

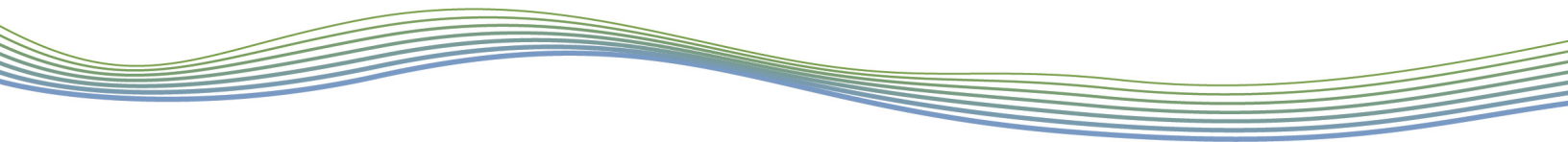


Appendix F

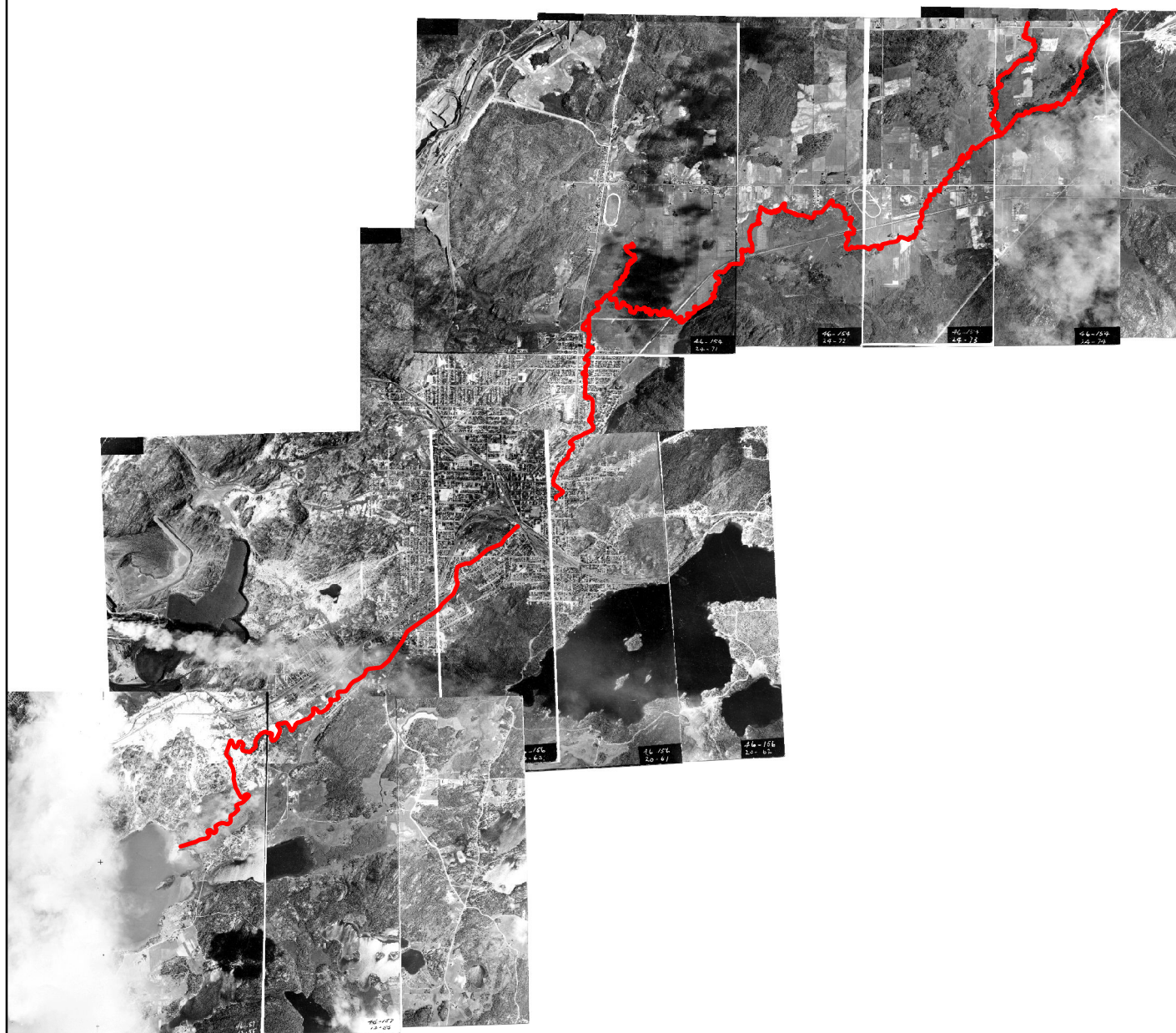
Stream Morphology

Appendix F1

Historical Aerials

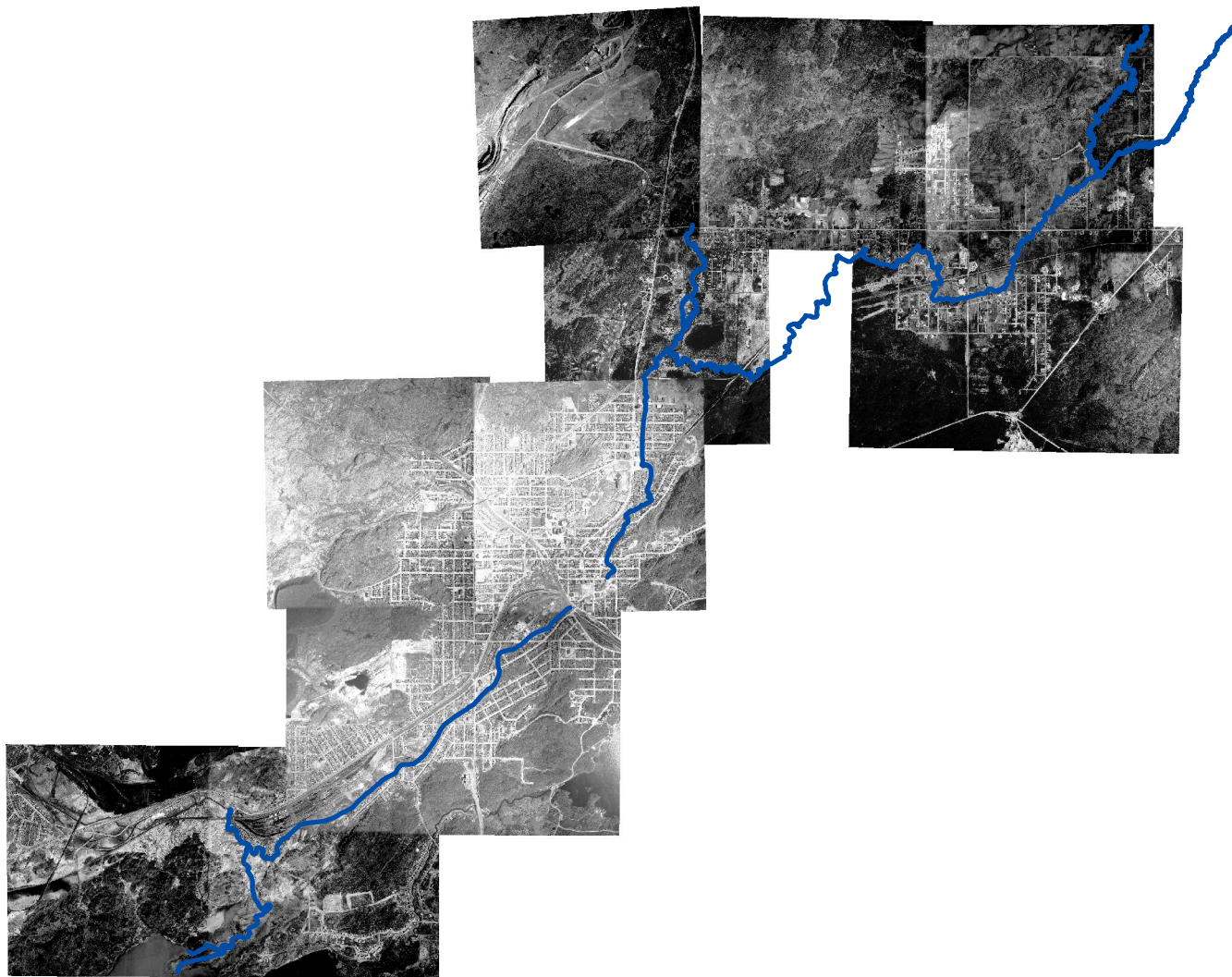


Delineation of Junction Creek 1946



0 425850 1,700 Kilometers
|-----|

Delineation of Junction Creek 1956



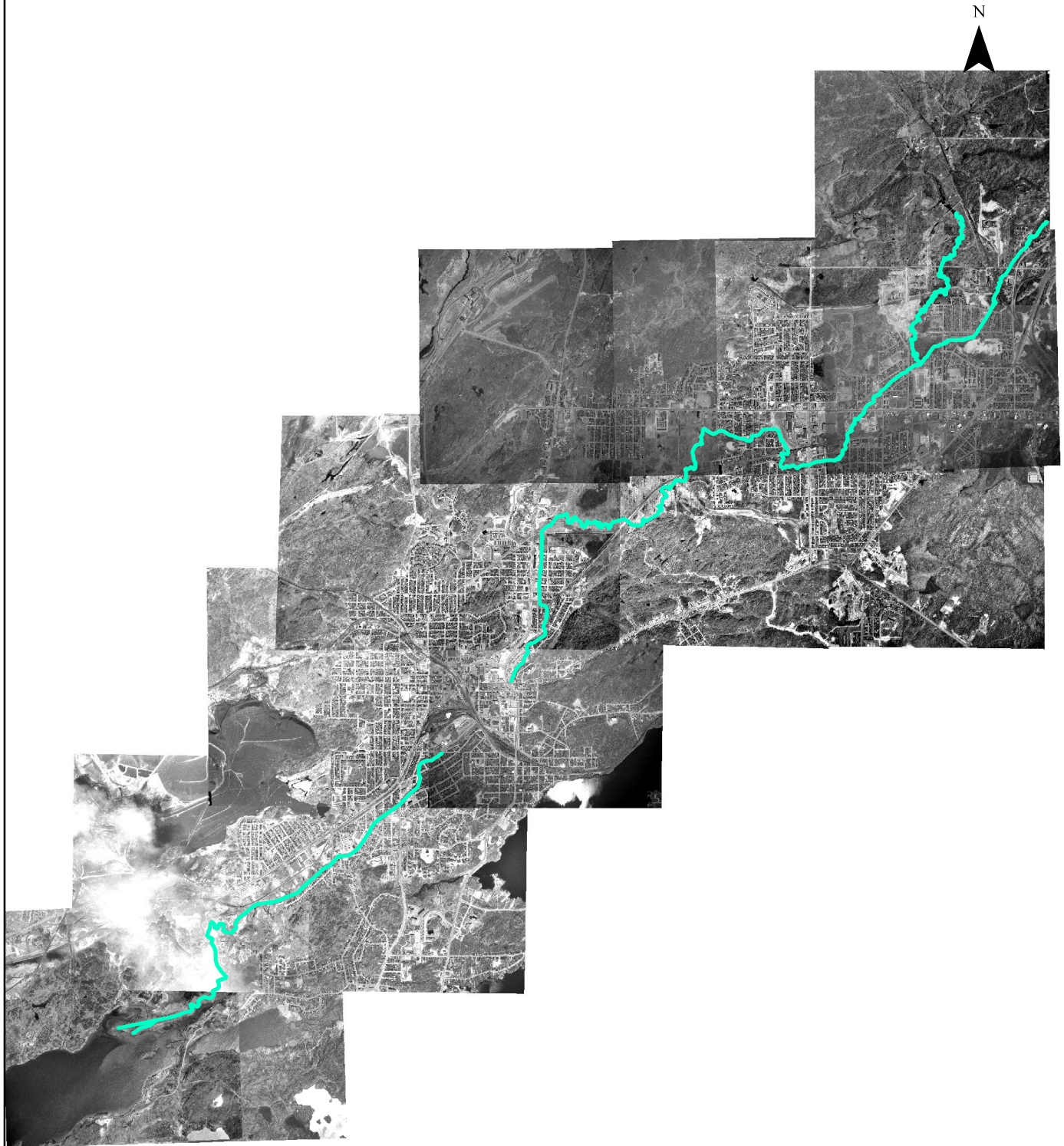
0 425850 1,700 Kilometers
|-----|

Delineation of Junction Creek 1969



0 425850 1,700 Kilometers
|-----|-----|-----|-----|-----|-----|

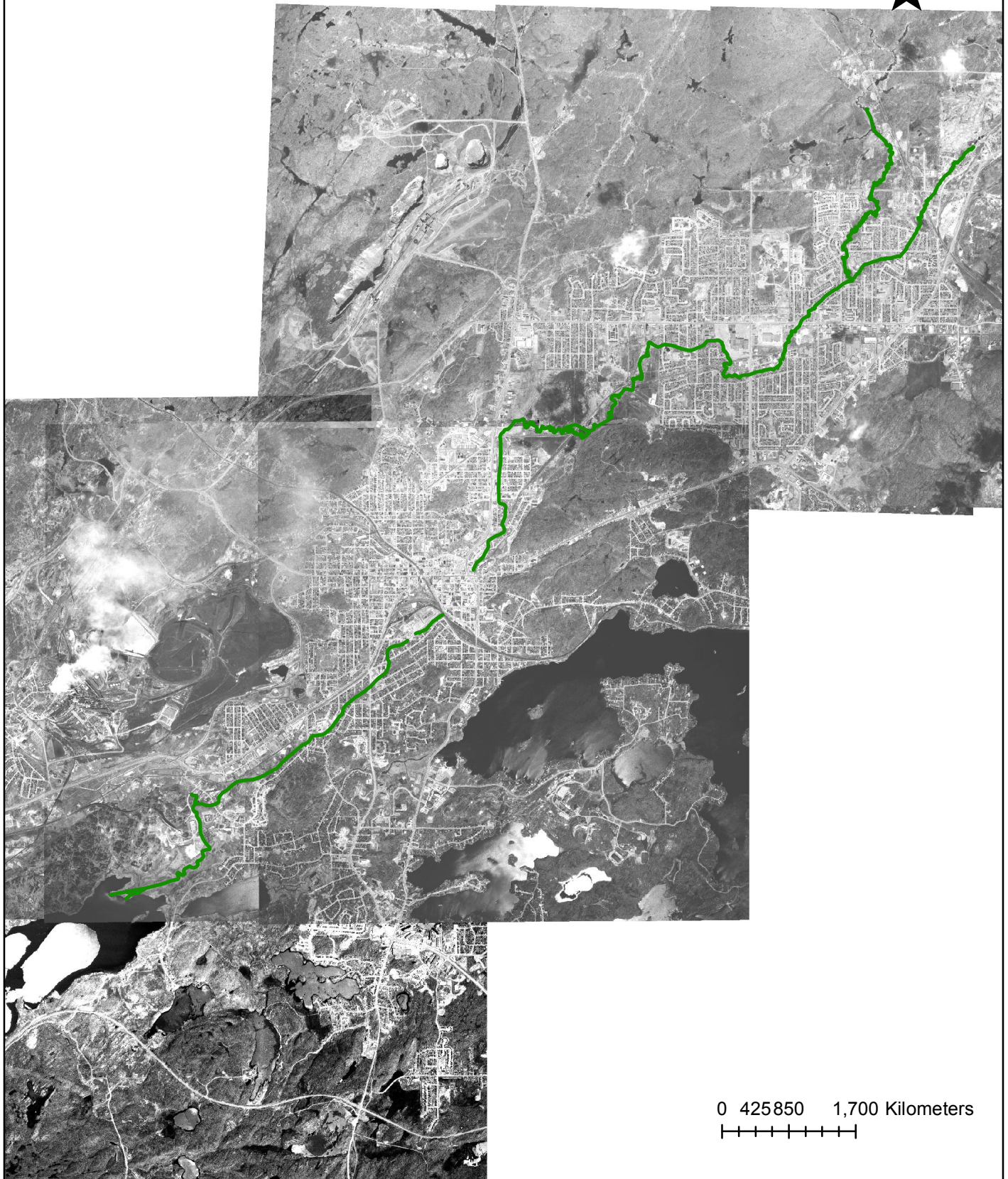
Delineation of Junction Creek 1975



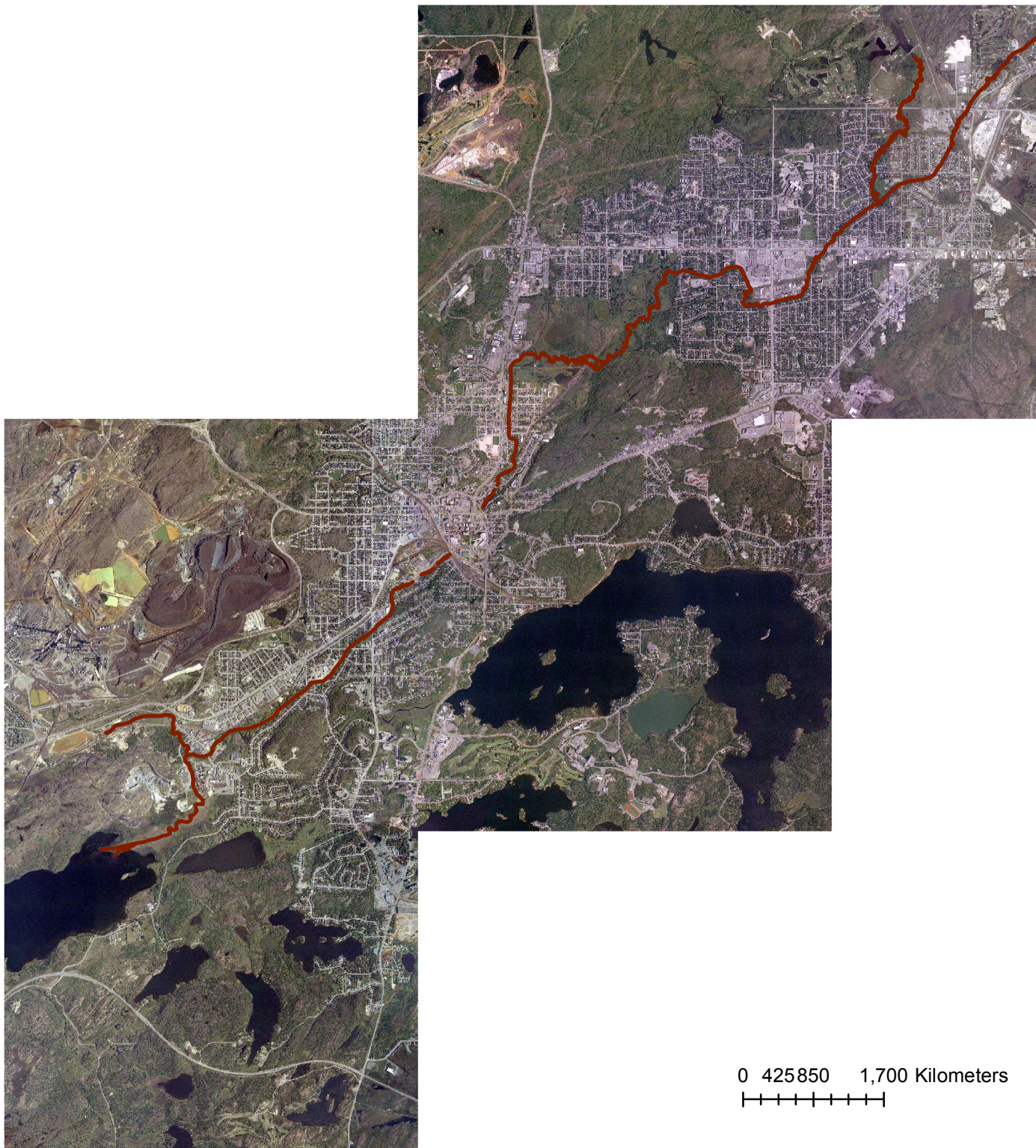
0 425850 1,700 Kilometers
|-----|-----|-----|-----|-----|-----|

Delineation of Junction Creek 1991

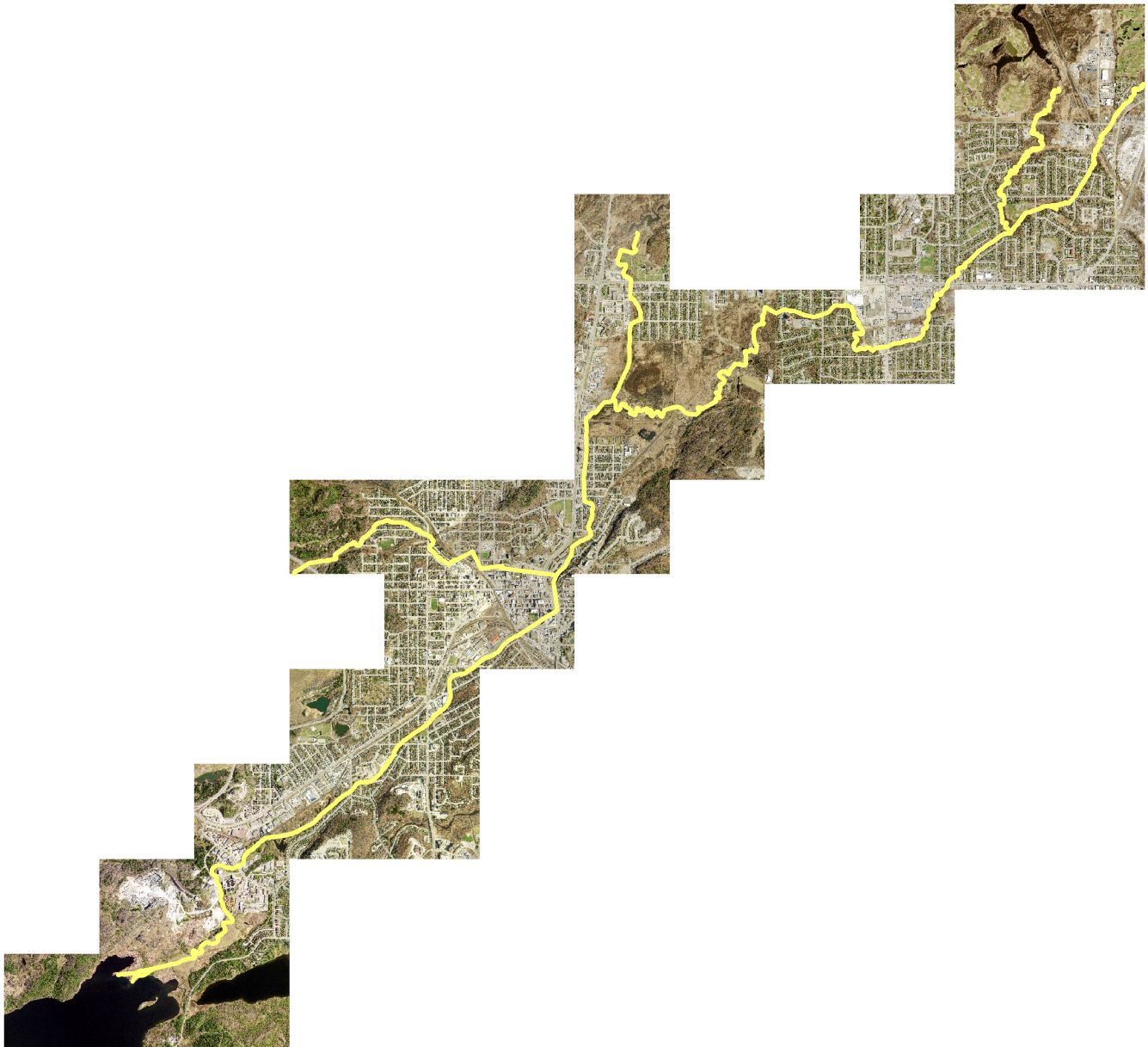
N



Delineation of Junction Creek 2003



Delineation of Junction Creek 2016



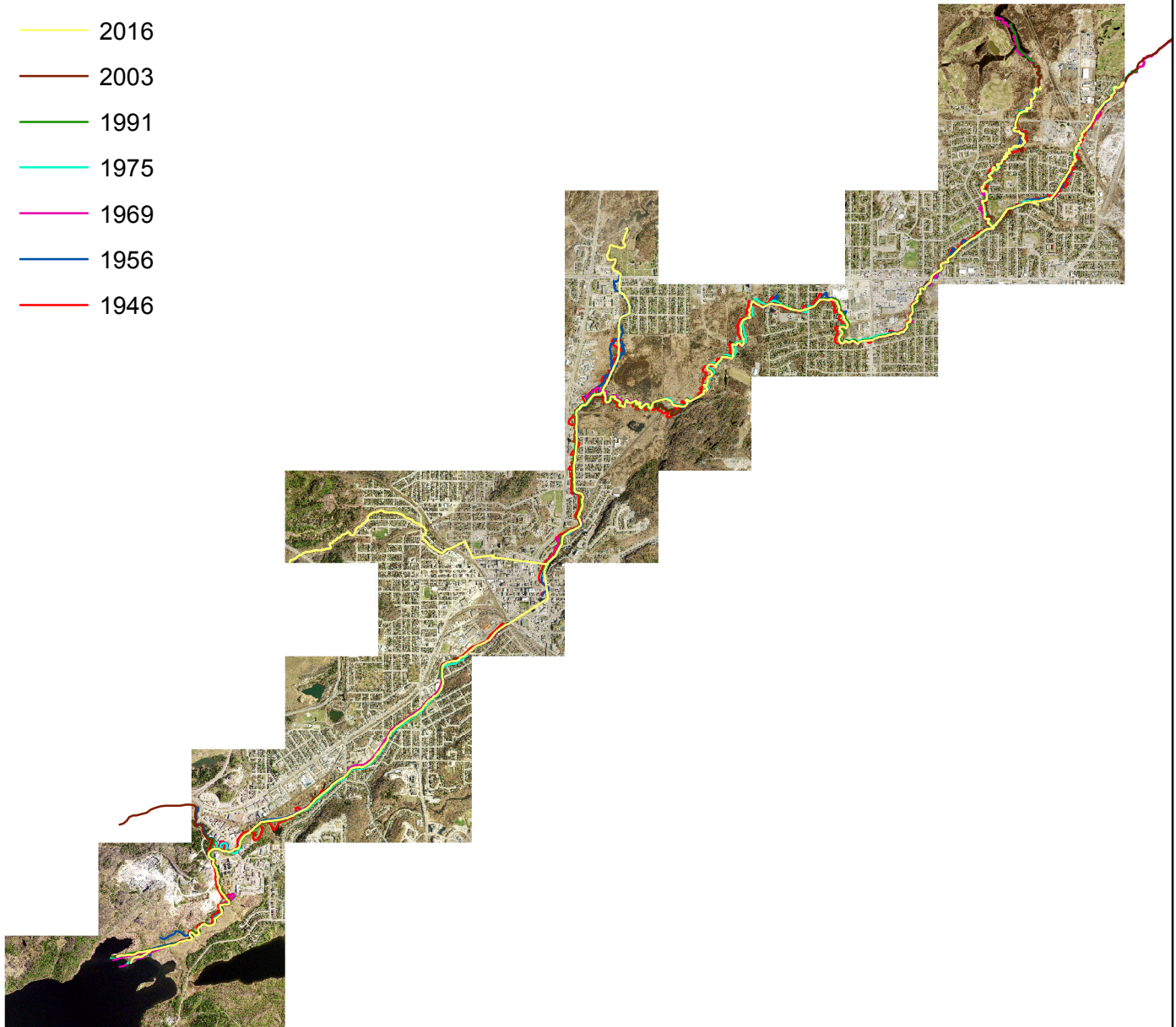
0 425850 1,700 Kilometers
|-----|-----|-----|-----|-----|-----|

Delineation of Junction Creek 1946-2016



Legend

- 2016
- 2003
- 1991
- 1975
- 1969
- 1956
- 1946



0 425 850 1,700 Kilometers
|-----|-----|-----|-----|-----|-----|

Appendix F2

Photographic Record

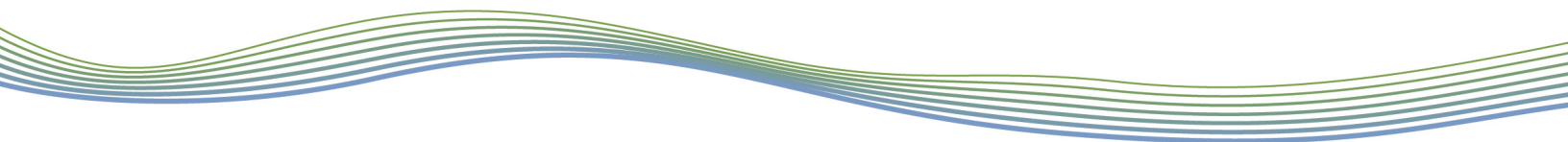


Photo
1
Reach
J7



Photograph taken facing upstream.
Point bars established on inside meander bends and bank failures on outside of bends.

Photo
2
Reach
J7



Photograph taken facing left bank.
Rotational sliding and slumping common along banks.

Photo
3
Reach
J8



Photograph taken facing downstream.
Undercutting and bank failures were observed, leaning trees common.

Photo
4
Reach
J8



Photograph taken facing left bank.
Rotational sliding and slumping of bank, leaning tree and woody debris in channel.

Photo
5
Reach
J9



Photograph taken facing downstream.
Woody debris in channel, leaning trees were observed.

Photo
6
Reach
J9



Photograph taken facing left bank.
Undercutting of banks, root exposure, and pipe outlets common along reach.

Photo
7
Reach
J10



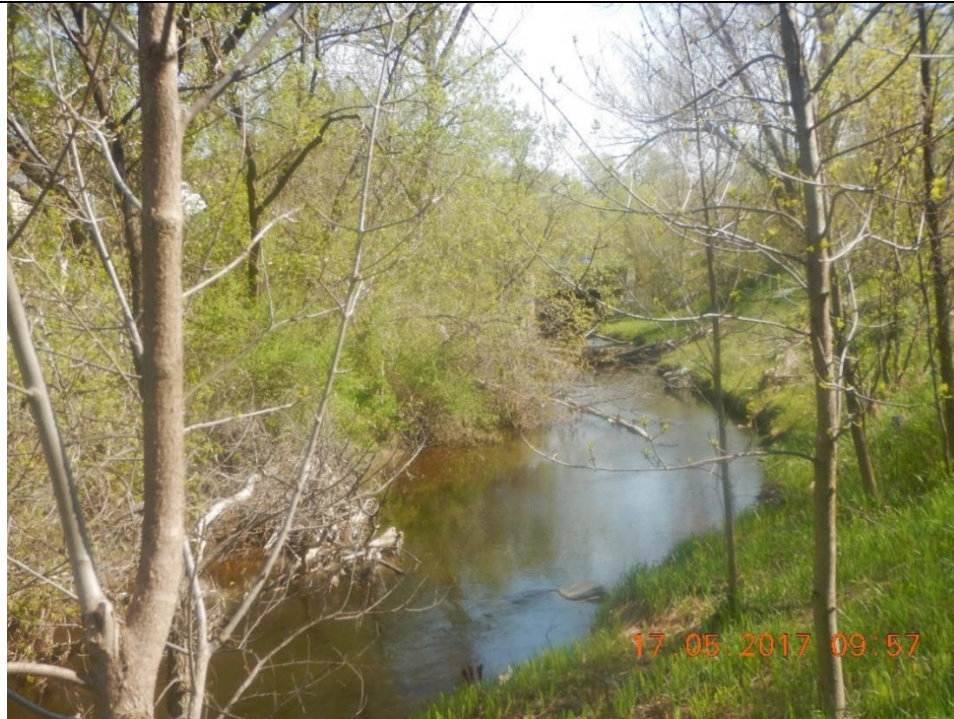
Photograph taken facing upstream.
Undercutting, slumping, and pipe outlets common. Rip rap observed.

Photo
8
Reach
J10



Photograph taken facing left bank.
Bank failure present and trash line observed at property edge.

Photo
9
Reach
J11



Photograph taken facing upstream.
Undercutting, leaning trees, pipe outlets, and large woody debris were all common.

Photo
10
Reach
J11



Photograph taken facing right bank.
Fracture lines and bank failure were noted.

Photo
11
Reach
J13



Photograph taken facing downstream.
Fracture lines and undercutting present along banks.

Photo
12
Reach
J13



Photograph taken facing upstream.
Established beaver dam at mid reach. Could not proceed downstream because of access.

Photo
13
Reach
J14



Photograph taken facing upstream.
Exposed tree roots and rip rap observed. Pipe outlets undercutting banks were common.

Photo
14
Reach
J14



Photograph taken facing downstream.
Leaning trees and large woody debris common throughout reach.

Photo
15
Reach
J15



Photograph taken facing upstream.
Bank undercutting, slumping, and large woody debris common.

Photo
16
Reach
J15



Photograph taken facing left bank.
Large erosion scar observed.

Photo
17
Reach
J16



Photograph taken facing downstream.
Slumping and bank erosion common. Woody debris observed in channel.

Photo
18
Reach
J16



Photograph taken facing downstream/ right bank.
Leaning trees and bank failure common. Exposed tree roots observed.

Photo
19
Reach
J17



Photo taken facing downstream to the left.
Mild undercutting and rooted emergent vegetation observed.

Photo
20
Reach
17



Photo taken facing downstream.
Mild bank erosion and large woody debris observed.

Photo
21
Reach
TJ-14



Photograph taken facing upstream.
Extensive backwatering from established beaver dams observed in lower half of reach.

Photo
22
Reach
TJ-14



Photograph taken facing downstream.
Backwatering and leaning trees observed along top portion of reach.

Photo
23

Reach
TJ-14-
1



Photograph taken facing downstream.
Large cobbles and boulders in riffles, rooted emergent vegetation observed.

Photo
24

Reach
TJ-14-
1



Photograph taken facing upstream.
Extensive backwatering observed upstream of large beaver dam.

Photo
25
Reach
TJ17



Photograph taken facing downstream/ left bank.
Undercutting and slumping, leaning trees, large woody debris in channel common.

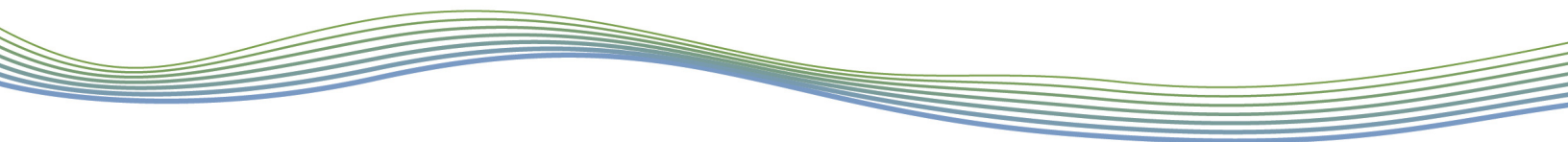
Photo
26
Reach
TJ17



Photograph taken facing downstream toward right bank.
Pipe outlets common throughout reach. Failure and erosion of right bank observed.

Appendix F3

Field Sheets



Reach Characteristics

Project Code/Phase: PM16107

Date:	May 17, 2017 / May 18, 2017	Stream/Reach:	J7
Weather:	Sunny 27°C / Sunny 23°C	Location:	Kelly Lake Rd.
Field staff:	AW, AV, SC / FBS, EG, AL	Watershed/Subwatershed:	Junction Creek
UTM (Upstream)		UTM (Downstream)	

Land Use (Table 1)	Valley Type (Table 2)	Channel Type (Table 3)	Channel Zone (Table 4)	Flow Type (Table 5)	Evidence:
4	1	13	3	1	iron staining

Riparian Vegetation		
Dominant Type: (Table 6)	Coverage:	Age Class (yrs):
2+3	<input type="checkbox"/> None <input checked="" type="checkbox"/> Fragmented <input type="checkbox"/> Continuous	<input type="checkbox"/> 1-4 <input checked="" type="checkbox"/> 4-10 <input type="checkbox"/> > 10
Species:		Encroachment: (Table 7)
		2

Aquatic/Instream Vegetation		
Type (Table 8)	Coverage of Reach (%)	
1, 2, 3		
Woody Debris	Density of WD:	
<input type="checkbox"/> Present in Cutbank <input checked="" type="checkbox"/> Present in Channel <input type="checkbox"/> Not Present	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High	

Water Quality	
Odour (Table 16)	1
Turbidity (Table 17)	2

Channel Characteristics

Sinuosity (Type) (Table 9)	2	Sinuosity (Degree) (Table 10)	3	Gradient (Table 11)	1	Number of Channels (Table 12)	1
Entrenchment (Table 13)	1	Type of Bank Failure (Table 14)	1, 3, 6	Downs's Classification (Table 15)	NA	Riffle/Substrate	<input checked="" type="checkbox"/>
Bankfull Width (m)	10.3	Wetted Width (m)	9.7	Wetted Depth (m)	0.4	Bank Material	<input checked="" type="checkbox"/>
Bankfull Depth (m)	1.26	Wetted Depth (m)	1.7 w/b WD	Meander Amplitude: (Table 16)	NA	Bank Angle	<input checked="" type="checkbox"/>
Riffle/Pool Spacing (m)	NA	% Riffles:	NA	% Pools:	NA	Bank Erosion	<input checked="" type="checkbox"/>
Pool Depth (m)	NA	Riffle Length (m)	NA	Undercuts (m)	NA	Bank Angle	<input checked="" type="checkbox"/>
Velocity (m/s)	0.076	Wiffle ball ADV / Estimated	0.57	Wiffle ball ADV / Estimated	0.57	Bank Erosion	<input checked="" type="checkbox"/>

Bank Angle	<input type="checkbox"/> 0-30 <input type="checkbox"/> 30-60 <input checked="" type="checkbox"/> 60-90 <input checked="" type="checkbox"/> Undercut
Bank Erosion	<input type="checkbox"/> < 5% <input type="checkbox"/> 5-30% <input type="checkbox"/> 30-60% <input checked="" type="checkbox"/> 60-100%

Notes:
exposed till, streak marks, No R-Ps observed
short section entrenched @ U/S extent

Completed by: FBS/AVL
Checked by: CH

May 17 @ U/S portion where access allowed.

Rapid Geomorphic Assessment

Project Code: PN16107

Date:	May 18, 2017	Stream/Reach:	J7
Weather:	Sun - 23°C	Location:	Kelly Lake Rd
Field Staff:	AW, AV, SC / FBJ, EG, AL	Watershed/Subwatershed:	Junction Crk

Process	Geomorphic Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		✓	2/6
	2	Coarse materials in riffles embedded	NA		
	3	Siltation in pools		✓	
	4	Medial bars		✓	
	5	Accretion on point bars	✓		
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone	✓		
Sum of indices =			2	4	0.33

Evidence of Degradation (DI)	1	Exposed bridge footing(s)	NA		1/6
	2	Exposed sanitary / storm sewer / pipeline / etc.		✓	
	3	Elevated storm sewer outfall(s)	NA		
	4	Undermined gabion baskets / concrete aprons / etc.	NA		
	5	Scour pools downstream of culverts / storm sewer outlets	NA		
	6	Cut face on bar forms		✓	
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock	✓		
Sum of indices =			1	5	0.17

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	✓		2/7
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle	NA		
	6	Outflanked gabion baskets / concrete walls / etc.	NA		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		✓	
	9	Fracture lines along top of bank	✓		
	10	Exposed building foundation	NA		
Sum of indices =			2	5	0.29

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	1/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / <u>reworked</u> removed	✓		
Sum of indices =			1	6	0.14

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.23

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	<input type="checkbox"/> 0.00 - 0.20	<input checked="" type="checkbox"/> 0.21 - 0.40	<input type="checkbox"/> 0.41

Completed by: _____ Checked by: CH

Rapid Stream Assessment Technique

Project Code: PN16107

Date:	May 18, 2017	Stream/Reach:	J7
Weather:	SUN 23°C	Location:	Kelly Lake Rd.
Field Staff:	AW, AN, SC / KBT, EGI, AI	Watershed/Subwatershed:	Junction Crk

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	<ul style="list-style-type: none"> < 50% of bank network stable Recent bank sloughing, slumping or failure frequently observed 	<ul style="list-style-type: none"> 50-70% of bank network stable Recent signs of bank sloughing, slumping or failure fairly common 	<ul style="list-style-type: none"> 71-80% of bank network stable Infrequent signs of bank sloughing, slumping or failure 	<ul style="list-style-type: none"> > 80% of bank network stable No evidence of bank sloughing, slumping or failure
	<ul style="list-style-type: none"> Stream bend areas highly unstable Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) Bank overhang > 0.8-1.0 m 	<ul style="list-style-type: none"> Stream bend areas unstable Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) Bank overhang 0.8-0.9m 	<ul style="list-style-type: none"> Stream bend areas stable Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) Bank overhang 0.6-0.8 m 	<ul style="list-style-type: none"> Stream bend areas very stable Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) Bank overhang < 0.6 m
	<ul style="list-style-type: none"> Young exposed tree roots abundant > 6 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Young exposed tree roots common 4-5 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots old, large and woody Generally 0-1 recent large tree falls per stream mile
	<ul style="list-style-type: none"> Bottom 1/3 of bank is highly erodible material Plant/soil matrix severely compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly erodible material Plant/soil matrix compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input checked="" type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8	<input type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11

Channel Scouring/ Sediment Deposition	<ul style="list-style-type: none"> > 75% embedded (> 85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 50-75% embedded (60-85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 25-49% embedded (35-59% embedded for large mainstem areas) 	<ul style="list-style-type: none"> Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	<ul style="list-style-type: none"> Few, if any, deep pools Pool substrate composition >81% sand-silt 	<ul style="list-style-type: none"> Low to moderate number of deep pools Pool substrate composition 60-80% sand-silt 	<ul style="list-style-type: none"> Moderate number of deep pools Pool substrate composition 30-59% sand-silt 	<ul style="list-style-type: none"> High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) Pool substrate composition <30% sand-silt
	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits uncommon 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits absent
	<ul style="list-style-type: none"> Fresh, large sand deposits very common in channel Moderate to heavy sand deposition along major portion of overbank area 	<ul style="list-style-type: none"> Fresh, large sand deposits common in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits uncommon in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits rare or absent from channel No evidence of fresh sediment deposition on overbank
	<ul style="list-style-type: none"> Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars common, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand 	<ul style="list-style-type: none"> Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

Date: May 18, 2017		Reach: J7		Project Code: PN16107	
Evaluation Category	Poor	Fair	Good	Excellent	
Physical Instream Habitat NA	Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)	
	Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	Good mix between riffles, runs and pools. Relatively diverse velocity and depth of flow	Riffles, runs and pool habitat present. Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)	
	Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble	Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble	Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble	Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble	
	Riffle depth < 10 cm for large mainstem areas	Riffle depth 10-15 cm for large mainstem areas	Riffle depth 15-20 cm for large mainstem areas	Riffle depth > 20 cm for large mainstem areas	
	Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure	
	Extensive channel alteration and/or point bar formation/enlargement	Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	No channel alteration or significant point bar formation/enlargement	
	Riffle/Pool ratio 0.49:1 ; $\geq 1.51:1$	Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	Riffle/Pool ratio 0.9-1.1:1	
Summer afternoon water temperature > 27°C	Summer afternoon water temperature 24-27°C	Summer afternoon water temperature 20-24°C	Summer afternoon water temperature < 20°C		
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input checked="" type="checkbox"/> 4	<input type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8	
Water Quality	Substrate fouling level: High (> 50%)	Substrate fouling level: Moderate (21-50%)	Substrate fouling level: Very light (11-20%)	Substrate fouling level: Rock underside (0-10%)	
	Brown colour	Grey colour	Slightly grey colour	Clear flow	
	TDS: > 150 mg/L	TDS: 101-150 mg/L	TDS: 50-100 mg/L	TDS: < 50 mg/L	
	Objects visible to depth < 0.15m below surface	Objects visible to depth 0.15-0.5m below surface	Objects visible to depth 0.5-1.0m below surface	Objects visible to depth > 1.0m below surface	
Moderate to strong organic odour	Slight to moderate organic odour	Slight organic odour	No odour		
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input type="checkbox"/> 5 <input type="checkbox"/> 6	<input checked="" type="checkbox"/> 7 <input type="checkbox"/> 8	
Riparian Habitat Conditions	Narrow riparian area of mostly non-woody vegetation	Riparian area predominantly wooded but with major localized gaps	Forested buffer generally > 31 m wide along major portion of both banks	Wide (> 60 m) mature forested buffer along both banks	
	Canopy coverage: < 50% shading (30% for large mainstem areas)	Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	Canopy coverage: > 80% shading (> 60% for large mainstem areas)	
Point range	<input type="checkbox"/> 0 <input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2 <input type="checkbox"/> 3	<input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7	
Total overall score (0-42) = 23		Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)

Completed by: _____ Checked by: CH

Map 1a

Junction Creek Subwatershed Study

Large Reach Break Map Set

Key Map

Legend

- Reach Break
- Study Area (Junction Creek)
- Piped Watercourse
- Primary Road
- Secondary Road
- Permanent Watercourse
- Intermittent Watercourse
- Contours (5m)

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Aquatic, Terrestrial and Wetland Biologists

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Project: 1844A	NADES - UTM Zone 17
Date: May 12, 2017	Size: 11x17"
Scale: 1:18,000	

Reach Characteristics

Project Code/Phase: PN16107

Date:	May 15, 2017	Stream/Reach:	J8
Weather:	Sunny	Location:	Kelly Lake Rd culvert
Field staff:	SC, AV, PP, GM, AL, PB	Watershed/Subwatershed:	Junction Creek
UTM (Upstream)		UTM (Downstream)	497476 5145437

Land Use (Table 1)	Valley Type (Table 2)	Channel Type (Table 3)	Channel Zone (Table 4)	Flow Type (Table 5)	Evidence:
4.5.7	3	7	2	1	WON STAINING

Riparian Vegetation	
Dominant Type: (Table 6)	Coverage: (Table 7)
1.3	None
Species:	Age Class (yrs):
deciduous and conifers	1-4
	4-10
	> 10
	Mature (>30)
	Encroachment: (Table 7)
	2

Aquatic/Instream Vegetation	
Type (Tables)	Coverage of Reach (%)
2.10	30
Woody Debris	Density of WD:
<input checked="" type="checkbox"/> Present in Cutbank	Low
<input checked="" type="checkbox"/> Present in Channel	Moderate
<input type="checkbox"/> Not Present	High
	WDJ/50m:
	0.25

Water Quality	
Odour (Table 16)	1
Turbidity (Table 17)	3

Channel Characteristics

Sinuosity (Type): (Table 9)	Sinuosity (Degree) (Table 10)	Gradient (Table 11)	Number of Channels (Table 12)	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
1	2	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Entrenchment (Table 13)	Type of Bank Failure (Table 14)	Downs's Classification (Table 15)	Riffle Substrate	Pool Substrate	Bank Material					
2	2.5	e	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Bankfull Width (m)	15.2	Wetted Width (m)	8.2	Bank Angle	<input type="checkbox"/> 0-30	Bank Erosion	<input type="checkbox"/> < 5%
Bankfull Depth (m)	1.7	Wetted Depth (m)	0.62	<input type="checkbox"/> 30-60	<input type="checkbox"/> 5-30%	<input type="checkbox"/> 30-60%	<input type="checkbox"/> 60-100%
Riffle/Pool Spacing (m)	7.6	% Riffles:	10	% Pools:	<input checked="" type="checkbox"/> Undercut		
Pool Depth (m)	0.65	Riffle Length (m)	13.15	Meander Amplitude:			
Velocity (m/s)	0.2	Undercuts (m)	0.3	Comments:			
		Wiffle ball / ADV / Estimated					

Notes:

Some of every bank failure type

Waste rock

12.2 erosion scar

17.7 erosion scar

DEAD TREES

beaver dam

orange stained water on opposite side of trail

Completed by: _____

Checked by: CH

Note: wetted depth recorded for 3rd point is depth on the shoulder. The depth in the middle is deeper but we were unable to measure due to the ground being too soft.

General Site Characteristics

Project Code: PM16107

Date:	May 15, 2017	Stream/Reach:	J8
Weather:	sun + 15°C	Location:	Kelly Lake Rd
Field Staff:	SC, AV, PP, GM, AL, PB	Watershed/Subwatershed:	Junction Crk

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Medial bar
- Eroded bank
- Undercut bank
- Rip rap/stabilization/gabion
- Leaning tree
- Fence
- Culvert/outfall
- Swamp/wetland
- Grasses
- Tree
- Instream log/tree
- Woody debris
- Station location
- Vegetated island

Flow Type

- H1** Standing water
- H2** Scarcely perceptible flow
- H3** Smooth surface flow
- H4** Upwelling
- H5** Rippled
- H6** Unbroken standing wave
- H7** Broken standing wave
- H8** Chute
- H9** Free fall

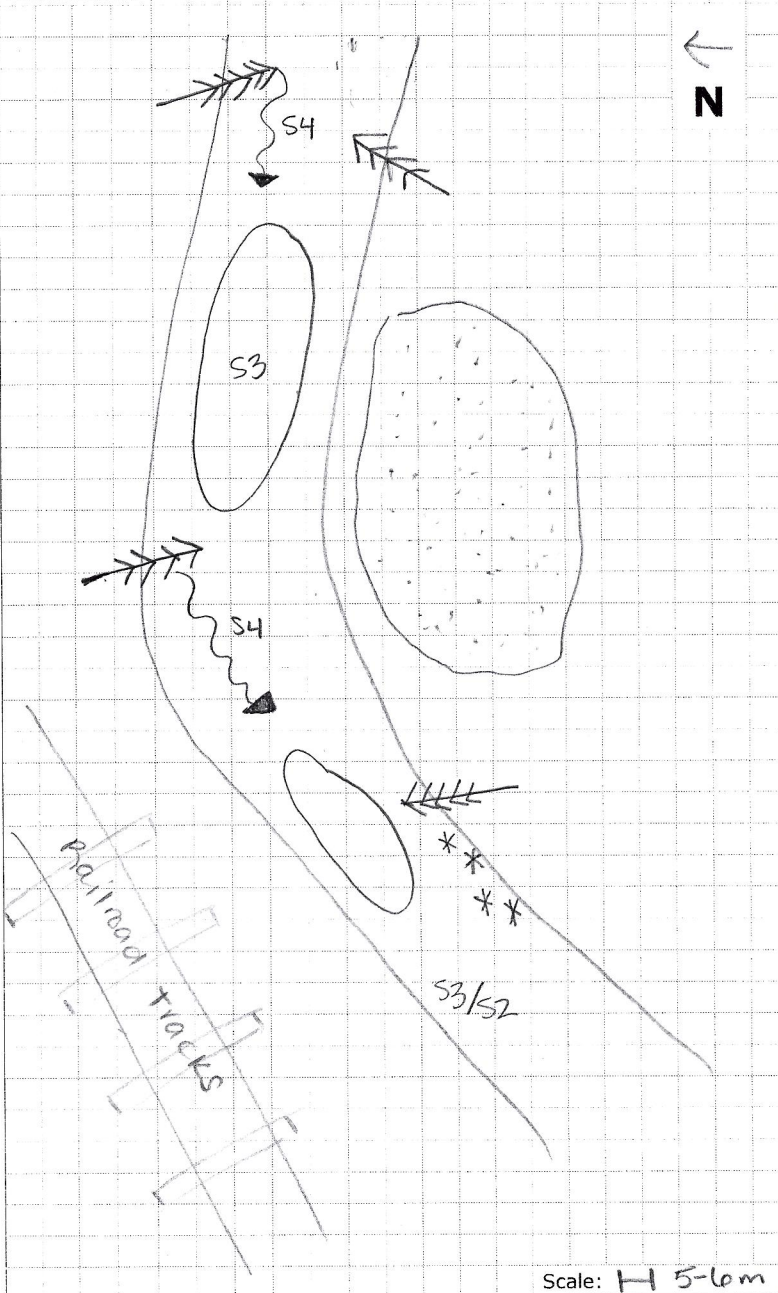
Substrate

- | | |
|------------------------|-------------------------|
| S1 Silt | S6 Small boulder |
| S2 Sand | S7 Large boulder |
| S3 Gravel | S8 Bimodal |
| S4 Small cobble | S9 Bedrock/till |
| S5 Large cobble | |

Other

- | | |
|--------------------------------|-----------------------|
| BM Benchmark | EP Erosion pin |
| BS Backsight | RB Rebar |
| DS Downstream | US Upstream |
| WDJ Woody debris jam | TR Terrace |
| VWC Valley wall contact | FC Flood chute |
| BOS Bottom of slope | FP Flood plain |
| TOS Top of slope | KP Knick point |

Site Sketch:



Additional Notes:

Only 2 riffles in the whole reach

Completed by: _____ Checked by: AL

Rapid Geomorphic Assessment

Project Code: PN16107

Date:	May 15, 2017	Stream/Reach:	J8
Weather:	Sunny	Location:	Kelly Lake Rd.
Field Staff:	SC, AV, PP, GM, AL, PB	Watershed/Subwatershed:	Junction Rd

Process	Geomorphic Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar	X		2/7
	2	Coarse materials in riffles embedded		X	
	3	Siltation in pools		X	
	4	Medial bars		X	
	5	Accretion on point bars		X	
	6	Poor longitudinal sorting of bed materials	X		
	7	Deposition in the overbank zone		X	
Sum of indices =			2	5	0.28

Evidence of Degradation (DI)	1	Exposed bridge footing(s)		X	1/8
	2	Exposed sanitary / storm sewer / pipeline / etc.		X	
	3	Elevated storm sewer outfall(s)	NA		
	4	Undermined gabion baskets / concrete aprons / etc.	NA		
	5	Scour pools downstream of culverts / storm sewer outlets		X	
	6	Cut face on bar forms		X	
	7	Head cutting due to knick point migration		X	
	8	Terrace cut through older bar material		X	
	9	Suspended armour layer visible in bank		X	
	10	Channel worn into undisturbed overburden / bedrock	X		
Sum of indices =			1	7	0.125

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	X		3/9
	2	Occurrence of large organic debris	X		
	3	Exposed tree roots		X	
	4	Basal scour on inside meander bends		X	
	5	Basal scour on both sides of channel through riffle		X	
	6	Outflanked gabion baskets / concrete walls / etc.		X	
	7	Length of basal scour > 50% through subject reach	X		
	8	Exposed length of previously buried pipe / cable / etc.		X	
	9	Fracture lines along top of bank		X	
	10	Exposed building foundation	NA		
Sum of indices =			3	6	0.33

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		X	0/4
	2	Single thread channel to multiple channel		X	
	3	Evolution of pool-riffle form to low bed relief form		X	
	4	Cut-off channel(s)		X	
	5	Formation of island(s)		X	
	6	Thalweg alignment out of phase with meander form		X	
	7	Bar forms poorly formed / reworked / removed		X	
Sum of indices =			0	7	0.0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.18

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	<input checked="" type="checkbox"/> 0.00 - 0.20	<input type="checkbox"/> 0.21 - 0.40	<input type="checkbox"/> 0.41

Completed by: _____ Checked by: GA

Rapid Stream Assessment Technique

Project Code: PN16107

Date:	May 15, 2017	Stream/Reach:	JR
Weather:	Sunny	Location:	Kelly Lake Rd
Field Staff:	SC, AU, PP, GM, AL, PR	Watershed/Subwatershed:	Jackson Creek

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	<ul style="list-style-type: none"> < 50% of bank network stable Recent bank sloughing, slumping or failure frequently observed 	<ul style="list-style-type: none"> 50-70% of bank network stable Recent signs of bank sloughing, slumping or failure fairly common 	<ul style="list-style-type: none"> 71-80% of bank network stable Infrequent signs of bank sloughing, slumping or failure 	<ul style="list-style-type: none"> > 80% of bank network stable No evidence of bank sloughing, slumping or failure
	<ul style="list-style-type: none"> Stream bend areas highly unstable Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) Bank overhang > 0.8-1.0 m 	<ul style="list-style-type: none"> Stream bend areas unstable Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) Bank overhang 0.8-0.9m 	<ul style="list-style-type: none"> Stream bend areas stable Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) Bank overhang 0.6-0.8 m 	<ul style="list-style-type: none"> Stream bend areas very stable Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) Bank overhang < 0.6 m
	<ul style="list-style-type: none"> Young exposed tree roots abundant > 6 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Young exposed tree roots common 4-5 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile 	<ul style="list-style-type: none"> Exposed tree roots old, large and woody Generally 0-1 recent large tree falls per stream mile
	<ul style="list-style-type: none"> Bottom 1/3 of bank is highly erodible material Plant/soil matrix severely compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly erodible material Plant/soil matrix compromised 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material 	<ul style="list-style-type: none"> Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally trapezoidally-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped 	<ul style="list-style-type: none"> Channel cross-section is generally V- or U-shaped
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	<input checked="" type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8	<input type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11

Channel Scouring/ Sediment Deposition	<ul style="list-style-type: none"> > 75% embedded (> 85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 50-75% embedded (60-85% embedded for large mainstem areas) 	<ul style="list-style-type: none"> 25-49% embedded (35-59% embedded for large mainstem areas) 	<ul style="list-style-type: none"> Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	<ul style="list-style-type: none"> Few, if any, deep pools Pool substrate composition >81% sand-silt 	<ul style="list-style-type: none"> Low to moderate number of deep pools Pool substrate composition 60-80% sand-silt 	<ul style="list-style-type: none"> Moderate number of deep pools Pool substrate composition 30-59% sand-silt 	<ul style="list-style-type: none"> High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) Pool substrate composition <30% sand-silt
	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits common 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits uncommon 	<ul style="list-style-type: none"> Streambed streak marks and/or "banana"-shaped sediment deposits absent
	<ul style="list-style-type: none"> Fresh, large sand deposits very common in channel Moderate to heavy sand deposition along major portion of overbank area 	<ul style="list-style-type: none"> Fresh, large sand deposits common in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits uncommon in channel Small localized areas of fresh sand deposits along top of low banks 	<ul style="list-style-type: none"> Fresh, large sand deposits rare or absent from channel No evidence of fresh sediment deposition on overbank
	<ul style="list-style-type: none"> Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars common, moderate to large and unstable with high amount of fresh sand 	<ul style="list-style-type: none"> Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand 	<ul style="list-style-type: none"> Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8

Date:	May 15, 2017	Reach:	18	Project Code:	PN16107
Evaluation Category	Poor	Fair	Good	Excellent	
Physical Instream Habitat	Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)	
	Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	Good mix between riffles, runs and pools. Relatively diverse velocity and depth of flow	Riffles, runs and pool habitat present. Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)	
	Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble	Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble	Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble	Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble	
	Riffle depth < 10 cm for large mainstem areas	Riffle depth 10-15 cm for large mainstem areas	Riffle depth 15-20 cm for large mainstem areas	Riffle depth > 20 cm for large mainstem areas	
	Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure	
	Extensive channel alteration and/or point bar formation/enlargement	Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	No channel alteration or significant point bar formation/enlargement	
	Riffle/Pool ratio 0.49:1 ; $\geq 1.51:1$	Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	Riffle/Pool ratio 0.9-1.1:1	
	Summer afternoon water temperature > 27°C	Summer afternoon water temperature 24-27°C	Summer afternoon water temperature 20-24°C	Summer afternoon water temperature < 20°C	
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8	
Water Quality	Substrate fouling level: High (> 50%)	Substrate fouling level: Moderate (21-50%)	Substrate fouling level: Very light (11-20%)	Substrate fouling level: Rock underside (0-10%)	
	Brown colour	Grey colour	Slightly grey colour	Clear flow	
	TDS: > 150 mg/L	TDS: 101-150 mg/L	TDS: 50-100 mg/L	TDS: < 50 mg/L	
	Objects visible to depth < 0.15m below surface	Objects visible to depth 0.15-0.5m below surface	Objects visible to depth 0.5-1.0m below surface	Objects visible to depth > 1.0m below surface	
Point range	Moderate to strong organic odour	Slight to moderate organic odour	Slight organic odour	No odour	
	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5 <input type="checkbox"/> 6	<input type="checkbox"/> 7 <input type="checkbox"/> 8	
Riparian Habitat Conditions	Narrow riparian area of mostly non-woody vegetation	Riparian area predominantly wooded but with major localized gaps	Forested buffer generally > 31 m wide along major portion of both banks	Wide (> 60 m) mature forested buffer along both banks	
	Canopy coverage: < 50% shading (30% for large mainstem areas)	Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	Canopy coverage: > 80% shading (> 60% for large mainstem areas)	
Point range	<input type="checkbox"/> 0 <input type="checkbox"/> 1	<input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	<input type="checkbox"/> 4 <input type="checkbox"/> 5	<input type="checkbox"/> 6 <input type="checkbox"/> 7	
Total overall score (0-42) = 23		Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)