XS5 kg/c Foot Used: Yes</td></td<>	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 0.20 Root Depth: 0.20 More Density: 15 Undercut: 0 Torvane: Taken at Kg/c representative XS5 kg/c Foot Used: Yes
Een □ Bedrock □ Till □ Clay □ Silt □ Sand Bank Height Bank Angle Root Depth Root Density Undercut Erosion Pin Torvane Penetrometer Foot Used Additional N	eft Bank Materials Gravel Gravel Gravel Small Cobble Gravel Small Boulder Large Cobble Small Boulder Large Boulder Carlon Marcon Small Boulder Marcon Small Boulder Marcon	Pies Saturated Secol/bon K IGW Compaction / Coho IGW Compaction / Coho IGW Station location Monumented XS Monumented photo Undercut bank Eroded bank/slope Bank stabilization Fence VVV Grasses Leaning tree Tree VVV Sediment sample Emmode Sediment sample 8 Scour/bed chain	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Bank Height: 25 0.20 m Root Depth: 0.20 More Density: 15 Torvane: Taken at kg/c Penetrometer: representative XS5 kg/c
Le Bedrock Till Clay Silt Sand Bank Height Bank Angle Root Depth Root Density Undercut Erosion Pin Torvane Penetrometer Foot Used Additional N	Signature Standward IKCly Near grandward IKCly Near grandward IKCly Near grandward ICobble Small Cobble Small Cobble Small Boulder ILarge Boulder * ICobble Small Roulder ILarge Boulder * ICobble m ILarge Boulder * IS % IS %<	Performance Features Image: Station location Monumented XS Image: Station location Monumented photo Image: Station location Monumented XS Image: Station location Monumented photo Image: Station location Monumented photo Image: Station location Monumented photo Image: Station location Monumented XS Image: Station location Monumented photo Image: Station location Station Image: Station location Fence Image: Station location Fence Image: Station location Fence Image: Station location Tree Image: Station location Sediment sample Image: Station location Scour/bed chain	Right Bank Materials Bedrock Gravel Till Small Cobble Clay Large Cobble Silt Small Boulder Sand Large Boulder Bank Height: 0.40 Root Depth: 0.20 Root Density: 15 Dundercut: 0 More Taken at kg/d Foot Used: Yes I No

0

Pag

Detailed Assessment Long Profile (Total Station) Project Code: PN 24061

	2024-04-25	Reach:	OVGC CR		
me:	/	Location:			
eather:	23°C Sunny	Watershed/Subwatershed:			
eld Staff:	ME EF	Rain in last 24 hours:	□ None □ Yes: Amount mm		
Point No.	Code	Notes	Survey Direction		
	RTK		Upstream to Downstream Downstream to Upstream		
	(Cross-sections		
	(-0.13m adjust		No. of Cross-sections Surveyed: S Monitoring Cross-sections: Image: Description in the section is section in the section in the section in the section in the section is section in the section in the section is section in the section in the section in the section is section in the section in the section in the section is section in the section in the section is section in the section in the section in the section is section in the section		
			Velocity & Sediment Transport		
			□ Velocitym/s Method: □ Dischargem ³ /s Sed. Transport (Table 21): ⊠ Suspender ⊠ Saltation □ Sliding □ Rolling		
			Percentage of Bed Active: %		
			Valley Type		
			□ Confined Ø Partially □ Unconfined		
			Channel Zone		
			Headwater Transfer Deposition		
			Land Use		
			Forest (golf course adjacent Vegetation		
			Aquatic Vegetation:N/ 🔾		
			Coverage of Reach:%		
			In Stream Margins On Bank		
			Riparian Vegetation: 🗆 No 🖾 Yes		
			Extent of Riparian Cover: (localized		
			□ Fragment □ None		
			Riparian Cover (channel widths):		
			□ 1-4 □ 4-10 ⊠ >10		
			Age Class of Riparian Vegetation:		
	0.201		Immature Established Mature		
			□ (<5 yrs) ⊠ (5-30 yrs) ♀ (>30 yrs)		
			Extent of Encroachment:		
			🗆 None 🛛 🖾 Minimal 🗆 Moderate		
			Heavy Extreme		
	6		Density of Woody Debris:		
			🗆 Low 🛛 Moderate 🖉 🗆 High		
			Blockage(s) in Channel:		

Version #3 Last edited: 21/02/2023

Page _____ of _____

General Site Characteristics

Project Number: 24061

Date: Stream: 2024-07-25 CREDIT RIVER Time: Reach: (PEDIT RIVER Weather: Location: 23°C Sunny OVGC **Field Staff:** Watershed/Subwatershed: FF MY CREDIT RIVER Site Sketch Features Monitoring Compass -o-o-o- Long-profile F Reach break 只 Station location - Monumented XS Cross-section 0 Monumented photo TSIC Begins Flow direction 10 Monumented photo dpo ~ Riffle direction Smallurs Pool Sediment sampling CARDO Sediment bar Erosion pins an book 8 Exposed + ######### Eroded bank/slope Scour chains ing Belgta) LBING under wind ----Undercut bank **Additional Symbols** -Kyalle XXXXXX Bank stabilization wall contar Leaning tree (Huge Fence x----x----x Culvert/outfall Exposed roots Swamp/wetland 0 Grasses UC, J-Shoped VVV C Tree E Instream log/tree Exposed root UC, J-Shord *** Woody debris #HAR Beaver dam VV toe confact Vegetated island W Fresh spond 25 Flow Type H1 Standing water H1A Back water H2 Scarcely perceptible flow saped Iscan Valle H3 Smooth surface flow Wall (r-bonty) +10m H4 Upwelling H5 Rippled H6 Unbroken standing wave H7 Broken standing wave Exposte H8 Chute 10015 pb H9 Free fall H9A Dissipates below free fall MC. 54 Substrate J-Shaped **S1** Silt **S6** Small boulder \$2 Sand **S7** Large boulder \$3 Gravel **S8** Bimodal **S**4 Trib Small cobble **S9** Bedrock/till **S**5 Large cobble Other BM Benchmark EP Erosion pin BS Backsight RB Rebar -clast DS Downstream US Upstream X52 WDJ Woody debris jam TR Terrace VWC Valley wall contact FC Flood chute DA KS x BOS Bottom of slope FP Flood plain Photos: K 600 L bank TOS Top of slope KP Knick point Notes:

Version #4 Last edited: 21/02/2023

Senior staff sign-off (if required): _____ Checked by: KS

_ Completed by: _______ Page 1 of 2

GEO MORPHIX-

General Site Characteristics

Project Numbe

Dat	e:	202	4-07-25		Stream:	C D
Tim	e:		1		Reach:	CREDIT RIVER
Wea	Weather: 23°C Sunny Field Staff: EF My		Location:		CREDIT RIVER	
Field			MY		Watershed / Subwatershed	OVEC
Feat	ures	Monitori	1-12		watersnea;	CR
	Reach break Station location Keach break Station location Cross-section Flow direction Riffle Pool Sediment bar Eroded bank/slope Undercut bank Bank stabilization Leaning tree Fence Culvert/outfall Swamp/wetland Grasses Tree Instream log/tree Woody debris Beaver dam	Monitori 	ng ong-profile onumented XS onumented photo orection ediment sampling osion pins our chains al Symbols	Site US	Sketch	Compass
Flow H1	Vegetated island Type Standing water H1/	A Back wat	er		X5	7 X A Destand
H2 H3 H4 H5 H6 H7 H8	Scarcely perceptible Smooth surface flow Upwelling Rippled Unbroken standing w Broken standing wave Chute	ave e	-		Sand deposition	Fran powns 3ed actum
H9 Subst	Free fall H9A	Dissipate	s below free fall		J. A	R 155
S1 S2 S3 S4 S5 Other BM BS DS WDJ VWC BOS	Silt Sand Gravel Small cobble Large cobble Benchmark Backsight Downstream Woody debris jam Valley wall contact Bottom of close	S6 S S7 L S8 B S9 B EP E RB R US U TR T FC FI	imall boulder arge boulder imodal edrock/till rosion pin ebar pstream errace ood chute	DS	crib wall the main of the sand the sand the sand the sand the sand the sand the sand	all crib wall? well veg t sland
BUS	Bottom of slope	FP FI	ood plain	Photos	:	
ros	Top of slope	KP K	nick point	Notes:		

Version #4 Last edited: 21/02/2023

Senior staff sign-off (if required): _____ Checked by: $_KS$ __ Completed by: $_Mk$ ___

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Project Number: 2406

Date:	2024-07-24	Cross-section:	XSI
Time:	4.17	Reach:	CREDIT RIVER DS
Weather:	24° CLOUDY	Location:	OVEC
Field Staff:	EF MK	Watershed/Subwatershed:	CZ

X	Y	NOTE			Notes	Cross-sectional Morphology (Table 22)
1.75	1155	LB P.N	15.8	1202		🗆 Riffle 🕵 Pool 🗆 Run 🗆 Other
2.1	1265		16.2	1048		Substrate Sample:
2.3	1503		16.6	0949		🗆 Bed 🗆 Bank 🗆 Subpavement 🗆 Water 🗆 None
2.12	1600		16.8	0895	RB PIN	Pebble Count Measurements A/B/C Axes (cm):
2.9	2859					A B C A B C A B C A B C
3.2	2990					1.1 1.1 SAND
35	3070					24 5 1
38	3068					1 2
4.2	3044					2.412.2:0.51.8:1:0.9
4.6	3015					0.8 6
50	3180					6.5 5.3
5.4	3160					2.4 2.9
38	3312					21,50.84,132
62	3355					1.2 3.5
66	3347					1.2 2.5
1.0	3395					Particle Shape: Platy Very Angular
74	3365					🖾 Sub-angular 🗆 Angular 🗆 Rounded
B.O	3287					Sub-Rounded 🗆 Well Rounded
8.4	3232					Embededness: <u>30</u> %
8.8	3190	·				Subpavement: [Pebble ABC axis guide]
9.2	3130	A HURLE DA				Sorting (Table 20): Well Moderate Poor Very poor
9.6	3108	1794	Contra-		1.000	Sediment Transport
10.0	3040	ant the	. Info			Obsv 🖄 Not Obsv 🗆 Not Visible - Reason:
10.4	2980	2004	10-1			If Observed (Table 21):
10.8	2889	And In	1.1			Suspended Sliding Rolling Saltation
11.2	2850		0.0			Percentage of Bed Active:%
11.6	2790					Velocity
12.0	2705	_				Measured 0. STZ m/s Method: USB
12.4	2575					Estimatedm/s XS ID: XS I
12.6	2505	WE				Distance 1.0 m Time 2.09 s V 0.419 m/s
13.0	2482					Distance <u>1.0</u> m Time <u>1.72</u> s V <u>0.581</u> m/s
13.4	2435					Distance <u>1.0</u> m Time <u>2.10</u> s V <u>0.47b</u> m/s
13.8	2426			32		Discharge
14.2	2394					Estimated/m³/s Method:
14.6	2400					Measuredm ³ /s XS ID:
15.0	2390					Depthm Widthm V ₆₀ m/s
15.26	2340					Depthm Widthm V ₆₀ m/s
15.30	1659	BF				Depthm Widthm V ₆₀ m/s
15.50	140S					Use V_{60} if Depth < 0.75 m and V_{20} / V_{80} if Depth > 0.75 m

Version #3 Last edited: 21/02/2023

Senior staff sign-off (if required): _____ Checked by: \underline{KS} Completed by: \underline{EF}

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GEO MORPHIX"





Project Number: 24061

Date:	2024-07-24	Cross-section:	xs ¹ 2
Time:	3:00	Reach:	CREDIT RIVER DS
Weather:	24° CLOUDY	Location:	OVEC
Field Staff:	EF MK	Watershed/Subwatershed:	CB

X	Y	NOTE	X	Y	Notes	Cross-sectio	onal Morpholog	y (Table 22)	
1.75	1545		16.2	3432			Riffle 🕅 Pool	🕅 Run 🗆 O	ther
2.2	1580		16.6	3405		Substrate S	ample:		
2.6	1588		17.0	3350		🗆 Bed 🛛	🗆 Bank 🗆 Subpa	vement 🗆 Wate	r 🗆 None
3.0	1600		17.4	3312		Pebble Cour	nt Measuremen	ts A/B/C Axes	(cm):
3.4	1610		1.8	3227		A B C	ABC	A B C	A B C
3.7	1690		18.2	3050		1	2.9	4	4
4.0	1875		18.6	2818		1.5	3.1	2.9	1.5
4.12	2040		19.02	2648	WE	2,	1	37	z.8
4.15	2678		19.1	2492		3.5 2.5 1.6	4.4 3 2	3,431	5 5 1
4.5	2840		19.5	2430		8-5	1.6	B.8	1.6
4.85	3055		19.92	2029	ßF	4	1.2	t	1.2
5.1	3160		20.0	1712		4.3	1.5	2.5	1.8
5.5	3215		20.2	1318		3 1.8 1.2	4-S 3.6 1	9 6.3 1.5	1.4 1.1 0.5
5.9	3258		20.5	1021		2:2	6	2	4
6.3	3300		20.7S	0918		2.6	4,6	8	3.S
6.7	3245		21.10	0921		Particle Sha	pe: 🗆 Platy	🗆 Very Ang	ular
7.1	3225		21.40	DYOR		🛒 Sub-angul	ar 🗆 Angular	Rounded	6/1
7.5	3220					🕅 Sub-Roun	ded 🗆 Well Rour	nded /	$\langle \mathcal{X} \rangle$
7.9	3125					Embedednes	s: <u>10</u> %	é	S.
8.3	3089					Subpavemen	t:	[Peb	ble ABC axis guide]
8.7	3060	a Marcal In				Sorting (Tab	le 20): 🗆 Well 📈	Moderate 🗆 Po	or 🗆 Very poor
9.1	2985					Sediment T	ransport	BAY ONE	a Swane 1
9.5	2986					🗆 Obsv 🗆 No	ot Obsv 🗆 Not Vi	sible - Reason:_	
9.9	2952	294.0.00				If Observed	(Table 21):		
10.3	2872				2015/101	□ Suspender	d 🗆 Sliding 🗆	Rolling 🗆 Salta	ation
10.7	2798					Percentage o	f Bed Active:		%
H.1	2800					Velocity	19		Solution and a
11.5	2829					D-Measured	0.715 m/s M	ethod: <u>WB</u>	
11.8	2852					Estimated	m/s X	SID: XSZ	
12-2	288B					Distance	1. Om Time	1.50 s V	0 667 m/s
12.6	2942		i Millione part		and the second s	Distance	1.0m Time	1.22 s V	<u>6.820</u> m/s
13	2980					Distance	<u>I. ∕⊅</u> m Time	1.52 s V	0.6 <u>5% m</u> /s
13.4	3030					Discharge	TIMA Set		rin binernanel
13.8	3110	0.0				Estimated	m³/s M	ethod:	Name of Street, Street
14.2	3202					□ Measured	m³/s	XS ID:	
14.6	3298					Depth	m Width	m V ₆₀ _	m/s
15	3372					Depth	m Width	m V ₆₀ _	m/s
15.4	3382					Depth	m Width	m V ₆₀ _	m/s
15.8	3398					Use V ₆₀ if	Depth < 0.75 m ar	nd V20 / V80 if Dept	h > 0.75 m
Version #3	3		Senio	r staff sign-	off (if requir	ed): C	hecked by: KS	Completed	by: <u>EF</u>

Version #3 Last edited: 21/02/2023

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LP.

Project Number: 24061

Date:	2024-07-25	Cross-section:	XS 3
Time:	9:50	Reach:	CREDIT BIJER
Weather:	18° SUNNY	Location:	OVGC
Field Staff:	EF MK	Watershed/Subwatershed:	(2

X	Y	NOTE	X.	4	Notes	Cross-section	nal Morpholog	y (Table 22)	
1.75	0667	LB PIN	16.65	2234		K R	iffle 🗆 Pool		Other
2.00	0728		17.05	2233		Substrate Sa	mple:		-31,27
2.30	0860	1	17.50	2248		🗆 Bed 🗆	Bank 🗆 Subpa	vement 🗆 Wate	er 🗆 None
2.60	1029		18.00	2191		Pebble Count	t Measuremen	ts A/B/C Axes	; (cm):
2.90	1128	5.5	18.40	2104		ABC	A B C	ABC	ABC
3.10	1178		18.75	1986		2.9	6.8	2 1	SAND
3.50	1226		18.92	1965		11	11.5	1.3	
3.70	1235		19.00	1636		10.8	3.1	5	
4.00	1439	BF	19.20	1528		144 8 41	6 4.8 2.1	85 6 1B	
4.30	1572		19.55	1446		9.1	28	6.4	·····
4.65	1651		20.00	1418		3.4	4	6.8	74
5.10	1682		20.55	1362		8.2	3.7	0.0	4
5.50	1641		21.10	1286		7 5.9 28	3933	39 8.2 1	41 2 2 8
5.90	1615		21.70	1258		5	6.3	0.6	4.1
6.35	1542		22.40	1232		۲	2.6	16	2 7
6.75	1516		23.00	1210		Particle Shap	e: Platy	Very Ang	ular
7-10	1507		13.75	1199		A Sub-angular	r 🗆 Angular	Rounded	
7.55	1504		24.50	1217		🖾 Sub-Rounde	ed 🗆 Well Roun	ided /	×//
8.00	1530		15.25	1241		Embededness:	15 %	L	A
8.45	1552		26.00	1188		Subpavement:			
8.65	1569	Loosd Str	27.00	1199		Sorting (Table	20): 🗆 Well 🗖	Moderate \Box Po	
8.82	1611		27.75	1299	a dia sa sa	Sediment Tra	insport		
8.90	1804	WE	28.50	1379		Obsy 🕅 Not	Obsy 🗆 Not Vis	ible - Reason:	
9.30	1930		29.25	1409		If Observed (Table 21):	ibic Reason	Rest of the second s
9.75	2176		30.00	1431		□ Suspended		Rolling 🗆 Salta	ation
10.10	2301		30.70	1391		Percentage of I	Bed Active:	d fugur	%
10.55	2411		31.30	1337		Velocity			The second restant
11.00	2617		31.90	1226		Measured C	0.743m/s Me	thod: WB	
11.50	2607		32.40	1086		Estimated	m/s XS	SID: X = 3	
12.00	2530		32.90	0945		Distance C) m Time	1.46 sv	0.685m/s
12.45	2416		33.35	0860		Distance 1.	0 m Time	1.30 s V (1769 m/s
12.90	2365		33.71	0751	RB PIN	Distance	0 m Time	1.29 eVI	3775m/s
13,40	2418		also and			Discharge			<u></u>
13.90	2351					Estimated	m ³ /s Me	thod:	
14.40	2205					Measured	m3/sX		
14.80	2177					Depth	m Width	m Vcc	m/c
15.30	2090					Depth	Width	m Vcc	m/s
15.75	2093					Depth	m Width	0 V60	m/s
16.20	2152					Use Ven if De	onth < 0.75 m	Vio (Do	m/s
	TO being the	1					./5 m and	v20/ V80 If Depth	> 0.75 m
ersion #3	21/02/20	23	Senior	staff sign-	off (if require	ed): Che	ecked by: <u>KS</u>	Completed	by: EF

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GEO

R P H I X "





Project Number: 24061

Date:	2024-07-25-	Cross-section:	XS 4
Time:	00:11	Reach:	CREDIT RIVER
Weather:	20° SUNNY	Location:	OVGC
Field Staff:	EFME	Watershed/Subwatershed:	CR

×	¥	Note	x	Y	Notes	Cross-sectional Morphology (Table 22)
1.75	1312	LB Pint	16.95	2684		🗆 Riffle 🗆 Pool 🕅 Run 🗆 Other
2.10	1348		17.30	7610		Substrate Sample:
2.45	1398		17.70	1511		🗆 Bed 🗆 Bank 🗆 Subpavement 🗆 Water 🗆 None
2.80	1419		18.10	2379		Pebble Count Measurements A/B/C Axes (cm):
320	1500		18.44	2322		A B C A B C A B C A B C
3.60	1548		18.55	1662	BF	SAND 1.5 3 7.2
4.00	1568		18.60	1602		9 1.2 6.8
4.40	1569		18.85	1500		6.3 2.3 5
4.80	1578		18.98	1389		15 13.59-1 4 2.4 1.5 3.5 2 0.9
5.20	609		19.30	1286		4.5 3 6.1
5.60	1642		19.75	1199		10 4.3 6
6.00	1659		20.10	1160	RB PIN	10.9 1 8
6.40	1613					4.93.31.6 6 5.5 2 2 1.9 0.7
6.80	1617					6-8 6.9 8 4.S
7.20	1560					5-9 9.5 11 2
7.60	1519					Particle Shape: Platy Very Angular
8 00	1527					🛛 🖾 Sub-angular 🗆 Angular 🗆 Rounded
8.40	1513					Sub-Rounded 🗆 Well Rounded
9.00	1531					Embededness: 20 %
9.35	1542					Subpavement: [Pebble ABC axis guide]
9.45	1695	in density (Sorting (Table 20): Well Moderate Poor Very poor
9.55	1782		and a			Sediment Transport
9.80	1838	ona D			The local sector	Obsv KNot Obsv Not Visible - Reason:
10.05	1941	L'al d	1101			If Observed (Table 21):
10.38	1995	WE	1.4			Suspended Sliding Rolling Saltation
10.80	2027		100			Percentage of Bed Active:%
11.25	2066		16-16-16			Velocity
11.65	2118					DKMeasured 0,758 m/s Method: W/B
12.05	2186					Estimatedm/s XS ID: XS 4
12.50	2270					Distance 1.0 m Time 1.68 s V 0.505 m/s
12.95	2331					Distance <u>l</u> o m Time <u>l</u> , <u>l</u> o s V <u>0.909</u> m/s
13.40	2352					Distance <u>1.0</u> m Time <u>1.30</u> s V <u>0.769</u> m/s
13.85	2480					Discharge
14.30	2520	1				Estimatedm ³ /s Method:
14.15	2566					Measuredm ³ /s XS ID:
15.20	2640					Depthm/ Widthm V ₆₀ m/s
15.65	2700					Depthm Widthm V ₆₀ m/s
16.05	2733					Depthm Widthm V ₆₀ m/s
6.50	2716					Use V ₆₀ if Depth < 0.75 m and V ₂₀ / V ₈₀ if Depth > 0.75 m
		<u>k</u>	d		J	

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Project Number: 24061

Date:	2024-07-25	Cross-section:	XSS
Time:	3:12	Reach:	CREDIT RIVER
Weather:	23° SUNNY	Location:	OVGC
Field Staff:	EP MK	Watershed/Subwatershed:	(8)

X	Y	NOTE	-		Notes	Cross-s	ection	al Morpholog	y (Table 22)		- and and
1.75	0962	LB PIN					\land Ri	ffle 🗆 Pool	□ Run □ 0	Other	
2.10	0965)				Substra	te Sa	mple:			
2.58	1059	BF				DB	Bed 🗆	Bank 🗆 Subpa	vement 🗆 Wate	er 🗆 No	ne
2.65	1311					Pebble	Count	Measurement	ts A/B/C Axes	(cm):	
2.72	1449					AB	С	ABC	ABC	A	BC
3.30	1545					SAND		7.3	1.8	2	5
3.80	1610							2	2.3		7
4.15	1627							1.4	2.9		2
4.60	1727							5 3.32.5	3 2.3 2	2.2	1.8 0.1
5.00	1739					V	*	1-4	2	e	1.3
5.50	1740					4		1	8		5
6.00	1760					2		3	10.5		2
6.50	1760					14 10	1.3	4.8 3 0.5	2.4 2 1	2 1	911
7.00	1771					1.1		2	6.5	2	3
7.50	1772				_	2.1		2.6	11	2.	7
8.00	1731					Particle	Shap	e: 🗆 Platy	Very And	ular	
8.50	1768					🖾 Sub-a	ngular	🗆 Angular	□ Rounded	1	\wedge
9.00	1769					🕅 Sub-R	ounde	d 🗆 Well Roun	ded /	$\langle \rangle$	
9.50	1787					Embedeo	iness:	10_%	l	A	
10.00	1805					Subpave	ment:	TILL	[Pet	ble ABC a	C vis quidel
10.50	1821	a month in	14g			Sorting (Table	20): 🗆 Well 🙉	Moderate 🗆 Po	or 🗆 Ve	ery poor
11.00	1839		and the same			Sedimer	nt Trai	nsport		Silver	7.1
11.50	1829		INT I		1.1	Obsv	S-Not	Obsy 🗆 Not Vis	ible - Reason:		111000 110
2.00	1825	0	12 (100	1.44	If Obser	ved (1	Table 21):			
12.50	1799					Susper	nded		Rolling 🗆 Salta	ation	
13.00	1735					Percentag	ge of B	Bed Active:		%	N.,
13.50	1702					Velocity				. intoren	a post
14.00	1682					🗈 Measur	red G	.637_m/s Me	thod: WB		
14.50	1619					🗆 Estima	ted	m/s XS	ID: XS 5		
15.00	1655					Distance	1.0	m Time	1.90 s V	0.571	, m/s
15.50	1608				1	Distance	1.0	m Time	1.71 s V	0.58	Sm/s
15.91	1410	WE	the other			Distance	1. 0	m Time	.25 s V	0.8	m/s
16.20	1405				10.04	Discharg	je	MID STOLEN		0.0	
16.48	1428					Estimat	ted	m ³ /s Met	:hod:		
16.56	1191					□ Measur	ed	/ m³/s X	S ID:		
16.70	1041					Depth	/	_m Width	m V60		m/s
17.00	0995					Depth		_m Width	m V ₆₀		
17.50	1029	RBPIN				Depth	/	_m Width	m V60		/s
						Use Ve	60 if Der	pth < 0.75 m and	V20 / Van if Denth	> 0.7F	
								and in and	· 207 vou il Depti	- 0.75	iu .

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Project Number: 24061

Date:	2024-07-25	Cross-section:	XS 6
Time:	2:35	Reach:	CREDIT RIVER
Weather:	22° SUNNY	Location:	OVGC
Field Staff:	EFMK	Watershed/Subwatershed:	

X	Y	NOTE			Notes	Cro	SS-S	ectio	nal M	orp	holo	gy	(Ta	ble	22	2)				
1.75	0805	LB PIN						🖾 R	iffle		Pool	100		Run			Othe	r		
2.20	0867					Sul	bstra	te Sa	mple											
2.60	0990	BF					Β	ed 🕅	Banl	< □	Subp	ave	eme	ent		Wat	er 🗆	Nor	ne	
2.80	(170					Pel	bble (Coun	t Mea	sur	eme	nts	A/	'B/	CA	Axe	s (ci	m):	-1.51.035	
3.30	1275				10	A	В	С	Α	В	C		Α	E	3	С	A		В	С
3.62	1360	WE				5	ANF	>		6.6				3	.6			3	S	
4,10	1455									3.	1			3	.2			2	.4	
4.60	1486									2.	2			8	1.3	,	1	3	.2	
5.20	1547							1	4.6	2.	2 1.1	3 1	4.4	3	.3	1-6	Z. 9	5 2	4	4
5.70	1580						V			2				3	>			11	0	
6.20	1575						3			4.	5			6-	5			2	Ч	
6.70	1610						2			3	3			9	.1			-	7	
7.20	1631					4	3	1.5	3.4	3.	21.0	1 2	2.6	2	4	0-5	5 2.1	1 2	.2	0.9
7.80	1678						3.2	-		4				3	.1			4	.5	
8.30	1720						9.4	1		3.	1			4	.2				3	
8.90	1723	and the second second				Pa	rticle	Shaj	e: 🗆	Pla	ty		C] V	ery	An	gula	r _	/	2
9.60	1740					A:	Sub-a	ingula	r 🗆	Ang	gular		C		lour	nde	d /	5	/	11
10.20	1775						Sub-R	lound	ed 🗆	We	ll Ro	und	led			1	(~	X	/	/
10.80	1821					Em	bedeo	dness	:	D	_ %					(C	1	/	
11.30	1856					Sul	bpave	ment	:	· ·	TIL	-				[Pe	bble A	ABC a	xis g	juide]
11.90	1838	A WEED	dt			Sor	ting	(Table	20):	R.	Nell		Mod	era	te [oor [⊐ Ve	ery	poor
12.50	1863					Se	dime	nt Tra	ansp	ort				243				130	L n L	
13.10	1732	10	NIT:				Obsv (🗵 Not	Obs	10	Not \	/isi	ble	- R	eas	on:				
13.70	1713	çma el				If	Obse	rved	(Tabl	e 21):									
14.20	1678				1.14		Suspe	ended		Slidir	ng [R	ollir	ng		Sal	tatio	n		ы.
14.60	1650	(nel 0				Per	centa	ige of	Bed ,	Activ	'e: _						10	_ %	•	
14.90	1452					Ve	locity	1	-	10	-						1	223		-14-1
15.00	1107					N,KO	Measu	ired _	0.63	53 1	n/s	Me	thoo	d: _	W	B			200	
15.30	1042						Estima	ated _			m/s	XS	ID:	2	5	6	C			
15.66	1021	RBPIN				Dis	tance	!e	0	_m	Time	e	1.7	13		s V	0.	57	<u>8</u> n	n/s
					4	Dis	tance	t	. 0	_m	Time	e	1.5	58	_	s V	0.	63:	<u>3</u> n	n/s
- Hardest						Dis	tance		0	_m	Time	e	1	15		s V	0.0	280	<u>1</u> n	n/s
las ar						Dis	schar	ge	30	No.	_							ian	1077	em4
	-				1		Estima	ated _		m	3/s	Met	hod	1:						
							Measu	ired _		_/r	n³/s	X	S IC): _						
						De	pth		m	Wic	lth _				m	V60			n	n/s
						De	pth	-	m	Wic	th_				m	V60		_	n	n/s
				1	đ	Dep	pth		_/m	Wic	lth _	-		-	m	V60			n	n/s
							Use	V60 if [Depth	< 0.7	75 m	and	V20	/ Va	30 if	Dep	oth >	0.75	m	caut

Version #3 Last edited: 21/02/2023 Senior staff sign-off (if required): _____ Checked by: KS___ Completed by:

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10

GEO MORPHIX

Detailed Cross-Section Characteristics

Project Number: 24061

Date:	2024-07-25	Cross-section:	XS 7
Time:	4:17	Reach:	CREDIT RIVER
Weather:	23° CLOURY	Location:	OVGC
Field Staff:	EF MK	Watershed/Subwatershed:	CR

×	Y	NOTE		Notes	Cross-sectional Morphology (Table 22)
75	1430	IB P.N			🖾 Riffle 🗆 Pool 🗆 Run 🗆 Other
.05	1451	~U (11			Substrate Sample:
40	1510				🗆 Bed 🗆 Bank 🗆 Subpavement 🗆 Water 🗆 None
190	1655		and the second second		Pebble Count Measurements A/B/C Axes (cm):
2 40	1725				A B C A B C A B C A B C
2 35	1815	RC			SAND 2 1 3.2
260	1975	DI			3 2.5 6
2 87	2125	LIE			1.5 L.8 2
450	22.79	W-			433516 5 2.8 15 2.9 2516
5.50	2297				V 9 S.I <u>3.I</u>
1 50	2405				3 7.1 4.9 3.5
7 50	2383				1,5 1.5 .6 2
850	1400		1		42321 3 16 1531 2 1 29 2 0.0
9 15	2290				1 5.4 3 3.1
9 07	2113	1. Fly	10.00		3.9 4 4.2 0.5
9 94	2010	weis	MADO		Particle Shape: Platy Very Angular
10 75	1009				Sub-angular 🗆 Angular 🗆 Rounded
11 40	2070		1		Sub-Rounded 🗆 Well Rounded
1. 19	2170	1.5	-		Embededness: 10 %
11.10-1	1205	WE			Subpavement:TILL [Pebble ABC axis guide
12 50	2725				Sorting (Table 20): Well Moderate Poor Very poo
14 50	2755				Sediment Transport
15 55	2771	tore in the			□ Obsy 🖉 Not Obsy □ Not Visible - Reason:
16 50	1749	1000	100		If Observed (Table 21):
17 50	22250		100	8.21	Suspended Sliding Rolling Saltation
10 50	2761	1.1 10.1 10.1	in the	1	Percentage of Bed Active: %
10.0-	21155		and the state		Velocity
70.50	07600		Contraction of the local distance		Measured 0.730m/s Method: WB
210.3	17546				Estimated m/s XS ID: XS 7
17 30	2200	1			Distance 1.0 m Time 1.16 s V 0.86Z m/s
11 8'	11090	1	Contract Spatiation		Distance 1.0 m Time 1-33 s V G. 752 m/s
12 2	01057	RC.			Distance 1.0 m Time 1.68 s V 0.595 m/s
20.0	1000	SOF			Discharge
24.00	0100-	5			□ Estimated m ³ /s Method:
25 61	21815				\square Measured / m ³ /s XS ID:
21 11	71-90	2000	1		Depth m Width m V ₆₀ m/s
20.7	11105	non	N		Depth m Width m V ₆₀ m/s
					Depth m Width m V60 m/s
					$\frac{1}{1}$
	_	and the state of the local data			

Version #3 Last edited: 21/02/2023

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GFO **Bank Characteristics** Project Number: 24061 MORPHIX Date: 2014-07-22 Cross-section: XSA Time: 4:17 **Reach:** Credit River Weather: Sunny 730C Location: OVGC Field Staff: EF MK Watershed/Subwatershed: CD Sketch (Viewed Downstream) Include: measurements, bank slope, evidence of geomorphic processes/adjustments, geomorphic/bedform units, vegetation type & location, bed & bank materials, approx. water level, evidence of erosion, stratification in bank sediments, soil horizons, bankfull indicators, woody debris, roots, etc. Left Bank **Right Bank** 8 SAND 15LAND V V COBUE c03916 SQUD SAND Left Bank Materials Features **Right Bank Materials** Bedrock □ Gravel 只 Station location □ Bedrock □ Gravel 🗆 Till □ Small Cobble Monumented XS Ł 1 🗆 Till □ Small Cobble 囟 Clay □ Large Cobble O Monumented photo 🖄 Clay □ Large Cobble 2 Silt □ Small Boulder Undercut bank 🖾 Silt Small Boulder 🖾 Sand □ Large Boulder ##### Eroded bank/slope D Sand Large Boulder 0.90 Bank Height: XXXXX 0.85 Bank stabilization m Bank Height: m 25 0 Bank Angle: 5 x--*--x Fence Bank Angle: 0 0.20 Root Depth: 0.20 m VVV Grasses Root Depth: m 15 15 Root Density: Leaning tree % Root Density: % 0.10 Undercut: 0 m 0 Tree Undercut: m **Erosion Pin:** 1 m *** Woody Debris Erosion Pin: m 0.25 0.25 Torvane: H Sediment sample kg/cm² Torvane: kg/cm² 1.75 0.25 Penetrometer: kg/cm² шШ Erosion pin Penetrometer: kg/cm² 8 □ Yes 🖾 No Foot Used: Scour/bed chain Foot Used: □ Yes ØKNo **Additional Notes Photos:** Version #4 Senior staff sign-off (if required): _____ Checked by: ___ KS EF Completed by: Last edited: 21/02/2023

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Detailed Cross-Section Characteristics Project Number: 24061

Date:	2024-07-25	Cross-section:	XSS
Time:	4:55	Reach:	CREDIT RIVER
Weather:	23° SUNNY	Location:	DUGC
Field Staff:	EF MK	Watershed/Subwatershed:	CR

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1.65	1467	BF] Be	d 🗆	Bar	nk ⊑	Su	ibpa	vem	ent		Vate	r 🗆	None	e
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10.60	1909				🖾 Sul	b-Ro	ound	ed 🛛	J W	ell I	Roui	nded			1		8	//
11.20	1922				Embe	ded	ness	: 1	0	0	10				L	A	X	/
11 80	1928			 	Subpa	aven	nent				TIL	L		_	[Dob	blo A		in guidel
12.50	1880				Sortin	ng (*	Table	20)	: 🗆	We		Mo	lera	te 🗆] Po	or [l Ver	
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12.85	1192		1.0			sv 🛛	Not	Ohs	V D	No	t Vi	sihle	- R	acr		-	1	-
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13.70	0930	RB PUL			Percer	ntaq	e of	Bed	Acti	ve:			-				%	
		NO UN			Veloc	ity					-							
			RIAN STOR		Mea	asur	ed	0,0	150	m/	s M	etho	d:	w	B			
					D Esti	imat	ed _			m/	s X	S ID		(5)	8			
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				 -	Depth		/	m	Wi	dth				m \	/60			m/s
					Depth		1	m	Wi	dth				n \	/60			,s
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Appendix C Detailed Field Assessment Summaries

Detailed Geomorphological Assessment Summary East Ponds Outlet Channel

Project Number:	PN24061			Date:	2024-0)7-24	
Client:	Votorantim	Cimentos		Length Surveyed (m):	30.8		
Location:	Caledon, O	N		# of Cross-Sections:	3		
Reach Characterist	ics						
Drainage Area:		0.162	km ²	Dominant Riparian Vegetation T	ype:	Coniferous T	Frees
Geology/Soils:		Glaciofluvia	I Deposits	Extent of Riparian Cover:		Continuo	us
Surrounding Land Use	:	Forest / Go	olf Course	Width of Riparian Cover:		4-10 Channel	Widths
Valley Type:		Confi	ned	Age Class of Riparian Vegetation	n:	Established - I	Mature
Dominant Instream Ve	egetation Type:	Not App	licable	Extent of Encroachment into Ch	annel:	Minimal	l
Portion of Reach with	Vegetation:	Not App	licable	Density of Woody Debris:		Low	
Hydrology							
Measured Discharge (m³/s):	0.C)1	Calculated Bankfull Discharge (m³/s):	0.6	8
Modelled 2-year Disch	arge (m³/s):	Not mo	delled	Calculated Bankfull Velocity (m.	/s):	0.8	36
Modelled 2-year Veloc	sity (m∕s):	Not mo	delled				
Profile Characteris	tics			Planform Characteristic	S		
Bankfull Gradient ((%):	0.7	/1	Sinuosity:		1.10	
Channel Bed Gradie	ent (%):	0.1	4	Meander Belt Width (m):			
Riffle Gradient (%)):			Radius of Curvature (m):		Not Applic	able
Riffle Length (m):		No Riffle Mo	orphology	Meander Amplitude (m):			
Riffle-Pool Spacing	ı (m):			Meander wavelength (m)):		
Longitudinal Drafil	_						
Longituumai Prom	e						
			Distar	nce (m)			
0	5	10	15	20 25		30	35
0.0	I	I		1		<u> </u>	
C 0.4							
<u> </u>				Bankfull Level			
	•			↓			
≥ 1.2		Water Level		•			
1.8				Channel Bed			
Bank Characteristi	<u></u>						
Darik Characteristi	63						
	Minimum	Maximum	Average		Minimum	Maximum	Average
Bank Height (m):	1.95	2.50	2.13				
Bank Angle (deg):	40	70	52	Torvane Value (kg/cm ²):	0.3	0.3	0.3
Root Depth (m):	1.00	1.00	1.00	Penetrometer Value (kg/cm ³):	1.5	2.5	2.1
Root Density (%):	10	15	12	Bank Material (range):	S	Sand, Silt, Cobble	es
Bank Undercut (m):	0	0.06	0.02				

Cross-Sectional Characteristics

	Minimum	Maximum	Average	
Bankfull Width (m):	2 35	2.65	2 5 3	
Avorago Bankfull Donth (m):	0.27	0.35	0.31	
Rankfull Width (Dopth (m/m))	7.5	9.6	8.2	
Ballkiuli Width/Deptil (III/III):	7.5	9.0	1.54	
wetted width (m):	0.87	2.13	1.50	
Average Water Depth (m):	0.05	0.10	0.07	Service States
Wetted Width/Depth (m/m):	19.1	25.6	22.1	
Entrenchment (m):		Entrenched		
Entrenchment Ratio (m/m):		(ER < 1.4)		
Maximum Water Depth (m):	0.11	3.75	1.34	
Manning's <i>n</i> :		0.045		



Photograph at cross section 2 (looking upstream)



Channel Thresholds			
Flow Competency (m/s):		Tractive Force at Bankfull (N/m ²):	21.63
for D ₅₀ :	0.59	Tractive Force at 2-year flow (N/m ²):	Not modelled
for D ₈₄ :	1.18	Critical Shear Stress (D ₅₀) (N/m ²):	7.83
Unit Stream Power at Bankfull (W/m ²):	18.57		

General Field Observations

Channel Description

The East Ponds Outlet Channel is a minor, ~35m tributary of the Credit River in Caledon, ON which conveys flows from the southeast side of the Osprey Valley Golf Course (OVGC) through a series of inline ponds, and into the mainstem of the Credit River. During the time of assessment, water was observed overtopping the banks of the nearest upstream inline pond, permitting flow through the subject reach, with no flow observed from the outflanked tile drain. The subject reach consisted of a straight channel within a confined, forested valley with a prominent knickpoint (~0.75m) at the upstream extent, revealing the exposed tile. Channel bed morphology was notably homogeneous downstream of the knickpoint and was planar in profile; however, channel substrates became gradually finer downstream, with materials consisting of sand and small to large cobbles (Embeddedness: 10-40%; D₅₀: 10.8 mm). The channel exhibited multiple indicators suggestive of aggradation, widening and degradation. Aggradation processes were supported by the observed sediment accumulation at the downstream extent, but was ultimately secondary to widening and degradational processes. These processes were evidenced by the persistent scour and exposed roots observed along the toe of the valley wall, as well as the exposed tile drainage.






Detailed Geomorphological Assessment Summary

Credit	River	at	Fast	Ponds	Outlet	Channe
CIEUII	RIVEL	αι	Lasi	r unus	Outlet	Channe

Project Number:	PN24061	Date:	2024-07-25
Client:	Votorantim Cimentos	Length Surveyed (m):	403.4
Location:	Caledon, ON	# of Cross-Sections:	8

Reach Characteristics					
Drainage Area:	150.51 km ²	Dominant Riparian Vegetation Type:	Coniferous Trees		
Geology/Soils:	Glaciofluvial and Organic Deposits	Extent of Riparian Cover:	Continuous		
Surrounding Land Use:	Forest / Golf Course	Width of Riparian Cover:	>10 Channel Widths		
Valley Type:	Partially Confined	Age Class of Riparian Vegetation:	Established - Mature		
Dominant Instream Vegeta	tion Type: N/A	Extent of Encroachment into Channel:	Minimal		
Portion of Reach with Vegetation: N/A		Density of Woody Debris:	Moderate		

Hydrology			
Estimated Discharge (m ³ /s):	0.547	Estimated Bankfull Discharge (m ³ /s):	14.75
Modelled 2-year Discharge (m ³ /s):	11.32	Estimated Bankfull Velocity (m/s):	1.02
Modelled 2-year Velocity (m/s):	1.46		

Profile Characteristics		Planform Characteristics	
Bankfull Gradient (%):	0.20	Sinuosity:	1.18
Channel Bed Gradient (%):	0.38	Meander Belt Width (m):	See Report
Riffle Gradient (%):	0.50	Radius of Curvature (m):	150.2
Riffle Length (m):	96.42	Meander Amplitude (m):	201.5
Riffle-Pool Spacing (m):	176.03	Meander Wavelength (m):	627.9

Longitudinal Profile

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Bank Characteristics Average Minimum Maximum Average Minimum Maximum Bank Height (m): 1.35 2.75 1.87 0.25 2.5 Penetrometer Value (kg/cm3): 1.4 Bank Angle (deg): 15 90 62 Bank Material (range): Clay, Silt, Sand, Cobbles Root Depth (m): 0.50 1.50 1.06 Root Density (%): 15 40 33 0.82 0.28 Bank Undercut (m): 0.00

Cross-Sectional Characteristics





Photograph at cross section 1 (looking downstream)





Channel Thresholds			
Flow Competency (m/s):		Tractive Force at Bankfull (N/m ²):	20.47
for D ₅₀ :	0.89	Tractive Force at 2-year flow (N/m ²):	17.43
for D ₈₄ :	1.33	Critical Shear Stress (D ₅₀) (N/m ²):	19.08
Unit Stream Power at Bankfull (W/m ²):	26.84		

General Field Observations

Channel Description

The assessed stretch of channel consisted of ~400m of the Credit River in Caledon, ON, receiving inputs from the East Ponds Outlet Channel originating from the Osprey Valley Golf Course (OVGC). The Credit River was characterized by a meandering channel set within a forested corridor. Dominant riparian vegetation consisted of coniferous trees which provided good cover over the channel and stability to the loosely consolidated, sandy-silt banks. Channel bed morphology demonstrated notable heterogeneity and was characterized by an alternating rifflepool sequence featuring abundant micro-habitats/refugia. Widening processes were evidenced by fallen and leaning trees, as well as bank scour, while evidence of planimetric form adjustment was observed by an occasionally misaligned thalweg in straight sections of channel. Significant valley wall contact was observed along both banks, particularly upstream from the confluence with the East Ponds Outlet Channel. Despite steady inputs of sand and silt due to the described bank scour, aggredational processes were less significant as stream conditions were sufficient in preventing the formation of in-channel bars and embedment of larger substrates that would otherwise be Cross Section 2 - Facing Upstream



GEO

Detailed Geomorphological Assessment Summary Reach __Trib 4____

-							
Project Number:	PN 24061			Date:	2024	-07-23	
Client:	Votorantim	Climentos		Length Surveyed (m):	98.5		
Location:	Caledon, O	N		# of Cross-Sections:	6		
Reach Characteris	stics						
Drainage Area:	2:	28.5 ha		Dominant Riparian Vegetation T	ype:	Coniferous trees	
Geology/Soils:	G	laciofluvial depos	sits	Extent of Riparian Cover:		Continuous	
Surrounding Land Us	se: G	olf course/forest	ed	Width of Riparian Cover:		>10 channel width	าร
Valley Type:	U	nconfined		Age Class of Riparian Vegetation	า:	Mature	
Dominant Instream	Vegetation Type	Rooted eme	rgent	Extent of Encroachment into Cha	annel:	Heavy	
Portion of Reach wit	h Vegetation:	50%		Density of Woody Debris:		High	
Hydrology							
Measured Discharge	(m ³ /s):	Stagnan	t water	Calculated Bankfull Discharge (r	m³/s):	0.4	14
Modelled 2-year Disc	charge (m³/s):	Data not a	available	Calculated Bankfull Velocity (m/	/s):	0.7	75
Modelled 2-year Velo	ocity (m/s):	Data not a	available				
Profile Characteri	stics			Planform Characteristics	S		
Bankfull Gradient	(%):	0.5	57	Sinuosity:		1.34	
Channel Bed Grad	lient (%):	0.96		Meander Belt Width (m):		Not modelled	
Riffle Gradient (%	6):	N7.	A	Radius of Curvature (m):		80.2	<u>)</u>
Riffle Length (m)	:	N7.	A	Meander Amplitude (m):		157	
RITTIE-POOI Spacin	ng (m):	187.	A	Meander Wavelength (m)	•	259	
Longitudinal Prof	ilo						
Longitudinari rol	ne						
			Dista	nce (m)			
0	10	20	30	40 50		60	70
1.1	Bankfull Level	•	Water Leve				
Ê 1.2	•						
<u> </u>				\sim			
0 1.5 1.6		\sim	\frown /				
	\checkmark	•					
LI 1.8 1.9		(Channel Bed				
2.0							
Bank Characterist	tics						
Barile on a deterns							
	Minimum	Maximum	Average		Minimum	n Maximum	Average
Bank Height (m):	0.31	0.58	0.45	2		<i>c</i> -	
Bank Angle (deg):	15	45	27	Torvane Value (kg/cm ²):	0.3	0.3	0.3
Root Depth (m):	0.15	0.80	0.30	Penetrometer Value (kg/cm ³):	0.3	0.3	0.3
Root Density (%):	10	N/A	18	Bank Material (range):			
Bank Undercut (m):	0	0	0.00				

Cross-Sectional Characteristics

	Minimum	Maximum	Average
Bankfull Width (m):	2.25	6.73	2.89
Average Bankfull Depth (m):	0.12	0.30	0.20
Bankfull Width/Depth (m/m):	13	23	19
Wetted Width (m):	0.00	3.20	1.04
Average Water Depth (m):	0.01	0.08	0.05
Wetted Width/Depth (m/m):	6	276	60
Entrenchment (m):		Low entrenchm	ent
Entrenchment Ratio (m/m):		(ER > 2.2)	
Maximum Water Depth (m):	0.05	0.15	0.08
Manning's <i>n</i> :		0.045	



Photograph at cross section 5 (looking downstream)

Representative Cross-Section #5



Substrate Characteristics Till Particle Size (mm) Subpavement: Sub-angular D₁₀ : <2 Particle shape: 2.0 20-80 D₅₀ : Embeddedness (%): D₈₄ : 22.6 N/A Particle range (riffle): Sand - cobbles Particle Range (pool): Cumulative Particle Size Distribution 100 90 80 70 Percent finer 60 50 40 30 20 10 0 -10 100 1000 1 Grain size (mm)

Channel Thresholds			
Flow Competency (m/s):		Tractive Force at Bankfull (N/m ²):	19.01
for D ₅₀ :	0.27	Tractive Force at 2-year flow (N/m ²):	Data not available
for D ₈₄ :	0.83	Critical Shear Stress (D ₅₀) (N/m ²):	1.46
Unit Stream Power at Bankfull (W/m ²):	14.24		

General Field Observations

Channel Description

Tributary 4 flows unconfined northwest through a golf course before discharging to the Credit River upstream of the **East Ponds Outlet Channel**. At time of assessment, the channel was predominantly dry with some flow occurring within isolated pools. The riparian zone was continuous, spanning over 10 channel widths and consists of mature vegetation. Heavy encroachment of vegetation into the channel was observed, along with a high density of woody debris. Rooted emergent aquatic vegetation was also present at time of assessment. Bank angles range from 15-45, with no undercutting observed. The right and left bank consisted primarily of very fine to medium sand, with a small percentage of coarse sand, gravel and small stones. The bed was composed of medium to very coarse sand, with small to large cobbles observed throughout the extent of the channel.

Cross Section 3 - Facing Downstream





Detailed Geomorphological Assessment Summary

Credit River at Tributary 4

Project Number:	PN24061	Date:	2024-07-25
Client:	Votorantim Cimentos	Length Surveyed (m):	450.0
Location:	Caledon, ON	# of Cross-Sections:	8

Reach Characteristics					
Drainage Area:	147.5 km ²	Dominant Riparian Vegetation Type:	Coniferous Trees		
Geology/Soils:	Glaciofluvial and Organic Deposits	Extent of Riparian Cover:	Continuous		
Surrounding Land Use:	Forest / Golf Course	Width of Riparian Cover:	>10 Channel Widths		
Valley Type:	Partially Confined	Age Class of Riparian Vegetation:	Established - Mature		
Dominant Instream Vegetat	tion Type: N/A	Extent of Encroachment into Channel:	Minimal		
Portion of Reach with Vegetation: N/A		Density of Woody Debris:	Moderate		

Hydrology			
Estimated Discharge (m ³ /s):	0.450	Estimated Bankfull Discharge (m ³ /s):	8.95
Modelled 2-year Discharge (m ³ /s):	11.32	Estimated Bankfull Velocity (m/s):	0.92
Modelled 2-year Velocity (m/s):	1.46		

Profile Characteristics		Planform Characteristics	
Bankfull Gradient (%):	0.08	Sinuosity:	1.13
Channel Bed Gradient (%):	0.30	Meander Belt Width (m):	See Report
Riffle Gradient (%):	0.50	Radius of Curvature (m):	133.1
Riffle Length (m):	113.42	Meander Amplitude (m):	116.6
Riffle-Pool Spacing (m):	93.27	Meander Wavelength (m):	557.2

Longitudinal Profile

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Bank Characteristics Minimum Maximum Average Maximum Average Minimum Bank Height (m): 0.63 0.90 0.78 0.25 2.5 1.4 Penetrometer Value (kg/cm3): Bank Angle (deg): 15 85 50 Bank Material (range): Clay, Silt, Sand Root Depth (m): 0.10 0.50 0.33 Root Density (%): 10 30 15 0.30 0.07 Bank Undercut (m): 0.00

Cross-Sectional Characteristics



Channel Thresholds					
Flow Competency (m/s):		Tractive Force at Bankfull (N/m ²): 19.40			
for D ₅₀ :	0.91	Tractive Force at 2-year flow (N/m ²):	17.43		
for D ₈₄ :	1.34	Critical Shear Stress (D ₅₀) (N/m ²):	20.32		
Unit Stream Power at Bankfull (W/m ²):	23.03				

General Field Observations

Channel Description

The assessed stretch of channel consisted of ~450m of the Credit River in Caledon, ON, receiving inputs from Tributary 4 from the Osprey Valley Golf Course (OVGC). The Credit River at Tributary 4 was characterized by a meandering channel set within an expansive, forested corridor, with localized pockets of meadow habitat. Dominant riparian vegetation consisted of coniferous trees which provided good cover over the channel and stability to the loosely consolidated, sandy-silt banks. Channel bed morphology demonstrated notable heterogeneity and was characterized by an alternating riffle-pool sequence featuring abundant micro-habitats/refugia. Widening processes were evidenced by fallen and leaning trees, as well as bank scour, while evidence of planimetric form adjustment was observed by an occasionally misaligned thalweg in straight sections of channel, and formation of several islands. The upstream extent of the channel was marked by a debris jam resulting in multiple flow paths and sediment accumulation. Aggradational processes within the channel were limited due to sufficient flow conditions allowing for transport of the fine sediment input from the eroded/undercut banks.



Cross Section 6 - Facing Upstream