

Regional Monitoring Program - Fluvial Geomorphology Component

Etobicoke Creek, Mimico Creek and Humber River Watersheds



Etobicoke Creek at site GET-3, Etobicoke, Ontario

Submitted To: Toronto and Region Conservation Authority
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Introduction

The Greater Toronto Area (GTA) is situated in the lower portion of nine watersheds which drain into Lake Ontario. Due to the large volume of urbanization that has occurred within these watersheds, especially throughout the GTA, the watercourses are experiencing various degrees of stress. Understanding of existing conditions, normal variations, and long-term changes in the quality and characteristics of aquatic habitat is inhibited due to the limited information that is available and the lack of an on-going monitoring program. To track changes in physical habitat, the Toronto and Region Conservation Authority has initiated a long-term monitoring program. Since the physical form and function of a watercourse are key elements of aquatic habitat, the monitoring program includes a fluvial geomorphology component. The TRCA has committed to establishing 150 monitoring sites over a period of three years. PARISH Geomorphic Ltd. was retained to set up 50 sites in year one (2001) of the program.

Beginning at the west end of the GTA, the first fifty sites were established to monitor aquatic habitat along Etobicoke Creek, Mimico Creek, and the Humber River (Figures 1 and 2). At each site standard fluvial geomorphology measurement techniques were used to characterize channel form and benchmarks were set-up to enable repeated surveys within a 3-year period. The collected data were entered into a database (Access 2000) and for each site, a detailed map was created to identify locations of monitoring sites, erosion pins, bed chain and benchmarks. The following report presents an overview of the type and methodology of field data collection, historical assessments, recommendations for improving the Access Database, steps for future monitoring, channel stability scores and for improving future monitoring work are presented.

Field Site Selection

At the outset of the monitoring program, the Mimico, Etobicoke and Humber drainage networks were stratified into valley segments along all 3rd or larger order channels (see PARISH Geomorphic Ltd., July 23, 2001). Valley segments are relatively homogenous geomorphic units in which all controls and modifiers of channel and valley form and of channel characteristics are similar. In total, 140 valley segments were identified. To facilitate the selection of representative field sites, the segments were classified according to average grade and catchment area and then further grouped according to geologic materials (i.e., percentage of coarse-textured soil in the subwatershed area). As a result, the 140 reaches were distributed over a total of 19 classification

groupings (see **Figure 3 and 4**). To ensure that the field sites would adequately represent the variability that occurs within the GTA watershed areas, the process of site selection was guided by results of the classification groupings. Wherever possible, the proportion of the 140 sites within a specific classification and grouping was maintained amongst the 50 monitoring sites. Similarly, the number of field sites within any watershed area was dictated by the number of valley segments that were identified within it. A breakdown of the site locations is as follows: Mimico Creek (5), Etobicoke Creek (10), Humber River (35).

Field Methods

Once the field site locations were identified, the process of collecting detailed field data began (**Appendix A**). At each site, standard geomorphological techniques were used to quantify and characterize channel dimensions. In some cases geomorphic data already existed for field sites, therefore these sites were just updated to fulfill the terms of reference (i.e. GMI -5 – erosion pins and a monitoring site had to be installed only). In addition to collecting data of existing conditions and establishing a control section, various tools were implemented that will enable an evaluation of rates of channel change (e.g., bank erosion). The work that was completed at each site is as follows:

- At each of 10 cross-sections:
 - Dimensions: bankfull width, bankfull depth, wetted width and water depth.
 - Substrate: Pebble counts, particle shape, hydraulic roughness, embeddedness, sub-pavement
 - Banks: bank height, angle, materials, cohesiveness of bank materials, root depth and percent protected by vegetation
 - General observations of the channel and the surrounding
- Amongst the 10 cross-sections, one would be established as a control cross-section. This section was typically situated in the middle of the site and on a riffle. At these sections, a pin (usually 12 inch nails in a washer painted orange) was embedded on the top of each bank. These pins remain in place so that a tape can easily and accurately be tied to the pins so that the cross-section can re-measured in the future. Flagging tape and spray paint marks on trees were placed in the vicinity of the monitoring cross-section to aid in future recognition of the section location.

- One bed chain was usually installed (flush to the bed) at, or near, the monitoring cross-section (typically in the bottom 1/3 of a riffle) and in the middle of the channel. The bed chain consisted of an 8 inch nail with a painted (usually orange) 30 cm chain attached to it.
- Five erosion pins were installed at varying heights along banks at each field site. Each erosion pin was a 1 m piece of 1 cm diameter re-bar, which was driven horizontally into the face of an eroding bank. The amount of bar left exposed was recorded. During subsequent visits, the exposed area of the bar will be remeasured to enable a rate of bank retreat to be quantified. Erosion pin locations are presented graphically for each site (**Appendix B**).
- A long profile level survey was conducted along the length of the channel within the field site. The survey included bankfull elevations, detailed bed morphology (riffle-pool sequences, any variation in bed configuration), and other modifying factors (i.e., log jams, weirs, rock check dams). During the survey an arbitrary datum was established (and given an elevation of zero), typically on a hard structure such as a culvert or a bridge. This point was described in the notes, marked with orange paint and in some cases the letter 'P' was etched into nearby concrete/stone. The purpose of this datum is to allow future surveys to tie in to this benchmark, enabling observation of changes in bed elevation over time to be made.
- Photos of the sites were taken from known documented vantage points so that they can easily be repeated.

Historical Assessment

An historical assessment was completed for each of the 50 sites using digital air photos (1999) and floodline maps for 1964 (1:2400) and 1987 (1:2000). The floodline maps were based on air photography from 1954 and 1976 respectively. The historic assessment was intended to identify changes in land use and channel structure and to make general observations of the watercourse and surrounding area. In addition, measurements of channel width were made and migration rates (measure the rate a particular area of stream moves across its valley) calculated. Results of the historic assessment are presented in **Table 1**. The measurements likely have a degree of error inherent in any measurements made on historic air photos (i.e., scale variability, measurement error).

Database Efficiency

The collected field data was entered into the Access 2000 Geomorphology Database (provided by TRCA). Summary sheets (showing monitoring cross-section, bankfull measurements, survey profile, etc.) are presented in **Appendix A**. The summary sheets show most of the data entered into the database, but are missing some bank information. For example, the dominant bank material and the associated Torvane values for each site are not included in the summary sheets. These values are important, as they are strong indicators of shear stress and stability of the banks. Embeddedness of substrate and hydraulic roughness were also collected in the field but not summarized in the database.

Appendix B presents summary pages of each site that the database fails to summarize. For example, survey calculations and pebble count calculations (i.e., D10) have been done manually. In order to increase efficiency, these calculations should be built into the structure of the database. The database will also have to be re-designed to accommodate future monitoring. For example, the survey profile and the monitoring site should have additional columns for the new data to facilitate year-to-year comparisons.

Channel Stability

An overall characterization of the stability of the streams was determined utilizing the data collected from the field. Channel stability was based on five categories: entrenchment ratio, width/depth ratio, inter-pool gradient compared to bankfull gradient, average bank angle, and substrate sorting. Each category was scored (i.e. 0 is low stability and 2 is high stability) and combined to give a channel stability score. The scoring system consists of the following values: 0 – 4 (low stability), 5-7 (moderate stability) and greater than 8 (high stability). These five categories are considered to represent an overall characterization of the stability of a stream. The majority of the channels for this study area were identified as having attained a moderate level of stability. This was representative of the area because most of the reaches for this study were located in un-urbanized areas. In **Appendix B**, each category was given a score and a stability ranking was calculated for the overall reach. The following is a detail description of the five categories and the significance they have to channel stability.

Entrenchment describes the relationship of a river to its valley and landform features and is a measure of the ability of high flows to access the floodplain (Kellerhals et al 1972). The lower the entrenchment ratio values are, the less likely the channel is able to access its floodplain and more likely the flow would be confined within the channel, resulting in channel change. Ratios of 1.0 to 1.99 represent entrenched streams (score of 0); 2.0 to 3.99 represent moderately entrenched streams (score of 1); and ratios greater than 4.0 (score of 2) indicate streams are slightly entrenched and have access to their floodplain.

The width/depth (W/D) ratio is defined as the ratio of the bankfull surface width to the mean depth of the bankfull channel (Rosgen, 1996). The W/D ratio provides insight into the potential channel processes occurring. Ratio values can be used to interpret shifts in channel stability. High width/depth ratios (i.e. shallow and wide channel) result in stress to be placed within the bank region. As the W/D ratio value increases (channel grows wider and more shallow), the hydraulic stress against the banks also increases and bank erosion is accelerated (Rosgen, 1996). Ratios between 8 to 18 are stable (score of 2); 19 to 35 are moderately stable (score of 1) and anything greater than 35 and less than 5 are unstable (score of 0).

A comparison of inter-pool gradient to bankfull gradient is a significant indicator to channel stability because it demonstrates the balance between sediment supply and transport in the channel along a reach. If the inter-pool gradient and bankfull gradients are similar then the channel stability is high because there is a “relative” equilibrium between sediment supply and transport of sediment in the channel. Likewise, if the two gradients are different then the pools are either filling with sediment or degradation (scour) of substrate is high. Reaches with an inter-pool gradient within 25% of bankfull gradient are stable (score of 2); within 25% to 50% are moderately stable (score of 1) and an inter-pool gradient greater than 50% suggests an unstable (aggrading/degrading) channel (score of 0).

Channel widening and bank failure is often caused by an increase in bank slope that is a result of channel degradation or planimetric adjustment. The average bank angle of the reach was used as an indicator of bank stability. An average bank angle of greater than 50 degrees is considered to be unstable (score of 0), 35 to 50 moderately stable (score of 1) and less than 35 is stable (score of 2).

Substrate sorting of bed material is a component in channel stability because it demonstrates whether the reach is aggrading or degrading. A “stable” channel often has a variety of sediment sizes on its bed. Poorly sorted channels are indicative of aggrading (deposits of similar sized material) or degrading (an armour layer consisting of similar sized material) channels. Sorting was assessed using a modified version of Phi Quartile Deviation by Robert L. Folk (1968). The equation calculates the average of the difference between the sediment sizes that correspond with the D10 and D90. Categories were identified by observing the spread of values for all 50 sites. Values greater than 7.1 are assigned a score of 2 (high stability); 5.1 to 7.0 were assigned a score of 1 (moderate stability) and anything less than 5 were score of 0 (low stability).

The scores for each category were totaled and the reaches were then assigned a final ranking between a low and high degree of stability (**Table 2**). Category values were assigned based on the overall score required for a reach to attain a relative degree of or lack of stability. When individual categories (e.g. inter-pool/bankfull gradient) could not be assigned a score the total was determined as a ratio and given value out of 10 for consistency. The overall stability index was:

- 0-4 – low stability
- 5-7 – moderate stability
- 8-10 – high stability

Table 2: Stability ranking for each reach.

REACH	STABILITY
GET-1	Moderate Stability
GET-2	Moderate Stability
GET-3	Moderate Stability
GET-4	Moderate Stability
GET-5	High Stability
GET-6	Moderate Stability
GET-7	High Stability
GET-8	High Stability
GET-9	Moderate Stability
GET-10	High Stability
GMI-1	Low Stability
GMI-2	Low Stability
GMI-3	Low Stability
GMI-4	Moderate Stability
GMI-5	Moderate Stability
GHU-1	Moderate Stability
GHU-2	Low Stability
GHU-3	Moderate Stability
GHU-4	Moderate Stability
GHU-5	Moderate Stability
GHU-6	Moderate Stability
GHU-7	High Stability
GHU-8	Moderate Stability
GHU-9	Moderate Stability

GHU-10	Moderate Stability
GHU-11	Moderate Stability
GHU-12	Moderate Stability
GHU-13	Moderate Stability
GHU-14	High Stability
GHU-15	Low Stability
GHU-16	Moderate Stability
GHU-17	Low Stability
GHU-18	Moderate Stability
GHU-19	Low Stability
GHU-20	High Stability
GHU-21	Moderate Stability
GHU-22	Moderate Stability
GHU-23	Moderate Stability
GHU-24	Moderate Stability
GHU-25	Moderate Stability
GHU-26	High Stability
GHU-27	Moderate Stability
GHU-28	Moderate Stability
GHU-29	Low Stability
GHU-30	Moderate Stability
GHU-31	Moderate Stability
GHU-32	Low Stability
GHU-33	Low Stability
GHU-34	Moderate Stability
GHU-35	Moderate Stability

Future Monitoring

The TRCA has committed to establishing a total of 150 monitoring sites over a period of three years. As part of this program all 50 sites established in the Etobicoke, Mimico and Humber watersheds in 2001 would need to be revisited in 2004. At that time all monitoring cross-sections, erosion pins, bed chains and the long profile survey are to be re-measured.

The monitoring cross-section has been set-up so that on each bank a fixed pin is embedded on top of the bank. These pins remain in place so that a tape can easily and accurately be tied to the pins to be re-measured. The start of the cross-section (zero end of the tape) always begins at the left bank pin (left side while facing downstream) and terminates at the right bank pin.

Typically, there were five erosion pins installed at varying heights along banks at each field site. The amount of pin left exposed was recorded. During subsequent visits, the exposed length of the pin will be re-measured and recorded to compare from previous years. If the amount of erosion at

any site has been sufficient enough to indicate that the pin may be lost, then the exposed area of the pin will be recorded and then the reset (driving the pin back into the bank). The new length of exposed pin should also be recorded and a note shall be made to indicate that the erosion pin has been 'reset'.

One bed chain was usually installed (flush to the bed) at, or near, the monitoring cross-section and typically in the thalweg. The bed chain consisted of an 8-inch nail with a 30 cm section of chain (usually painted orange or pink) attached to it. During the revisit scheduled for 2004, the bed chain should be relocated (based on instructions from benchmark; a magnetic wane or similar apparatus may be required) and in the event that aggradation (sediment accumulation) has occurred, carefully lift the loose end of the chain from the new sediment. The substrate should then be carefully excavated along one side of the chain (being careful not to disturb the sediment on the opposite side) until the head of the nail is uncovered. The depth of accumulated sediment should then be measured based on the length of chain left between the head of the nail and the surface of the substrate. In the event that the channel has degraded (a loss of bed substrate) a measurement from the surface of the substrate to the head of the nail shall be made. After this measurement is made the nail should be driven flush with the substrate and a note should be made to indicate that the bed chain has been 'reset'.

The final monitoring work involves a long profile survey of the site. The survey included bankfull elevations, detailed bed morphology (riffle-pool sequences, any variation in bed configuration), and other modifying factors (i.e., log jams, weirs, rock check dams). During the survey an arbitrary datum was established (and given an elevation of zero), typically on a hard structure such as a culvert or a bridge. This point was described in the notes, marked with orange paint and in some cases the letter 'P' was etched into nearby concrete/stone. The purpose of this datum is to allow future surveys to tie in to this benchmark, enabling observation of changes in bed elevation over time to be made. All the benchmark elevations are zero; therefore, during the monitoring work the survey station can be set up anywhere making sure the benchmark is also surveyed.

Future Improvements / Recommendations

The following are suggestions for improving and/or adding to the monitoring program:

- Record a GPS reading of the monitoring cross-section, erosion pins, and bed chain locations. This will assist those who revisit the sites to relocate specific items.

- Have more common fishery and geomorphology sites. This will allow for greater efficiency in subsequent monitoring and more direct linkage and integration between disciplines.
- For sites that are not located near permanent structures it would be beneficial to establish permanent benchmarks (e.g., a large steel rod). This year, nails used for the monitoring cross-section were occasionally used as the benchmark if no existing hard structure was present. These nails may not be easy to relocate and due to their size are susceptible to movement from natural forces (e.g., freezing and thawing).
- Always ensure that there are appropriate amounts of flagging or other obvious markings to allow those involved in the subsequent remeasuring to easily locate the pins, nails and benchmarks.
- Ensure that clear, accurate and detailed descriptions of the pin, nail and benchmark locations are recorded to ensure that subsequent visits to the site are efficient.

References

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- Rosgen, Dave (1996): Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

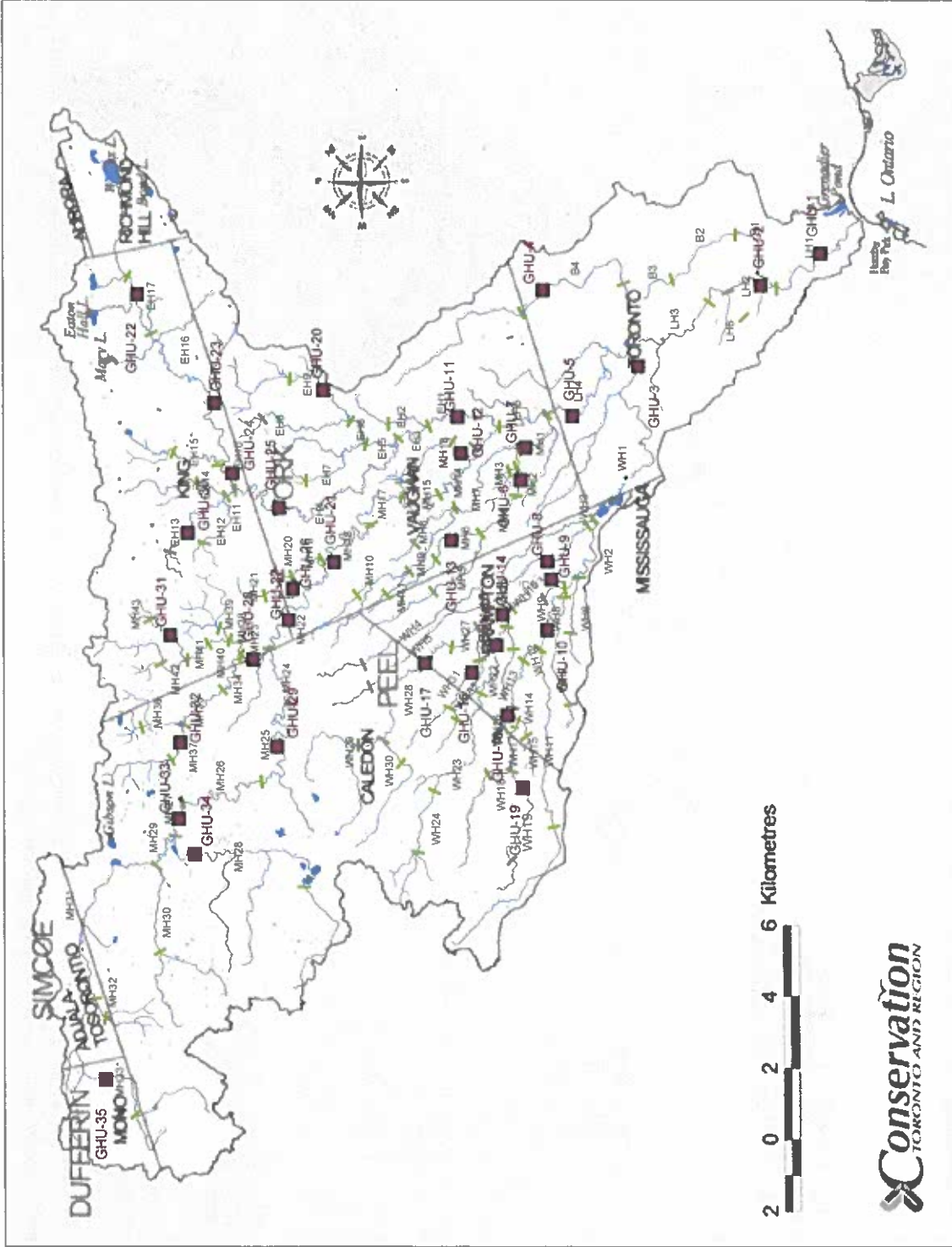


Figure 1 Geomorphic monitoring sites within the Humber River Watershed

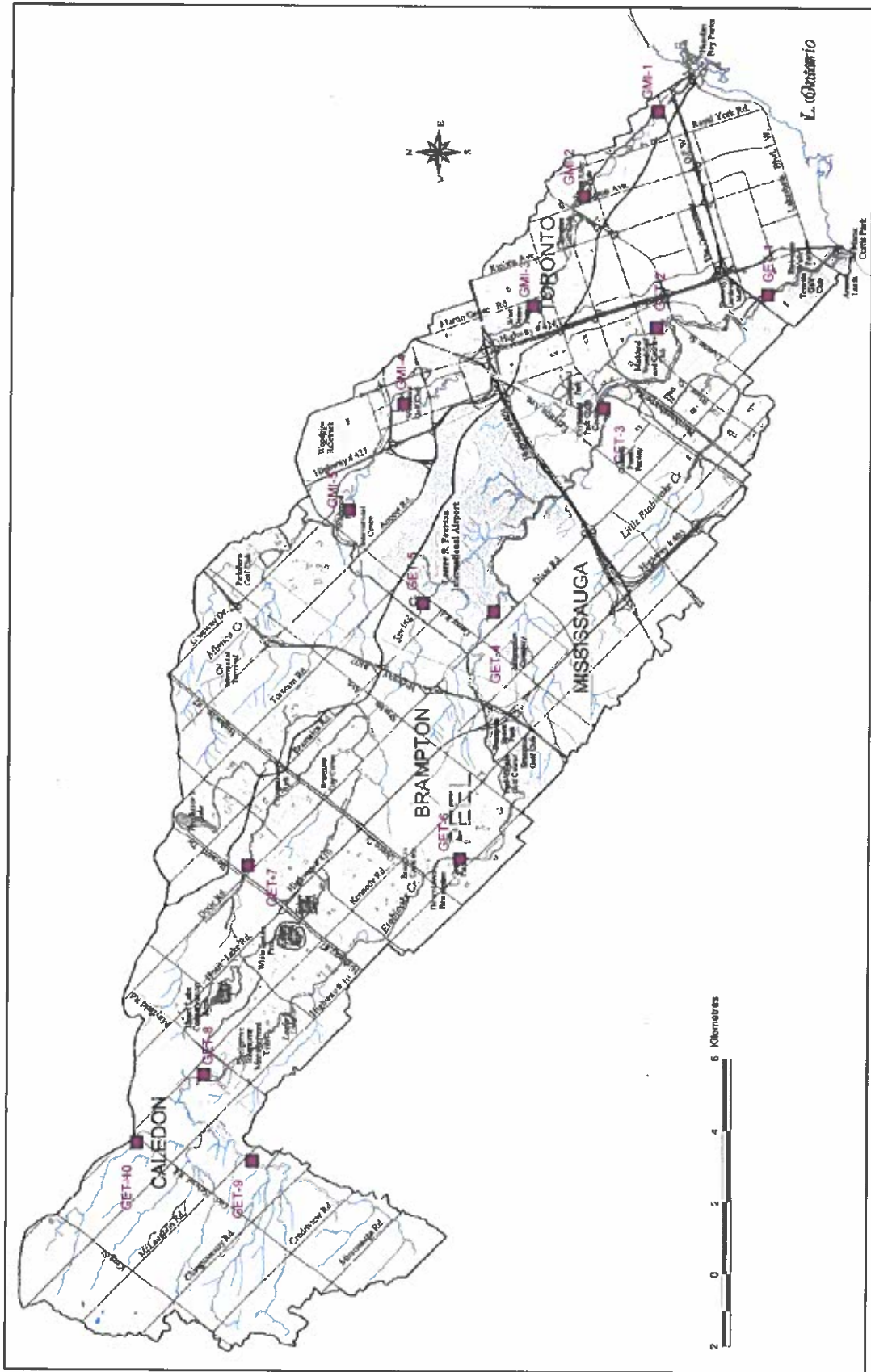


Figure 2. Geomorphic monitoring sites within Etobicoke and Mimico Watersheds.

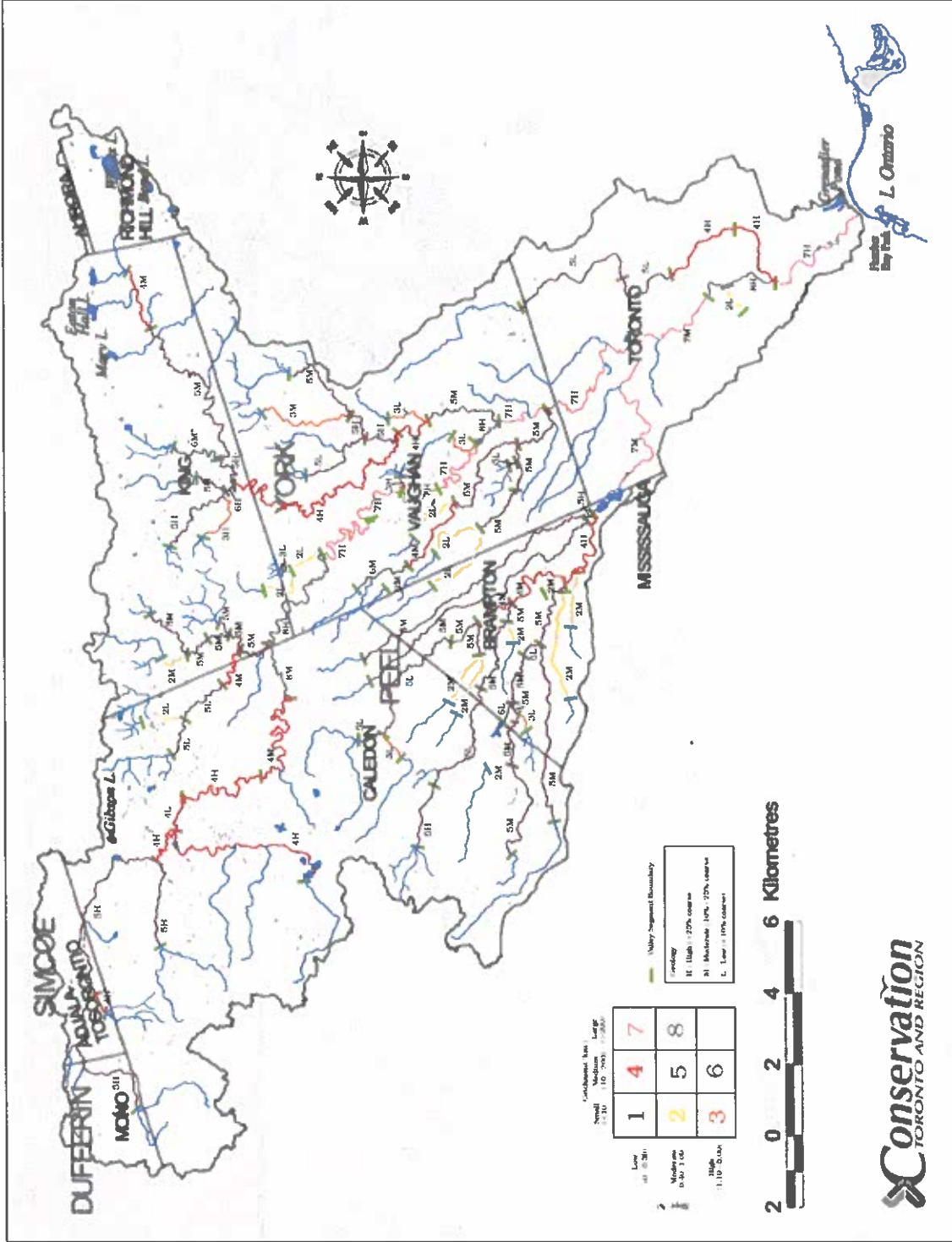


Figure 3. Valley segment classification in the Humber River watershed.

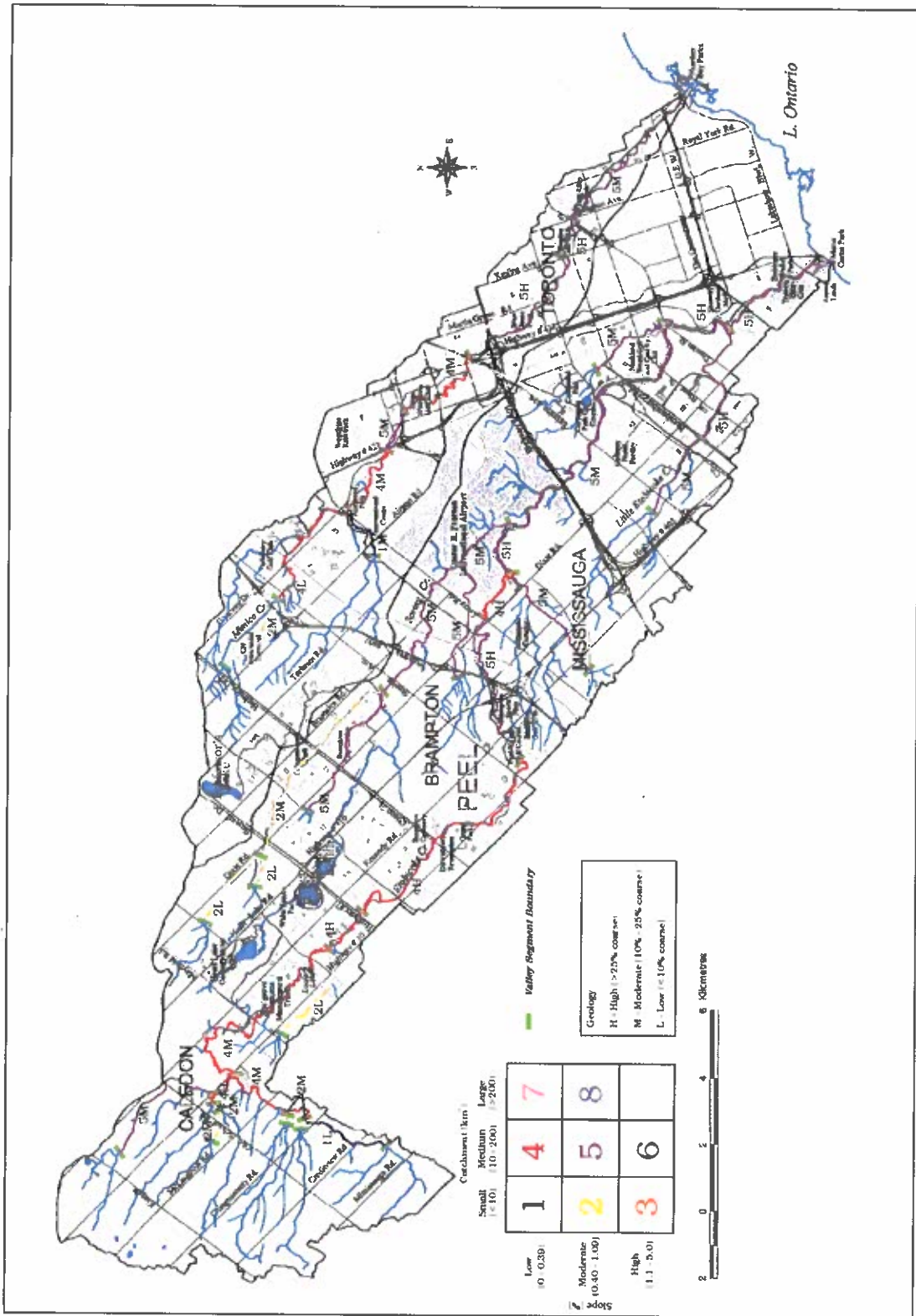


Figure 4. Valley segment classification in the Biobiocke Creek and Mimico Creek watersheds.

Table 1: Historic Analysis for all 50 Sites Investigated within Etobicoke Creek, Mimico Creek and the Humber River.

Reach	Land-Use	Channel Change	Channel Width	Migration Rates (m/yr)
GET-1	1954 to 1999 has not changed - Urban residential/Urban Golf Course	Channel length has not changed	1954 = 19m 1978 = 18.3m 1999 = 23.1m Not available - obscured by forest cover	No change
GET-2	In 1954 rural agriculture/residential was dominant but changed after 1978 to urban rural/golf course	Not available - obscured by forest cover	Not available - obscured by forest cover	Not available - obscured by forest cover
GET-3	1954 = Rural agriculture 1978 = Rural residential, Rural vacant 1999 = Urban mix of commercial and residential, Urban golf course	Altered between 1954 to 1978; channel length has decreased; valley wall erosion has increased	1954 = 10.3m 1978 = 13.9m 1999 = 14.5m	Not available - altered
GET-4	1954 to 1999 has not changed - airport property	Between 1954 to 1999 -4.6% change in length Since 1954 sections were relocated and hardened to accommodate runway expansion for the airport	44.9% change between 1954 to 1999	0.28 m/yr 1954 - 1999
GET-5	Agriculture surrounds the corridor of the reach while commercial buildings have increased since 1954 to surround the perimeter	Between 1954 to 1999 -21% change in channel length Top portion of the reach is straight and unchanged since 1954, bottom have of reach realigned since 1978	78.5% change between 1954 to 1999	0.11 m/yr 1954 to 1999
GET-6	No coverage			
GET-7	No coverage			
GET-8	1978 to 1988 - agriculture 1988 to 1995 - residential areas were created East of Hwy 10	Planform remains similar, slight shift in channel has occurred due to the presence of meander cut-off and oxbow in a meander depression on the floodplain	Not available - poor aerial image resolution	0.11 to 0.30 m/yr
GET-9	No coverage			
GET-10	No coverage			
GMI-1	Predominately urban since 1954	Planform remains similar, local reinforcement visible in aenals	No change	No change
GMI-2	1954 = Urban residential 1978 = Urban mix of commercial and residential 1999 = Urban mix of commercial and residential	Historically unaltered	1954 = 9.6m 1978 = 8.0m 1999 = 9.8m	Not available - poor aerial image resolution
GMI-3	1954 = Rural agriculture 1978 = Urban residential, Urban park 1999 = Urban residential, Urban park	Has been straightened since 1954, channel length has decreased by 26.2% by 1978 because of the construction of Hwy 401	1954 = 8.7m 1978 = 8.0m 1999 = 8.8m	Altered channel
GMI-4	1954 = Rural agriculture 1978 = Urban commercial, Urban vacant 1999 = Urban commercial, Urban golf course	Some alteration has occurred to accommodate the building of Hwy 409	1954 = 7.9m 1978 = 7.5m 1999 = 9.0m	Between 1954 to 1978 = 0.04 m/yr
GMI-5	1954 = Rural commercial, Rural vacant - parkland 1978 = Urban commercial, Urban parkland 1999 = Urban parkland	Slight planform change since 1954, difficult to see anything because channel is obscured by trees Goreway Drive was not built in 1954	1954 = 10m 1976 = 8.8m 1999 = Not available - obscured by trees	Not available
GHU-1	Urban residential growth has increased since 1954	Planform remains the same, local bank treatment is visible in the 1999 air photo and deposit present downstream of Floor St. W. bridge	1954 = 60m 1976 = 57m 1999 = 59m	No change
GHU-2	Urban growth has increased since 1954, apartment buildings seen in 1978 and 1999 were not all present on 1954 1999 = Urban parkland, Urban residential, Urban golf course	In 1954 the channel looks wider downstream of the Scarlett Road bridge than in 1978 and 1999. Islands seen in topo maps of 1954 and 1978 are not visible in the 1999 aerial photographs	1954 = 42m 1976 = 42m 1999 = 42m	No change between 76 to 99

Reach	Land-Use	Channel Change	Channel Width	Migration Rates (m/yr)
GHU-3	No change in land-use is observed over the 45 years examined - Urban Residential/Parkland	In 1954 underneath the Alton Road bridge the channel was really wide in comparison to the other years (mid-channel bar present), mid-channel bars visible throughout the years, slinging Avenue changed configuration after 1954	1954 = 18.5m 1976 = 22m 1999 = 23m	No change
GHU-4	Not Available for 1954 1976 and 1999 the the landuse has not changed - Urban residential and Urban cultural/Parkland	Channel planform looks similar but heavy forest cover in 1999 skew the view	Not available - obscured by forest cover 1954 - no coverage	Not available - obscured by forest cover 1954 - no coverage
GHU-5	Steeles Avenue north of the river does not appear in 1954 but does in 1978 and 1999, the large apartment buildings east of Kipling Avenue are not present in 1954. Landuse has not changed but has increased its urbanized residential dwellings. A parkland surrounds the corridor of the river.	Throughout the years examined the same island is present. channel planform has remained the same	1954 = 26m 1976 = 28m 1999 = 27.5m	No change between 1976 and 1999
GHU-6	1954 - agriculture and a woodlot are the main land-use 1978 - scrubland, woodlot and south of the channel industrial buildings 1996 - scrubland, woodlot and south of the channel industrial buildings	Channel planform looks similar throughout the years examined	No change in channel width	0.15m/yr downvalley migration between 1954 and 1976
GHU-7	1954 and 1978 the landuse has remained the same - scrubland, agricultural, patches of trees and residential complex (east of the channel). In 1996, scrubland east of the channel had been replaced by homes, while the west of the channel, the former agricultural fields were occupied by large industrial buildings.	Slight changes in channel planform have occurred between 1954 and 1978 - In 1954, downstream of Hwy 7 the channel was more sinuous than in 1978/1996. In 1978 a bend has a higher radius of curvature than 1954. Channel planform in 1996 remained the same as 1978.	No change in channel width between 1978 and 1996	Across valley migration of 0.63 m/yr between 1954 and 1978 and 0.042m/yr between 1978 and 1996.
GHU-8	No coverage available for 1954 and 1976 1999 - golf course	Within the site there was no dominant channel planform change Large amounts of deposition was seen in channel near the club house in bend area (1999) - it looks like it was an old dam that they have opened up - in the 1976 topo this area looks like an on-line pond was present, in 1954 the on-line pond was not present	1954 = 9m 1976 = 8.5m 1999 = 10m	Not available
GHU-9	In 1976 and 1999 a golf course was the dominant landuse Pedestrian bridge closest to McVean Drive was not present in 1976 but was seen in the 1999 air photo. No bridges were evident in the 1954 topo	Channel planform looked similar throughout the years examined Mid-channel bars were present in the 1954 topo mapping but not seen in 1976 and 1999	1954 = 15.5m 1976 = 14m 1999 = 12m	0.08 m/yr across valley migration between 1978 to 1999
GHU-10	No Coverage	Not available - channel comdor was surrounded by trees	Not available	Not available
GHU-11	Langstaff Road was not present in 1954 but was seen in 1978 and 1999 Boyd Conservation Area was the dominant landuse in 1978 and 1999 followed by residential homes, a bridge was seen upstream of Lanstaff Road in 1978 and 1999 but not prominent in the 1954 topo maps	Meander cut-off was prominent in the 1999 air photo just upstream of Castimore Road - does not show in the 1978 topo, planform has not changed between 1978 to 1999	1976 = 12m 1999 = 12m	0.06 m/yr down valley migration between 1978 to 1999
GHU-12	Increase in urban residential has occurred since 1954	West of McVean Road the channel profile for 1999 looks a little different - instead of it being straight as it shows in the 1976 topo, the channel shows to curving outwards in 1999 (a vegetated bar is seen in this area not shown in the 1978 topo)	1976 = 5 m 1999 = 5.1m	Negligible - no change (1976-1999)
GHU-13	No coverage	Channel planform has not changed between 1976 to 1999	Not available	Not available - obscured by vegetation
GHU-14	Agriculture dominate landuse in 1999 No coverage for 1954			
GHU-15	In 1999 the channel landuse was agriculture and scrubland A residential property by the site was not visible in the 1978 topo as it was in the 1999 aerial photograph. No 1954 coverage			
GHU-16	1999 - Scrubforest 1976 - No coverage 1954 - No coverage			

Reach	Land-Use	Channel Change	Channel Width	Migration Rates (m/yr)
GHU-17	Woodlot and agricultural fields were the dominate landuse in 1978 and 1999 1954 - no coverage	Channel planform had remained the same but the meanders in 1999 seem to be more prominent than in 1976	1976 = 7.0m 1999 = 5.5m	Negligible - no change (1976-1999)
GHU-18	Woodlot and agriculture fields were the dominate landuse between 1978 to 1999 1954 - no coverage	Channel planform has remained the same for both of the years (1976 to 1999)	1976 = 6.5m 1999 = 7.5m	Negligible - no change (1976-1999)
GHU-19	Woodlot and agriculture fields were the dominate landuse between 1978 to 1999 1954 - no coverage	Difficult to assess with the tree cover		
GHU-20	Reach surrounded by woodlot	Difficult to assess with the tree cover		
GHU-21	Woodlot/scrub forest and agriculture were the dominate landuse for all of the years - no change	Channel planform has remained the same for all the years, deposition is visible in all of the three years. Kirby Road (crosses the site) is seen in all of the years examined	1954 = 15.5m 1976 = 14m 1999 = 18m	0.36 m/yr across valley migration between 1954 to 1999 0.34 m/yr across valley migration between 1978 to 1999
GHU-22	Agriculture and scrubland are the dominate landuses	Channel planform has remained the same for all the years examined	1976 = 3.5m 1999 = 3m	Negligible - no change (1976-1999)
GHU-23	Dense woodlot surrounds the channel in 1978 and 1954 - cannot make out the channel. Laskay Lane is seen upstream of the stream both in 1976 and 1978 1954 - no coverage	Not available - obscured by trees but upstream and downstream of the site no channel change has occurred	Not available - obscured by trees	Not available - obscured by trees
GHU-24	There are buildings (homes) shown north of the channel in 1954 that were not seen in 1978 and 1999. Humber Trails Forest and Wildlife Area was the dominate landuse in 1999	Channel planform was similar in all of the three years, although difficult to tell in 1999 because of the trees. The 1976 planform may have been a little more sinuous than the 1954	1954 = 9.5m 1976 = 10.5m 1999 = obscured by trees	Not available - no set benchmarks to measure from
GHU-25	Agriculture and Scrubland/forest were the dominate landuses	Large island present just downstream of the King/Vaughn Road bridge that was not seen in 1954 or 1999, channel planform was the same for of the three years examined	1954 = 9.4m 1976 = 9.75m 1999 = 9.5m	Bend area close to the King/Vaughn Road shows no significant migration rate for all of the three years examined
GHU-26	Not available - cannot see the channel - vegetation too dense			
GHU-27	Scrubforest and agriculture were the dominate landuse for the stream - no change	Large island present in 1954 that was not seen in 1976 or 1999, channel planform was similar for all of the years examined	1954 = 13m 1976 = 15m 1999 = 14m	Not available - no set benchmarks to measure from
GHU-28	Scrubforest and a couple of homes were present around the channel in 1999	Channel planform was similar for 1954 and 1999, deposition visible in 1954 was not seen in 1999 aerial photograph, pond in 1999 not seen in 1954 topo map	1954 = 10m 1999 = 10m	Not available - no set benchmarks to measure from in the 1954 topo map
GHU-29	Forest/Scrubforest was the dominate surrounding landuse - no change	Channel planform was the same for all of the three years examined	1954 = 12.5m 1976 = 13.5m 1999 = 13m	Negligible - no change (1954-1999)
GHU-30	No coverage			
GHU-31	No coverage			
GHU-32	No coverage			
GHU-33	Conservation roads present in 1978 were not seen in 1954 Conservation land was the dominate landuse in 1999 and 1978	Channel seems to be similar in shape for all of the three years examined, deposition was seen in all the years examined	1954 = 14m 1976 = 13.5m 1999 = 14m	Negligible - no change (1978-1999) Not available for 1954 because no set benchmark to measure from 1954 topo

Reach **Land-Use**
GHU-34 Scrubland and conservation land were the dominate land-use surrounding this site

Channel Change
Channel planform was the same except the reservoir located downstream of the site does not show in the 1954 top map

Channel Width
1954 = 8.5m
1976 = 10m
1999 = obscured by vegetation

Migration Rates (m/yr)
Not available - no set benchmarks to measure from

GHU-35 Cedar thicket forest surrounded the channel in 1999

Channel Change
Dense cedar thicket forest - too difficult to observe any planform differences between 1999 and 1976
1954 = no coverage

1999 = obscured by cedar thicket

Not available - no set benchmarks to measure from

- 1999 - Digital Air Photos
- 1976 - 1:2000 topo map
- 1954 - 1:2400 topo map
- 1954 - 1:15 9000 aerial photos
- 1999 - 1: 5300 aerial photo

APPENDIX A – ACCESS SUMMARY OUTPUT

Access summary output is not available in this .PDF Report. Please contact Toronto Region Conservation for Fluvial Geomorphology Data if required.

APPENDIX B – EXCEL SUMMARY OUTPUT

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-1

Date of Survey: 15-Nov-01
Number of cross-sections: 8
Associated Fisheries Site: HU003WM
Access: Main Humber River, site begins immediately downstream of Bloor Street West.
 Park at Toronto Humber Yacht Club

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.17 %	Riffle Length	56 m
Inter-Pool Gradient	0.21 %	Riffle-Pool Spacing	206 m
Inter-Riffle Gradient	NA	Max Pool Depth	3.8 m
Riffle Gradient	1.51 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.000247
D50	0.0039
D90	0.56

Historical Analysis

Land Use: Urban residential growth has increased since 1954

Channel Change: Planform remains the same for all the three years examined, local bank treatment is visible in the 1999 air photo and deposit present downstream of Bloor St. W.

Migration Rates (m/yr): No change

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>	
	Angle:	2			0 = low
	Inter-Pool:	2			1 = moderate
	Width/Depth Ratio:	0			2 = high
	Substrate Sorting:	1			
	Stability:	6 Moderate Stability			
			0-4 = low stability		
			5-7 = moderate stability		
			8-10 = high stability		

Site Photo's

GHU-1



Photo 1. At monitoring cross-section looking upstream



Photo 2. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-2

Date of Survey: 19-Dec-01
 Number of cross-sections: 8
 Associated Fisheries Site: None
 Access: Main Humber River, just downstream of Scarlett Road

Site Map



Planform Characteristics

Long Profile (avg)			
Bankfull Gradient	NA %	Riffle Length	56 m
Inter-Pool Gradient	NA %	Riffle-Pool Spacing	206 m
Inter-Riffle Gradient	NA	Max Pool Depth	3.8 m
Riffle Gradient	1.51 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.52
D50	12.11
D90	23.62

Historical Analysis

Land Use: Urban growth has increased since 1954, apartment buildings seen in 1978 and 1999 were not all present on 1954
 1999 = Urban parkland, Urban residential, Urban golf course

Channel Change: In 1954 the channel looks wider downstream of the Scarlett Road bridge than in 1978 and 1999. Islands seen in topo maps of 1954 and 1978 are note visible in the 1999 aerial photographs

Migration Rates (m/yr): No change between '76 to '99

Stability	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	NA	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	0	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	2.5* Low Stability	* - ranking is displayed out of a possible 10	
*while measures indicate a low stability, field observations suggest a moderate stability				

Site Photo's

GHU-2



Photo 1. At monitoring cross-section looking upstream



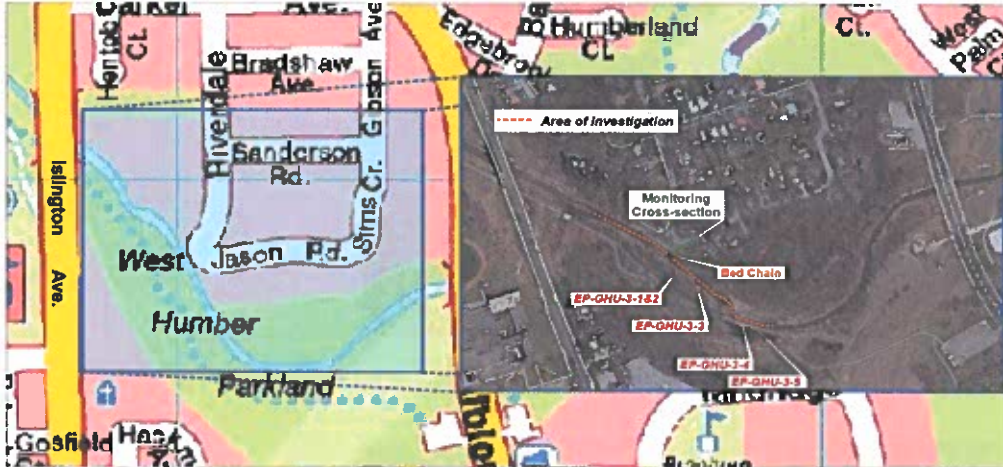
Photo 2. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

West Humber River ~ GHU-3

Date of Survey: 20-Dec-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Between Islington Avenue and Albion Road. Park at parking lot just off Albion Road - West Humber Parkland. Walk the path on the right bank to the channel.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	NA	Riffle Length	NA
Inter-Pool Gradient	NA	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	NA
Riffle Gradient	NA		

Particle Sizes (cm)

	Pebble Counts
D10	0.09
D50	4.65
D90	Bedrock

Historical Analysis

Land Use: No change in land-use is observed over the 45 years examined - Urban Residential/Parkland

Channel Change: In 1954 underneath the Albion Road bridge the channel was really wide in comparison to the other years (mid-channel bar present), mid-channel bars visible throughout the years, Islington Avenue changed configuration after 1954

Migration Rates (m/yr): No change

Stability

Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
Angle:	2	0 = low	0-4 = low stability
Inter-Pool:	NA	1 = moderate	5-7 = moderate stability
Width/Depth Ratio:	1	2 = high	8-10 = high stability
Substrate Sorting:	1		
Stability:	5* Moderate Stability		* - ranking is displayed out of a possible 10

Site Photo's

GHU-3



Photo 1. At monitoring cross-section looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Black Creek ~ GHU-4

Date of Survey: 17-Dec-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: Downstream of Shoreham Drive, East of Jane Street. Park at TRCA office and walk downstream to the channel.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	NA	Riffle Length	NA
Inter-Pool Gradient	NA	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	NA
Riffle Gradient	NA		

<i>Particle Sizes (cm)</i>	
	Pebble Counts
D10	0.0041
D50	1.2
D90	6

Historical Analysis

Land Use: N/A for 1954
 1976 and 1999 the landuse has not changed - Urban residential and Urban cultural/Parkland

Channel Change: Channel planform looks similar but heavy forest cover in 1999 skew the view

Migration Rates (m/yr): N/A obscured by forest cove
 1954 - no coverage

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0	0 = low	0-4 = low stability
	Inter-Pool:	NA	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	5* Moderate Stability		* - ranking is displayed out of a possible 10

Site Photo's

GHU-4



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-5

Date of Survey: 17-Dec-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: South of Steeles Avenue West and North of Finch Avenue West, Between Kipling Avenue and Islington Avenue in Rowntree Mills Park. Park at the end of Riverside Drive and walk downstream

Site Map



Planform Characteristics

Long Profile (avg)			
Bankfull Gradient	NA	Riffle Length	NA
Inter-Pool Gradient	NA	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	NA
Riffle Gradient	NA		

Particle Sizes (cm)	
	Pebble Counts
D10	0.00033
D50	1.65
D90	27.27

Historical Analysis

Land Use: Steeles Avenue north of the river does not appear in 1954 but does in 197 and 1999, the large apartment buildings east of Kipling Avenue are not present in 1954, Landuse has not changed but has increased its urbanized residential dwellings. A parkland surrounds the corridor of the river.

Channel Change: Throughout the years examined the same island is present channel planform has remained the same

Migration Rates (m/yr): No change between 1976 and 1999

Stability	Entrenchment:	1	Individual Categories	Overall Score		
	Angle:	1			0 = low	0-4 = low stability
	Inter-Pool:	NA			1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1			2 = high	8-10 = high stability
	Substrate Sorting:	2				

Stability:

5* Moderate Stability

* - ranking is displayed out of a possible 10

Site Photo's

GHU-5



Photo 1. At monitoring cross-section looking upstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Rainbow Creek ~ GHU-6

Date of Survey: 06-Sep-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: North of Highway 7, East of Highway 27. Park on the shoulder of Highway 27 beside the creek, the site begins ~150 m downstream from the bridge and ends at the beginning of the fore:

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.36 %	Riffle Length	4.7 m
Inter-Pool Gradient	0.71 %	Riffle-Pool Spacing	11.75 m
Inter-Riffle Gradient	1.23 %	Max Pool Depth	1.4 m
Riffle Gradient	3.8 %		

Particle Sizes (cm)

	Pebble Counts
D10	< 0.0002
D50	0.005
D90	4.17

Historical Analysis

Land Use: 1954 - agriculture and a woodlot are the main land-us;
 1978 - scrubland, woodlot and south of the channel industrial buildings
 1996 - scrubland, woodlot and south of the channel industrial buildings

Channel Change: Channel planform looks similar throughout the years examine

Migration Rates (m/yr): 0.15m/yr downvalley migration between 1954 and 1978

Stability	Entrenchment:	2	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	6	Moderate Stability	

FLUVIAL GEOMORPHOLOGY SUMMARY

Rainbow Creek ~ GHU-7

Date of Survey: 08-Sep-01
 Number of cross-sections: 10
 Associated Fisheries Site: HU011WM
 Access: South of Highway 7, West of Kipling Avenue, just off of Angelina Avenue. Park at the end of Angelina Avenue and walk down to the stream.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.46 %	Riffle Length	10.34 m
Inter-Pool Gradient	0.38 %	Riffle-Pool Spacing	17.86 m
Inter-Riffle Gradient	0.99 %	Max Pool Depth	1.46 m
Riffle Gradient	5.48 %		

Particle Sizes (cm)

Pebble Counts	
D10	0.025
D50	2.87
D90	Bedrock

Historical Analysis

Land Use: 1954 and 1978 the landuse has remained the same - scrubland, agricultural, patches of trees and residential complex (east of the channel). In 1996, scrubland east of the channel had been replaced by homes, while the west of the channel, the former agricultural fields were occupied by large industrial buildings.

Channel Change: Slight changes in channel planform have occurred between 1954 and 1978 - In 1954, downstream of Hwy 7 the channel was more sinuous than in 1978/1996. In 1978 a bend has a higher radius of curvature than 1954. Channel planform in 1996 remained the same as 1978.

Migration Rates (m/yr): Across valley migration of 0.63 m/yr between 1954 and 1978 and 0.042m/yr 0.042m/yr between 1978 and 1996.

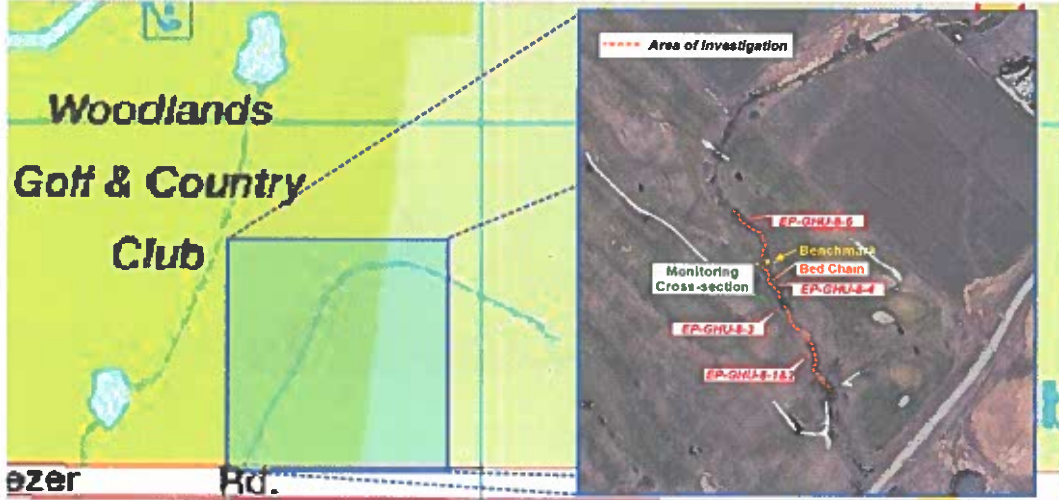
Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	8 High Stability		

FLUVIAL GEOMORPHOLOGY SUMMARY

West Humber River ~ GHU-8

Date of Survey: October 1, 2001
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: North of Ebenezer Road, East of McVean Drive in the Woodlands Golf and Country Club - Brampton. Park on the shoulder of Ebenezer Road and go upstream of the culve

Site Map



Planform Characteristics

Long Profile (avg)

Bankfull Gradient	0.74 %	Riffle Length	10.81 m
Inter-Pool Gradient	0.89 %	Riffle-Pool Spacing	13.1 m
Inter-Riffle Gradient	1.01 %	Max Pool Depth	0.95 m
Riffle Gradient	4.4 %		

Particle Sizes (cm)

	Pebble Counts
D10	< 0.0002
D50	0.0042
D90	3.96

Historical Analysis

Land Use: No coverage available for 1954 and 197
 1999 - golf course

<i>Stability</i>	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	6 Moderate Stability		

Site Photo's

GHU-8



Photo 1. At monitoring cross-section looking upstream



Photo 2. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

West Humber River ~ GHU-9

Date of Survey: 02-Oct-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Main West Humber River in Woodlands Golf and Country Club just East of McVean Drive. Park at shoulder of McVean Drive, site is immediately upstream of bridge

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.61 %	Riffle Length	6.25 m
Inter-Pool Gradient	1.57 %	Riffle-Pool Spacing	12.67 m
Inter-Riffle Gradient	1.64 %	Max Pool Depth	1.04 m
Riffle Gradient	4.21 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.017
D50	3.82
D90	Bedrock

Historical Analysis

Land Use: In 1978 and 1999 a golf course was the dominant landuse. Pedestrian bridge closest to McVean Drive was not present in 1976 but was seen in the 1999 air photo. No bridges were evident in the 1954 topo.

Channel Change: Within the site there was no dominant channel planform change. Large amounts of deposition was seen in channel near the club house in bend area (1999) - it looks like it was an old dam that they have opened up - in the 1976 topo this area looks like an on-line pond was present, in 1954 the on-line pond was not present.

Migration Rates (m/yr): N/A

Stability	Entrenchment:	1	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	5 Moderate Stability		

Site Photo's

GHU-9



Photo 1. At monitoring cross-section looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary of West Humber River ~ GHU-10

Date of Survey: 13-Dec-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Castlemore Road and Goreway Drive are the main intersections, the first stream west of Goreway Drive. Park on the side of the road, the site is immediately upstream of the road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.135 %	Riffle Length	6.5 m
Inter-Pool Gradient	0.36 %	Riffle-Pool Spacing	20 m
Inter-Riffle Gradient	0.37 %	Max Pool Depth	1.6 m
Riffle Gradient	3.7 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.00041
D50	0.57
D90	9.33

Historical Analysis

No Coverage

Stability	Entrenchment:	2	Individual Categories	Overall Score
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	7 Moderate Stability		

Site Photo's

GHU-10



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

East Humber River ~ GHU-11

Date of Survey: 03-Oct-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: Enter Boyd Conservation Area from Islington Ave. and follow the trail until it ends at parking lot
 Walk downstream to the stream, the site begins at the large meander

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.285 %	Riffle Length	23 m
Inter-Pool Gradient	0.09 %	Riffle-Pool Spacing	36 m
Inter-Riffle Gradient	0.98 %	Max Pool Depth	2.1 m
Riffle Gradient	3.81 %		

Particle Sizes (cm)	Pebble Counts
	D10 0.00073
	D50 1.25
	D90 14.93

Historical Analysis

Land Use: Langstaff Road was not present in 1954 but was seen in 1978 and 1999. Boyd Conservation Area was the dominant landuse in 1978 and 1999 followed by residential homes, a bridge was seen upstream of Langstaff Road in 1978 and 1999 but not prominent in the 1954 topo maps

Channel Change: Channel planform looked similar throughout the years examined. Mid-channel bars were present in the 1954 topo mapping but not seen in 1976 and 1999

Migration Rates (m/yr): 0.08 m/yr across valley migration between 1978 to 1999

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	7 Moderate Stability		

Site Photo's

GHU-11



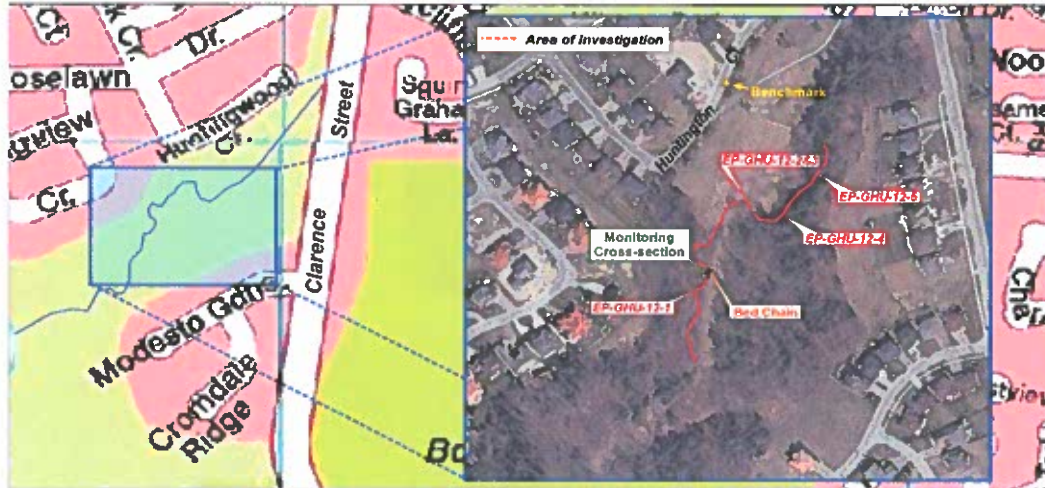
Photo 1. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to Humber River ~ GHU-12

Date of Survey: 13-Nov-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: City of Vaughan Main Intersection: Rutherford Road and Clarence Street West of Clarence Street just off Huntingwood Court. Park on Huntingwood Court and walk down to the stream

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.92 %	Riffle Length	6.4 m
Inter-Pool Gradient	1.34 %	Riffle-Pool Spacing	13.43 m
Inter-Riffle Gradient	0.93 %	Max Pool Depth	1.06 m
Riffle Gradient	2.26 %		

<i>Particle Sizes (cm)</i>	
	Pebble Counts
D10	0.00042
D50	0.078
D90	4.77

Historical Analysis

Land Use: Increase in urban residential has occurred since 195
 Channel Change: Not Available - channel corridor was surrounded by trees
 Migration Rates (m/yr): Not Available - channel corridor was surrounded by trees

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0	0 = low	0-4 = low stability
	Inter-Pool:	1	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	5 Moderate Stability		

Site Photo's

GHU-12



Photo 1. At monitoring cross-section looking downstream

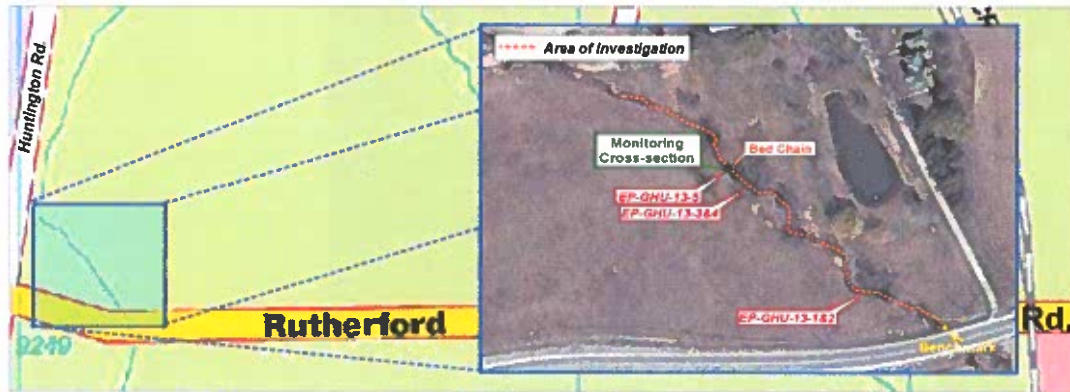


FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to Humber River ~ GHU-13

Date of Survey: 09-Oct-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: Main Intersection: East Huntington Road and North of Rutherford Road; first stream north of Rutherford Road. Park on the shoulder of Rutherford Road. site is immediately upstream of the road

Site Map



Planform Characteristics

Long Profile (avg)

Bankfull Gradient	0.49 %	Riffle Length	8.5 m
Inter-Pool Gradient	0.29 %	Riffle-Pool Spacing	14 m
Inter-Riffle Gradient	0.6 %	Max Pool Depth	1 m
Riffle Gradient	3.81 %		

Particle Sizes (cm)

	Pebble Counts
D10	< 0.0002
D50	0.00087
D90	1.22

Historical Analysis

No coverage

Stability

Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
Angle:	2	0 = low	0-4 = low stability
Inter-Pool:	2	1 = moderate	5-7 = moderate stability
Width/Depth Ratio:	1	2 = high	8-10 = high stability
Substrate Sorting:	1		
Stability:	7	Moderate Stability	

Site Photo's

GHU-13



Photo 1. At monitoring cross-section looking upstream



Photo 2. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to West Humber River ~ GHU-14

Date of Survey: 22-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: North of Castlemore Road in-between McVean Drive and The Gore Road in Brampton, park on Castlemore Rd (shoulder of the road), the site is immediately upstream of the culver

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.48 %	Riffle Length	5 m
Inter-Pool Gradient	0.13 %	Riffle-Pool Spacing	16.6 m
Inter-Riffle Gradient	0.72 %	Max Pool Depth	1.3 m
Riffle Gradient	3.11 %		

Particle Sizes (cm)	
	Pebble Counts
	D10 0.00075
	D50 0.56
	D90 9.22

Historical Analysis

Land Use: Agriculture dominate landuse in 1999
 No coverage for 1954

Channel Change: Meander cut-off is prominent in the 1999 air photo just upstream of Castlemore Road - does not show in the 1978 topo, planform has not changed between 1978 to 1999

Migration Rates (m/yr): 0.08 m/yr down valley migration between 1978 to 1999

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	8	High Stability	

Site Photo's

GHU-14



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Salt Creek ~ GHU-15

Date of Survey: 21-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Brampton - North of Castlemore Road , West of McVean Drive, just east of Samuel Drive.
 Park on the shoulder of McVean Drive and walk upstream to the site

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.57 %	Riffle Length	NA
Inter-Pool Gradient	0.89 %	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	0.8 m
Riffle Gradient	NA		

Particle Sizes (cm)	Pebble Counts
D10	silt
D50	0.0042
D90	14.67

Historical Analysis

Land Use: In 1999 the channel landuse was agriculture and scrubland
 A residential property by the site was not visible in the 1978 topo as it was in the 1999 aerial photograph, No 1954 coverage

Channel Change: West of McVean Road the channel profile for 1999 looks a little different - instead of it being straight as it showed in the 1976 topo, the channel shows to be curving outwards in 1999 (a vegetated bar is seen in this area not shown in the 1978 topo)

Migration Rates (m/yr): Negligible - no change (1976-1999)

Stability	Entrenchment:	0	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	3 Low Stability		

Site Photo's

GHU-15



Photo 1. At monitoring cross-section looking upstream

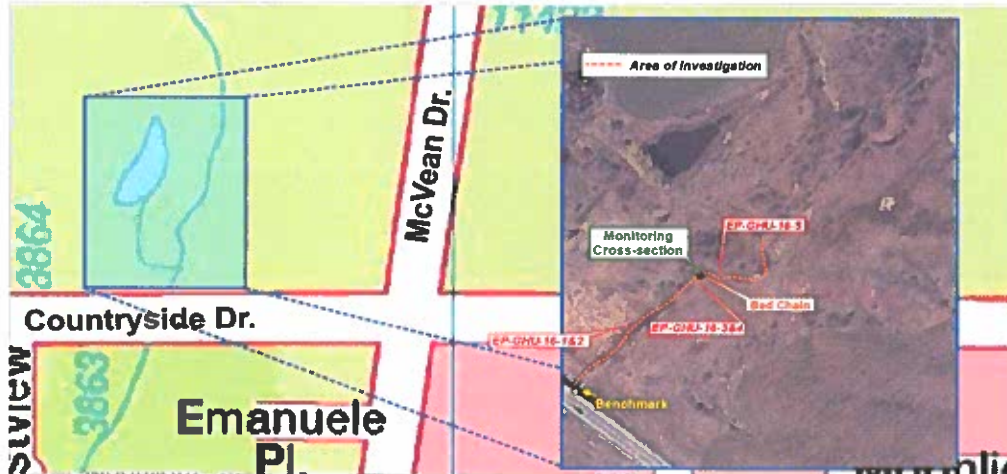


FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-16

Date of Survey: 31-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: North of Countryside Drive, West of McVean Drive in Brampton. Park on the shoulder of Countryside Drive, the site is immediately upstream of the road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.59 %	Riffle Length	11.4
Inter-Pool Gradient	0.47 %	Riffle-Pool Spacing	18.6 m
Inter-Riffle Gradient	0.78 %	Max Pool Depth	0.6 m
Riffle Gradient	3.82 %		

Particle Sizes (cm)

	Pebble Counts
D10	silt
D50	silt
D90	0.12

Historical Analysis

Land Use: 1999 - Scrubforest
 1976 - No coverage
 1954 - No coverage

Channel Change: Channel planform has not changed between 1976 to 1995

Migration Rates (m/yr): Not Available - obscured by vegetation

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	6 Moderate Stability		

Site Photo's

GHU-16

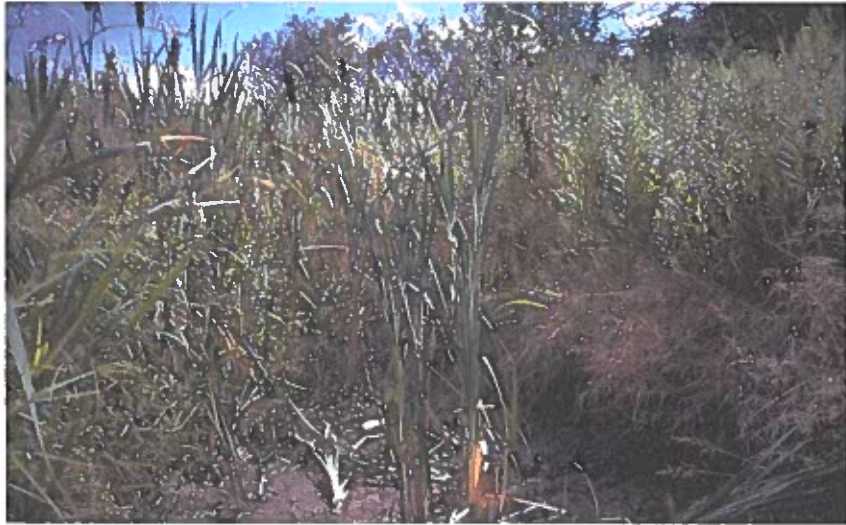


Photo 1. At monitoring cross-section looking downstream

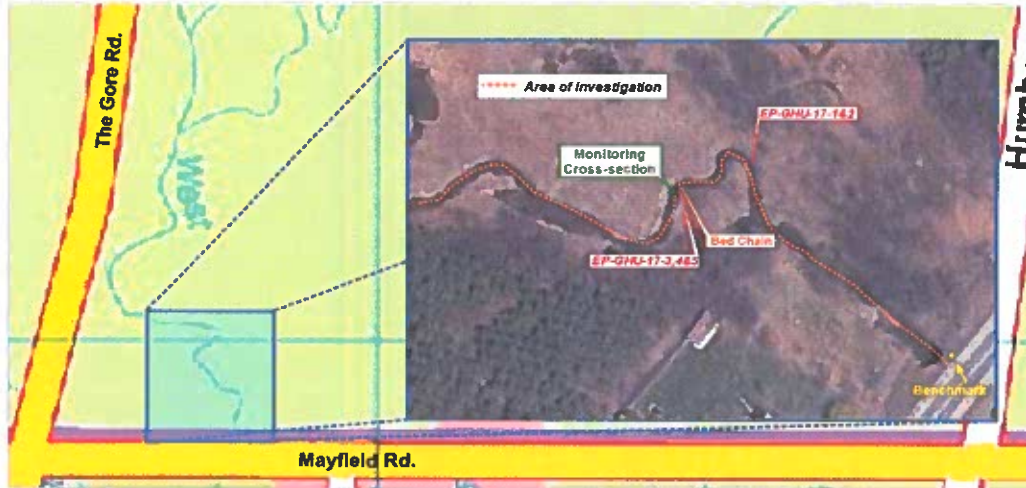


FLUVIAL GEOMORPHOLOGY SUMMARY

West Humber River ~ GHU-17

Date of Survey: 21-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: In the town of WildField, North of Mayfield Road and East of The Gore Road is West Humber River. Park on the shoulder of Mayfield Road and the site is immediately north of road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.335 %	Riffle Length	5.5 m
Inter-Pool Gradient	0.86 %	Riffle-Pool Spacing	8 m
Inter-Riffle Gradient	0.39 %	Max Pool Depth	1.2 m
Riffle Gradient	2.01 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.00081
D50	0.65
D90	9.83

Historical Analysis

Land Use: Woodlot and agricultural fields were the dominate landuse in 1978 and 1999; 1954 - no coverage
Channel Change: Channel planform have remained the same but the meanders in 1999 seem to be more prominent than in 1976
Migration Rates (m/yr): Negligible - no change (1976-1999)

Stability	Entrenchment:	0	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	4	Low Stability	

Site Photo's

GHU-17



Photo 1. At monitoring cross-section looking downstream

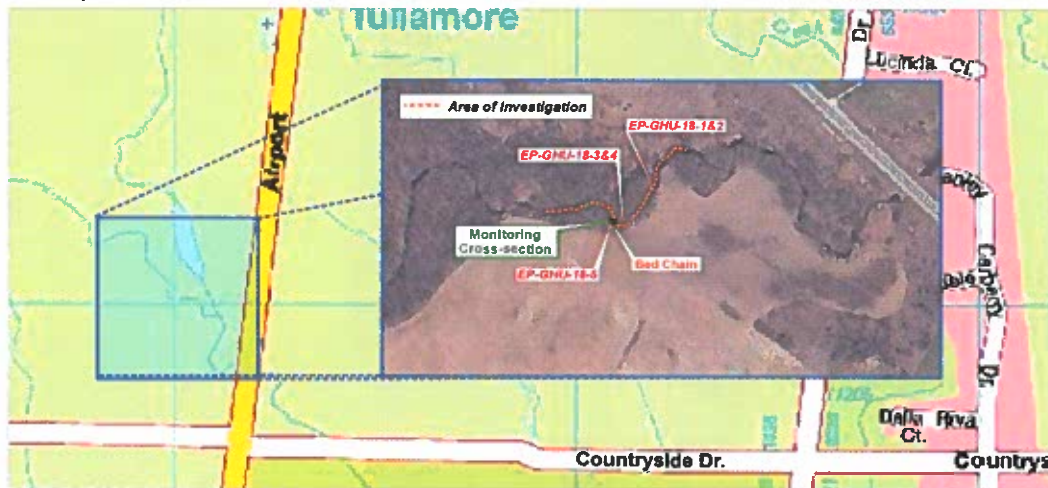


FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to West Humber River ~ GHU-18

Date of Survey: 10-Oct-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: West of Airport Road, North of Countryside Drive. West branch tributary above the confluence of the tributary with the on-line pond. Park on the shoulder of Airport Road and walk upstream

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	1.03 %	Riffle Length	9.5 m
Inter-Pool Gradient	1.16 %	Riffle-Pool Spacing	21.8 m
Inter-Riffle Gradient	1.03 %	Max Pool Depth	1.15 m
Riffle Gradient	3.04 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.022
D50	1.85
D90	12.53

Historical Analysis

Land Use: Woodlot and agriculture fields were the dominate landuse between 1976 to 1991
 1954 - no coverage

Channel Change: Channel planform have remained the same for both of the years (1976 to 1999)

Migration Rates (m/yr): Negligible - no change (1976-1999)

<i>Stability</i>	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	7 Moderate Stability		

Site Photo's

GHU-18



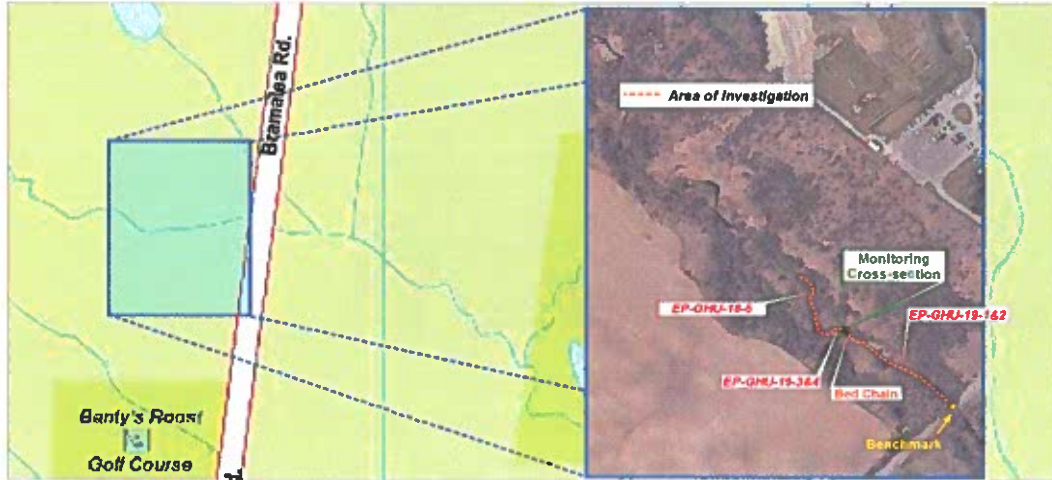
Photo 1. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to Humber River ~ GHU-19

Date of Survey: 24-Aug-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: North of Mayfield Road, West of Bramalea Road, just above Banty's Roost Golf Course. Third stream north of Mayfield Road and west of Bramalea Road is the channel. Site is immediately upstream of the ro:

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.71 %	Riffle Length	11.5 m
Inter-Pool Gradient	1.38 %	Riffle-Pool Spacing	14.33 m
Inter-Riffle Gradient	1.2 %	Max Pool Depth	1.02 m
Riffle Gradient	3.55 %		

<i>Particle Sizes (cm)</i>	
	Pebble Counts
D10	0.022
D50	1.85
D90	12.53

Historical Analysis

Land Use: Reach surrounded by woodlc
Channel Change: Difficult to assess with the tree cover
Migration Rates (m/yr): Difficult to assess with the tree cover

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	4	Low Stability	

Site Photo's

GHU-19



Photo 1. At monitoring cross-section looking downstream

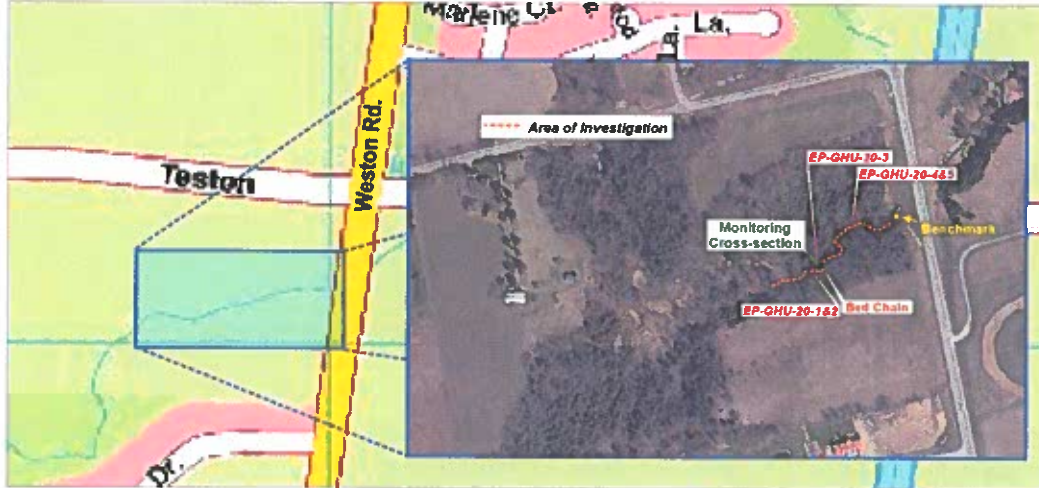


FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to East Humber River ~ GHU-20

Date of Survey: 30-Oct-01
 Number of cross-sections: 10
 Associated Fisheries Site: HU020WM
 Access: West of Highway 56 (Weston Road) and south of Teston Road, first tributary west of Weston Road - park on the shoulder of the road and the site is immediately downstream

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.46 %	Riffle Length	9.3 m
Inter-Pool Gradient	0.47 %	Riffle-Pool Spacing	30 m
Inter-Riffle Gradient	0.44 %	Max Pool Depth	1.5 m
Riffle Gradient	2.23 %		

<i>Particle Sizes (cm)</i>	
	Pebble Counts
D10	0.00044
D50	0.0133
D90	1.37

Historical Analysis

Land Use: Reach surrounded by woodlot
 Channel Change: Difficult to assess with the tree cover
 Migration Rates (m/yr): Difficult to assess with the tree cover

<i>Stability</i>	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	8 High Stability		

Site Photo's

GHU-20



Photo 1. At monitoring cross-section looking downstream

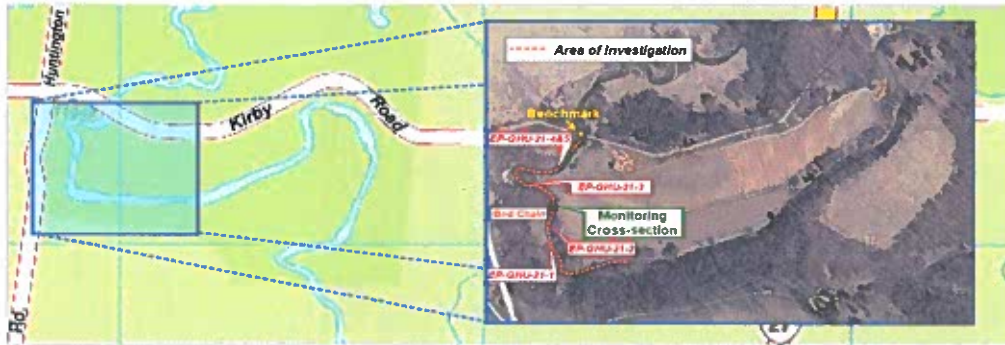


FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-21

Date of Survey: 22-Nov-01
Number of cross-sections: 10
Associated Fisheries Site: HU002WM
Access: Main intersections: Huntington Road and Kirby Road. Park on the shoulder of Kirby road, the site is immediately downstream of Kirby Road

Site Map



Planform Characteristics

Long Profile (avg)				
Bankfull Gradient	0.135 %	Riffle Length	8.17 m	
Inter-Pool Gradient	0.16 %	Riffle-Pool Spacing	26.43 m	
Inter-Riffle Gradient	0.27 %	Max Pool Depth	1.8 m	
Riffle Gradient	3.53 %			

Particle Sizes (cm)		Pebble Counts
	D10	0.00046
	D50	0.55
	D90	9.96

Historical Analysis

Land Use: Woodlot/scrub forest and agriculture were the dominate landuse for all of th years - no change

Channel Change: Channel planform has remained the same for all the years, depositic was visible in all of the three years, Kirby Road (crossing the site) was seen in all of the years examined

Migration Rates (m/yr): 0.36 m/yr across valley migration between 1954 to 1999
 0.34 m/yr across valley migration between 1978 to 1999

Stability	Entrenchment:	0	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		

Stability:

6 Moderate Stability

Site Photo's

GHU-21



Photo 1. At monitoring cross-section looking downstream

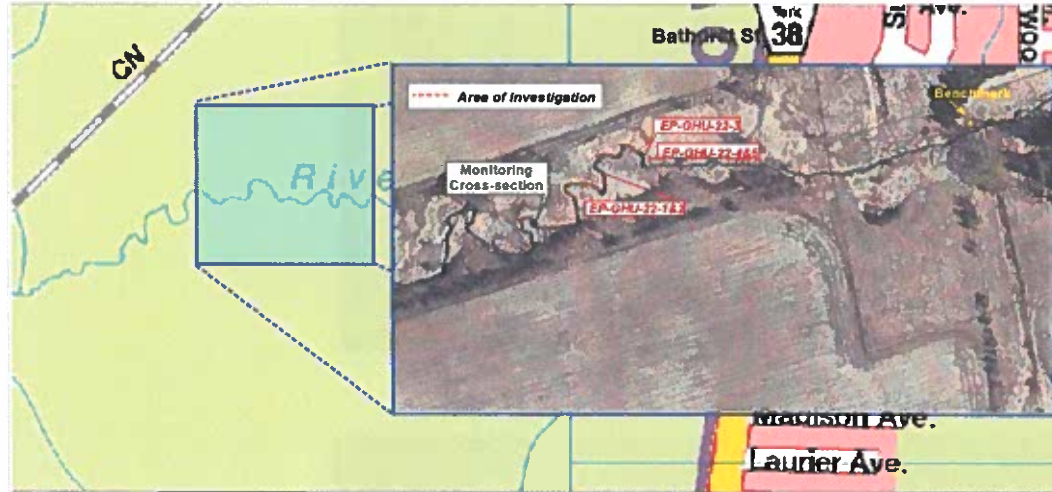


FLUVIAL GEOMORPHOLOGY SUMMARY

East Humber River ~ GHU-22

Date of Survey: 05-Sep-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: In King City; North of King Road, West of Bathurst Street. Site begins at first meander upstream of Bathurst Street. Park on Bathurst Street and walk downstream to the stream

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.06 %	Riffle Length	NA m
Inter-Pool Gradient	0.008 %	Riffle-Pool Spacing	NA m
Inter-Riffle Gradient	NA %	Max Pool Depth	0.99 m
Riffle Gradient	NA %		

Particle Sizes (cm)	Pebble Counts
D10	0.00046
D50	0.55
D90	9.96

Historical Analysis

Land Use: Agriculture and scrubland were the dominate landuse
Channel Change: Channel planform have remained the same for all the years examin
Migration Rates (m/yr): Negligible - no change (1976-1999)

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	5 Moderate Stability		

Site Photo's

GHU-22



Photo 1. At monitoring cross-section looking upstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to East Humber River ~ GHU-23

Date of Survey: 29-Oct-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: East of Weston Road, south of King Road, immediately south of Laskay Lane in the Town of Laskay. Park on the shoulder of Laskay Lane and the site is immediately upstream of the bridge

Site Map



Planform Characteristics

Long Profile (avg)

Bankfull Gradient	0.54 %	Riffle Length	14.23 m
Inter-Pool Gradient	0.77 %	Riffle-Pool Spacing	26.4 m
Inter-Riffle Gradient	0.53 %	Max Pool Depth	1.9 m
Riffle Gradient	3.24 %		

Particle Sizes (cm)

	Pebble Counts
D10	silt
D50	0.493
D90	12.06

Historical Analysis

Land Use: Dense woodlot surrounds the channel in 1978 and 1954 - cannot make out the channel, Laskay Lane is seen upstream of the stream both in 1976 and 1978 1954 - no coverage

Channel Change: Channel planform have remained the same for all the years examined

Migration Rates (m/yr): Not Available - obscured by trees

Stability

Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
Angle:	1	0 = low	0-4 = low stability
Inter-Pool:	1	1 = moderate	5-7 = moderate stability
Width/Depth Ratio:	2	2 = high	8-10 = high stability
Substrate Sorting:	1		
Stability:	5		Moderate Stability

Site Photo's

GHU-23



Photo 1. At monitoring cross-section looking upstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-24

Date of Survey: 07-Dec-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: 3 km east of the Village of Nobleton on York Reg. Road 11 (King Road) and 0.9km south of Mill Road. Park at dead end road in the conservation area:

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.165 %	Riffle Length	8.2 m
Inter-Pool Gradient	1.1 %	Riffle-Pool Spacing	15 m
Inter-Riffle Gradient	0.32 %	Max Pool Depth	2 m
Riffle Gradient	2.2 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.00066
D50	0.24
D90	5.54

Historical Analysis

Land Use: There are buildings (homes) shown north of the channel in 1954 that were not seen in 1978 and 1999. Humber Trails Forest and Wildlife Area was the dominate landuse in 1999

Channel Change: Channel planform was similar in all of the three years, although difficult to tell in 1999 because of the trees. The 1976 planform may have been a little more sinuous than the 1954

Migration Rates (m/yr): Not Available - no set benchmarks to measure

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		

Stability: 5 Moderate Stability

Site Photo's

GHU-24



Photo 1. At monitoring cross-section looking upstream

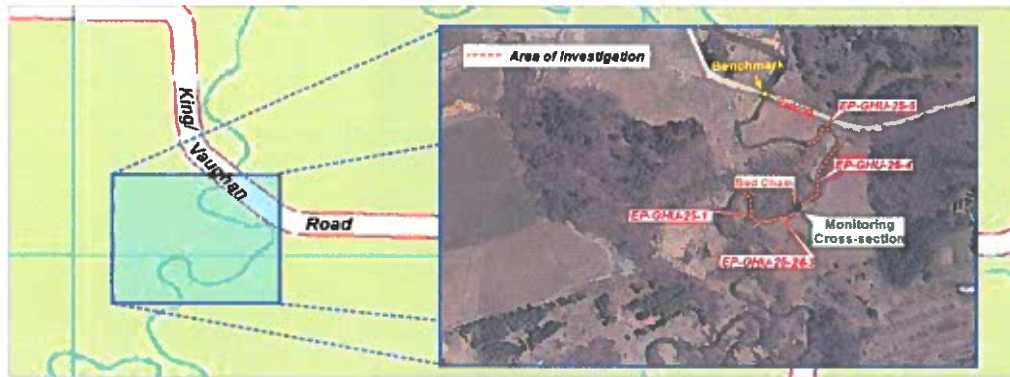


FLUVIAL GEOMORPHOLOGY SUMMARY

East Humber River ~ GHU-25

Date of Survey: 23-Nov-01
Number of cross-sections: 10
Associated Fisheries Site: HU022WM
Access: East Humber River, Downstream of King/Vaughan Road - the site begins at the bend that follows the road Park on King/Vaughn Road and walk downstream to the creek

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.18 %	Riffle Length	9.8 m
Inter-Pool Gradient	0.074 %	Riffle-Pool Spacing	23.75 m
Inter-Riffle Gradient	0.59 %	Max Pool Depth	1.3 m
Riffle Gradient	3.54 %		

Particle Sizes (cm)	Pebble Counts
D10	0.00059
D50	97
D90	9.61

Historical Analysis

Land Use: Agriculture and Scrubland/forest were the dominate landuse

Channel Change: Large island present just downstream of the King/Vaughn Road bridg that was not seen in 1954 or 1999, channel planform was the same for of the three years examined

Migration Rates (m/yr): Bend area close to the King/Vaughn Road shows no significant migratio rate for all of the three years examined

<i>Stability</i>	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	6	Moderate Stability	

Site Photo's

GHU-25



Photo 1. At monitoring cross-section looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary of Humber River ~ GHU-26

Date of Survey: 23-Nov-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: Corner of 10 Concession and King/Vaughan Road in Nobleton behind home #71 on Ranch Trail Road - stream is located by the valley wall

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.98 %	Riffle Length	NA
Inter-Pool Gradient	0.45 %	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	1.25 m
Riffle Gradient	NA		

Particle Sizes (cm)	
	Pebble Counts
D10	silt
D50	0.021
D90	3.29

Historical Analysis

Not Available - cannot see the channel - vegetation too den

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	8 High Stability		

Site Photo's

GHU-26



Photo 1. At monitoring cross-section looking downstream



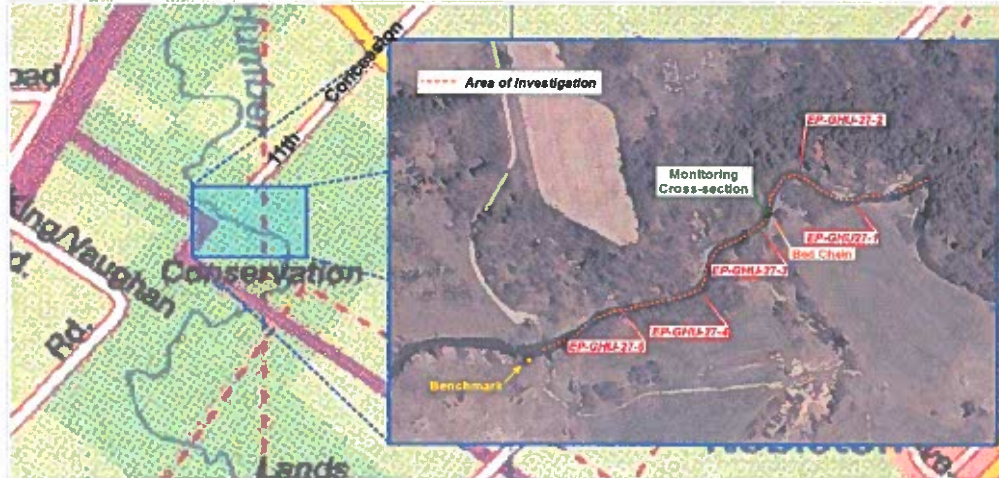
Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-27

Date of Survey: 06-Dec-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: South of York Road 11 (King Road) on 11 Concession Road in Conservation Lands. Dead end of 11 Concession, the site is downstream of the tractor crossing or Dead end road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.285 %	Riffle Length	24.67 m
Inter-Pool Gradient	0.35 %	Riffle-Pool Spacing	50.17 m
Inter-Riffle Gradient	0.34 %	Max Pool Depth	1.5 m
Riffle Gradient	1.02 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.0021
D50	1.85
D90	10.47

Historical Analysis

Land Use: Scrubforest and agriculture were the dominate landuse for the stream - no change

Channel Change: Large island present in 1954 that was not seen in 1976 or 1999, channel planform was similar for all of the years examined

Migration Rates (m/yr): Not Available - no set benchmarks to measure

Stability	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	5 Moderate Stability		

Site Photo's

GHU-27



Photo 1. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-28

Date of Survey: 07-Nov-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: North of King Road (Hwy 11), East of Caledon/King Townline. Park on the shoulder of Caledon/King Townline and the site is immediately upstream of the bridge

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.09 %	Riffle Length	5.5 m
Inter-Pool Gradient	0.47 %	Riffle-Pool Spacing	16 m
Inter-Riffle Gradient	0.36 %	Max Pool Depth	2.4 m
Riffle Gradient	4.39 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.00044
D50	0.041
D90	5.84

Historical Analysis

Land Use: Scrubforest and a couple of homes were present around the channel in 1999

Channel Change: Channel planform was similar for 1954 and 1999, deposition visible in 1954 was not seen in 1999 aerial photograph, pond in 1999 not seen in 1954 topo map

Migration Rates (m/yr): Not Available

Stability	Entrenchment:	2	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	6 Moderate Stability		

Site Photo's

GHU-28



Photo 1. At monitoring cross-section looking upstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-29

Date of Survey: 07-Nov-01
Number of cross-sections: 10
Associated Fisheries Site: HU029WM
Access: Main Humber just west of Bolton, immediately north of Sixth Line (Duffys Lane) in conservation lands. Park on shoulder of Sixth Line, site is upstream of the road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.13 %	Riffle Length	39 m
Inter-Pool Gradient	0.51 %	Riffle-Pool Spacing	88 m
Inter-Riffle Gradient	0.42 %	Max Pool Depth	1.74 m
Riffle Gradient	1.26 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.00074
D50	0.9
D90	5.92

Historical Analysis

Land Use: Forest/Scrubforest was the dominate surrounding landuse - no change
Channel Change: Channel planform was the same for all of the three years examined
Migration Rates (m/yr): Negligible - no change (1954-1999)

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	3	Low Stability	

Site Photo's

GHU-29



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to East Humber River ~ GHU-30

Date of Survey: 15-Oct-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: South of 15th Sideroad, East of Highway 27, downstream of pond located west of Keewaydin Road; park on the shore of 15th Sideroad and walk downstream to the stream.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.6 %	Riffle Length	NA
Inter-Pool Gradient	NA	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	0.5 m
Riffle Gradient	NA		

Particle Sizes (cm)		Pebble Counts
	D10	silt
	D50	0.00076
	D90	0.53

Historical Analysis

No Coverage

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>		
	Angle:	2			0 = low	0-4 = low stability
	Inter-Pool:	NA			1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1			2 = high	8-10 = high stability
	Substrate Sorting:	0				
	Stability:	4* Low Stability	* - ranking is displayed out of a possible 10			

Site Photo's

GHU-30



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Tributary to Cold Creek ~ GHU-31

Date of Survey: 15-Oct-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: Town of Holly Park, First tributary North of 16th Sideroad, East of 11th Concession; park on 16th Sideroad, the site is immediately upstream of the road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.245 %	Riffle Length	18 m
Inter-Pool Gradient	NA	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	0.7 m
Riffle Gradient	1.08 %		

<i>Particle Sizes (cm)</i>	
	Pebble Counts
D10	clay
D50	clay
D90	0.00071

Historical Analysis

No Coverage

<i>Stability</i>	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	NA	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	7.5* Moderate Stability	* - ranking is displayed out of a possible 10	

Site Photo's

GHU-31



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Cold Creek ~ GHU-32

Date of Survey: 23-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: In the town of Castlederg, North of 15th Sideroad (Castlederg Sideroad) in-between Mount Hope Rd (8th Line) and Mount Pleasant Rd (9th Line), downstream of pond area. Park on the shoulder of the road (Castlederg Sideroad) the site is immediately upstream of the road.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.36 %	Riffle Length	7 m
Inter-Pool Gradient	NA	Riffle-Pool Spacing	9 m
Inter-Riffle Gradient	NA	Max Pool Depth	0.88 m
Riffle Gradient	1.6 %		

Particle Sizes (cm)

	Pebble Counts
D10	silt
D50	0.00062
D90	0.01

Historical Analysis

No Coverage

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0		
	Inter-Pool:	NA		
	Width/Depth Ratio:	1		
	Substrate Sorting:	0		
Stability:	3.8* Low Stability			* - ranking is displayed out of a possible 10

Site Photo's

GHU-32



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-33

Date of Survey: 06-Dec-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: 7 km south of Hwy9 on Hwy 50, inside MTRCA lands, Albion Hills Conservation Area
 campground adjacent to campground over night office

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.065 %	Riffle Length	16 m
Inter-Pool Gradient	0.1 %	Riffle-Pool Spacing	45.67 m
Inter-Riffle Gradient	0.17 %	Max Pool Depth	2.7 m
Riffle Gradient	0.53 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.001
D50	1.42
D90	12.11

Historical Analysis

Land Use: Conservation roads present in 1978 were not seen in 1954
 Conservation land was the dominate landuse in 1999 and 1978

Channel Change: Channel seems to be similar in shape for all of the three years examined
 deposition was seen in all the years examined

Migration Rates (m/yr): Negligible - no change (1979-1999)
 Not available for 1954 because no set benchmark to measure from 1954 topo

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	4 Moderate Stability		

Site Photo's

GHU-33



Photo 1. At monitoring cross-section on looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Centreville Creek ~ GHU-34

Date of Survey: 26-Nov-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Inside the Albion Hills Conservation Area just upstream of the reservoir. Main Intersection: 25th Sideroad and 5th Lin Park in the parking lot beside the stream (left bank), upstream of the bridge

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.425 %	Riffle Length	8.3 m
Inter-Pool Gradient	0.41	Riffle-Pool Spacing	22 m
Inter-Riffle Gradient	0.46	Max Pool Depth	1.24 m
Riffle Gradient	1.01 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.00061
D50	0.11
D90	3.03

Historical Analysis

Land Use: Scrubland and conservation land were the dominate land-use surrounding this site

Channel Change: Channel planform was the same except the reservoir located downstream of the site does not show in the 1954 top map

Migration Rates (m/yr): Not Available - no set benchmarks to measure

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	0	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	6 Moderate Stability		

Site Photo's

GHU-34



Photo 1. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Humber River ~ GHU-35

Date of Survey: 12-Dec-01
Number of cross-sections: 10
Associated Fisheries Site: HU038WM
Access: Main Intersection: west of Mono-Adjala Town and north of Highway 9, follow the Bruce Trail into a Cedar thicket; the first bridge crossing is the Humber River, site is immediately downstream of bridge, park at the side of the rd (Mono-Adjala Town).

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	1.32 %	Riffle Length	18.33 m
Inter-Pool Gradient	3.65 %	Riffle-Pool Spacing	27.33 m
Inter-Riffle Gradient	4.98 %	Max Pool Depth	1.4 m
Riffle Gradient	3.53 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.00086
D50	0.77
D90	16.8

Historical Analysis

Land Use: Cedar thicket forest
Channel Change: Dense cedar thicket forest - too difficult to observe any planform change
Migration Rates (m/yr): Not Available - no set benchmarks to measure

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	6 Moderate Stability		

Site Photo's

GHU-35



Photo 1. At monitoring cross-section looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-1

Date of Survey: 26-Sep-00
 Number of cross-sections: 10
 Associated Fisheries Site: None

Access: Immediately downstream of Queen Elizabeth Highway. Park at the end of Savona Drive/Westhead Road in a parking lot designated for park users. Go down the stairs across the baseball diamond field and the site is just below the QEW bridge.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.56 %	Riffle Length	88.83 m
Inter-Pool Gradient	0.63 %	Riffle-Pool Spacing	103.25 m
Inter-Riffle Gradient	0.73 %	Max Pool Depth	1.62 m
Riffle Gradient	1.73 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.18
D50	9.7
D90	Bedrock

Historical Analysis

Land Use: 1954 to 1999 has not changed - Urban residential /Urban Golf Courses

Channel Change: Channel length has not changed, no change in channel was visible

Migration Rates (m/yr): Negligible - No change

<i>Stability</i>	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	5	Moderate Stability	

Site Photo's

GET-1



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Renforth Creek ~ GET-2

Date of Survey: 12-Oct-00
Number of cross-sections: 10
Associated Fisheries Site: EC003WM
Access: Parking available in Creative Arts Centre, paved pathway leads down to channel

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	1.38 %	Riffle Length	23.5 m
Inter-Pool Gradient	2.32 %	Riffle-Pool Spacing	33.7 m
Inter-Riffle Gradient	1.9 %	Max Pool Depth	1.95 m
Riffle Gradient	3.9 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.01
D50	1.07
D90	15.71

Historical Analysis

Land Use: In 1954 rural agriculture/residential was dominant but changed after 1978 to urban rural/golf course
Channel Change: N/A obscured by forest cover
Migration Rates (m/yr): N/A obscured by forest cover

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>	
	Angle:	2			0 = low
	Inter-Pool:	0			1 = moderate
	Width/Depth Ratio:	1			2 = high
	Substrate Sorting:	1			
	Stability:	5 Moderate Stability			

Site Photo's

GET-2



Photo 1. Monitoring cross-section as seen looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-3

Date of Survey: 19-Oct-00
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Upstream of Rathburn Road East - Mississauga. Park at the apartment complex at the end of Rathburn Road East (Mississauga side) and follow the path upstream to the river.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.39 %	Riffle Length	NA
Inter-Pool Gradient	NA	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	NA
Riffle Gradient	NA		

Particle Sizes (cm)	
	Pebble Counts
D10	0.54
D50	23.52
D90	Bedrock

Historical Analysis

Land Use: 1954 = Rural agriculture
 1978 = Rural residential. Rural vacant
 1999 = Urban mix of commercial and residential, Urban golf course

Channel Change: Altered between 1954 to 1978; channel length has decreased; valley wall erosion has increased

Migration Rates (m/yr): altered

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1		
	Inter-Pool:	NA		
	Width/Depth Ratio:	1		
	Substrate Sorting:	1		
	Stability:	5* Moderate Stability		* - ranking is displayed out of a possible 10

Site Photo's

GET-3



Photo 1. At monitoring cross-section looking downstream

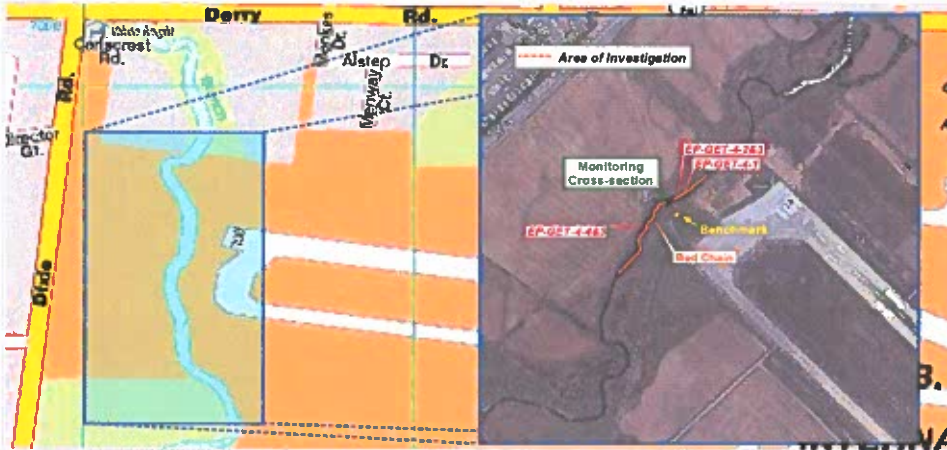


FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-4

Date of Survey: 06-Sep-01
Number of cross-sections: 10
Associated Fisheries Site: EC007WM
Access: South of Derry Road East and East of Dixie Road in airport grounds, site begins at the end of Runway Park on Carlscrest Road and walk downstream to the stream

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.77 %	Riffle Length	14.5 m
Inter-Pool Gradient	0.89 %	Riffle-Pool Spacing	31.17 m
Inter-Riffle Gradient	0.63 %	Max Pool Depth	1.2 m
Riffle Gradient	3.57 %		

Particle Sizes (cm)

Pebble Counts	
D10	0.27
D50	6.88
D90	Bedrock

Historical Analysis

Land Use: 1954 to 1999 has not changed - airport property

Channel Change: Between 1954 to 1999 -4.6% change in length
 Since 1954 sections were relocated and hardened to accommodate runway expansion for the airport

Migration Rates (m/yr): 1954 -1999 - 0.28 m/yr

Stability	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	2	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	7	Moderate Stability	

Site Photo's

GET-4



Photo 1. Looking downstream - Note the truck parked on the left bank just below the fence line - that is the location of the monitoring cross-section.

FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-5

Date of Survey: 28-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: East of Bramalea Road, South of Drew Road, North of Derry Road East
 Park on Derry Road East, the site is upstream of the road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.46 %	Riffle Length	10.2 m
Inter-Pool Gradient	0.45 %	Riffle-Pool Spacing	23.25 m
Inter-Riffle Gradient	0.98 %	Max Pool Depth	1.6 m
Riffle Gradient	5.02 %		

Particle Sizes (cm)	Pebble Counts
	D10 0.025
	D50 1.01
	D90 Bedrock

Historical Analysis

Land Use: Agriculture surrounds the corridor of the reach while commercial buildings have increased since 1954 to surround the perimeter

Channel Change: Between 1954 to 1999 -21% change in channel length
 Top portion of the reach is straight and unchanged since 1954, bottom have of reach realigned since 1976

Migration Rates (m/yr): 1954 to 1999 - 0.11 m/yr

Stability	Entrenchment:	2	Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	8 High Stability	*while measures indicate a high stability, field observations suggest a moderate to low stability	

FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-6

Date of Survey: 20-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: Brampton - North of Clarence Street, East of Guest St./Mary St. Park at the Centennial Rec. Centre. Park at rec. centre and walk downstream (pass the Horseshoe courts) and go down to the strea

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.13 %	Riffle Length	25.37 m
Inter-Pool Gradient	0.82 %	Riffle-Pool Spacing	21 m
Inter-Riffle Gradient	0.1 %	Max Pool Depth	1.59 m
Riffle Gradient	3.34 %		

Particle Sizes (cm)

Pebble Counts	
D10	0.0027
D50	1.16
D90	9.55

Historical Analysis

No Coverage

<i>Stability</i>			<i>Individual Categories</i>		<i>Overall Score</i>
	Entrenchment:	1	0 = low	0-4 = low stability	
	Angle:	1	1 = moderate	5-7 = moderate stability	
	Inter-Pool:	0	2 = high	8-10 = high stability	
	Width/Depth Ratio:	2			
	Substrate Sorting:	1			
	Stability:	5 Moderate Stability			

Site Photo's

GET-6



Photo 1. At monitoring cross-section looking downstream



Photo 2. At monitoring cross-section looking upstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-7

Date of Survey: 30-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: EC010WM
Access: Brampton, first stream south of Bovaird Drive and East of Dixie Road.
 Park on Moregate Crescent (north corner parallel to Dixie Road); go down the hill until you reach the stre.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.205 %	Riffle Length	4 m
Inter-Pool Gradient	0.19 %	Riffle-Pool Spacing	35 m
Inter-Riffle Gradient	0.19 %	Max Pool Depth	1 m
Riffle Gradient	3.27 %		

Particle Sizes (cm)

Pebble Counts	
D10	silt
D50	0.0048
D90	20.75

Historical Analysis

No Coverage

<i>Stability</i>			<i>Individual Categories</i>	<i>Overall Score</i>
	Entrenchment:	1	0 = low	0-4 = low stability
	Angle:	1	1 = moderate	5-7 = moderate stability
	Inter-Pool:	2	2 = high	8-10 = high stability
	Width/Depth Ratio:	2		
	Substrate Sorting:	2		
	Stability:	8 High Stability		

Site Photo's

GET-7



Photo 1. At monitoring cross-section looking upstream



Photo 2. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-8

Date of Survey: 28-Aug-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: East of Highway 20, North of Mayfield Road, just off Cliffview Court.
 Park on Cliffview Court, follow the dirt road that leads directly to the creek

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.96 %	Riffle Length	4.17 m
Inter-Pool Gradient	0.7 %	Riffle-Pool Spacing	37 m
Inter-Riffle Gradient	0.31 %	Max Pool Depth	1.5 m
Riffle Gradient	5.77 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.00072
D50	0.59
D90	11.75

Historical Analysis

Land Use: 1978 to 1988 - agriculture
 1988 to 1995 - residential areas were created East of Hwy 10

Channel Change: planform remains similar, slight shift in channel has occurred due to the presence of meander cut-off and oxbow in a meander depression on the floodplain

Migration Rates (m/yr): 0.11 to 0.30

<i>Stability</i>	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1		
	Inter-Pool:	2		
	Width/Depth Ratio:	2		
	Substrate Sorting:	1		
	Stability:	7 Moderate Stability		
			0 = low	0-4 = low stability
			1 = moderate	5-7 = moderate stability
			2 = high	8-10 = high stability

Site Photo's

GET-8



Photo 1. At monitoring cross-section looking upstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-9

Date of Survey: 10-Aug-01
 Number of cross-sections: 10
 Associated Fisheries Site: EC014WM
 Access: West of McLaughlin Road, in-between North of Mayfield Road and South of Old School Road
 Park on the shoulder of McLaughlin Road - site is immediately upstream of the ro:

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.035 %	Riffle Length	5 m
Inter-Pool Gradient	0.056 %	Riffle-Pool Spacing	NA
Inter-Riffle Gradient	NA	Max Pool Depth	1 m
Riffle Gradient	0.56 %		

Particle Sizes (cm)	
	Pebble Counts
D10	0.00031
D50	0.0009
D90	0.37

Historical Analysis

No coverage

<i>Stability</i>	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>		
	Angle:	2			0 = low	0-4 = low stability
	Inter-Pool:	0			1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2			2 = high	8-10 = high stability
	Substrate Sorting:	1				
	Stability:	5 Moderate Stability				

Site Photo's



Photo 1. At monitoring cross-section looking upstream



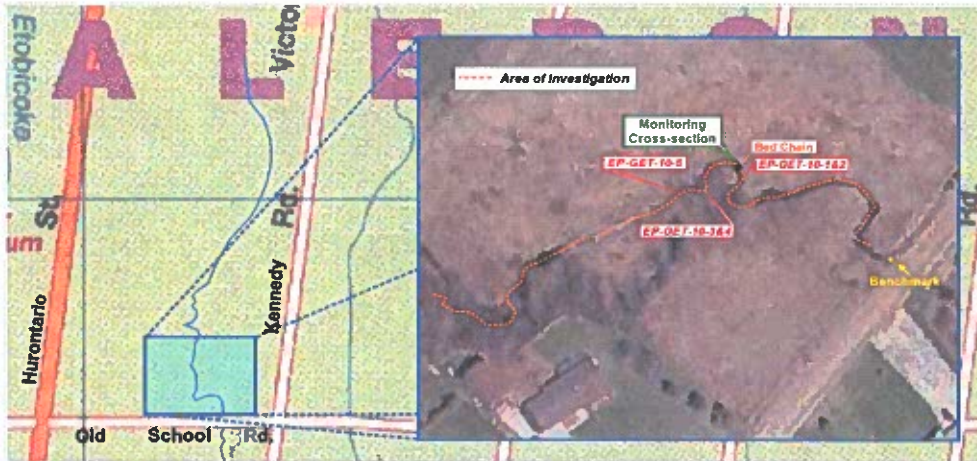
Photo 2. At monitoring cross-section looking downstream

FLUVIAL GEOMORPHOLOGY SUMMARY

Etobicoke Creek ~ GET-10

Date of Survey: 28-Aug-01
Number of cross-sections: 10
Associated Fisheries Site: None
Access: First stream East of Kennedy Road and North of Old School Road. Site is immediately upstream, park on the shoulder of Old School Road

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.77 %	Riffle Length	5.3 m
Inter-Pool Gradient	0.88 %	Riffle-Pool Spacing	16.64 m
Inter-Riffle Gradient	1.07 %	Max Pool Depth	0.89 m
Riffle Gradient	1.94 %		

Particle Sizes (cm)

Pebble Counts	
D10	< 0.0002
D50	0.002
D90	3.95

Historical Analysis

No coverage

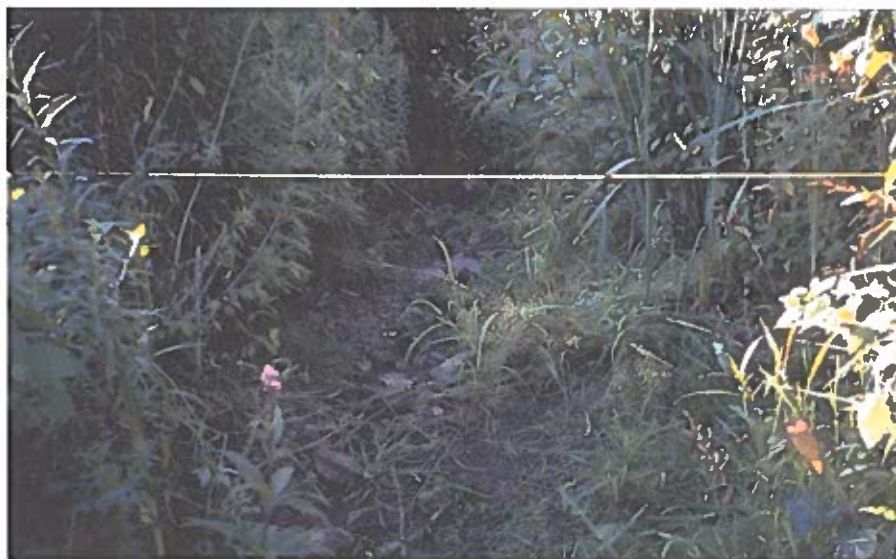
Stability	Entrenchment		Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	2		
	Stability:	8 High Stability		

Site Photo's

GET-10



Photo 1. At monitoring cross-section looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Mimico Creek ~ GMI-1

Date of Survey: 16-Oct-00
Number of cross-sections: 10
Associated Fisheries Site: None
Access: North of The Queensway, West of Parklawn Road. Parking is at the end of Delroy Drive at the parking lot in the park.

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.68 %	Riffle Length	51.5 m
Inter-Pool Gradient	0.96 %	Riffle-Pool Spacing	57.83 m
Inter-Riffle Gradient	0.91 %	Max Pool Depth	1.34 m
Riffle Gradient	1.76 %		

<i>Particle Sizes (cm)</i>	
	Pebble Counts
D10	0.093
D50	14.88
D90	Bedrock

Historical Analysis

Land Use: Predominately urban since 1950
Channel Change: Planform remains similar; local reinforcement visible in aerea
Migration Rates (m/yr): No change

<i>Stability</i>	Entrenchment:	0	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	1	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	1		
	Stability:	4 Low Stability		

Site Photo's

GMI-1



Photo 1. At monitoring cross-section looking downstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Mimico Creek ~ GMI-2

Date of Survey: 27-Sep-00
Number of cross-sections: 10
Associated Fisheries Site: None
Access: North of Bloor St. West, West of Montgomery Road Site is between the railway to subway railway. Park at the end of Central Arena and walk down to the pedestrian footbridge.

Site Map



Planform Characteristics

Long Profile (avg)

Bankfull Gradient	0.49 %	Riffle Length	45.67 m
Inter-Pool Gradient	0.61 %	Riffle-Pool Spacing	73.17 m
Inter-Riffle Gradient	0.45 %	Max Pool Depth	1.96 m
Riffle Gradient	1.65 %		

Particle Sizes (cm)

Pebble Counts	
D10	0.035
D50	3.19
D90	18.99

Historical Analysis

Land Use: 1954 = Urban residential
 1978 = Urban mix of commercial and residential
 1999 = Urban mix of commercial and residential

Channel Change: Historically unaltered

Migration Rates (m/yr): Not Available - poor aerial image resolution

Stability	Entrenchment:		Individual Categories	Overall Score
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	2	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	1	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	4	Low Stability	

Site Photo's

GMI-2



Photo 1. At monitoring cross-section looking upstream

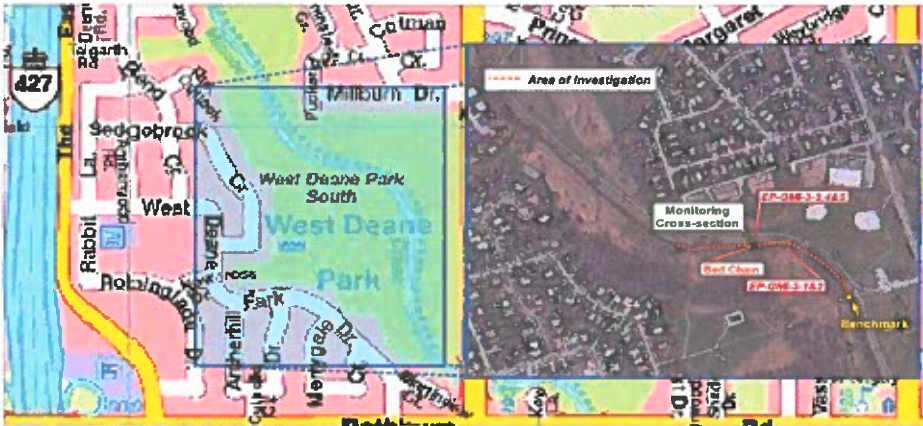


FLUVIAL GEOMORPHOLOGY SUMMARY

Mimico Creek ~ GMI-3

Date of Survey: 14-Sep-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: In West Deane Park; North of Rathbun Road, East of Martin Grove Road.
 Park in the parkland parking lot by the baseball diamonds

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.18 %	Riffle Length	37 m
Inter-Pool Gradient	0.36 %	Riffle-Pool Spacing	103.5 m
Inter-Riffle Gradient	0.45 %	Max Pool Depth	1.3 m
Riffle Gradient	0.88 %		

Particle Sizes (cm)	Pebble Counts
	D10 0.19
	D50 4.98
	D90 15.99

Historical Analysis

Land Use: 1954 = Rural agriculture
 1978 = Urban residential, Urban park
 1999 = Urban residential, Urban park

Channel Change: Has been straightened since 1954, channel length has decreased by 26.2% by 1978 because of the construction of Hwy 401

Migration Rates (m/yr): Altered channel

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1		
	Inter-Pool:	0		
	Width/Depth Ratio:	2		
	Substrate Sorting:	0		
			0 = low	0-4 = low stability
			1 = moderate	5-7 = moderate stability
			2 = high	8-10 = high stability

Stability:

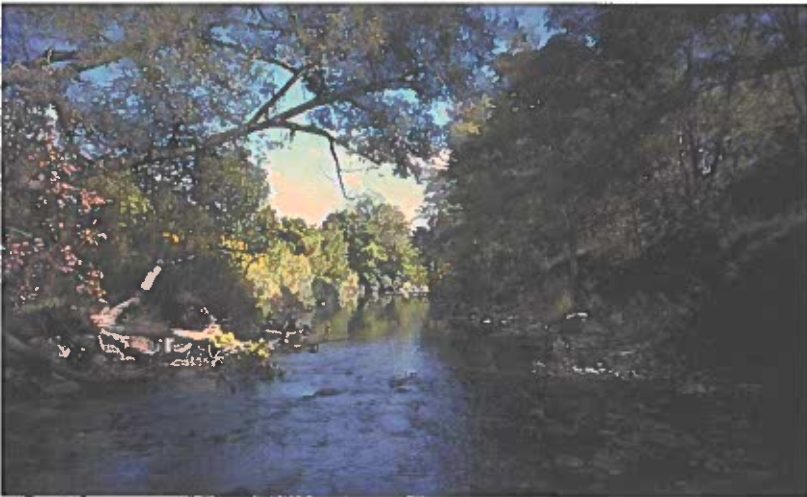
4 Low Stability

Site Photo's

GMI-3



Photo 1. At monitoring cross-section looking upstream



FLUVIAL GEOMORPHOLOGY SUMMARY

Mimico Creek ~ GMI-4

Date of Survey: 13-Oct-00
Number of cross-sections: 10
Associated Fisheries Site: None
Access: South of Highway 409, East of Highway 427 in the Royal Woodbine Golf and Country Club.
 Contact Robert Cowen to get cart and show site

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.09 %	Riffle Length	8.71 m
Inter-Pool Gradient	0.86 %	Riffle-Pool Spacing	25.5 m
Inter-Riffle Gradient	0.34 %	Max Pool Depth	1.52 m
Riffle Gradient	2.42 %		

Particle Sizes (cm)

	Pebble Counts
D10	0.00999
D50	1.39
D90	9.4

Historical Analysis

Land Use: 1954 = Rural agriculture
 1978 = Urban commercial, Urban vacant
 1999 = Urban commercial, Urban golf course

Channel Change: Some alteration has occurred to accommodate the building of Hwy 409

Migration Rates (m/yr): Between 1954 to 1978 = 0.04

Stability	Entrenchment:	2	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	0		
	Stability:	5 Moderate Stability		

FLUVIAL GEOMORPHOLOGY SUMMARY

Mimico Creek ~ GMI-5

Date of Survey: 13-Sep-01
 Number of cross-sections: 10
 Associated Fisheries Site: None
 Access: In Wildwood Park; South of Derry Road East, West of Goreway Drive.
 Park at the most southerly parking lot in the park and walk downstream to the creel

Site Map



Planform Characteristics

<i>Long Profile (avg)</i>			
Bankfull Gradient	0.125 %	Riffle Length	7.5 m
Inter-Pool Gradient	0.51 %	Riffle-Pool Spacing	21.67 m
Inter-Riffle Gradient	0.38 %	Max Pool Depth	1.74 m
Riffle Gradient	4.6 %		

Particle Sizes (cm)	Pebble Counts
	D10 0.0074
	D50 0.765
	D90 8.55

Historical Analysis

Land Use: 1954 = Rural commercial, Rural vacant - parkland
 1978 = Urban commercial, Urban parkland
 1999 = Urban parkland

Channel Change: Slight planform change since 1954, difficult to see anything because channel is obscured by trees
 Goreway Drive was not built in 1954

Migration Rates (m/yr): Not Available - obscured by trees

<i>Stability</i>	Entrenchment:	1	<i>Individual Categories</i>	<i>Overall Score</i>
	Angle:	1	0 = low	0-4 = low stability
	Inter-Pool:	0	1 = moderate	5-7 = moderate stability
	Width/Depth Ratio:	2	2 = high	8-10 = high stability
	Substrate Sorting:	1		

Stability:

5 Moderate Stability

Site Photo's

GMI-5



Photo 1. At monitoring cross-section looking downstream

