Appendix A: CLI ECA Appendix A

Appendix A – Stormwater Management Criteria

1.0 Applicability of Criteria

1.1 The criteria listed under Table A1 of this Appendix applies to all drainage areas greater than 0.1 ha, with the construction erosion and sediment control criteria applying also to sites <0.1 ha;

1.2 Despite condition 1.1 of Appendix A, if some or all of the criteria listed under Table A1 of this Appendix have been assessed for and addressed in other adjacent developed lands to the project site through a subwatershed plan or equivalent study, then those criteria may not be applicable to the project site.

Table A1. Performance Criteria

Water Balance [1]	**FOR DEVELOPMENT SCENARIOS** [2] **Assessment Studies:** i) Control [3] as per the criteria identified in the water balance assessment completed in one or more of the following studies [15], if undertaken: a watershed/subwatershed plan; Source Protection Plan (Assessment Report component); Master Stormwater Management Plan, Master Environmental Servicing Plan; Class EA, or similar approach that transparently considers social, environmental and financial impacts; or local site study including natural heritage, Ecologically significant Groundwater Recharge Areas (EGRA), inflow and infiltration strategies. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; OR **IF Assessment Studies in i) NOT completed:** ii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iii) Control [3] the runoff from the 90th percentile storm event. **Lake Simcoe Watershed Municipalities:** iv) Control [3] as per the evaluation of anticipated changes in water balance between Pre-development and post-development assessed through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If it is demonstrated, using the approved water balance estimation methods **[7]**, that the site's post to Pre-development water balance cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use Lake Simcoe and Region Conservation Authority's (LSRCA) Recharge Compensation Program [9]. **FOR RETROFIT SCENARIOS** [10] **Assessment Studies:** i) Control as per criteria identified in the water balance assessment completed in one or more of the following studies: a watershed/subwatershed

	plan, Source Protection Plan (Assessment Report component), Master Stormwater Management Plan, Master Environmental Servicing Plan, Class EA, or local site study including natural heritage, EGRA, inflow and infiltration strategies, if undertaken. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; **OR** ii) If constraints [11] identified in i), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14]. **IF Assessment Studies in i) NOT completed:** iii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iv) Control [3] the runoff from the 90th percentile storm event.
Water Quality [1]	**FOR DEVELOPMENT SCENARIOS** [2] All of the following criteria must be met for development scenarios: **General:** i) Characterize the water quality to be protected and Stormwater Contaminants (e.g., suspended solids, nutrients, bacteria, water temperature) for potential impact on the Natural Environment, and control as necessary, **OR** ii) As per the watershed/subwatershed plan, similar area-wide Stormwater study, or Stormwater management plan to minimize, or where possible, prevent increases in Contaminant loads and impacts to receiving waters. **Suspended Solids:** i) Control [3] 90th percentile storm event and if conventional methods are necessary, then enhanced, normal, or basic levels of protection (80%, 70%, or 60% respectively) for suspended solids removal (based on the receiver). **Phosphorus:** i) Minimize existing phosphorus loadings to Lake Erie and its tributaries, as compared to 2018 or conditions prior to the proposed development, **OR** ii) Minimize phosphorus loadings to Lake Simcoe and its tributaries. Proponents with development sites located in the Lake Simcoe watershed shall evaluate anticipated changes in phosphorus loadings between Pre-development and post-development through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If, using the approved phosphorus budget tool [12], it is demonstrated that the site's post to Pre-development phosphorus budget cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use LSRCA's Phosphorus Offsetting Policy [9]. **FOR RETROFIT SCENARIOS** [10] i) Improve the level of water quality control currently provided on site; **AND** ii) As per the 'Development' criteria for Suspended Solids, **OR** iii) **If 'Development' criteria for Suspended Solids cannot be met**, Works are designed as a multi-year retrofit project, in accordance with a rehabilitation study or similar area-wide Stormwater study, such that the completed treatment train will achieve the 'Development' criteria for

	Suspended Solids or local needs[14], within ten (10) years; **OR** iv) If constraints [11] identified in ii) and iii), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies.
Erosion Control (Watershed) [1]	**FOR DEVELOPMENT SCENARIOS** [8] i) As per erosion assessment completed in watershed/subwatershed plan, Master Stormwater Management Plan, Master Environmental Servicing Plan, Drainage Plan, Class EA, local site study, geomorphologic study, or erosion analysis; **OR** ii) As per the Detailed Design Approach or Simplified Design Approach methods described in the Stormwater Management Planning and Design Manual: a. The Detailed Design Approach may be selected by the proponent for any development regardless of size and location within the watershed provided technical specialists are available for the completion of the technical assessments; or considered more appropriate than the simplified approach given the size and location of the development within the watershed and the sensitivity of the receiving waters in terms of morphology and habitat function. b. The Simplified Design Approach may be adopted for watersheds whose development area is generally less than twenty hectares AND either one of the following two conditions apply: 1) The catchment area of the receiving channel at the point-of-entry of Stormwater drainage from the development is equal to or greater than twenty-five square kilometres; or 2) Meets the following conditions: • The channel bankfull depth is less than three quarters of a metre; • The channel is a headwater stream; • The receiving channel is not designated as an Environmentally Sensitive Area (ESA) or Area of Natural or Scientific Interest (ANSI) and does not provide habitat for a sensitive aquatic species; • The channel is stable to transitional; and • The channel is slightly entrenched; **OR** iii) In the absence of a guiding study, detain at minimum, the runoff volume generated from a 25 mm storm event over 24 to 48 hours. **FOR RETROFIT SCENARIOS** [10] i) If approaches i-iii) under ‘Development Scenarios’ are not feasible as per identified constraints [11], then improve the level of erosion control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14].
Water Quantity (Minor and Major System) [1]	**i)** As per municipal standards, Master Stormwater Management Plan, Class EA, Individual EA and/or ECA, as appropriate for the type of project [13]
Flood Control (Watershed Hydrology) [1]	**FOR DEVELOPMENT SCENARIOS** [2] i) Manage peak flow control as per watershed/subwatershed plans, municipal criteria being a minimum 100 year return storm (except for site-specific considerations and proximity to receiving water bodies), municipal guidelines and standards, Individual/Class EA, ECA, Master Plan,

	as appropriate for the type of project [13]. **FOR RETROFIT SCENARIOS** [10] i) If approaches i) under 'Development Scenarios' are not feasible as per identified constraints [11], then improve the level of flood control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies.
Construction Erosion and Sediment Control	i) Manage construction erosion and sediment control through development and implementation of an erosion and sediment control (ESC) plan. The ESC plan shall: a. Have regard to Canadian Standards Association (CSA) W202 Erosion and Sediment Control Inspection and Monitoring Standard (as amended); OR b. Have regard to Erosion and Sediment Control Guideline for Urban Construction 2019 by TRCA (as amended). ii) Be prepared by a QP for sites with drainage areas greater than 5 ha or if specified by the Owner for a drainage lower than 5 ha. iii) Installation and maintenance of the ESC measures specified in the ESC plan shall have regard to CSA W208:20 Erosion and Sediment Control Installation and Maintenance (as amended). iv) For sites with drainage areas greater than 5 ha, a QP shall inspect the construction ESC measures, as specified in the ESC plan.
Footnote	1. Where the opportunity exists on your project site or the same subwatershed, reallocation of development elements may be optimal for management as described in footnote [3]. 2. Development includes new development, redevelopment, infill development, or conversion of a rural cross-section into an urban cross-section. 3. Stormwater volumes generated from the geographically specific 90th percentile rainfall event on an annual average basis from all surfaces on the entire site are targeted for control. Control is in the following hierarchical order, with each step exhausted before proceeding to the next: 1) retention (infiltration, reuse, or evapotranspiration), 2) LID filtration, and 3) conventional Stormwater management. Step 3, conventional Stormwater management, should proceed only once Maximum Extent Possible [8] has been attained for Steps 1 and 2 for retention and filtration. 4. Recharge is the infiltration and movement of surface water into the soil, past the vegetation root zone, to the zone of saturation, or water table. 5. Pre-development is defined as the more stringent of the two following scenarios: 1) a site's existing condition, or 2) as defined by the local municipality. 6. Major Development has the same meaning as in the Lake Simcoe Protection Plan, 2009. 7. Currently, the approved tool by LSRCA for calculating the water balance is the Thornthwaite-Mather Method. Other tools agreed upon by relevant approval agencies (e.g., LSRCA, municipality, or Ministry) may also be acceptable, subject to written acceptance by the Director. 8. Maximum Extent Possible means maximum achievable Stormwater volume control through retention and LID filtration engineered/landscaped/technical Stormwater practices, given the site constraints [11]. 9. Information pertaining to LSRCA's Recharge Compensation Program and Phosphorus Offsetting Policy is available on LSRCA's website (lsrca.on.ca), or in "Water Balance Recharge Policy for the Lake Simcoe Protection Plan", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority and "Phosphorus Offsetting Policy", dated July 2021, and prepared by Lake Simcoe Region Conservation

	Authority. 10. Retrofit means: 1) a modification to the management of the existing infrastructure, 2) changes to major and minor systems, or 3) adding Stormwater infrastructure, in an existing area on municipal right-of-way, municipal block, or easement. It does not include conversion of a rural cross-section into an urban cross-section. 11. Site constraints must be documented. A list of site constraints can be found in Table A2. 12. Tools for calculating phosphorus budgets may include the Ministry's Phosphorus Tool, the Low Impact Development Treatment Train Tool developed in partnership by TRCA, LSRCA, and Credit Valley Conservation (CVC), or other tools agreed upon by the LSRCA and other relevant approval agencies including the municipality. 13. Possible to look at combined grey infrastructure and LID system capacity jointly. 14. Local needs include requirements for water quality, erosion, and/or water balance retrofits identified by the owner through ongoing operation and maintenance of the stormwater system, including inspection of local receiving systems and the characterization of issues requiring remediation through retrofit controls. 15. All studies shall conform with Ministry policies. If any conclusions in the studies negate policy, then the project will require a direct submission to the Ministry for review through an application pertaining to a Schedule C Notice.

Table A2. Stormwater Management Practices Site Constraints

	Site Constraints
a)	Shallow bedrock [1], areas of blasted bedrock [2], and Karst;
b)	High groundwater [1] or areas where increased infiltration will result in elevated groundwater levels which can be shown through an appropriate area specific study to impact critical utilities or property (e.g., susceptible to flooding);
c)	Swelling clays [3] or unstable sub-soils;
d)	Contaminated soils (e.g., brownfields);
e)	High Risk Site Activities including spill prone areas;
f)	Prohibitions and or restrictions per the approved Source Protection Plans and where impacts to private drinking water wells and /or Vulnerable Domestic Well Supply Areas cannot be appropriately mitigated;
g)	Flood risk prone areas or structures and/ or areas of high inflow and infiltration (I/I) where wastewater systems (storm and sanitary) have been shown through technical studies to be sensitive to groundwater conditions that contribute to extraneous flow rates that cause property flooding / Sewer back-ups;
h)	For existing municipal rights-of-way infrastructure (e.g., roads, sidewalks, utility corridor, Sewers, LID, and trails) where reconstruction is proposed and where surface and subsurface areas are not available based on a site-specific assessment completed by a QP;
i)	For developments within partially separated wastewater systems where reconstruction is proposed and where, based on a site-specific assessment completed by a QP, can be shown to: i Increase private property flood risk liabilities that cannot be mitigated through design;

	ii Impact pumping and treatment cost that cannot be mitigated through design; or iii Increase risks of structural collapse of Sewer and ground systems due to infiltration and the loss of pipe and/or pavement support that cannot be mitigated through design.
j)	Surface water dominated or dependent features including but not limited to marshes and/or riparian forest wetlands which derive all or a majority of their water from surface water, including streams, runoff, and overbank flooding. Surface water dominated or dependent features which are identified through approved site specific hydrologic or hydrogeologic studies, and/or Environmental Impact Statements (EIS) may be considered for a reduced volume control target. Pre-consultation with the MECP and local agencies is encouraged;
k)	Existing urban areas where risk to water distribution systems has been identified through assessments to meet applicable drinking water requirements, including Procedures F-6 and F-6-1, and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
l)	Existing urban areas where risk to life, human health, property, or infrastructure has been is identified and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
m)	Water reuse feasibility study has been completed to determine non-potable reuse of Stormwater for onsite or shared use;
n)	Economic considerations set by infrastructure feasibility and prioritization studies undertaken at either the local/site or municipal/system level [4].

Footnote:

1. May limit infiltration capabilities if bedrock and groundwater is within 1m of the proposed Facility invert per Table 3.4.1 of the LID Stormwater Planning and Design Guide (2010, V1.0 or most recent by TRCA/CVC). Detailed assessment or studies are required to demonstrate infiltration effects and results may permit relaxation of the minimum 1m offset.
2. Where blasting is more localized, this constraint may not be an issue elsewhere on the property. While infiltration-based practices may be limited in blasted rock areas, other forms of LID, such as filtration, evapotranspiration, etc., are still viable options that should be pursued.
3. Swelling clays are clay soils that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content.
4. Infrastructure feasibility and prioritization studies should comprehensively assess Stormwater site opportunities and constraints to improve cost effectiveness, environmental performance, and overall benefit to the receivers and the community. The studies include assessing and prioritizing municipal infrastructure for upgrades in a prudent and economically feasible manner.

Appendix B: Landowner Access Letter

BRANTFORD
PUBLIC WORKS

November 3, 2021

Notice of Temporary Access
Environmental Field Investigations- North Brantford and Tutela Heights Subwatershed Study Update - Phase 2

Dear Resident/ Land Owner \ Business Owner/ Tenant/ Agency:

The City of Brantford has initiated the above-noted project to minimize the negative impacts of flooding and stormwater movement, improve safety, preserve local character, and protect the natural environment, water resource system, environmental features, including the quality and quantity of water in North Brantford and Tutela Heights lands. A Draft Subwatershed Study was completed in 2020, which provided the foundation of Phase 2 of the current Subwatershed Study Update. The results of this updated study will protect and enhance the ecological processes, functions, and significant natural features of the area in a manner that is environmentally sound, and socially and environmentally sustainable.

For the purposes of the above-noted project, we seek your permission to occasionally access your property to undertake environmental field works, and Stream Surveying and Assessment, which may involve the installation of stream flow monitors (loggers) during the period from fall 2021 to fall 2022.

Aquafor Beech Limited is the consultant retained by the City to undertake the above-noted project. The consultant will take all measures to ensure no damage occurs to the property or any crops and the stream during the field visits.

The field crew would consist of 2-4 individuals, depending on the activity being completed. The team will carry with them a photo ID and a copy of this letter.

We ask that you read, sign and return the enclosed Consent to Enter Form provided with this letter as soon as possible to indicate that your permission to access the property is either granted or denied.

For your convenience, a postage paid addressed envelope has also been enclosed; or, alternately, you may respond via email at nghbn@brantford.ca to indicate that your permission to access the property is either granted or denied.

If you have any concerns or questions about potential access to your property by the consulting team as described above, please contact Nahed Ghbn via email at nghbn@brantford.ca.

The City of Brantford appreciates your cooperation in this matter.

Yours truly,

Wendy Teufel
Manager, Design and Construction, Engineering Services

cc:
Inderjit Hans, P.Eng., PMP, General Manager, Public Works Commission
Nahed Ghbn, P. Eng., Senior Project Manager, Engineering Services

BRANTFORD
PUBLIC WORKS

Consent to Enter Form

North Brantford and Tutela Heights Subwatershed Study Update - Phase 2

PLEASE CHECK ONE OF THE FOLLOWING:

☐ I/we understand the letter, dated November 3, 2021, from The Corporation of the City of Brantford, regarding Notice of Occasional Access to Property in the New North Brantford and Tutela Heights Lands AND give permission to the City of Brantford and Aquafor Beech team to access my/our property for the purposes outlined in the attached letter.

☐ I/we do not agree to give access to my/our property in regards to the stream flow monitoring.

PROPERTY OWNER INFORMATION:

Name:

____

Full mailing address:

____
Street Address

____
Postal Code | Telephone Number | Email

Property Address(es)
(If different from mailing address):

____

____

Signature **Date**

Please kindly return by mail using the enclosed addressed envelope to:
Nahed Ghbn P.Eng, City of Brantford
City Hall, 58 Dalhousie Street, Brantford, Ontario N3T 2J2
Tel: 519-759-4150 ext. 5262
By Email: nghbn@brantford.ca

Please let us know of any site hazards that you are aware of (e.g., livestock, dogs, and electrified fences).

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Appendix C: Rapid Geomorphic Assessment

Watercourse:

Reach boundaries? LF TRIB B

Form/ Process	Geomorphic Indicator no.	Description	Present No	Present Yes	FactorValue
			n/a	n/a	
Evidence of Aggradation (AI)	1	Lobate bar	✓		3/7 = 0.429
	2	Coarse material in riffle embedded	1	✓	
	3	Siltation in pools	1	✓	
	4	Medial bars	✓	1	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓ 1	
	7	Deposition in overbank zone	✓	1	
Evidence of Degradation (DI)	1	Exposed bridge footings	✓		0/10 = 0
	2	Exposed sanitary/storm sewer/pipeline etc	✓		
	3	Elevated stormsewer outfall	✓		
	4	undermined gabion basket/concrete apron/etc	✓		
	5	Scour pools d/s of culverts/stormsewers	✓		
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material	✓		
	9	Suspended armor layer visible in bank	✓		
	10	Channel worn into undisturbed overburden/bedrock	✓		
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc		✓	4/9 = 0.444
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends	✓		
	5	Basal scour on both sides of channel through riffle	✓		
	6	Gabion baskets/concrete walls/armour stone etc. out flanked	✓		
	7	Length of basal scour > 50% through subject reach	✓		
	8	Exposed length of previously buried pipe/cable etc.	✓		
	9	Fracture lines along top of bank		✓	
	~~10~~	~~Exposed building foundation~~			
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	✓		2/7 = 0.286
	2	Evolution of single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cutoff channel(s)	✓		
	5	Formation of island(s)	✓		
	6	Thalweg alignment out of phase with meander geometry		✓	
	7	Bar forms poorly formed/reworked/removed		✓	
Stability Index (SI) = (AI+DI+WI+PI)/m				SI = 1.159/4 = 0.29	

Where m=4, AI, DI, WI and PI arer the normalized values of the aggradation, degredation, width enlargemnet and planimetric indices, respectively. The normailzed value of each of the four FORM/PROCESS categories is computed as the sum of the GEMOGRAPHIC INDICATORS for which a Yes Determination is reported in the PRESENT colum divided by n=the number of GEOMORPHIC INDICATORS used for each index. If a GEOMORPHIC INDICATOR is not applicable note n/a opposite this INDICATOR in the PRESENT column and reduce n by 1. For example, if there are no bridges in the reach then GEOMORPHIC INDICATOR No.1 "exposed bridge footing(s)" under EVIDENCE OF DEGREDATION (DI) is not applicable and the observer should record as n/a opposite this INDICATOR, reduce n to 9 and move on to the next INDICATOR.

* Performed by Aquafor Beech Limited

Watercourse:

Reach boundaries? LB TRIB A

Form/ Process	Geomorphic Indicator no.	Description	Present No	Present Yes	FactorValue
Evidence of Aggradation (AI)	1	Lobate bar	n/a ✓	n/a	2/7 =0.286
	2	Coarse material in riffle embedded	✓ 1		
	3	Siltation in pools	1	✓	
	4	Medial bars	✓	1	
	5	Accretion on point bars	✓ 1		
	6	Poor longitudinal sorting of bed materials		✓ 1	
	7	Deposition in overbank zone	✓	1	
Evidence of Degradation (DI)	1	Exposed bridge footings	✓		1/10 =0.10
	2	Exposed sanitary/storm sewer/pipeline etc	✓		
	3	Elevated stormsewer outfall	✓		
	4	undermined gabion basket/concrete apron/etc	✓		
	5	Scour pools d/s of culverts/stormsewers	✓		
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material	✓		
	9	Suspended armor layer visible in bank	✓		
	10	Channel worn into undisturbed overburden/bedrock		✓	
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc		✓	5/9 =0.556
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle	✓		
	6	Gabion baskets/concrete walls/armour stone etc. out flanked	✓		
	7	Length of basal scour > 50% through subject reach	✓		
	8	Exposed length of previously buried pipe/cable etc.	✓		
	9	Fracture lines along top of bank		✓	
	~~10~~	~~Exposed building foundation~~			
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	✓		1/7 =0.143
	2	Evolution of single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cutoff channel(s)	✓		
	5	Formation of island(s)	✓		
	6	Thalweg alignment out of phase with meander geometry		✓	
	7	Bar forms poorly formed/reworked/removed	✓		
Stability Index (SI) = (AI+DI+WI+PI)/m				SI = 1.085/4 = 0.271	

Where m=4, AI, DI, WI and PI arer the normalized values of the aggradation, degredation, width enlargemnet and planimetric indices, respectively. The normailzed value of each of the four FORM/PROCESS categories is computed as the sum of the GEMOGRAPHIC INDICATORS for which a Yes Determination is reported in the PRESENT colum divided by n=the number of GEOMORPHIC INDICATORS used for each index. If a GEOMORPHIC INDICATOR is not applicable note n/a opposite this INDICATOR in the PRESENT column and reduce n by 1. For example, if there are no bridges in the reach then GEOMORPHIC INDICATOR No.1 "exposed bridge footing(s)" under EVIDENCE OF DEGREDATION (DI) is not applicable and the observer should record as n/a opposite this INDICATOR, reduce n to 9 and move on to the next INDICATOR.

* Performed by Aquafor Beech Limited

JC TRIB K - 1C

Watercourse: North Brantford – Powerline Rd & Memorial Dr

Reach boundaries? West Reach

Form/ Process	Geomorphic Indicator no.	Description	Present No	Present Yes	FactorValue
Evidence of Aggradation (AI)	1	Lobate bar	n/a	n/a ✓	3/7
	2	Coarse material in riffle embedded	✓ 1	✓	.4286
	3	Siltation in pools	1	✓	
	4	Medial bars	✓	1	
	5	Accretion on point bars	1	✓	
	6	Poor longitudinal sorting of bed materials	✗	1	
	7	Deposition in overbank zone	✓	1	
Evidence of Degradation (DI)	1	Exposed bridge footings	✓		3/10
	2	Exposed sanitary/storm sewer/pipeline etc	✓		0.30
	3	Elevated stormsewer outfall		✓	
	4	undermined gabion basket/concrete apron/etc	✓		
	5	Scour pools d/s of culverts/stormsewers		✓	
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material	✓		
	9	Suspended armor layer visible in bank	✓		
	10	Channel worn into undisturbed overburden/bedrock		✓	
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc		✓	5/9
	2	Occurrence of large organic debris		✓	0.5556
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends	✓		
	5	Basal scour on both sides of channel through riffle		✓	
	6	Gabion baskets/concrete walls/armour stone etc. out flanked	✓		
	7	Length of basal scour > 50% through subject reach		✓	
	8	Exposed length of previously buried pipe/cable etc.	✓		
	9	Fracture lines along top of bank	✓		
	~~10~~	~~Exposed building foundation~~	✓		← no building
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	✓		1/7
	2	Evolution of single thread channel to multiple channel	✓		0.1429
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cutoff channel(s)	✓		
	5	Formation of island(s)	✓		
	6	Thalweg alignment out of phase with meander geometry	✓		
	7	Bar forms poorly formed/reworked/removed	✓	✓	
Stability Index (SI) = (AI+DI+WI+PI)/m				SI = 1.43/4 = 0.357	

Where m=4, AI, DI, WI and PI arer the normalized values of the aggradation, degredation, width enlargemnet and planimetric indices, respectively. The normailzed value of each of the four FORM/PROCESS categories is computed as the sum of the GEMOGRAPHIC INDICATORS for which a Yes Determination is reported in the PRESENT colum divided by n=the number of GEOMORPHIC INDICATORS used for each index. If a GEOMORPHIC INDICATOR is not applicable note n/a opposite this INDICATOR in the PRESENT column and reduce n by 1. For example, if there are no bridges in the reach then GEOMORPHIC INDICATOR No.1 "exposed bridge footing(s)" under EVIDENCE OF DEGREDATION (DI) is not applicable and the observer should record as n/a opposite this INDICATOR, reduce n to 9 and move on to the next INDICATOR.

* Performed by Aquafor Beech Limited

Aquafor Beech Limited

Date JUNE 6, 2023

Reach SC-A

RAPID GEOMORPHIC ASSESSMENT

Watercourse: ~~SC-A~~ FAIRCHILD
Staff: SG + ML
Reach boundaries:

Form/ Process	Geomorphic Indicator no.	Description	Present: No	Present: Yes	FactorValue
Evidence of Aggradation (AI)	1	Lobate bar	✓		2/7 0.286
	2	Coarse material in riffle embedded	✓		
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in overbank zone	✓		
Evidence of Degradation (DI)	1	Exposed bridge footings	✓		2/10 0.2
	2	Exposed sanitary/storm sewer/pipeline etc	✓		
	3	Elevated stormsewer outfall	✓		
	4	undermined gabion basket/concrete apron/etc	✓		
	5	Scour pools d/s of culverts/stormsewers	✓		
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material	✓		
	9	Suspended armor layer visible in bank	✓		
	10	Channel worn into undisturbed overburden/bedrock		✓	
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc		✓	5/9 0.555
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle	✓		
	6	Gabion baskets/concrete walls/armour stone etc. out flanked	✓		
	7	Length of basal scour > 50% through subject reach	✓		
	8	Exposed length of previously buried pipe/cable etc.	✓		
	9	Fracture lines along top of bank		✓	
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	✓		2/7 0.286
	2	Evolution of single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cutoff channel(s)	✓		
	5	Formation of island(s)	✓		
	6	Thalweg alignment out of phase with meander geometry		✓	
	7	Bar forms poorly formed/reworked/removed		✓	
Stability Index (SI) = (AI+DI+WI+PI)/m				SI = 0.332	

Where m=4, AI, DI, WI and PI arer the normalized values of the aggradation, degredation, width enlargemnet and planimetric indices, respectively. The normailzed value of each of the four FORM/PROCESS categories is computed as the sum of the GEMOGRAPHIC INDICATORS for which a Yes Determination is reported in the PRESENT colum divided by n=the number of GEOMORPHIC INDICATORS used for each index. If a GEOMORPHIC INDICATOR is not applicable note n/a opposite this INDICATOR in the PRESENT column and reduce n by 1. For example, if there are no bridges in the reach then GEOMORPHIC INDICATOR No.1 "exposed bridge footing(s)" under EVIDENCE OF DEGREDATION (DI) is not applicable and the observer should record as n/a opposite this INDICATOR, reduce n to 9 and move on to the next INDICATOR.

Watercourse: FAIR CHILD

Reach boundaries? SC

Form/ Process	Geomorphic Indicator no.	Description	Present No	Present Yes	FactorValue
Evidence of Aggradation (AI)	1	Lobate bar	n/a	n/a	2/7
	2	Coarse material in riffle embedded	✓		
	3	Siltation in pools	✓		
	4	Medial bars		✓ 1	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓ 1	
	7	Deposition in overbank zone	✓		
Evidence of Degradation (DI)	1	Exposed bridge footings	✓		1/10
	2	Exposed sanitary/storm sewer/pipeline etc	✓		
	3	Elevated stormsewer outfall	✓		
	4	undermined gabion basket/concrete apron/etc	✓		
	5	Scour pools d/s of culverts/stormsewers	✓		
	6	Cut face on bar forms	✓		
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material	✓		
	9	Suspended armor layer visible in bank			
	10	Channel worn into undisturbed overburden/bedrock		✓	
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc		✓	5/9
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle	✓		
	6	Gabion baskets/concrete walls/armour stone etc. out flanked	✓		
	7	Length of basal scour > 50% through subject reach	✓		
	8	Exposed length of previously buried pipe/cable etc.	✓		
	9	Fracture lines along top of bank		✓	
	~~10~~	~~Exposed building foundation~~			
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	✓		2/7
	2	Evolution of single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form	✓		
	4	Cutoff channel(s)	✓		
	5	Formation of island(s)	✓		
	6	Thalweg alignment out of phase with meander geometry		✓	
	7	Bar forms poorly formed/reworked/removed		✓	
Stability Index (SI) = (AI+DI+WI+PI)/m	(0.286 + 0.1 + 0.556 + 0.286)/4			SI = 0.307	

Where m=4, AI, DI, WI and PI arer the normalized values of the aggradation, degredation, width enlargemnet and planimetric indices, respectively. The normaized value of each of the four FORM/PROCESS categories is computed as the sum of the GEMOGRAPHIC INDICATORS for which a Yes Determination is reported in the PRESENT colum divided by n=the number of GEOMORPHIC INDICATORS used for each index. If a GEOMORPHIC INDICATOR is not applicable note n/a opposite this INDICATOR in the PRESENT column and reduce n by 1. For example, if there are no bridges in the reach then GEOMORPHIC INDICATOR No.1 "exposed bridge footing(s)" under EVIDENCE OF DEGREDATION (DI) is not applicable and the observer should record as n/a opposite this INDICATOR, reduce n to 9 and move on to the next INDICATOR.

* Performed by Aquafor Beech Limited

Watercourse: NORTH BRANTFORD – Powerline Rd & Memorial Dr

Reach boundaries? West Reach JC TRIB K - 1A

Form/ Process	Geomorphic Indicator no.	Description	Present No	Present Yes	FactorValue
Evidence of Aggradation (AI)	1	Lobate bar	n/a	n/a ✓	
	2	Coarse material in riffle embedded	✓ 1		
	3	Siltation in pools	1	✓	3/7
	4	Medial bars	✓	1	.4286
	5	Accretion on point bars	✓ 1	✓	
	6	Poor longitudinal sorting of bed materials	✓	1	
	7	Deposition in overbank zone	✓	1	
Evidence of Degradation (DI)	1	Exposed bridge footings	✓		
	2	Exposed sanitary/storm sewer/pipeline etc	✓		
	3	Elevated stormsewer outfall		✓	
	4	undermined gabion basket/concrete apron/etc	✓		3/10
	5	Scour pools d/s of culverts/stormsewers		✓	
	6	Cut face on bar forms	✓		0.30
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material	✓		
	9	Suspended armor layer visible in bank	✓		
	10	Channel worn into undisturbed overburden/bedrock		✓	
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc		✓	
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends	✓		5/9
	5	Basal scour on both sides of channel through riffle		✓	
	6	Gabion baskets/concrete walls/armour stone etc. out flanked	✓		0.5556
	7	Length of basal scour > 50% through subject reach		✓	
	8	Exposed length of previously buried pipe/cable etc.	✓		
	9	Fracture lines along top of bank	✓		
	~~10~~	~~Exposed building foundation~~	✓		no building
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	✓		
	2	Evolution of single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form	✓		1/7
	4	Cutoff channel(s)	✓		
	5	Formation of island(s)	✓		0.1429
	6	Thalweg alignment out of phase with meander geometry	✓		
	7	Bar forms poorly formed/reworked/removed		✓	
Stability Index (SI) = (AI+DI+WI+PI)/m				SI =	1.43/4 = 0.357

Where m=4, AI, DI, WI and PI arer the normalized values of the aggradation, degredation, width enlargemnet and planimetric indices, respectively. The normailzed value of each of the four FORM/PROCESS categories is computed as the sum of the GEMOGRAPHIC INDICATORS for which a Yes Determination is reported in the PRESENT colum divided by n=the number of GEOMORPHIC INDICATORS used for each index. If a GEOMORPHIC INDICATOR is not applicable note n/a opposite this INDICATOR in the PRESENT column and reduce n by 1. For example, if there are no bridges in the reach then GEOMORPHIC INDICATOR No.1 "exposed bridge footing(s)" under EVIDENCE OF DEGREDATION (DI) is not applicable and the observer should record as n/a opposite this INDICATOR, reduce n to 9 and move on to the next INDICATOR.

* Performed by Aquafor Beech Limited