



Appendix F
Stream Morphology

APPENDIX A
Field Data Summaries

DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

Project: Premier Gateway SWS: HT-1 Detailed Site

Site Location: HT-1 Premier Gateway

Length surveyed: 150m

Number of cross-sections: 7

Date of Survey: 17-Sep-15

Modifying Factors

Surrounding Land Use: meadow

General Riparian Vegetation: tall herbs and grasses

Existing Channel Disturbances: road crossing

Woody Debris: none

Cross-Sectional Characteristics

	Range	Average
Bankfull Width (m)	2.62 - 3.65	3.14
Bankfull Depth (m)	0.44 - 0.62	0.50
Width / Depth	5.42 - 10.37	6.49
Wetted Width (m)	1.41 - 2.51	1.99
Water Depth (m)	0.06 - 15.88	2.39
Wetted Width / Depth	0.15 - 22.95	12.86

DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

Project: Premier Gateway SWS: HT-1 Detailed Site

Bank Characteristics

	Range	Average
Bank Height (m)	1 - 2	1.32
Bank Angle (degrees)	70 - 90	85
Root Depth (cm)	5.0 - 20	10.6
Root Density (1=Low - 5=High)	1 - 5	3.0
Protected by vegetation (%)	70 - 95	83.9
Amount of undercut (cm)	30.0 - 30	30.00000
Banks with undercuts (%)	1 / 14	7%

Bank Materials: si/fs/cl

Planform Characteristics

Long Profile (avg)

Bankfull Gradient:	0.26 %
Bed Gradient:	0.22 %

Substrate Characteristics

Particle Shape (cm):		Range	Average
	X	4 - 15	10.3
	Y	3 - 12	7.4
	Z	0.5 - 6	2.5

DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

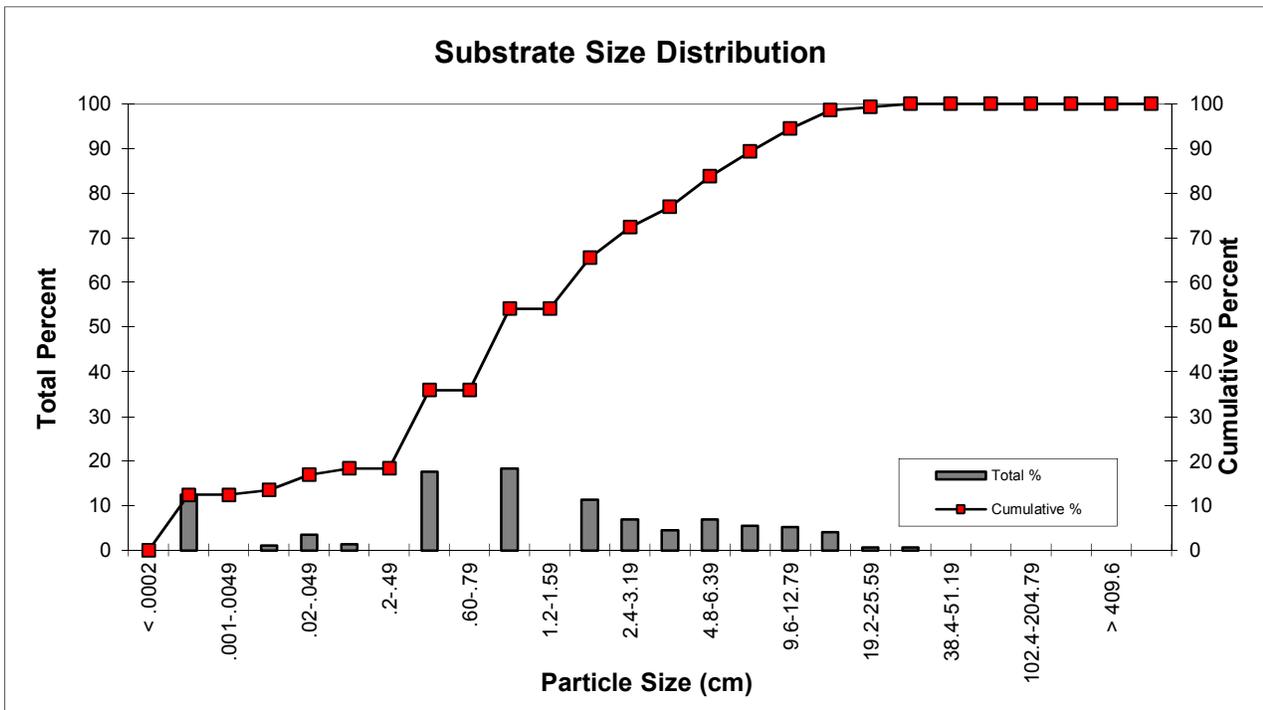
Project: Premier Gateway SWS: HT-1 Detailed Site

Hydraulic Roughness (cm):		Range	Average
	Maximum	0 - 12	7.7
	Median	0 - 1	0.9
	Minimum	0 - 0.001	0.0

Embeddedness (%): 0 - 80 60.0

Particle Sizes (cm):

	Pebble Counts
D10	0.0007639 cm
D50	1.10 cm
D90	10.02 cm



DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

Project: Premier Gateway SWS: HT-1 Detailed Site

Field Observations

XS1

RB is 30cm undercut

large cobble with silt overlay

xs is 10m US of bend/tree on RB

Xs2

A lot of silt deposition with larger cobbles

Aquatic vegetation in channel

banks are slumping

Xs3

plate-like particles

banks are slumping

banks are heavily vegetated

Xs4

left bank is terraced

xs is in apex of meander bend

heavily vegetated banks

Xs5

vertical banks

small pebbles in riffle

Xs6

LB is slumped 30cm U/S

substrate is unconsolidated

xs is in apex of meander bend

Xs7

LB is slumped

substrate has coarser gravel, cobbles with silt overlay

DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

Project: Premier Gateway SWS

Site Location: W-T1-2 Premier gateway Site #2
Length surveyed: 160m
Number of cross-sections: 7
Date of Survey: 23-Sep-15

Modifying Factors

Surrounding Land Use: forest/ agricultural field/ residential
General Riparian Vegetation: deciduous trees, grasses, herbs
Existing Channel Disturbances:

Woody Debris: minor

Cross-Sectional Characteristics

	Range	Average
Bankfull Width (m)	3.90 - 5.50	4.79
Bankfull Depth (m)	0.29 - 0.37	0.32
Bankfull Width / Depth	10.67 - 17.97	14.97
Wetted Width (m)	1.55 - 2.45	2.05
Water Depth (m)	0.05 - 0.15	0.08
Wetted Width / Depth	16.80 - 35.20	26.79

DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

Project: Premier Gateway SWS

Bank Characteristics

	Range	Average
Bank Height (m)	0.8 - 1.7	1.35
Bank Angle (degrees)	30 - 90	67.857143
Root Depth (cm)	5.0 - 20	11.4
Root Density (1=Low - 5=High)	1 - 5	3.1
Protected by vegetation (%)	40 - 90	67.1
Amount of undercut (cm)	0.0 - 0	0.00
Banks with undercuts (%)	0 / 14	0%

Planform Characteristics

Long Profile (avg)

Bankfull Gradient:	0.12 %
Bed Gradient:	0.18 %

Substrate Characteristics

Particle Shape (cm):		Range	Average
	X	4 - 19	8.5
	Y	2 - 13	6.2
	Z	0.5 - 4	2.0

DETAILED GEOMORPHOLOGICAL FIELD DATA SUMMARY

Project: Premier Gateway SWS

Field Observations

Xs1

LB is eroded with vertical banks
RB is low angled bank
xs is in end of meander bend
exposed clay along LB

xs2

exposed clay along LB
LB is eroded and vertical
RB is eroded at toe with lower bank angle
xs at apex of meander

xs3

LB has exposed clay
Lb vertical and overhanging veg
RB has low bank angle

Xs4

LB has exposed clay along toe and bed
LB is vertical an slumped
RB has low bank angle

Xs5

RB is eroded with vertical banks and exposed clay
LB has low bank angle with a piont bar
channel widens into large pool 1m U/S

Xs6

RB has low bank angle
LB is eroded with vertical banks near the top of bank.
LB has exposed clay

Xs7

LB overhanging and eroded bank with exposed clay
RB has low angle with small gravel piont bar

APPENDIX B
Field Photograph Summary

*Matrix Supplied
November 13, 2015*



1. W-T1-3 Riffle and lateral bar formation along right bank

*Matrix Supplied
November 13, 2015*



2. W-T1-3 erosion on bank causing leaning trees

*Matrix Supplied
November 13, 2015*



3. W-T1-3 Exposed clay on bed

*Matrix Supplied
November 13, 2015*



4. W-T1-3 Major woody debris jam at upstream end of reach



*Matrix Supplied
June 1, 2015*

5. W-T1-2b CSP under driveway at far upstream end of reach.



*Matrix Supplied
June 1, 2015*

6. W-T1-2b width of channel (approximately 24cm) at far upstream end of reach.

*Matrix Supplied
November 13, 2015*



7. W-T1-2b facing downstream. Flow path through tall grasses at downstream end of reach.

*Matrix Supplied
November 13, 2015*



8. W-T1-2b facing downstream. Flow into CSP located under farm lane.

*Matrix Supplied
November 13, 2015*



9. W-T1-2a Channel flowing out of phragmites patch which widens downstream.

*Matrix Supplied
November 13, 2015*



10. W-T1-2a facing downstream through treed section. Shallow wetted width and low banks.

*Matrix Supplied
November 13, 2015*



11. W-T1-2a facing downstream. Channel more narrow and less defined as it travels through grasses.

*Matrix Supplied
November 13, 2015*



12. W-T1-2a facing downstream. Channel is very narrow at the confluence with the main channel.

*Matrix Supplied
September 23, 2015*



13. W-T1-2 Cross-section 1 facing upstream

*Matrix Supplied
September 23, 2015*



14. W-T1-2 Cross-section 1 facing downstream

*Matrix Supplied
September 23, 2015*



15. W-T1-2 Cross-section 2 facing upstream

*Matrix Supplied
September 23, 2015*



16. W-T1-2 Cross-section 2 facing downstream

*Matrix Supplied
September 23, 2015*



17. W-T1-2 Cross-section 3 facing upstream

*Matrix Supplied
September 23, 2015*



18. W-T1-2 Cross-section 3 facing downstream

*Matrix Supplied
September 23, 2015*



19. W-T1-2 Cross-section 4 facing upstream

*Matrix Supplied
September 23, 2015*



20. W-T1-2 Cross-section 4 facing downstream

*Matrix Supplied
September 23, 2015*



21. W-T1-2 Cross-section 5 facing upstream

*Matrix Supplied
September 23, 2015*



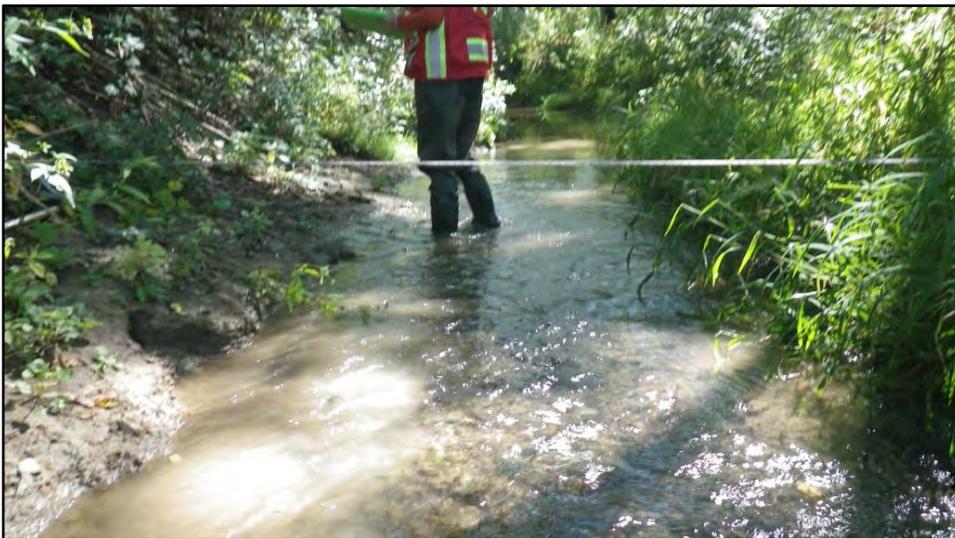
22. W-T1-2 Cross-section 5 facing downstream

*Matrix Supplied
September 23, 2015*



23. W-T1-2 Cross-section 6 facing upstream

*Matrix Supplied
September 23, 2015*



24. W-T1-2 Cross-section 6 facing downstream

*Matrix Supplied
September 23, 2015*



25. W-T1-2 Cross-section 7 facing upstream

*Matrix Supplied
September 23, 2015*



26. W-T1-2 Cross-section 7 facing downstream

*Matrix Supplied
November 13, 2015*



27. W-T1-3 facing downstream. Large vegetated lateral bars inducing sinuosity.

*Matrix Supplied
November 13, 2015*



28. W-T1-3 Banks experiencing erosion opposite of bars producing bank slumping and undercutting which exposes roots.

*Matrix Supplied
November 13, 2015*



29. W-T1-2 typical conditions.

*Matrix Supplied
November 13, 2015*



30. W-T1-2 Large woody debris jam at upstream end

*Matrix Supplied
July 3, 2015*



31. W-T1-2 gravel bar accumulation along inner bank.

*Matrix Supplied
July 3, 2015*



32. W-T1-1 calving of bank material.

*Matrix Supplied
July 3, 2015*



33. W-T1-1 Channel flows through dense meadow vegetation.

*Matrix Supplied
July 3, 2015*



34. W-T1-1 Narrowing of wetted width due to dense grass vegetation.



*Matrix Supplied
June 1, 2015*

35. HDF-3 channel with cattails in channel and manicured lawn banks.



*Matrix Supplied
June 1, 2015*

36. HDF-3- channel confluence into pond.



*Matrix Supplied
June 1, 2015*

37. HDF-4 culvert under golf course trail.



*Matrix Supplied
June 1, 2015*

38. HDF-4 dry channel dry at time of photo.

*Matrix Supplied
July 3, 2015*



39. HDF-1- poned area at farm lane.

*Matrix Supplied
July 3, 2015*



40. HDF-1- Stagnant water located in grass channel undefined.

*Matrix Supplied
July 3, 2015*



41. HDF-1 Channel flows as drainage ditch along fenceline (right side of photograph)



*Matrix Supplied
June 1, 2015*

42. E-T1-4 Standing water in trapezoidal shaped channel at downstream extent of RGA/RSAT analysis



*Matrix Supplied
June 1, 2015*

43. E-T1-4 Channel is dry and armoring placed along left bank placed to prevent erosion along fairway boundary.



*Matrix Supplied
June 1, 2015*

44. E-T1-4 Channel alternates between being piped under golf course fairways (as seen in this photograph) and being a grassed trapezoidal channel.



*Matrix Supplied
June 1, 2015*

45. E-T1-4 Channel alternates between being piped under golf course fairways and being an intermittent grassed trapezoidal channel (as seen in this photograph).



*Matrix Supplied
May 28, 2015*

46. E-T1-3 Small pebbles and gravel through thalweg and silt accumulation (10-15cm) in other areas.



*Matrix Supplied
May 28, 2015*

47. E-T1-3 Good grass riparian buffer between the channel and golf course.



*Matrix Supplied
May 28, 2015*

48. E-T1-3 CSP's damaged by weight of crossing, did not convey water efficiently.



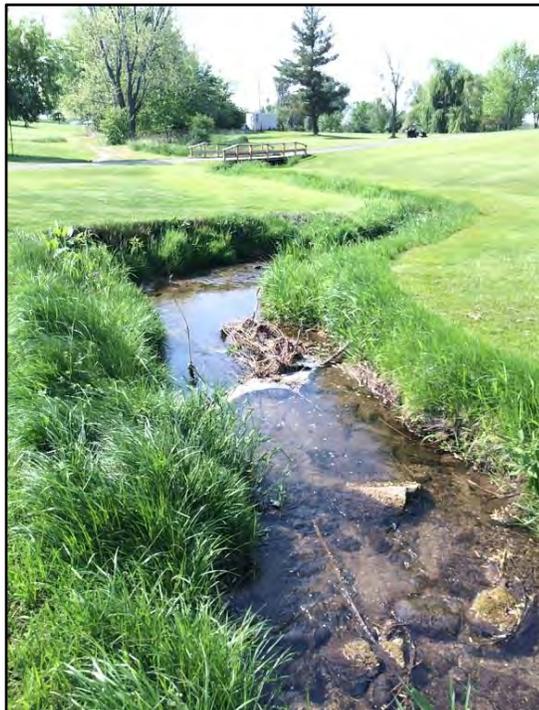
*Matrix Supplied
May 28, 2015*

49. E-T1-3 Channel runs through woodlot as it approaches clubhouse.



*Matrix Supplied
May 28, 2015*

50. E-T1-3 Manicured lawn next to putting green is slumping.



*Matrix Supplied
May 28, 2015*

51. E-T1-3 riparian zone decreases in width.



*Matrix Supplied
May 28, 2015*

52. E-T1-3 Silt accumulation in multiple areas of the channel.



*Matrix Supplied
May 28, 2015*

53. E-T1-3 Area of active erosion in areas lacking riparian buffer.

*Matrix Supplied
November 13, 2015*



54. E-T1-2 Dense emergent aquatic vegetation, including algae (not seen in photograph).

*Matrix Supplied
November 13, 2015*



55. E-T1-2 Bank failure and other areas of erosion due to surrounding landuse.

*Matrix Supplied
November 13, 2015*



56. E-T1-2 Flow splits due to large island formation in center of channel.

*Matrix Supplied
November 13, 2015*



57. E-T1-2 Channel wetted width varies throughout reach.

*Matrix Supplied
November 13, 2015*



58. E-T1-2 Substrate upstream is more firm consisting of sands and gravel, as opposed to silt downstream.

*Matrix Supplied
November 13, 2015*



59. E-T1-2 Long eroding exposed bank face at upstream extent of reach walk. Bank height approximately 1.5-2m in height.

*Matrix Supplied
July 3, 2015*



60. E-T1-1 Channel crossing farm lane with no CSP.

*Matrix Supplied
July 3, 2015*



61. E-T1-1 Active erosion and undercutting on outside bend of reach downstream of farm lane.

*Matrix Supplied
July 8, 2015*



62. T1 Low gradient and slow moving flow with slight erosion on banks hidden by overhanging vegetation.

*Matrix Supplied
July 8, 2015*



63. T1 Bridge crossing is quite low with major siltation underneath the structure.



*Matrix Supplied
July 8, 2015*

63. T1 Woody debris jam.



*Matrix Supplied
July 8, 2015*

64. T1 Erosion being experienced on embankment that meets road. Some places embankment has become concave (not shown in photograph).



*Matrix Supplied
May 28, 2015*

65. HT-2a-2 Erosion and undercutting along right bank. Two small riffle in channel just upstream of double box culvert at Trafalger Rd.



*Matrix Supplied
May 28, 2015*

66. HT-2a-2 Erosion along both banks with leaning trees over channel (elevated). Large angular riffle material.



*Matrix Supplied
May 28, 2015*

67. HT-2a-2 Rip rap placed along toe of right bank protecting private property.



*Matrix Supplied
May 28, 2015*

68. HT-2a-2 Woody debris jam consisting of large vegetation causing siltation upstream of it. WDJ found at downstream end of reach.

*Matrix Supplied
November 13, 2015*



69. HT-2a-1 Flow splits around vegetated bar in center of channel. Channel does this multiple times within reach.

*Matrix Supplied
November 13, 2015*



70. HT-2a-1 Boulders placed to make weir structure.

*Matrix Supplied
November 13, 2015*



70. HT-2a-1 Exposed clay along bed at toe of bank.

*Matrix Supplied
November 13, 2015*



71. HT-2a-1 Severe undercutting on bank with overhanging vegetation.



*Matrix Supplied
June 1, 2015*

72. HT-2b-3 Dry at time of visit, localized depression on an agricultural property.



*Matrix Supplied
June 1, 2015*

73. HT-2b-3 Depression is approximately 0.5m in width and 0.15m in depth.



*Matrix Supplied
May 28, 2015*

74. HT-2b-2 Feature dry but well defined with signs of riffle features.



*Matrix Supplied
May 28, 2015*

75. HT-2b-2 Feature disperses into cattail marsh.

*Matrix Supplied
November 13, 2015*



76. HT-2b-1 Narrow channel with dense overhanging grasses.

*Matrix Supplied
November 13, 2015*



77. HT-2b-1 Lateral bar formation on right bank. Primarily consisting of 1cm particles, pebbles and fine.

*Matrix Supplied
November 18, 2015*



78. HT-2b-1 Channel becomes undefined through cattail patch.

*Matrix Supplied
November 18, 2015*



79. HT-2b-1 Farm crossing of channel with no CSP to convey flow.

*Matrix Supplied
November 18, 2015*



80. HT-2b-1 Severe undercutting found at parts of the reach. Up to 0.30m of undercutting observed.

*Matrix Supplied
November 18, 2015*



90. HT-2b-1 Parts of channel are quite sinuous.

*Matrix Supplied
September 17, 2015*



91. HT-1 Cross-section 1 facing upstream

*Matrix Supplied
September 17, 2015*



92. HT-1 Cross-section 1 facing downstream

*Matrix Supplied
September 17, 2015*



93. HT-1 Cross-section 2 facing upstream

*Matrix Supplied
September 17, 2015*



94. HT-1 Cross-section 2 facing downstream

*Matrix Supplied
September 17, 2015*



95. HT-1 Cross-section 3 facing upstream

*Matrix Supplied
September 17, 2015*



96. HT-1 Cross-section 3 facing downstream

*Matrix Supplied
September 17, 2015*



97. HT-1 Cross-section 4 facing upstream

*Matrix Supplied
September 17, 2015*



98. HT-1 Cross-section 4 facing downstream

*Matrix Supplied
September 17, 2015*



99. HT-1 Cross-section 4 facing upstream

*Matrix Supplied
September 17, 2015*



100. HT-1 Cross-section 5 facing downstream

*Matrix Supplied
September 17, 2015*



101. HT-1 Cross-section 6 facing upstream

*Matrix Supplied
September 17, 2015*



102. HT-1 Cross-section 6 facing downstream

*Matrix Supplied
September 17, 2015*



103. HT-1 Cross-section 7 facing upstream

*Matrix Supplied
September 17, 2015*



104. HT-1 Cross-section facing downstream

*Matrix Supplied
July 8, 2015*



105. HT-1 Material that has slumped off bank has created island causing the flow to split.

*Matrix Supplied
July 8, 2015*



106. HT-1 Channel narrows in multiple areas to a wetted width of approximately 1m.

*Matrix Supplied
July 8, 2015*



107. HT-1 Woody debris causing obstacles for regular flow patterns.

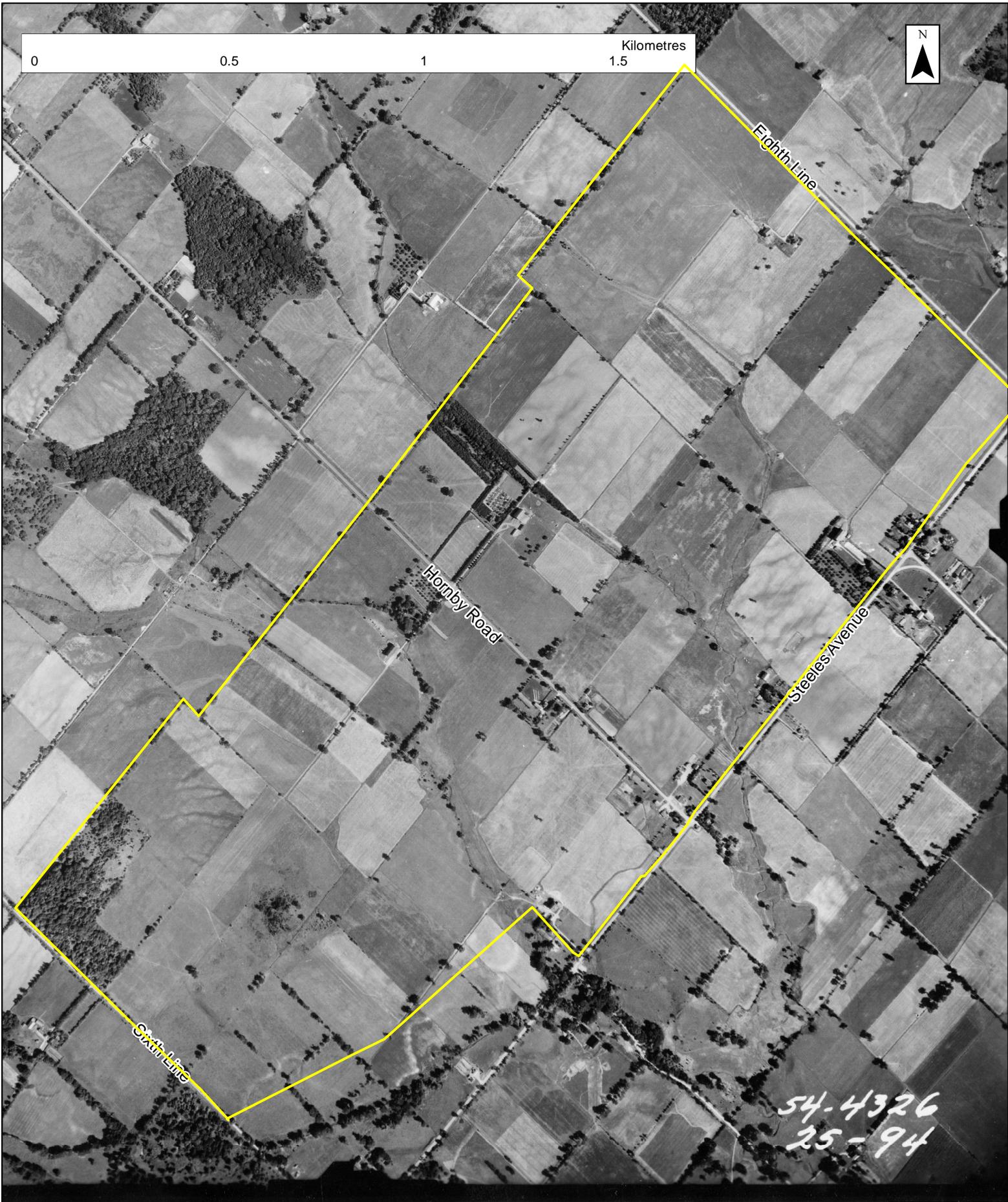
*Matrix Supplied
July 8, 2015*



108. HT-1 downstream extent of reach is more sinuous than further upstream. Bends become over widened with evidence of planform adjustment.

APPENDIX C
Historic Aerial Photographs

0 0.5 1 1.5 Kilometres



54-4326
25-94

1954 Historic Photos
Scale 1:12,500
Source: Archives of Ontario

0 0.5 1 1.5 Kilometres



Trafalgar Road

Hornby Road

Steeles Avenue

Steeles Ave

1978 Historic Photos
Scale 1:11,179
Source: Archives of Ontario



0 0.5 1 1.5 Kilometres



2002 Historic Photos
Scale 1:11,179
Provided by Conservation Halton



2007 Historic Photos
Scale 1:11,179
Provided by Conservation Halton