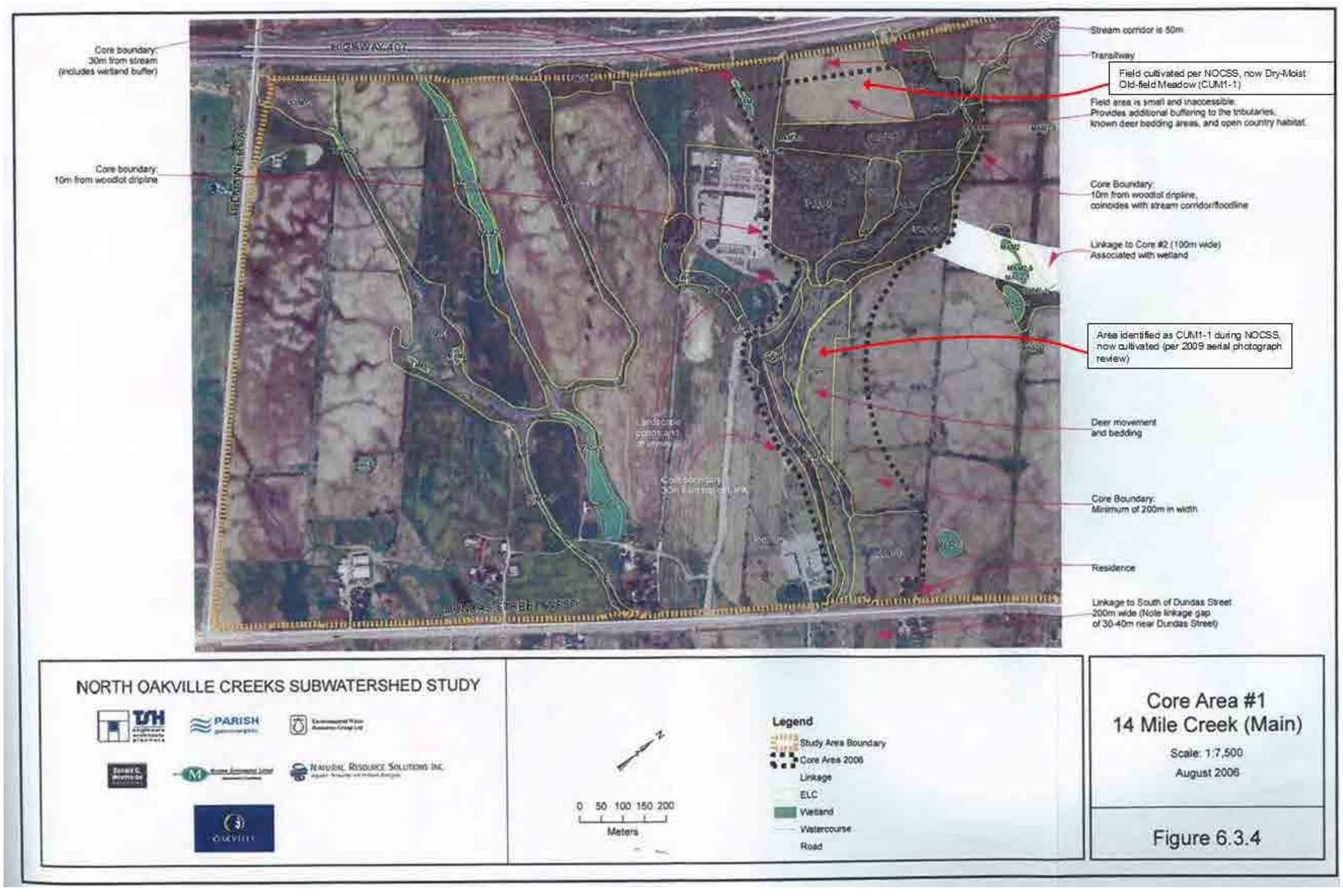
Appendix 5.4 – Core #1 and Linkage to Core #2 Vegetation Community Mapping (Modified by MMM from NOCSS)


Core boundary:
30m from stream
(includes wetland buffer)
Core boundary:
10m from woodlot dripline
HIGHWAY 407
Stream corridor is 50m
Transitway
Field cultivated per NOCSS, now Dry-Moist Old-field Meadow (CUM1-1)
Field area is small and inaccessible.
Provides additional buffering to the tributaries,
known deer bedding areas, and open country habitat.
Core Boundary:
10m from woodlot dripline,
coincides with stream corridor/floodline
Linkage to Core #2 (100m wide)
Associated with wetland
Area identified as CUM1-1 during NOCSS,
now cultivated (per 2009 aerial photograph review)
Deer movement
and bedding
Core Boundary:
Minimum of 200m in width
Residence
Linkage to South of Dundas Street
200m wide (Note linkage gap
of 30-40m near Dundas Street)
NORTH OAKVILLE CREEKS SUBWATERSHED STUDY
PARISH
NATURAL RESOURCE SOLUTIONS INC.
0 50 100 150 200
Meters
Legend
Study Area Boundary
Core Area 2006
Linkage
ELC
Wetland
Watercourse
Road
Core Area #1
14 Mile Creek (Main)
Scale: 1:7,500
August 2006
Figure 6.3.4


HIGHWAY 407
REGIONAL ROAD 25
DUNDAS STREET WEST
Residence & Church
Linkage to Core #1 (100m)
Core boundary: 10m from woodlot dripline
Residences
Core boundary: At the limit of dense natural vegetation (includes floodline of channel and wetland areas)
Residences and other buildings
Connection to 16 Mile Creek (Associated with ORC Lands)
Note: Floodlines associated with watercourses
Core boundary to follow stream corridor
Core boundary: 30m from pond/wetland, which equates to 110m floodplain width
Linkage to south of Dundas Street (note the gap along Dundas Street)
NORTH OAKVILLE CREEKS SUBWATERSHED STUDY
NATURAL RESOURCE SOLUTIONS INC.
0 100
Meters
Legend
Study Area Boundary
Core Area 2006
Linkage
ELC
Wetland
Watercourse
Road
Core Area #2
14 Mile Creek East
(ORC Lands)
Scale: 1:10,000
August 2006
Figure 6.3.5

Appendix 5.5 – ELC Field Data Sheets

- FOD
- Mid-aged.
- Abrupt mature edge.
- 80% canopy cover

ELC
PLANT SPECIES LIST

SITE: Ok Lazy Pat
POLYGON: 01
DATE: Aug. 18 '09
SURVEYOR(S): Spinka

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Pinu str					
Pinu syl					
Thuj occ					
Tilia cor					
Acer Sacc.					
Acer neg.					
Carya					

SPECIES CODE	LAYER 1	2	3	4	COL.
Rham cat					
Frax amer.					

M'daged [illegible] FoD
disturbed by constructed
trail for Zenon/GE treatment plant employees.
90+ canopy cover, generally good health of trees.

ELC PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: 02
DATE: Aug. 18/09
SURVEYOR(S): S Dinka

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Acer saca	D				
Fraxnat.					
Pinustro.					
Quer alb.					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

ELC
PLANT SPECIES LIST

SITE: Lacey Pat
POLYGON: 03
DATE: Aug. 18/09
SURVEYOR(S): S Dinka.

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COL.
	1	2	3	4	
Acer saca					
Fraxinus					

ELC
PLANT SPECIES LIST

SITE: Lazy Pat 3460
POLYGON: 04
DATE: Sept 11, 2009
SURVEYOR(S): SD

Mid-aged to Mature FOD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Quebus sp					
Carya ov.					
Acer sac					

ELC
PLANT SPECIES LIST

SITE: Lazy Cat 3460
POLYGON: 105
DATE: Sept 11 2009
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

FOD, Hickory dominant.

SPECIES CODE	LAYER 1	2	3	4	COL.
Carya ov.	A				
Pinu stro	O				
Frax pen	O				
Acer sac.					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of .....

MAM area ~~dang~~ flows thrown middle of forest block, majority is shagbark hickory dominated mid-aged. FOD

ELC
PLANT SPECIES LIST

SITE: Lazy Cat 3460
POLYGON: 06
DATE: Sept. 11, 2009.
SURVEYOR(S): SP

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Corya ova					
Fraxi amer					
Frax pen					
Acer sacc					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

mid-aged FOD, Hickory dominant, residential properties cut out of forest block.

ELC
PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: 07
DATE: Sept. 11, 2009
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER				COL.
	1	2	3	4	

ELC
PLANT SPECIES LIST

SITE: Lazy Pat 3460
POLYGON: 08
DATE: Sept. 11 2009
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Acer Sac.	A				
Pinus Str.	F				
Carya ov	O				
Quercus sp.	O				

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

mid-aged FOD5, FOM2
moderately large pond on south corner

ELC
PLANT SPECIES LIST

SITE: Lazy Pat 3460
POLYGON: ~~09~~ 09
DATE: Sept. 11, 2009
SURVEYOR(S): SD

Mid aged to mature FOD5

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Acer saca	A				
Pinu stob.	F				
Carya ov.					
Populus ser					
Fax amer					
Quercus sp					

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC
PLANT SPECIES LIST

SITE: Lazy Pat 3460
POLYGON: 10
DATE: Sept. 11, 2009
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Pinus sp.					
Acer sac.					
Crataegus.					
Quercus sp					
Carya ov.					
Tilia amer.					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

FOM 2 -
CUS 1-1 – hawthorn cultural savannah.
FOD 5
several watercourse features + p-n's.

ELC
PLANT SPECIES LIST

SITE: Lazy Pat 3460
POLYGON: A / 11
DATE: Sept. 11, 2009.
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Acer saca	A				
Carya ov.					
Pinus stro					
Quer rub.					
Quer sp.					
Ulm amer					
Frax amer					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

midaged FOD5 transected by watercourse.

ELC
PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: 12
DATE: Sept. 11, 2009
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Phalaris arun					
Typha ang					
Typha lat					
Lythrum sal					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

- MAM2-2/CUM
- 2 ponds with ~~Stuff~~ cattail shallow marsh fringe. near 407 ROW Fence.

ELC
PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: 13
DATE: Sept. 11 2009
SURVEYOR(S): SD.

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Ulm amer					
Phalar arun					
Lythrum sal					
Acer neg.					
Typha sp.					

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ..... of ....

- MAM/CUM band surrounding watercourse with occasional trees and very small cattail shallow marsh pockets.
- watercourse surrounded by active agriculture.

ELC PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: Unit 1 wetland
DATE: Aug 20, 2009
SURVEYOR(S): KD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
(S) Salix sp	O				
Acer sacc.	O				
Frax pen.	O				
Ulmus am.	O				
Malus pum	S				

ELC PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: ~~Unit 3~~ FOD 7-3
DATE: Aug 20, 2009
SURVEYOR(S): SDinka.

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Sali. fragg.	D				
Ulmus amer		O			
Frax nig.		S			
Acer plat.		F			
Parth. in.				O	
Vitis rip.				F	
Rubus idaeus/ideus				O	
Cornus foem				O	
Lonitat.				O	
Rhamnat.				O	

SPECIES CODE	LAYER 1	2	3	4	COL.
Carex vulp.				O	
Lyth sal.				F	
Phal arun.				O	
Dipsa full.				O	
Leers ory.				O	
grass				A	
small unknown				S	
Ali. ort				O	
yellow rocket				O	
wild mustard				O	
Carex sp				O	
Phal arun.				O	
Aster lae.				F	
watercress				S	
Brom. iner				F	
Hesp mat				O	
Dandelion					
Frag vir.					

near Dundas road only

as sampled unit 1.

as sampled unit 1.

as sampled unit 2.

→ Alisma plantago-aq

broad leaf inclusive.

Page ..... of ....

wildlife American goldfinch. Blue jay, water striders in some pools.

Notes

- no flow at time of survey. but small pools of standing water, algae,
- lots of dumping etc. in channel.
- frequent canopy gaps, trees to 50cm dbh.

ELC PLANT SPECIES LIST

SITE: Lazy Pat 3460
POLYGON: Unit 4
DATE: Aug. 30
SURVEYOR(S): SDinka

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Com daisy				F	
Lady's thumb.				O	
Common ragweed				A	
waterweed.				F	
Poa prat.				F	
redtop				F	
Echin crus.				O	
(5) Polygonum sp.				A	
Plant maj.				F	
Rumex crisp.				F	
bidens frond				S	
(5) grass sp				F	
hairy willowherb.				S	
Trifo rep.					

* Chrysanthemum seg.

these 2 abundant.

— Epilobium hir.

Page ..... of ....

wildlife

* leopard frog +++
* 3 mallards in dug pond.

notes

* soils soft, esp. towards Dundas.
* dug pond has apparent overflow outlet to Dundas road ditch.
* north end appears to have been plowed.

ELC
PLANT SPECIES LIST

SITE: Lazy Cat
POLYGON: Northern Portion of Unit 2
DATE: Aug. 20/09
SURVEYOR(S): SD

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
Crataegus sp		S			
Tilia amer.		S			
Carya ovata		S			
Salix eno		S			

SPECIES CODE	LAYER 1	2	3	4	COL.
Brom. inerm				A	
Phalaris arun				F	
Lyth sal.				F	
Aster pun.				O	
Algae.				F	→ in stagnant pools.
Soli alt.				O	
Carex vulp				O	→ as sampled.
Scirp atro.				S	
Leersia oryz				O	
Woolgrass bulrush.				S	
Typ cap-				S	
(S) grass				A	
Juncus torreyii				D	→ Juncus torreyii
as sampled unit					

Page ..... of ....

Brom. inerm

#notes

* narrow CUM = small MAM patches in narrow valley between raised soybean fields. valley basicens and floodplain boundaries from point indicated on map.

wildlife

* frogs (none id'd).
* mud crickets.

ELC
PLANT SPECIES LIST

SITE: Lazy Pat
POLYGON: ~~unit 1~~ Unit 2 typical MAM2-10
DATE: Aug 20 '09
SURVEYOR(S): SDinka

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

SPECIES CODE	LAYER 1	2	3	4	COL.
Phalaris arun				F	
Aster lanceo				A	
hairy willowherb				F	
Lythrum sal.					
sampled grass from unit 3					
Euth gram.					
annual rag					
lady's thumb.					
Dandelion.					
Bromus inerm.					
sampled herb mash from unit 2.					

as sampled unit 3
Epilobium hir
Juncus tenuis

905

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: A – pasture
DATE: Sept 24, 2014
SURVEYOR(S): LJA

Slope

UTM WP 449.

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
8cm O	Ol				
	Ap				
75	Too tough/sticks to auger				
A TEXTURE	SC	dk brown			
COURSE FRAGMENTS	2%	stony			
B TEXTURE					
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS	0				
SURFACE ROCKINESS	0				
DEPTH TO / OF					
MOTTLES	15.5				
GLEY	∞				
BEDROCK	∞				
WATER TABLE	∞				
CARBONATES					
DEPTH OF ORGANICS	8cm				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC
PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: B - pasture
DATE: SEPT 24 2014
SURVEYOR(S): LTH

Slope UTM WP 250

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
	0 AR 36cm				
	SC				
	55 stoney				
A TEXTURE	SC	dk Brown			
COURSE FRAGMENTS	0%				
B TEXTURE					
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES	11				
GLEY	∞				
BEDROCK	∞				
WATER TABLE	∞				
CARBONATES					
DEPTH OF ORGANICS	6				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: C - 2A CUM1-1
DATE: SEPT 24, 2014
SURVEYOR(S): LSA

Slope UTM WP 402

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
0	SiC				
26	SC				
53	SC				
61 TO Diff		Stoney & clay.			
A TEXTURE	SiC	DK Brown			
COURSE FRAGMENTS	< 1%				
B TEXTURE	SC	Or Brown			
COURSE FRAGMENTS	1%				
C TEXTURE	SC	Med Brown w/ dk Red & grey specks			
COURSE FRAGMENTS		& clay. & sandstone.			
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES	10				
GLEY	53 ?				
BEDROCK	∞				
WATER TABLE	∞				
CARBONATES	∞				
DEPTH OF ORGANICS	0				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: RENTALL
POLYGON: D/2A-CUMI-1
DATE: SEPT 24, 2014
SURVEYOR(S): LJA

Slope

UTM WP 453

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON	OL 5cm	mSCL Ap 23	CL B 55	C 62	TOO STONEY/TOUGH
A TEXTURE	mSCL	dk brown			
COURSE FRAGMENTS	0				
B TEXTURE	CL	dk brown; Red brick spots			
COURSE FRAGMENTS	5%	Queenston Shale → Red.			
C TEXTURE	C				
COURSE FRAGMENTS	70%	red & grey stones.			
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES	12				
GLEY	∞				
BEDROCK	65?				
WATER TABLE	∞				
CARBONATES					
DEPTH OF ORGANICS	5				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC
PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL

POLYGON: E1ZA - CUM1-1

DATE: SEPT 24, 2014

SURVEYOR(S): LJA

Slope

UTM WP458

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
0	A				
17	B				
44	STONINESS				
A TEXTURE	Si Cl	red (brick)			
COURSE FRAGMENTS	5%				
B TEXTURE	Si L	med (brown)			
COURSE FRAGMENTS	0				
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES					
GLEY					
BEDROCK					
WATER TABLE					
CARBONATES					
DEPTH OF ORGANICS					
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC

PLANT SPECIES LIST

SITE:

POLYGON:

DATE:

SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: ~~SWB~~ 2B
DATE: SEPT 24, 2014
SURVEYOR(S): LJA

Slope UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON	5 O SiCl 20 C 65 TOO TOUGH	VP4 Med Brown			
A TEXTURE	SiCl	Med Brown			
COURSE FRAGMENTS	0				
B TEXTURE	C	Med Brown			
COURSE FRAGMENTS	0				
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES	~~40~~ 3				
GLEY	∞				
BEDROCK	∞				
WATER TABLE	∞				
CARBONATES					
DEPTH OF ORGANICS	5				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC

PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: 2D - MAS2-1
DATE: SEPT 24, 2014
SURVEYOR(S): LJA

Slope

UTM WP 454

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON	Ol	20			
	Oh	15			
0					
	A				
40					
	B				
60					
Oh TEXTURE	Oh	dk Brown			
COURSE FRAGMENTS	0				
A TEXTURE	SiC	dk Brown			
COURSE FRAGMENTS	1-2%				
B TEXTURE	C	Red & Grey Brown			
COURSE FRAGMENTS	50	Red Queenston Shale			
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					

DEPTH TO / OF

MOTTLES	5cm				
GLEY	∞				
BEDROCK	?				
WATER TABLE	∞				
CARBONATES					
DEPTH OF ORGANICS	20cm				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					

SOIL SURVEY MAP					
LEGEND CLASS					

ELC

PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: 2G
DATE: SEPT 24, 2014
SURVEYOR(S): LJA

Slope / UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
0	CL	10			
	A				
20	SiCl	B			
50		C			
80	STONINESS				
A TEXTURE	SiCl				
COURSE FRAGMENTS	0	Grey Brown			
B TEXTURE	SiCl				
COURSE FRAGMENTS	15	Red Brown			
C TEXTURE	SiCl				
COURSE FRAGMENTS	50%	RED!			
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES	20				
GLEY	∞				
BEDROCK	?				
WATER TABLE	15				
CARBONATES					
DEPTH OF ORGANICS	10				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC
PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: F/SA - FOD2-2
DATE: SEPT 24, 2014
SURVEYOR(S): LJA

Slope

UTM WP 460

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON	0 – SiFS 20 ← Too Compacted				
A TEXTURE	SiFS				
COURSE FRAGMENTS	0				
B TEXTURE					
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES					
GLEY					
BEDROCK					
WATER TABLE					
CARBONATES					
DEPTH OF ORGANICS					
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC
PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: 5B
DATE: SEPT 24, 2014
SURVEYOR(S): LJA

Slope — UTM WP 460

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON	OL A ~~Ahm~~ B				
A TEXTURE	mSL				
COURSE FRAGMENTS	1%				
B TEXTURE	mSCL				
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES					
GLEY					
BEDROCK					
WATER TABLE					
CARBONATES					
DEPTH OF ORGANICS					
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

ELC
PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC

SOILS ONTARIO

SITE: BENTALL
POLYGON: G – Ag.
DATE: SEPT 24 2014
SURVEYOR(S): LJA

Slope UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
3	OL				
0					
	A				
17					
	B				
50	auger	refused			
A TEXTURE	SiC	dk brown.			
COURSE FRAGMENTS	0				
B TEXTURE	C	mod. brown			
COURSE FRAGMENTS	15%				
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES	7				
GLEY	∞				
BEDROCK	∞				
WATER TABLE	∞				
CARBONATES					
DEPTH OF ORGANICS	3				
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME	V. moist				
SOIL SURVEY MAP					
LEGEND CLASS					

ELC

PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

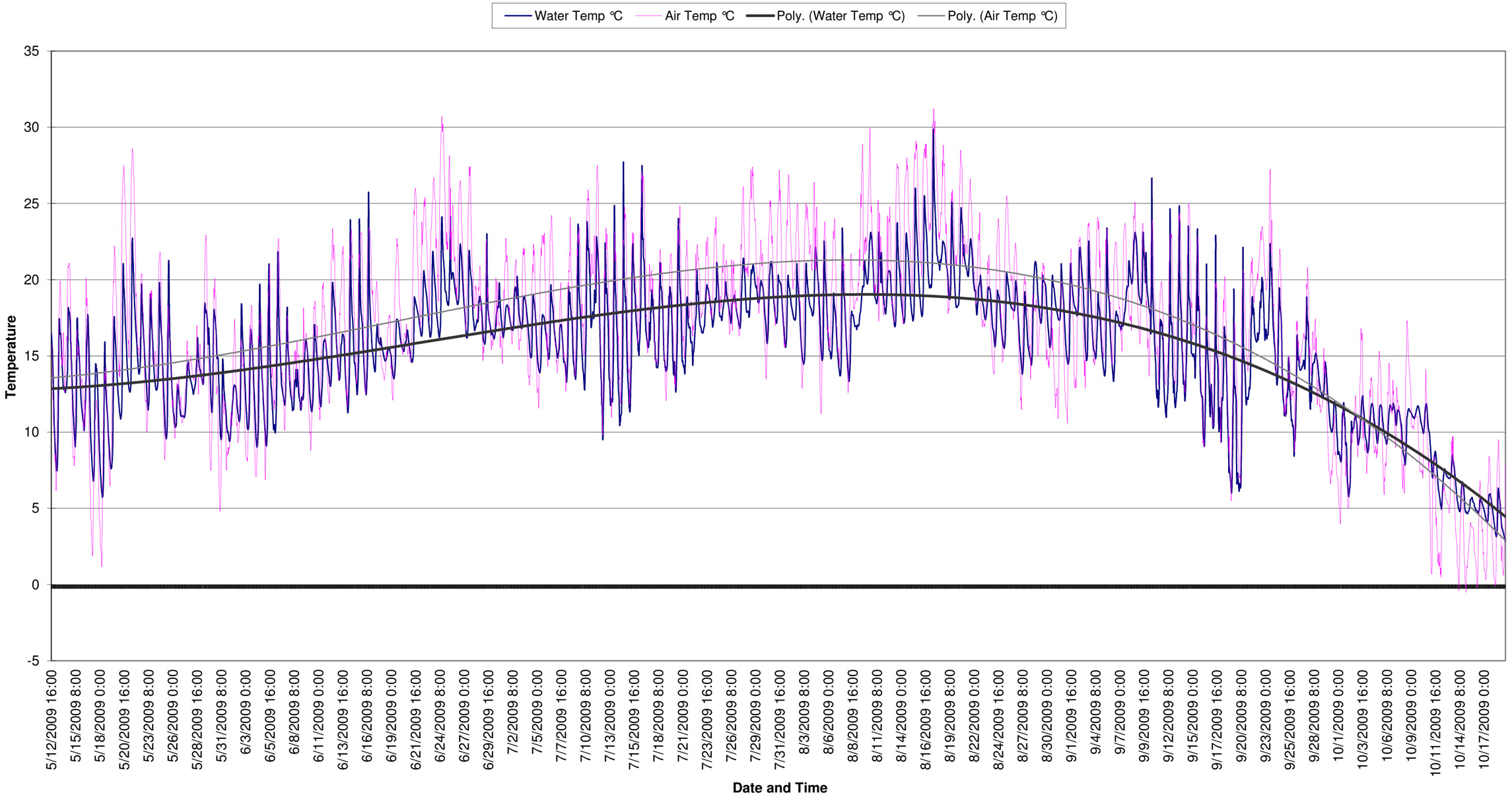
LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

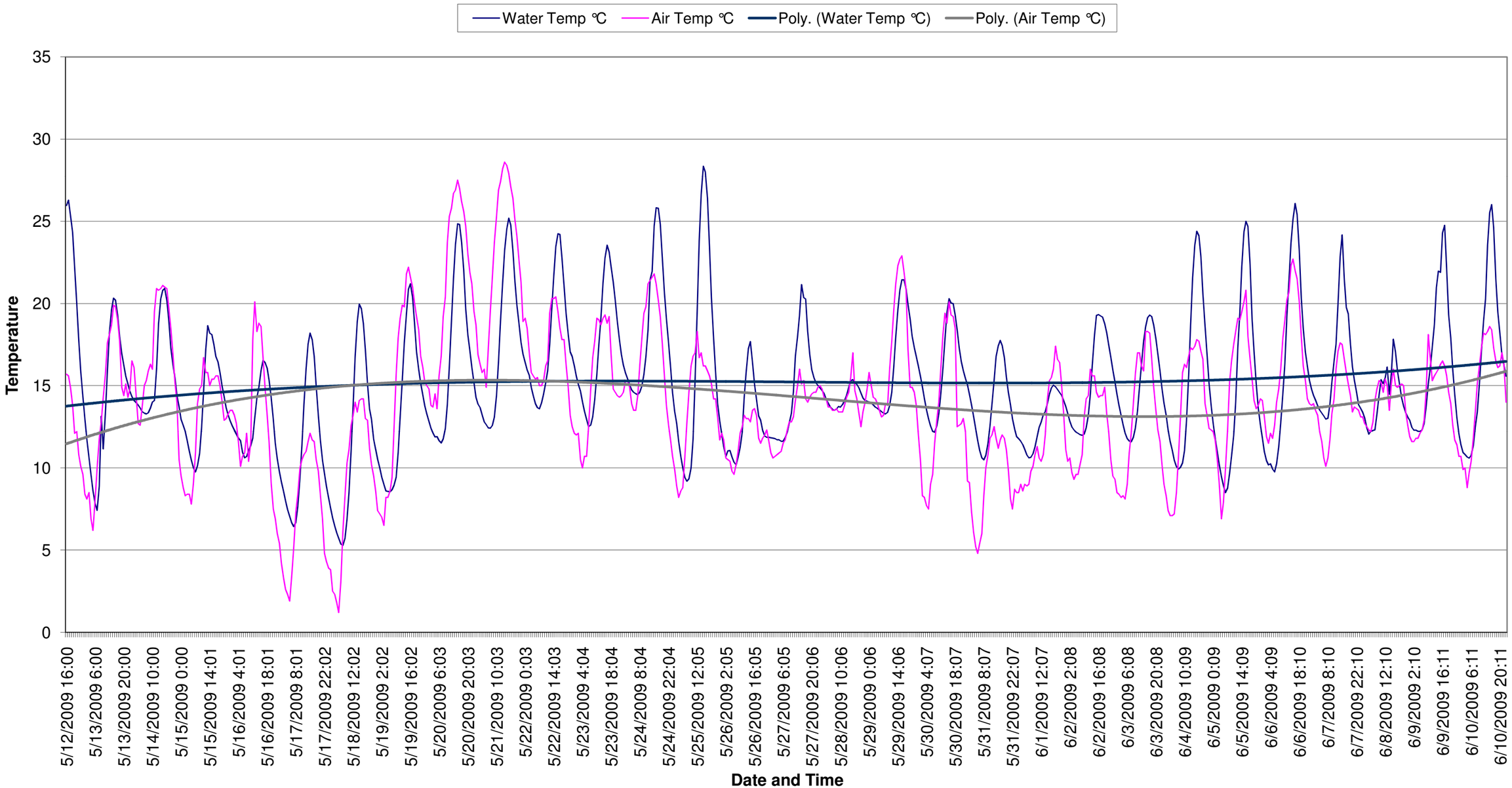
SPECIES CODE	LAYER 1	2	3	4	COL.

Appendix 5.6 – Water Temperature Monitoring Data

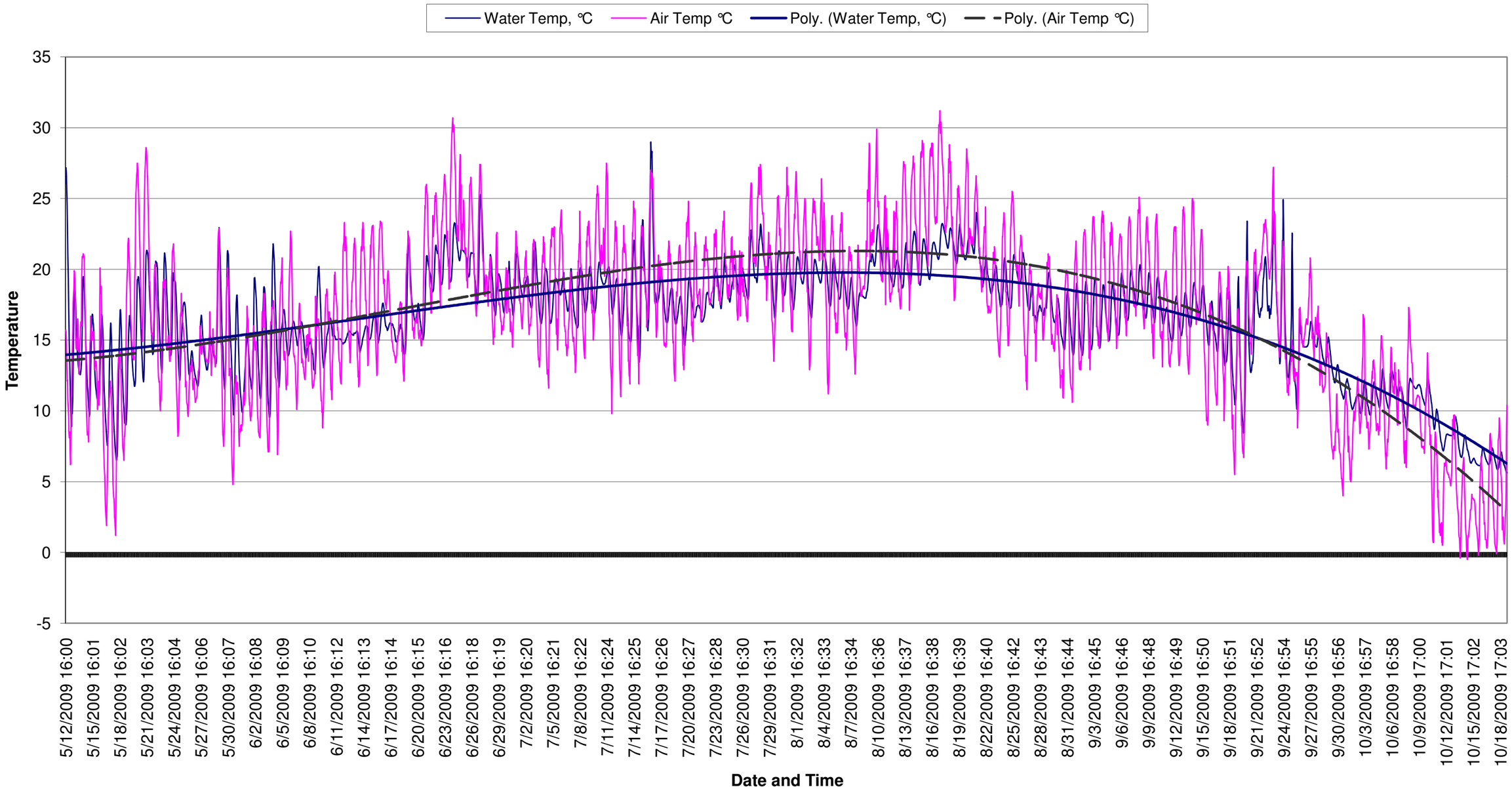
14W-11A


Water Temp ℃
Air Temp ℃
Poly. (Water Temp ℃)
Poly. (Air Temp ℃)
Temperature
35
30
25
20
15
10
5
0
-5
5/12/2009 16:00
5/15/2009 8:00
5/18/2009 0:00
5/20/2009 16:00
5/23/2009 8:00
5/26/2009 0:00
5/28/2009 16:00
5/31/2009 8:00
6/3/2009 0:00
6/5/2009 16:00
6/8/2009 8:00
6/11/2009 0:00
6/13/2009 16:00
6/16/2009 8:00
6/19/2009 0:00
6/21/2009 16:00
6/24/2009 8:00
6/27/2009 0:00
6/29/2009 16:00
7/2/2009 8:00
7/5/2009 0:00
7/7/2009 16:00
7/10/2009 8:00
7/13/2009 0:00
7/15/2009 16:00
7/18/2009 8:00
7/21/2009 0:00
7/23/2009 16:00
7/26/2009 8:00
7/29/2009 0:00
7/31/2009 16:00
8/3/2009 8:00
8/6/2009 0:00
8/8/2009 16:00
8/11/2009 8:00
8/14/2009 0:00
8/16/2009 16:00
8/19/2009 8:00
8/22/2009 0:00
8/24/2009 16:00
8/27/2009 8:00
8/30/2009 0:00
9/1/2009 16:00
9/4/2009 8:00
9/7/2009 0:00
9/9/2009 16:00
9/12/2009 8:00
9/15/2009 0:00
9/17/2009 16:00
9/20/2009 8:00
9/23/2009 0:00
9/25/2009 16:00
9/28/2009 8:00
10/1/2009 0:00
10/3/2009 16:00
10/6/2009 8:00
10/9/2009 0:00
10/11/2009 16:00
10/14/2009 8:00
10/17/2009 0:00
Date and Time

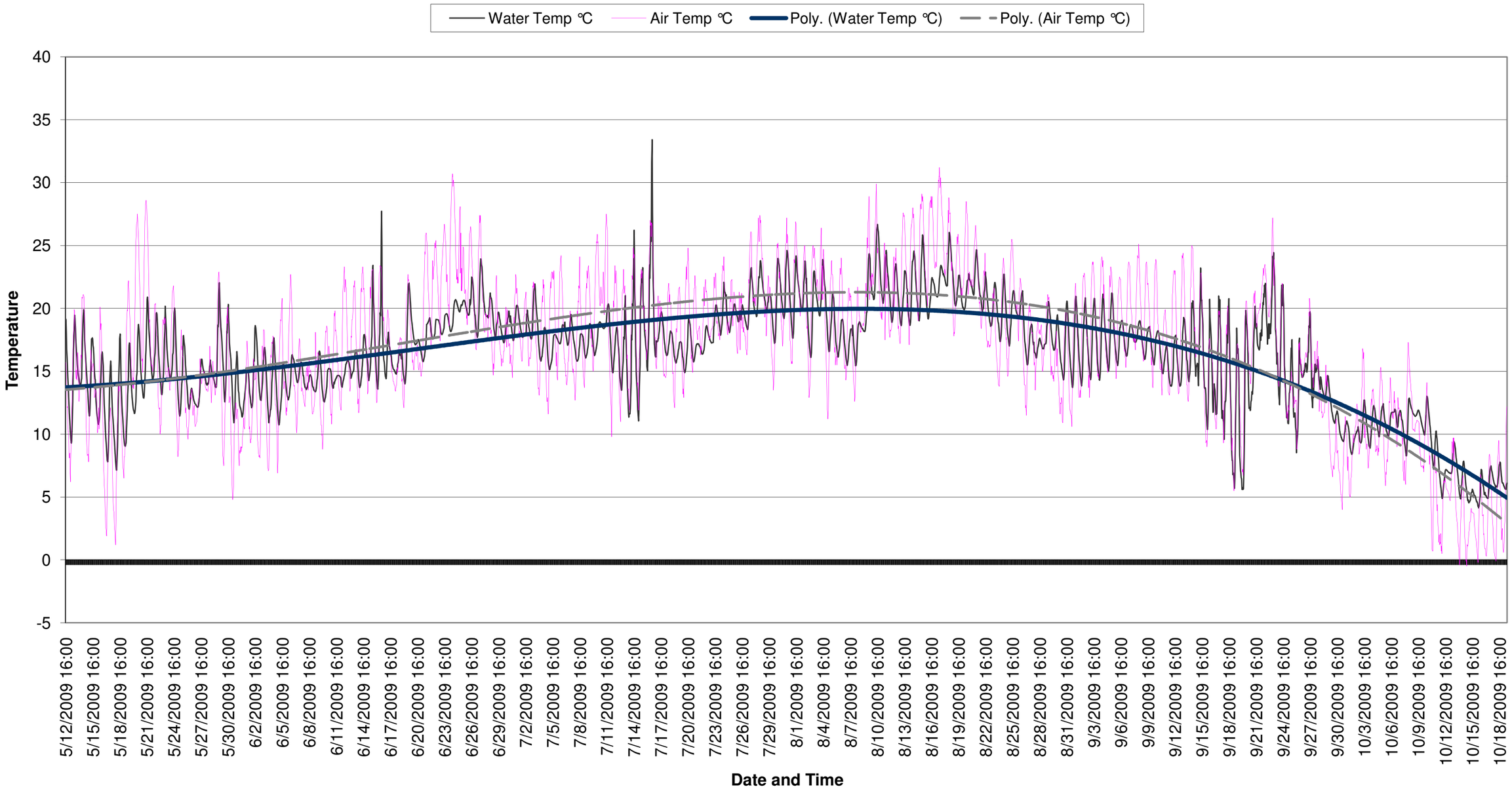
14W-12A


Water Temp ℃
Air Temp ℃
Poly. (Water Temp ℃)
Poly. (Air Temp ℃)
Temperature
35
30
25
20
15
10
5
0
5/12/2009 16:00
5/13/2009 6:00
5/13/2009 20:00
5/14/2009 10:00
5/15/2009 0:00
5/15/2009 14:01
5/16/2009 4:01
5/16/2009 18:01
5/17/2009 8:01
5/17/2009 22:02
5/18/2009 12:02
5/19/2009 2:02
5/19/2009 16:02
5/20/2009 6:03
5/20/2009 20:03
5/21/2009 10:03
5/22/2009 0:03
5/22/2009 14:03
5/23/2009 4:04
5/23/2009 18:04
5/24/2009 8:04
5/24/2009 22:04
5/25/2009 12:05
5/26/2009 2:05
5/26/2009 16:05
5/27/2009 6:05
5/27/2009 20:06
5/28/2009 10:06
5/29/2009 0:06
5/29/2009 14:06
5/30/2009 4:07
5/30/2009 18:07
5/31/2009 8:07
5/31/2009 22:07
6/1/2009 12:07
6/2/2009 2:08
6/2/2009 16:08
6/3/2009 6:08
6/3/2009 20:08
6/4/2009 10:09
6/5/2009 0:09
6/5/2009 14:09
6/6/2009 4:09
6/6/2009 18:10
6/7/2009 8:10
6/7/2009 22:10
6/8/2009 12:10
6/9/2009 2:10
6/9/2009 16:11
6/10/2009 6:11
6/10/2009 20:11
Date and Time

14W-16


Water Temp, ℃
Air Temp ℃
Poly. (Water Temp, ℃)
Poly. (Air Temp ℃)
Temperature
35
30
25
20
15
10
5
0
-5
5/12/2009 16:00
5/15/2009 16:01
5/18/2009 16:02
5/21/2009 16:03
5/24/2009 16:04
5/27/2009 16:06
5/30/2009 16:07
6/2/2009 16:08
6/5/2009 16:09
6/8/2009 16:10
6/11/2009 16:12
6/14/2009 16:13
6/17/2009 16:14
6/20/2009 16:15
6/23/2009 16:16
6/26/2009 16:18
6/29/2009 16:19
7/2/2009 16:20
7/5/2009 16:21
7/8/2009 16:22
7/11/2009 16:24
7/14/2009 16:25
7/17/2009 16:26
7/20/2009 16:27
7/23/2009 16:28
7/26/2009 16:30
7/29/2009 16:31
8/1/2009 16:32
8/4/2009 16:33
8/7/2009 16:34
8/10/2009 16:36
8/13/2009 16:37
8/16/2009 16:38
8/19/2009 16:39
8/22/2009 16:40
8/25/2009 16:42
8/28/2009 16:43
8/31/2009 16:44
9/3/2009 16:45
9/6/2009 16:46
9/9/2009 16:48
9/12/2009 16:49
9/15/2009 16:50
9/18/2009 16:51
9/21/2009 16:52
9/24/2009 16:54
9/27/2009 16:55
9/30/2009 16:56
10/3/2009 16:57
10/6/2009 16:58
10/9/2009 17:00
10/12/2009 17:01
10/15/2009 17:02
10/18/2009 17:03
Date and Time

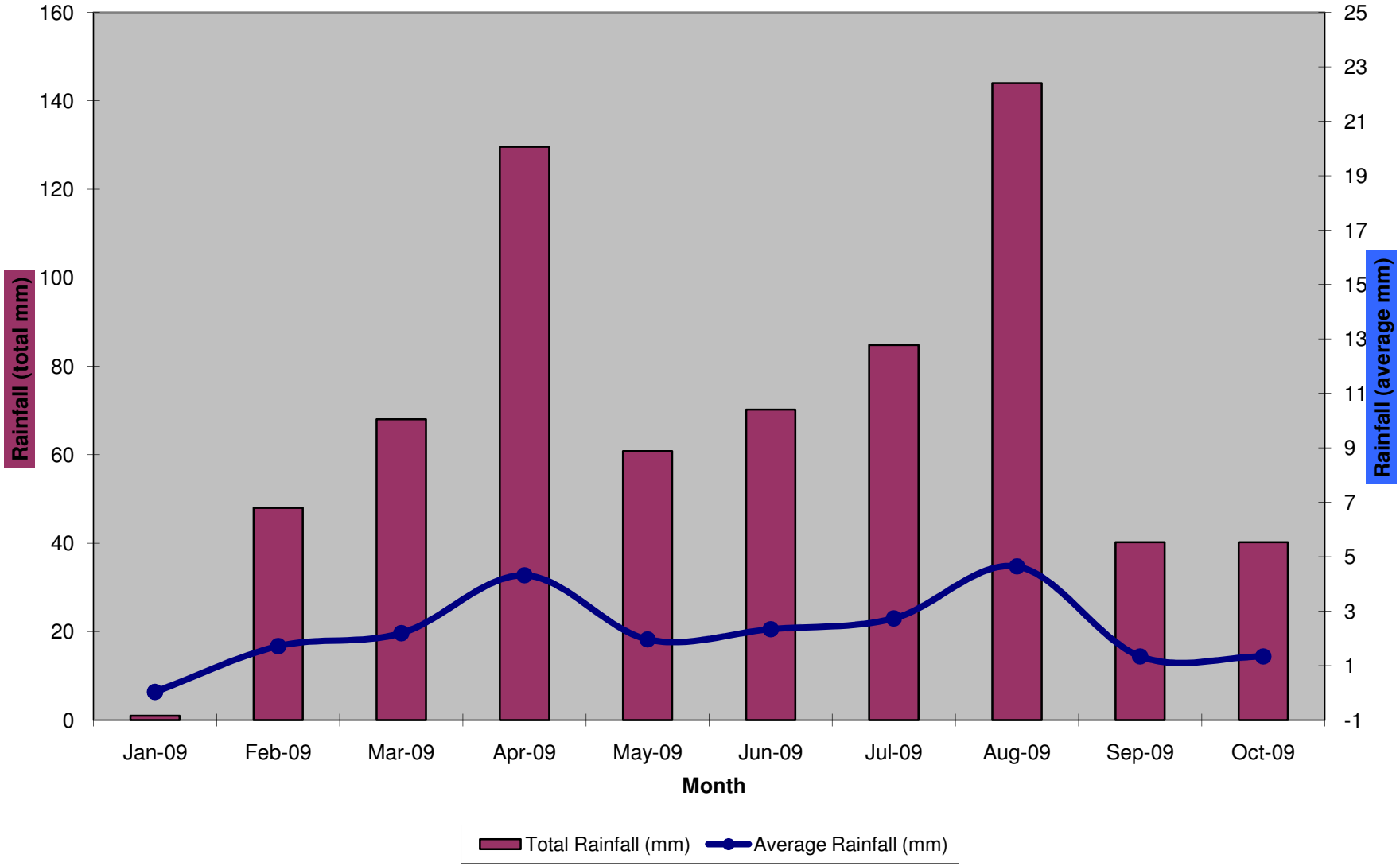
14W-12


Water Temp ℃
Air Temp ℃
Poly. (Water Temp ℃)
Poly. (Air Temp ℃)
Temperature
40
35
30
25
20
15
10
5
0
-5
5/12/2009 16:00
5/15/2009 16:00
5/18/2009 16:00
5/21/2009 16:00
5/24/2009 16:00
5/27/2009 16:00
5/30/2009 16:00
6/2/2009 16:00
6/5/2009 16:00
6/8/2009 16:00
6/11/2009 16:00
6/14/2009 16:00
6/17/2009 16:00
6/20/2009 16:00
6/23/2009 16:00
6/26/2009 16:00
6/29/2009 16:00
7/2/2009 16:00
7/5/2009 16:00
7/8/2009 16:00
7/11/2009 16:00
7/14/2009 16:00
7/17/2009 16:00
7/20/2009 16:00
7/23/2009 16:00
7/26/2009 16:00
7/29/2009 16:00
8/1/2009 16:00
8/4/2009 16:00
8/7/2009 16:00
8/10/2009 16:00
8/13/2009 16:00
8/16/2009 16:00
8/19/2009 16:00
8/22/2009 16:00
8/25/2009 16:00
8/28/2009 16:00
8/31/2009 16:00
9/3/2009 16:00
9/6/2009 16:00
9/9/2009 16:00
9/12/2009 16:00
9/15/2009 16:00
9/18/2009 16:00
9/21/2009 16:00
9/24/2009 16:00
9/27/2009 16:00
9/30/2009 16:00
10/3/2009 16:00
10/6/2009 16:00
10/9/2009 16:00
10/12/2009 16:00
10/15/2009 16:00
10/18/2009 16:00
Date and Time

Dissolved Oxygen	Result	Meaning
	<= 3	Biotic Crisis
	<4	Minimum limit in many states
	5	USEPA minimum limit
	>5	Adequate for fish
	9.8	Median of US Sites
	8.7 - 10.5	Middle 50% US Sites
DO Saturation	<80%	Evidence of elevated Oxy use
	>90%	High saturation of DO
TDS	**Result**	**Meaning**
	250	USEPA Maximum for water supply
	500	New York state Maximum
	<100	Low Concentration
	100-500	Medium Concentration
	500-1000	High Concentration
	>1000	Very High Concentration
pH	**Result**	**Meaning**
	<4	Stressed
	6.5 - 9.0	Suitable for biota
	6.5 - 8.5	Most Productive
	7.8	Median for US Sites
	7.3 - 8.1	Middle 50% US Sites
Temperature	**Result**	**Meaning**
	<18	Coldwater
	>18 to 25	Coolwater
	>25	Warmwater
Conductivity	k-value	TDS - k * SC
	0.65	Average k value
	0.55	Minimum variation of k
	0.75	Maximum variation of k

Sampling Date/Time	Temperature	TDS Value	Dissolved Oxygen	pH	Conductivity	Evaluation of TDS	Evaluation of DO	Evaluation of pH	Thermal Category	Evaluation of DO Saturation	Calculated TDS from Conductivity	Evaulation of Calculated TDS	Notes
14W-11A													
May 12, 2009 - 1015	20.2	587	10.31	8.38	1158	High	Adequate for Fish	Suitable for biota	Potential Coolwater	High Saturation Value	752.7	High	
May 28, 2009 - 0845	15.7	896	7.28	7.75	1801	High	Adequate for Fish	Suitable for biota	Potential Coldwater	Oxygen Usage	1170.65	VERY HIGH	
June 11, 2009 - 0850	14	926	4.58	7.31	1848	High	Poor for Fish	Suitable for biota	Potential Coldwater	Oxygen Usage	1201.2	VERY HIGH	
June 26, 2009 - 1108	22	1141	5.3	7.42	2285	VERY HIGH	Adequate for Fish	Suitable for biota	Potential Coolwater	Oxygen Usage	1485.25	VERY HIGH	
July 8, 2009 - 0915													
July 30, 2009 - 0938	17.5	475	7.65	7.95	930	Medium	Adequate for Fish	Suitable for biota	Potential Coldwater	High Saturation Value	604.5	High	
August 28, 2009 - 1027	16.4	830	5.98	7.33	1637	High	Adequate for Fish	Suitable for biota	Potential Coldwater	Oxygen Usage	1064.05	VERY HIGH	
September 10, 2009 - 0913													No data for this location on this date. Site was dry with very wet soils. No flowing or standing water u/s or d/s.
September 30, 2009 - 0932	11	855	8.4	7.8	1679	High	Adequate for Fish	Suitable for biota	Potential Coldwater	Oxygen Usage	1091.35	VERY HIGH	
October 19, 2009 - 0910	3	848	6.14	7.46	1700	High	Adequate for Fish	Suitable for biota	Potential Coldwater	Oxygen Usage	1105	VERY HIGH	
October 30, 2009 - 0939	10	796	7.11	7.85	1588	High	Adequate for Fish	Suitable for biota	Potential Coldwater	Oxygen Usage	1032.2	VERY HIGH	
Upstream from Logger													
July 8, 2009 - 0915	22.5		4.84	8.4	2530		Poor for Fish	Suitable for biota	Potential Coolwater	Oxygen Usage	1644.5	VERY HIGH	Shocking Site at Field Crossing
14W-12													
May 28, 2009 - 0900	13.9	815	7.57	7.9	1630	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1059.5	VERY HIGH	
June 11, 2009 - 0930	15.3	813	5.67	7.54	1634	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1062.1	VERY HIGH	
June 26, 2009 - 1157	22	858	5.2	7.74	1880	High	Adequate for Fish	Suitable for biota	Potential Coolwater		1222	VERY HIGH	
July 8, 2009 - 1420	21	1036	5.4	8.32	2062	VERY HIGH	Adequate for Fish	Suitable for biota	Potential Coolwater		1340.3	VERY HIGH	
July 30, 2009 - 1042	19	444	7.77	7.79	882	Medium	Adequate for Fish	Suitable for biota	Potential Coolwater		573.3	High	Highest volume of flowing water observed to date on site.
August 28, 2009 - 1135	20.9	899	7.28	7.89	1797	High	Adequate for Fish	Suitable for biota	Potential Coolwater		1168.05	VERY HIGH	
September 10, 2009 - 1025	16.3	740	4.88	7.72	1489	High	Poor for Fish	Suitable for biota	Potential Coldwater		967.85	High	
September 30, 2009 - 1038	10.5	896	7.25	7.57	1752	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1138.8	VERY HIGH	
October 19, 2009 - 1255	8	639	8.93	7.83	1280	High	Adequate for Fish	Suitable for biota	Potential Coldwater		832	High	
October 30, 2009 - 1200	10.4	795	8.43	8	1591	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1034.15	VERY HIGH	
14W-12A													
May 28, 2009 - 0900	13.8	639	3.38	7.53	1276	High	Very poor for Fish	Suitable for biota	Potential Coldwater		829.4	High	
October 30, 2009 - 1136	10.5	726	6.7	7.91	1454	High	Adequate for Fish	Suitable for biota	Potential Coldwater		945.1	High	
14W-16													
May 12, 2009 - 1400	19	731	14	8.38	1434	High	Adequate for Fish	Suitable for biota	Potential Coolwater		932.1	High	
May 28, 2009 - 0900	13.1	862	8.62	7.89	1714	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1114.1	VERY HIGH	
June 11, 2009 - 0905	16	660	10.82	7.92	1317	High	Adequate for Fish	Suitable for biota	Potential Coldwater		856.05	High	
June 26, 2009 - 1130	22.6	687	8.58	8.04	1384	High	Adequate for Fish	Suitable for biota	Potential Coolwater		899.6	High	
July 8, 2009 - 1230	22	988	6.35	8.45	1971	High	Adequate for Fish	Suitable for biota	Potential Coolwater		1281.15	VERY HIGH	
July 30, 2009 - 1012	17	586	7.89	7.77	1174	High	Adequate for Fish	Suitable for biota	Potential Coldwater		763.1	High	
August 28, 2009 - 1100	18.5	917	7.95	7.86	1807	High	Adequate for Fish	Suitable for biota	Potential Coolwater		1174.55	VERY HIGH	
September 10, 2009 - 0945	16.5	676	7.5	7.86	1350	High	Adequate for Fish	Suitable for biota	Potential Coldwater		877.5	High	
September 30, 2009 - 1007	11.5	918	8.89	7.83	1795	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1166.75	VERY HIGH	
October 19, 2009 - 1156	5.5	815	9.95	8.09	1621	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1053.65	VERY HIGH	
October 30, 2009 -1129	10.7	935	9.35	8.05	1875	High	Adequate for Fish	Suitable for biota	Potential Coldwater		1218.75	VERY HIGH	
Small and Large Pond													
Small Pond - July 8, 2009	26.3	189	5.3	9.3	380	Medium	Adequate for Fish	Alkaline	Potential Warmwater		247	Medium	
Large Pond - July 8, 2009	26	371	4.51	8.58	745	Medium	Poor for Fish	Suitable for biota	Potential Warmwater		484.25	Medium	

Recorded Rainfall



Bentall - Lazy Pat Lands Water Temperature Monitoring 2009 (Chu et.al. Method)

Water Temperature

Maximum Air Temperature

40.00
35.00
30.00
25.00
20.00
15.00
10.00

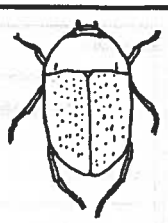
20
22
24
26
28
30
32

14W-12
14W-11A
14W-16
Linear (14W-12)
Linear (14W-11A)
Linear (14W-16)

y = 0.7143x + 2.7511
y = 0.7258x + 1.6491
y = 0.6501x + 3.9636

Appendix 5.7 – Field Survey Collection Sheets

Ontario Benthos Biomonitoring Network Field Sheet: STREAMS



Date: May 12/ 2009
Time 10:15am
Agency: Aurora
Investigators: SR3 JS

Stream name:
Site #: HW-11A1
Location: centroid of 3 replicates; Lat/Long or UTM
Elevation (m asl):
Datum/zone:

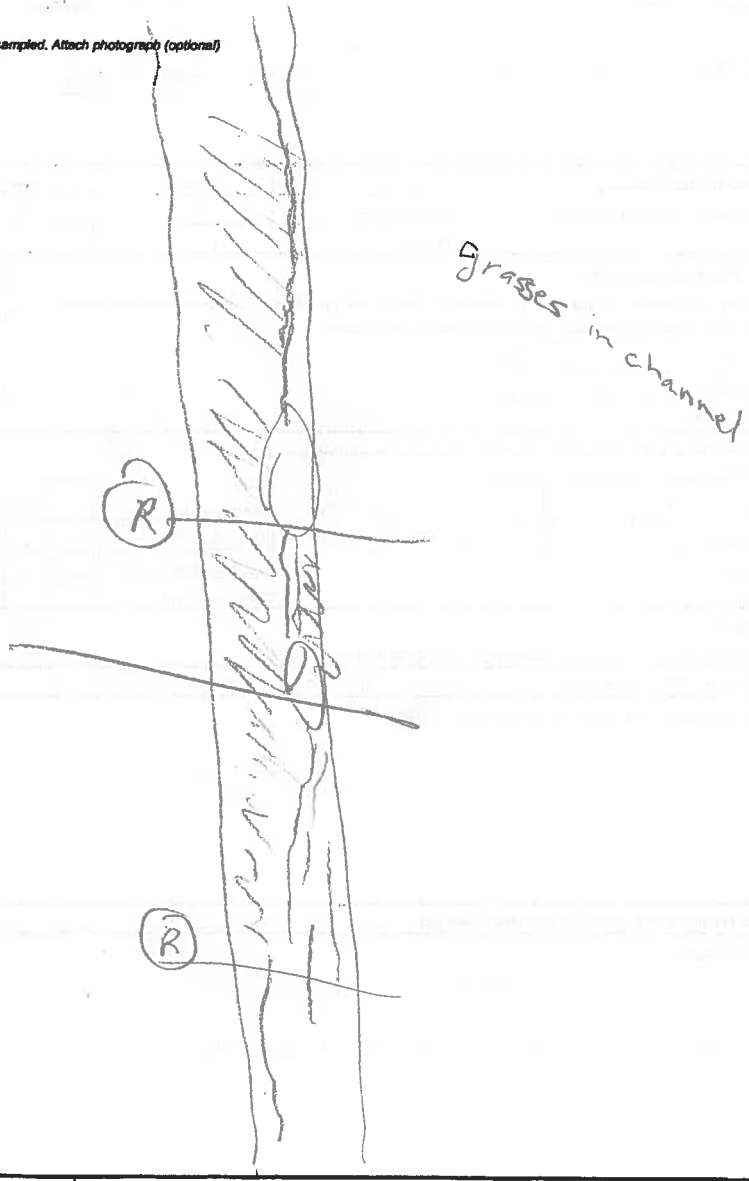
Water Quality

Water Temperature (°C): 20.2
DO (mg/l): 10.31
Conductivity (uS/cm): 1158
pH: 8.38
~~Alkalinity (mg/l as $CaCO_3$)~~: TDS 587

Site Description and Map

Draw a map of the site (with landmarks) and indicate areas sampled. Attach photograph (optional)

Show north arrow.



Benthos Collection Method (circle one):

- Traveling Kick & Sweep
- Grab Sample
- Other (specify):

Gear Type (circle one)

- D-net
- Ponar
- Other (specify):
- Ekman
- Rock Baskets

Mesh Size: 500 micron (or specify)

Sub-samples	Sampling distance covered (m)	Time (min.)	Max. Depth (m)	Wetted Width (m)	Max. Hydraulic Head (mm)	# Grabs pooled per sample
Sample 1: Riffle (cross-over)				1.8		
Sample 2: Pool						
Sample 3: Riffle (cross-over)						

Substrate

Enter dominant substrate class and second dominant class for each sub-sample

	Sample 1	Sample 2	Sample 3
Dominant	1		
2nd Dominant	2		

Class	Description
1	Clay (hard pan)
2	Silt (gritty, < 0.06 mm particle diameter)
3	Sand (grainy, 0.06 - 2 mm)
4	Gravel (2 - 65 mm)
5	Cobble (65 - 250 mm)
6	Boulder (> 250 mm)
7	Bed Rock

Substrate Notes - clay then silt continues into fields

Organic Matter-Areal Coverage		Sample 1	Sample 2	Sample 3
Use 1: Abundant, 2: Present, 3: Absent	Woody Debris	3		
	Detritis	1		

Riparian Vegetative Community

Use: 1 (None), 2 (cultivated), 3 (meadow), 4 (scrubland), 5 (forest, mainly coniferous), 6 (forest, mainly deciduous)

Zone (dist. From water's e	Left Bank	Right Bank (facing downstream)
1.5-10 m	3	3
10-30 m	2	2
30-100 m	1	2

% Canopy Cover (circle one)

0-24 25-49 50-74 75-100

If instrument used, record type:

Aquatic Macrophytes and Algae (Use: 1 (Abundant), 2 (Present), 3 (Absent). Circle dominant type.

Macrophytes	Sample 1	Sample 2	Sample 3
Emergent	1		
Rooted Floating	2	Pond weed (x1)	
Submergent	3		
Free Floating	3		

Algae	Sample 1	Sample 2	Sample 3
Floating Algae	3		
Filaments	1		
Attached Algae	3		
Slimes or Crusts	3		

Stream Size/Flow

Bank Full Width (m): Discharge (m^3/s, optional, indicate method):

River Characterisation (circle one) Perennial (Intermittent) Unknown

Notes (esp. related to land-use, habitat, obvious stressors)

Candidate reference Site - Minimally Impacted? (circle one) Yes (No)

General Comments

Flows through Agri. fields

Highway run off contributes flow

Site Identification Form

Stream Name	Stream Code (Unique Code)	Site Code	Year	Sample
Tributary Fourteen Mile Creek	FOR	14W-11A	2009	1

Uncorrected Grid (XX) UTM Coordinates	Easting (XXX,XXX)	Northing (X,XXX,XXX)	OR	Lati-tude	Deg (15-60)	Min (0-60)	Sec (0-60)	Long-ilude	Deg (50-75)	Min (0-60)	Sec (0-60)

Corrected Grid (XXX) UTM Coordinates	Easting (XXX,XXX)	Northing (X,XXX,XXX)	Source of GIS Stream Layer used to correct UTM coordinate data (e.g. NRVIS 2)

Source of Coordinates (OBM Map, GPS Unit, Differential GPS)	Datum of Coordinate Source: (NAD 27, NAD 83, WGS 84) (This can be found on the legends of maps or in set-up of GP3 units)
GPS Unit	

Township/Municipality	Lot	Concession	MNR District	Watershed Code
Oakville	32	2S	Aurora	

Access Route

Exit from Dundas Street onto farm access driveway. Drive north to the end of the gravel road. Follow GPS point, northeast of the access road

Site Description

The watercourse flows between two active agricultural fields with minimal buffer veg to either side of the watercouse. Small treed stands u/s & immediately d/s of site. The channel appears to be straightened to accommodate the agricultural fields

Site Marker Description

Downstream Marker

Measure from Stake to Site Bearing (Degrees):	Distance (m.):	Photograph Numbers:	Looking Upstream:	Looking Downstream:

Description: No permanent site marker; marked with flagging tape & GPS point

Upstream Marker

Measure from Stake to Site Bearing (Degrees):	Distance (m.):	Photograph Numbers:	Looking Upstream:	Looking Downstream:

Description: No permanent site marker; tree on left u/s bank has been flagged; GPS point

Crew S. Rankin/J. Smith Recorder S. Rankin Date (YYYY/MM/DD) 2009/05/12

Comments

Limited locations within the property limit where a 40m section of watercourse could be located in order to complete OSAP.

Site Length (m.) 40

Enter dates and initials when data entered in Computer.

	Date	Init.
Entered	05/05/21	
Verified		
Corrected		

Site Sketch Draw two sketches on the back of this sheet. First draw a map to the area of the site then draw a sketch of the site. Be sure to include enough detail to ensure that someone could find the site again, including a north arrow and the locations of all markers, as well as the locations of any noted features. The artist should also sign the sketches.

Site Features Form

Stream Name:	Stream Code:	Site Code:	Year:	Sample:	Date (YYYY/MM/DD):
		14W-11A	2009	1	2009/05/12

For each landuse, check off all boxes which apply. Be sure to include comments explaining the particulars, including names and numbers of contacts.

Site Features	Ongoing and Active	Historical Evidence	No Evidence but Reported	No Evidence	Unknown	Comments
Potential Point or Non-point Source Contaminant Sources	☐	☐	☐	☐	☒	
Major Nutrient Sources Upstream	☐	☐	☐	☒	☐	
Channel Hardening or Straightening	☒	☐	☐	☐	☐	channel realignment
Adjacent Landuses That Destabilize Banks	☒	☐	☐	☐	☐	Field crossing u/s of site
Sediment Loading or Deprivation	☐	☐	☐	☐	☒	
Instream Habitat Modifications	☐	☐	☐	☒	☐	
Barriers and/or Dams in the Vicinity of the Site	☐	☐	☐	☒	☐	
High Fishing Pressure	☐	☐	☐	☒	☐	
Log Jam Deflectors	☐	☐	☐	☒	☐	
Springs or Seeps at the Site	☐	☐	☐	☒	☐	
Impervious Substrate Limiting Burrowing Depth of Fish	☐	☐	☐	☒	☐	
Other Activities That Could Influence Biota or Habitat	☐	☐	☐	☒	☐	

Temperatures

Water Temperature(°C): ° Date: Time: Air Temperature At Same Time (°C): °

Maximum Air Temperature (°C): ° Source of Maximum Air Temp: Maximum Water Temperature(°C):: °

Crew: J. Smith & S. Rankin Recorder: S. Rankin

Comments:

Sources of Information: ☒ Visual Immediate ☐ Visual Extended ☐ Interview ☒ Maps/Photos

Riparian Vegetation Community — Only Check one box for each bank and zone

Riparian Zone	Dominant Vegetation Type: Left Bank None	Left Bank Cultivated	Left Bank Meadow	Left Bank Scrubland	Left Bank Forest	Right Bank None	Right Bank Cultivated	Right Bank Meadow	Right Bank Scrubland	Right Bank Forest
1.5-10m.	☐	☐	☒	☐	☐	☐	☐	☒	☐	☐
10-30m.	☐	☒	☐	☐	☐	☐	☒	☐	☐	☐
30-100m.	☐	☒	☐	☐	☐	☐	☒	☐	☐	☐

Entered dates and initial when data entered in computer

	Date	Init.
Entered	8/06	AR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name	Stream Code: (Unique Code)	Site Code	Year	Sample #:	Date: (YYYY/MM/DD)	Transect #
Trib of 14mile Creek	FOR	14W-11A	2009		2009/05/12	1 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0 | Site Length (m.) 40

Number of Transects 15 | Transect Spacing (m.) 2.85

Number of Points/ Transect (N) 3

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 2.4 (3.9 / 0.4)

Point Spacing (m.) .98

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 282

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	RR ooucnkd	Floatk	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.90	30	0	Si	Si	0										X		X	
2	2.7	40	0	Si	Si	2										X		X	
3	3.5	35	0	Si	Si	2										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		200	155	100	0		6			X		
Right		190	180	100	0		6			X		
Bank Particle Median Diameters (mm.)		Si	Si	C1	C1							
		Si	Si	C1	C1							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	SR
Verified		
Corrected		

Data entered.

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: MW-11A	Year: 2009	Sample #:	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 2 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length (m.) 40

Transect Spacing (m.) 2.85 = Site Length / (Number of Transects – 1)

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.9 3.4

Point Spacing (m.) 0.63 0.32

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 279

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.82	30	⊗	5;	5;	2				X						X		X	
2	2.45	50	⊗	"	"	"				X						X		X	
3	3.08	40	⊗	"	"	⊗										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		230	220	135	0	X	4			X		
Right		220	150	170	0	X	11			X		
Bank Particle Median Diameters (mm.)		5;	5;	<1	<1							
		5;	5;	<1	<1							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	06/05	AK
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14WM11A	Year: 2009	Sample #:	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 3 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 — Site Length (m.) 40

Number of Points/ Transect (N) 3 — Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.8 3.3

Point Spacing (m.) 0.6 0.3

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 279

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Root	Fish	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.80	40	0	S;	S;	2					X						X		X	
2	2.40	40	0	S;	S;	0											X		X	
3	3.00	30	0	S;	S;	0											X		X	
4																				
5																				
6																				

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; if a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		165	120	120	0	X	4		X			
Right		200	180	110	90	X	4			X		
Bank Particle Median Diameters (mm.)		S;	S;	C1	C1							
		S;	S;	C1	C1							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 4 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 2.00 3.5

Point Spacing (m.) 0.66 0.33

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 278

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.83	40	0	5.	5.	0										X		X	
2	2.49	35	0	5;	5;	0										X		X	
3	3.15	75	0	5.	5;	0										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		245	220	200	0	X	3		X			
Right		170	160	80	0	X	5		X			
Bank Particle Median Diameters (mm.)		5.	5;	<1	<1							
		5;	5;	<1	<1							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	JK
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W2-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 5 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length / (Number of Transects – 1)

Site Length (m.) 40

Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.7 3.2

Point Spacing (m.) 0.57 0.28

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 290

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.78	35	Ø	S;	S,	Ø										X		X	
2	2.35	85	Ø	S;	S,	Ø												X	
3	2.92	60	Ø	S;	S,	2				X						X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		240	190	155	0	X	10					X
Right		160	110	140	100	X	3		X			
Bank Particle Median Diameters (mm.)		S;	C1	C1	C1							
		S;	S;	C1	C1							

Comments: 1 tree = Forest

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	SR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: MW-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 6 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.2 2.7

Point Spacing (m.) 0.4 0.2

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 288

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.70	65	0	5;	5;	0										X		X	
2	2.10	70		5;	5;	0										X		X	
3	2.50	30		5;	5;	0										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		265	220	210	0	X	8		X			
Right		210	170	110	0	X	7		X			
Bank Particle Median Diameters (mm.)		5;	<1	<1	<1							
		5;	5;	<1	<1							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	JR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14WJ-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 7 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 14
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.3 2.8

Point Spacing (m.) 0.43 2.2

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 284

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock Rounded	Rock Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.72	55	0	Si	Si	0										X		X	
2	2.15	50	0	Si	Si	0										X		X	
3	2.58	50	0	Si	Si	0										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		240	225	140	0	X	5		X			
Right		220	120	100	50	X	6	X	X			
Bank Particle Median Diameters (mm.)		Si	Si	C1	C1							
		Si	Si	C1	C1							

Comments: Pondweed?

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	JR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 8 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.4 — 2.9

Point Spacing (m.) 0.47 — 2.3

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 288

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.73	30	Ø	Si	Si	Ø										X		X	
2	2.20	40	Ø	Si	Si	Ø										X		X	
3	2.67	20	Ø	Si	Si	Ø										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		265	120	105	Ø	X	7		X			
Right		200	130	100	Ø	X	5		X			
Bank Particle Median Diameters (mm.)		Si	Cl	Cl	Cl							
		Si	Si	<1	<1							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	AP
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 9 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 40m
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.5

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.10 2.6

Point Spacing (m.) 0.37 0.18

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 290

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm.		Particle Sizes (mm.)		Cover							Aquatic Vegetation Types Present (Put X in box if present, Put – if not.)						
		Depth (mm.)	Hydraulic Head (mm.)	Point	Maximum In Ring	Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Rock	Mac	Bank	Oth	FL	AL	SS	MC	WC	GR	TR
1	1.68	40	Ø	5	5	Ø												X	
2	2.05	50	Ø	5	5	Ø												X	
3	2.42	40	Ø	5	5	Ø												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points					Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.				
	> 2m	0 mm.	250 mm.	750 mm.	1500 mm.			None	Cultivated	Meadow	Scrubland	Forest
Left		210	160	80	Ø	X	4		X			
Right		180	130	160	Ø	X	3		X			
Bank Particle Median Diameters (mm.)		5	5	C1	C1							
		5	5	C1	C1							

Comments:

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	KR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2004	Sample #: 1	Date: (YYYY/MM/DD): 2004/05/12	Transect # 10 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.0 (2.5)

Point Spacing (m.) 0.33 (0.17)

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 189

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.67	120	Ø	Si	Si	Ø							X						
2	2.00	160	Ø	Si	Si	Ø							X						
3	2.33	160	Ø	Si	Si	Ø												X	X
4																			
5																			
6																			

Vegetation Types
FL = Filamentous Algae
AL = Non-Filamentous Algae
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		260	230	165	Ø	X	5		X			
Right		245	110	170	Ø	X	6		X			
Bank Particle Median Diameters (mm.)		Si	Si	Cl	Cl							
		Si	Cl	Cl	Cl							

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/05	AL
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 11 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.5

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.0 2.5

Point Spacing (m.) 0.33 1.0

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 286

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.67	40	0	5;	5;	0										X		X	
2	2.00	40	0	5;	5;	0										X		X	
3	2.33	20	0	5;	5;	0										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)
Left		190	200	125	0	X	5
Right		180	160	60	0	X	7
Bank Particle Median Diameters (mm.)		5;	5;	<1	<1		
		5;	5;	<1	<1		

Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.

None	Cultivated	Meadow	Scrubland	Forest
	X			
	X			

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	9/05	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 12 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length (Number of Transects – 1)

Site Length (m.) 40

Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.3 2.8

Point Spacing (m.) 0.43 0.22

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 288

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Rock Bucket	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.72	40	Ø	5	5	Ø											X		X	
2	2.15	30	Ø	5	5	Ø													X	
3	2.58	20	Ø	5	5	Ø											X		✓	
4																				
5																				
6																				

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		210	170	120	Ø	X	3		X			
Right		190	120	130	Ø	X	7		X			
Bank Particle Median Diameters (mm.)		5	C1	C1	C1							
		5	5	C1	C1							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	AR
Verified		
Corrected		

Diagnostic Indicators of Channel Stability

@ 13/15

Stream Name:	Stream Code (Unique Code)	Site Code: 14W-11A	Year 2009	Sample #: 1	Date (YYYY/MM/DD) 2009/05/12	Transect # 13 of 15

Record these values only on the first transect — Site Length (m): 40 | Transect Spacing (m): 2.85 | Crew: SR J J S | Comments

Obstructions to Flow (If none present, check "None Present" Otherwise check the applicable types.)

- [x] None Present
- [ ] Trampled Banks
- [ ] Wood Deflectors
- [ ] Inorganic Deflectors
- [ ] Armouring
- [ ] Inlets
- [ ] Others (List Types)

DISCHARGE APPROXIMATES BASEFLOW YES [x] NO [ ]

Indicators Used to Locate Bankfull Level

	Left Bank	Right Bank
Inflection Point	[x]	[x]
Bank Material	[ ]	[ ]
Top of Point Bar	[ ]	[ ]
Vegetation	[x]	[x]
Minimum Width:Depth	[ ]	[ ]
Others (List Types)		

Entrenchment

Entrenchment Height = 2 X Maximum Channel Depth

Entrenchment Width = Horizontal distance from the location of the Maximum Channel Depth to the bank at the Entrenchment Height

Record either the Left and Right widths, or the Total Width

Left Entrenchment Width (m):

Right Entrenchment Width (m):

Total Entrenchment Width (m): >40

Channel Profile

Feature	Horiz. Loc. (m)	Vert Ht to Bankfull (mm)	Vert Ht* to Tape (mm)	Velocity Measurements (Recommended depth ratio from stream bottom is 0.4): Water Depth (mm)	Observation Depth (mm)	Turns/ Min	Velocity (m/s)
Left BFD	0.8	125					
Right BFD	4.0	90					
Max Channel Depth	2.65	345					
Left Active Channel	1.5	220					
Right Active Channel	3.1	220					
Measurement 1	1.37	185					
2	2.4	300					
3	3.47	145					
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

* This column is for recording data when the minimum width:depth ratio indicator is used and the bankfull level is NOT identified in the field.

Channel Profile (continued)

Measurement	Horiz. Loc. (m)	Vert Ht to Bankfull (mm)	Vert Ht* to Tape (mm)	Velocity Measurements: Water Depth (mm.)	Observation Depth (mm)	Turns/ Min	Velocity (m/s)
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							

Comments

Transect and Point Layout

Use this table to provide guidance for selecting how many points per transect to measure, given the minimum width of the stream.

Minimum Width (m.)	Low variance in velocity or depth	High variance in velocity or depth
> 3.0	8 + 1 every 2 metre	10 + 1 every 1 metre
1.5 – 3.0	5	8
1.0 – 1.49	3	6
< 1.0	2	4

1.07
0.53

Active Width (W) (m.) 3.2

Point Spacing (S) (m.) = Active Width (W) (m.) / # Points per transect (N) 3

1.06

Point Spacing (S) (m.) 1.06

0.53

First point is S/2 from the left bank

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 13 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.)	1.6 (3.1)
Point Spacing (m.)	0.53 (0.27)
Point Spacing, S = Active Width W (m.) / # Points per Transect	
First point is S/2 from the left bank	
Compass Bearing:	288

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.77	50	Ø	Si	Si	2				X						X		X	
2	2.30	50	Ø	Si	Si	2				X								X	
3	2.83	45	Ø	Si	Si	Ø												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		250	170	130	Ø	X	8		X			
Right		230	170	120	Ø	X	9		X			
Bank Particle Median Diameters (mm.)		Si	Si	Cl	Cl							
		Cl	Cl	Cl	Cl							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/03	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 12W-11A	Year:	Sample #:	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 14 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.8

Point Spacing (m.) 0.6

Point Spacing, S = Active Width W (m.) / # Points per Transect

3.3 / 0.3

First point is S/2 from the left bank

Compass Bearing: 288

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.4	15	⊗	S;	S.	⊗												X	
2	2.4	120	⊗	S;	S;	⊗												X	
3	3.0	60	⊗	Cl	S;	⊗										X		X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		270	190	145	⊗	X	2		X			
Right		250	150	90	⊗	X	6		X			
Bank Particle Median Diameters (mm.)		S.	Cl	Cl	Cl							
		S.	Cl	Cl	Cl							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: 1 tree.

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-11A	Year: 2009	Sample #: 1	Date: 2009/05/12 (YYYY/MM/DD):	Transect # 15 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.85

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.2 (2.7)

Point Spacing (m.) 0.4 (0.2)

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 288

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rr Ock	Rr Ock	Rr Ock	Rr Ock	Rr Ock	Rr Ock	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.7	40	0	Si	Si	2				X									X	
2	2.1	80	0	Si	Si	0													X	
3	2.5	60	0	Si	Si	2												X	X	
4																				
5																				
6																				

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		230	230	190	0	+	9		X			
Right		250	170	80	0	+	7		X			
Bank Particle Median Diameters (mm.)		Si	Si	Si	C1							
		Si	C1	C1	C1							

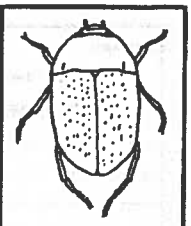
Comments:

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/9	
Verified		
Corrected		

Ontario Benthos Biomonitoring Network Field Sheet: STREAMS



Date: May 12/2009
Time 2.8m
Agency: Aurora
Investigators: JS, SR

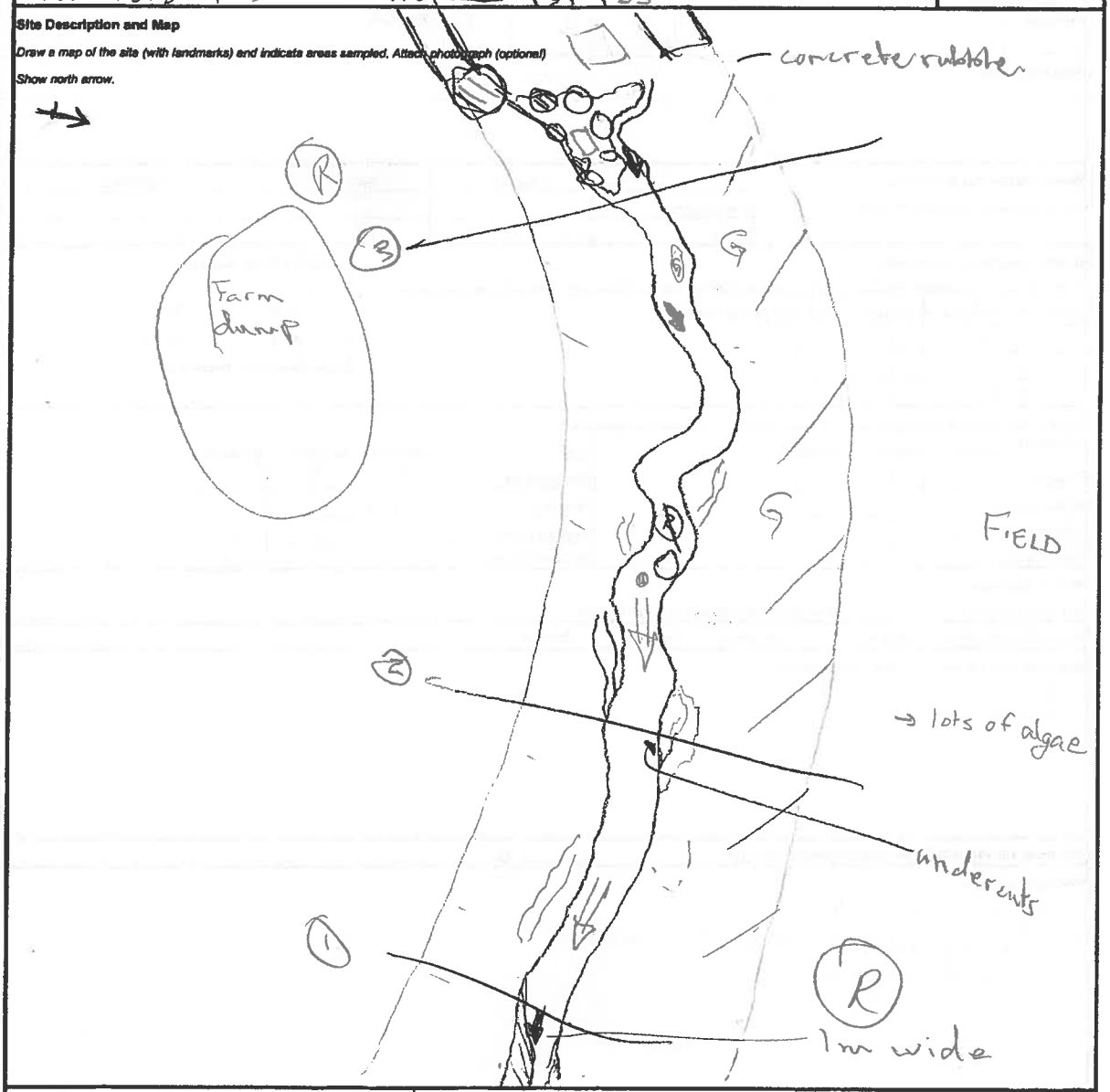
Stream name:
Site #: 14W-16
Location: centroid of 3 replicates; Lat/Long or UTM
Elevation (m asl):
Datum/zone:

Water Quality
Water Temperature (°C): 19
DO (mg/l): 13.8 - 14.5
Conductivity (uS/cm): 1434
pH: 8.38
Alkalinity (mg/l as $CaCO_3$): 731 TDS

Site Description and Map

Draw a map of the site (with landmarks) and indicate areas sampled. Attach photograph (optional)

Show north arrow.



Benthos Collection Method (circle one):
- Traveling Kick & Sweep
- Grab Sample
- Other (specify):

Gear Type (circle one)
- D-net
- Ponar
- Other (specify):
- Ekman
- Rock Baskets

Mesh Size: 500 micron (or specify)

Sub-samples	Sampling distance covered (m)	Time (min.)	Max. Depth (m)	Wetted Width (m)	Max. Hydraulic Head (mm)	# Grabs pooled per sample
Sample 1: Riffle (cross-over)		3.00	0.21	1.00	~~0~~	
Sample 2: Pool		3.00	0.31	1.1	~~0~~	
Sample 3: Riffle (cross-over)		3.00	0.08	0.4	10	

Substrate

Enter dominant substrate class and second dominant class for each sub-sample

	Sample 1	Sample 2	Sample 3
Dominant	2	2	2
2nd Dominant	1	1	4

Class	Description
1	Clay (hard pan)
2	Silt (gritty, < 0.06 mm particle diameter)
3	Sand (grainy, 0.06 - 2 mm)
4	Gravel (2 - 65 mm)
5	Cobble (65 - 250 mm)
6	Boulder (> 250 mm)
7	Bed Rock

Substrate Notes

Organic Matter-Areal Coverage		Sample 1	Sample 2	Sample 3
Use 1: Abundant, 2: Present, 3: Absent	Woody Debris	2	2	2
	Detritis	2	2	2

Riparian Vegetative Community

Use: 1 (None), 2 (cultivated), 3 (meadow), 4 (scrubland), 5 (forest, mainly coniferous), 6 (forest, mainly deciduous)

Zone (dist. From water's e	Left Bank	Right Bank (facing downstream)
1.5-10 m	3	3
10-30 m	2	
30-100 m	2	

% Canopy Cover (circle one)

0-24 (circled) 25-49 50-74 75-100

If instrument used, record type:

Aquatic Macrophytes and Algae (Use: 1 (Abundant), 2 (Present), 3 (Absent). Circle dominant type.

Macrophytes	Sample 1	Sample 2	Sample 3
Emergent	3	3	2
Rooted Floating	3	3	3
Submergent	3	3	3
Free Floating	3	3	3

Algae	Sample 1	Sample 2	Sample 3
Floating Algae	3	3	3
Filaments	1	1	1
Attached Algae	3	3	3
Slimes or Crusts	3	3	3

Stream Size/Flow

Bank Full Width (m): Discharge (m^3/s, optional, indicate method):

River Characterisation (circle one) (Perennial)? Intermittent Unknown

Notes (esp. related to land-use, habitat, obvious stressors)

- slow flow
- lots of algae

Candidate reference Site - Minimally Impacted? (circle one) Yes (No)

General Comments

- veg islands
- overflow pockets along the banks
- incised channel

Blacknose Dace
Stickleback

Data Entered

Site Identification Form

Stream Name	Stream Code (Unique Code)	Site Code	Year	Sample
Tributary of Fourteen Mile Creek		14W-16	2009	1

	Easting (XXX,XXX)	Northing (X,XXX,XXX)	OR	Lati-tude	Deg (15-60)	Min (0-60)	Sec (0-60)	Long-itude	Deg (50-75)	Min (0-60)	Sec (0-60)
Uncorrected Grid (XX) UTM Coordinates 17T	597842	4809170									
Corrected Grid (XX) UTM Coordinates 17T	597813	4809146									

Source of GIS Stream Layer used to correct UTM coordinate data (e.g. NRVIS 2):

Source of Coordinates (OBM Map, GPS Unit, Differential GPS): GPS Unit.

Datum of Coordinate Source: (NAD 27, (NAD 83), WGS 84)

(This can be found on the legends of maps or in set-up of GP3 units)

Township/Municipality	Lot	Concession	MNR District	Watershed Code
Oakville	32	2S?	Aurora	

Access Route

North on Farm road from Dundas Rd. Walk west across the field (north of the large pond). Follow watercourse northwest to GPS point. (Downstream of historic crossing)

Site Description

within an entrenched valley between agricultural fields. Upstream from the confluence of the large pond outlet channel and main tributary that flows southerly to Dundas Street W.

Site Marker Description

Downstream Marker

Measure from Stake to Site Bearing (Degrees):	Distance (m.):	Photograph Numbers:	Looking Upstream:	Looking Downstream:
			✓	✓

Description:

Upstream Marker

Measure from Stake to Site Bearing (Degrees):	Distance (m.):	Photograph Numbers:	Looking Upstream:	Looking Downstream:
			✓	✓

Description: The upstream limit extended to an abandoned/historic field crossing

Crew S. Rankin/T. Smith Recorder J. Smith Date (YYYY/MM/DD) 2009/05/13

Comments: Upstream from convergence of watercourses.

Site Length (m.)

Enter dates and initials when data entered in Computer.

	Date	Init.
Entered	6/05	KR
Verified		
Corrected		

Site Sketch: Draw two sketches on the back of this sheet. First draw a map to the area of the site then draw a sketch of the site. Be sure to include enough detail to ensure that someone could find the site again, including a north arrow and the locations of all markers, as well as the locations of any noted features. The artist should also sign the sketches.

Site Features Form

Stream Name:	Stream Code:	Site Code:	Year:	Sample:	Date: (YYYY/MM/DD)
Trib 14-Mile Creek		14W-16	2009	1	2009/05/13

For each landuse, check off all boxes which apply. Be sure to include comments explaining the particulars, including names and numbers of contacts.

Site Features	Ongoing and Active	Historical Evidence	No Evidence but Reported	No Evidence	Unknown	Comments
Potential Point or Non-point Source Contaminant Sources	☒	☐	☐	☐	☐	- abandoned equipment refuse
Major Nutrient Sources Upstream	☐	☐	☐	☐	☐	
Channel Hardening or Straightening	☒	☐	☐	☐	☐	- concrete abutments of old crossing.
Adjacent Landuses That Destabilize Banks	☐	☐	☐	☒	☐	
Sediment Loading or Deprivation	☐	☐	☐	☐	☐	
Instream Habitat Modifications	☐	☒	☐	☐	☐	Field crossing.
Barriers and/or Dams in the Vicinity of the Site	☒	☐	☐	☐	☐	- rubble at old crossing.
High Fishing Pressure	☐	☐	☐	☐	☐	
Log Jam Deflectors	☐	☐	☐	☐	☐	
Springs or Seeps at the Site	☐	☐	☐	☐	☐	
Impervious Substrate Limiting Burrowing Depth of Fish	☐	☐	☐	☐	☐	
Other Activities That Could Influence Biota or Habitat	☐	☐	☐	☐	☐	

Temperatures

Water Temperature(°C): ° Date: Time: Air Temperature At Same Time (°C): °

Maximum Air Temperature (°C): ° Source of Maximum Air Temp: Maximum Water Temperature(°C):: °

Crew: J. Smith & S. Rankin. Recorder: S. Rankin.

Comments:

Sources of Information:
- ☒ Visual Immediate
- ☐ Visual Extended
- ☐ Interview
- ☒ Maps/Photos

Riparian Vegetation Community — Only Check one box for each bank and zone

Riparian Zone	Dominant Vegetation Type: Left Bank None	Left Bank Cultivated	Left Bank Meadow	Left Bank Scrubland	Left Bank Forest	Right Bank None	Right Bank Cultivated	Right Bank Meadow	Right Bank Scrubland	Right Bank Forest
1.5-10m.	☐	☐	☒	☐	☐	☐	☐	☒	☐	☐
10-30m.	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐
30-100m.	☐	☒	☐	☐	☐	☐	☒	☐	☐	☐

Entered dates and initial when data entered in computer

	Date	Init.
Entered		
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code:	Year:	Sample #:	Date: (YYYY/MM/DD):	Transect #
Trib. 14-mile Creek		14W-16	09	1	2009/05/13	1 of 20

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Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.82

Site Length / (Number of Transects – 1)

Number of Transects 20 — Site Length (m.) 40

Number of Points/ Transect (N) 2 — Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.8m

Point Spacing (m.) 0.4

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.2

First point is S/2 from the left bank

Compass Bearing: 244

425
34m

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth
1	1.70	-85	0	uc	105	1		X				
2	2.10	40	0	20	20	0						
3												
4												
5												
6												

Aquatic Vegetation Types Present (Put X in box if present, Put – if not.)	FL	AL	SS	MC	WC	GR	TR
Point 1	X					X	
Point 2	X					X	
Point 3							
Point 4							
Point 5							
Point 6							

Vegetation Types
FL = Filamentous Algae
AL = Non-Filamentous Algae
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)
Left		440	150	170	0	0	13
Right		380	60	40	0	0	9
Bank Particle Median Diameters (mm.)		Sa	uc	uc	uc		
		Sa	uc	uc	uc		

Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.	None	Cultivated	Meadow	Scrubland	Forest
Left			X		
Right			X		

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/05	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code:	Year:	Sample #:	Date: (YYYY/MM/DD):	Transect #
Trib. 14-mile creek		14W-16	09	1	2009/05/13	2 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length = Minimum Width (m.) 0.32 × (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.05

Point Spacing (m.) 0.53

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.26

First point is S/2 from the left bank

Compass Bearing: 259

2.55

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.76	195	0	Sa	120	1		X					X						
2	2.29	160	0	Sa	110	2					X		X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		435	350	280	0	0	8			X		
Right		100	90	220	0	210	5			X		
Bank Particle Median Diameters (mm.)		Si	Si	uc	uc							
		uc	uc	uc	uc							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	AR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code:	Year:	Sample #:	Date: (YYYY/MM/DD):	Transect #
Trib to Mile Creek		HW-16	09	1	2009/05/13	3 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) ~~0.1~~ 0.32 Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.10

Point Spacing (m.) 0.55

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect 0.28

First point is S/2 from the left bank

Compass Bearing: 270

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X In box If present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.78	240	~~0~~	Sa	Sa	~~0~~							X						
2	2.33	220	~~0~~	Sa	Sa	~~0~~							X						
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		300	260	130	~~0~~	~~0~~	9			X		
Right		220	100	320	~~0~~	~~0~~	8			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/08	AR
Verified		
Corrected		

Channel Morphology Data Form

268

Stream Name	Stream Code: (Unique Code)	Site Code	Year	Sample #	Date: (YYYY/MM/DD)	Transect #
Trib 14-Mile Crk		14W-16	09	1	2009/05/13	4 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.18

Point Spacing (m.) 0.59

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.3

First point is S/2 from the left bank

Compass Bearing: 240

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.80	220	0	uc	sa	2					X		X				X		
2	2.39	250	0	uc	60	0							X						
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		160	140	170	0	190	13			X		
Right		180	180	280	0	0	7			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	uc	sa	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/08	
Verified		
Corrected		

Channel Morphology Data Form

2.92

Stream Name	Stream Code: (Unique Code)	Site Code	Year	Sample #	Date: (YYYY/MM/DD)	Transect #
Trib to 14-mile Creek		14W-16	09	1	2009/05/13	5 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) [illegible] 0.32 Site Length / (Number of Transects – 1)

Number of Transects 20 — Site Length (m.) 40

Number of Points/ Transect (N) 2 — Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.42

Point Spacing (m.) 0.71

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.36

First point is S/2 from the left bank

Compass Bearing: 259

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.86	220	0	Sa	Sa	0							X						
2	2.57	250	0	Sa	70	0							X						
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		380	190	180	0	0	12			X		
Right		200	220	110	0	170	9			X		
Bank Particle Median Diameters (mm.)		UC	UC	UC	UC							
		UC	UC	UC	UC							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	[illegible]
Verified		
Corrected		

Channel Morphology Data Form

Stream Name	Stream Code: (Unique Code)	Site Code	Year	Sample #	Date: (YYYY/MM/DD)	Transect #
Trib 14-mile Creek		14W-16	09	1	2009/05/13	6 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) N/A

0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.50

Point Spacing (m.) 0.75

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

0.38

First point is S/2 from the left bank

Compass Bearing: 240

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, t, 2)	Cover Types Present: Wood	Rock	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.88	260	0	uc	20	0								X						
2	2.63	110	0	Sa	Sa	0								X					X	
3																				
4																				
5																				
6																				

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		340	175	90	0	0	6			X		
Right		500	250	120	0	0	3			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/08	MR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code:	Year:	Sample #:	Date: (YYYY/MM/DD):	Transect #
Trib 14-mile Creek		14W-16	09	1	2009/05/13	7 of 20

2.65

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 684 × 0.32 = Site Length (Number of Transects – 1)

Number of Transects 20 — Site Length (m.) 40

Number of Points/ Transect (N) 2 — Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.15

Point Spacing (m.) 0.58

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.29

First point is S/2 from the left bank

Compass Bearing: 240

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.79	140	0	uc	Sa	2						X	X	X					X	
2	2.37	220	0	uc	Sa	2							X	X						
3																				
4																				
5																				
6																				

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		190	110	120	0	170	11			X		
Right		420	230	100	470	0	11			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: Other Cover = FL

Enter dates and initials when data entered in computer

	Date	Init.
Entered	9/08	SR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14w-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 8 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) DRY 0.32 Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.96

Point Spacing (m.) 0.48

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.24

First point is S/2 from the left bank

Compass Bearing: 310

2.46

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.74	120	0	20	60	0							X						
2	2.22	220	0	uc	50	2						X	X						
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)
Left		110	120	150	0	0	0
Right		250	150	80	0	0	12
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc		
		uc	uc	uc	uc		

Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.

None	Cultivated	Meadow	Scrubland	Forest
		X		

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: Other cover = FL

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	AR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD) 2009/05/13	Transect # 9 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.97 × 0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.85

Point Spacing (m.) 0.43

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.21

First point is S/2 from the left bank

1.95
2.80

Compass Bearing: 242

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rrounckd	Fl Rock	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	2.15	100	0	UC	30	2					X		X					X	
2	2.58	150	0	125	125	2					X		X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)
Left		180	120	230	120	150	8
Right		250	170	310	0	100	9
Bank Particle Median Diameters (mm.)		UC	UC	UC	UC		
		UC	UC	UC	UC		

Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.

None	Cultivated	Meadow	Scrubland	Forest
		X		

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 10 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.44 → 0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.25

Point Spacing (m.) 0.63

Point Spacing, S = Active Width W (m.) / # Points per Transect

0.31

First point is S/2 from the left bank

Compass Bearing: 290

Point Number	Location (m.)*	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rrock	Fract	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.81	90	0	Sa	100	2			X				X						
2	2.44	180	0	uc	50	2						X	X						
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; if a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		220	120	110	0	0	11			X		
Right		330	200	140	0	0	14			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: other Cover = FL

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/28	MK
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 11 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.4 → 0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.65

Point Spacing (m.) 0.32

Point Spacing, S = Active Width W (m.) / # Points per Transect

0.16

First point is S/2 from the left bank

2.15

Compass Bearing: 240

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rrock	Flact	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.66	110	0	uc	140	2			X				X					X	
2	1.98	50	0	uc	60	2					X		X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)
Left	\	480	380	180	0	0	8
Right		240	220	140	0	150	7
Bank Particle Median Diameters (mm.)	\	uc	uc	uc	uc		
	\	uc	uc	uc	uc		

Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.

None	Cultivated	Meadow	Scrubland	Forest
		X		
		X		

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD):	Transect # 12 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) ~~0.24~~ 0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.60

2.1

Point Spacing (m.) 0.30

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.15

First point is S/2 from the left bank

Compass Bearing: 230

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	RR ooc kd	Float	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.65	30	0	10	440	2		X					X					X	
2	1.95	100	0	20	440	2		X					X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; if a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		530	340	300	0	0	12			X		
Right		580	540	380	0	0	5			X		
Bank Particle Median Diameters (mm.)		Sa	uc	uc	uc							
		Si	Si	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/6	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 13 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.32 = Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.60

Point Spacing (m.) 0.30

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.15

First point is S/2 from the left bank

2.1

Compass Bearing: 222

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.65	110	0	Sa	90	0							X					X	
2	1.95	50	0	Si	60	0							X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		480	450	430	0	0	4				X	
Right		570	270	150	0	0	6				X	
Bank Particle Median Diameters (mm.)		Sa	uc	Si	uc							
		Si	uc	uc	uc							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	[illegible]	[illegible]
Verified		
Corrected		

Diagnostic Indicators of Channel Stability

Stream Name:	Stream Code (Unique Code)	Site Code: 14W-16	Year 09	Sample #: 1	Date (YYYY/MM/DD) 2009/05/13	Transect # 14 of 20

Record these values only on the first transect — Site Length (m): 40 | Transect Spacing (m): 2.1 | Crew: JS, SR | Comments

Obstructions to Flow (If none present, check "None Present" Otherwise check the applicable types.)

- [x] None Present
- [ ] Trampled Banks
- [ ] Wood Deflectors
- [ ] Inorganic Deflectors
- [ ] Armouring
- [ ] Inlets
- [ ] Others (List Types)

Indicators Used to Locate Bankfull Level

	Left Bank	Right Bank
Inflection Point	[x]	[x]
Bank Material	[ ]	[ ]
Top of Point Bar	[ ]	[ ]
Vegetation	[x]	[x]
Minimum Width:Depth	[ ]	[ ]
Others (List Types)		

Entrenchment

Entrenchment Height = 2 X Maximum Channel Depth

Entrenchment Width = Horizontal distance from the location of the Maximum Channel Depth to the bank at the Entrenchment Height

Record either the Left and Right widths, or the Total Width

Left Entrenchment Width (m): 7.2

Right Entrenchment Width (m): 2.8

Total Entrenchment Width (m):

DISCHARGE APPROXIMATES BASEFLOW YES [x] NO [ ]

Channel Profile

Feature	Horiz. Loc. (m)	Vert Ht to Bankfull (mm)	Vert Ht* to Tape (mm)
Left BFD	0.4	0	
Right BFD	3.2	0	
Max Channel Depth	2.03	660	
Left Active Channel	1.5	430	
Right Active Channel	2.38	520	
Measurement 1	1.4	250	
2	2.8	370	
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

* This column is for recording data when the minimum width:depth ratio indicator is used and the bankfull level is NOT identified in the field.

Velocity Measurements (Recommended depth ratio from stream bottom is 0.4)

Water Depth (mm)	Observation Depth (mm)	Turns/ Min	Velocity (m/s)

Channel Profile (continued)

Measurement	Horiz. Loc. (m)	Vert Ht to Bankfull (mm)	Vert Ht* to Tape (mm)	Velocity Measurements: Water Depth (mm.)	Observation Depth (mm)	Turns/ Min	Velocity (m/s)
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							

Comments

Transect and Point Layout

Use this table to provide guidance for selecting how many points per transect to measure, given the minimum width of the stream.

Minimum Width (m.) 0.32	Low variance in velocity or depth	High variance in velocity or depth
> 3.0	8 + 1 every 2 metre	10 + 1 every 1 metre
1.5 – 3.0	5	8
1.0 – 1.49	3	6
(<1.0)	(2)	4

Active Width (W) (m.) 2.8

Point Spacing (S) (m.) = Active Width (W) (m.) / # Points per transect (N)

Point Spacing (S) (m.) 1.4

First point is S/2 from the left bank 0.7

Enter dates and initials when data entered in computer

	Date	Init.
Entered		
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 14 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 0.32	
Number of Transects 20	Site Length (m.) 40
Number of Points/ Transect (N) 2	Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.8

Point Spacing (m.) 0.4

Point Spacing, S = Active Width W (m.) / # Points per Transect

0.2

First point is S/2 from the left bank

Compass Bearing: 240

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rr Boulder	Rock Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.70	100	0	uc	70	0							X						
2	2.10	120	0	10	40	2					X		X					X	
3																			
4																			
5																			
6																			

Vegetation Types
FL = Filamentous Algae
AL = Non-Filamentous Algae
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		560	290	370	0	0	9			X		
Right		290	410	230	0	120	3			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	10	uc	uc							

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	5/08	AR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 15 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.32

Site Length / (Number of Transects – 1)

Number of Transects 20 | Site Length (m.) 40

Number of Points/ Transect (N) 2 | Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.55

Point Spacing (m.) 0.28

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

0.14

First point is S/2 from the left bank

2.05

Compass Bearing: 237

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rr Boulder	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.64	110	0	uc	80	0													X	
2	1.92	130	0	sa	80	2							X	X					X	
3																				
4																				
5																				
6																				

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		230	250	160	0	80	11			X		
Right		420	290	150	0	0	13			X		
Bank Particle Median Diameters (mm.)		uc	uc	uc	uc							
		uc	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: Other Cover = FL

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	TK
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 16 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 0.32	
Number of Transects 20	Site Length (m.) 40
Number of Points/ Transect (N) 2	Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.95

Point Spacing (m.) 0.48

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.24

First point is S/2 from the left bank

Compass Bearing: 230

2.45

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.74	30	0	8	150	1			X				X	X				X	
2	2.22	40	0	Sa	30	0							X	X				X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		520	320	240	0	0	12			X		
Right		530	240	370	0	0	5			X		
Bank Particle Median Diameters (mm.)		Sa	uc	uc	uc							
		30	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	JR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 17 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 0.4	
Number of Transects 20	Site Length (m.) 40
Number of Points/ Transect (N) 2	Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.45

Point Spacing (m.) 0.23

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect = 0.11

First point is S/2 from the left bank

Compass Bearing: 228

1.95

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.61	65	0	uc	70	0							X					X	
2	1.84	90	0	70	70	2						X	X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		440	350	290	0	0	4			X		
Right		380	270	230	0	0	2			X		
Bank Particle Median Diameters (mm.)		Si	uc	uc	uc							
		uc	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: other cover = FL

Enter dates and initials when data entered in computer

	Date	Init.
Entered	2/6/8	HP
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 18 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.32 — Site Length / (Number of Transects – 1)

Number of Transects 20 — Site Length (m.) 40

Number of Points/ Transect (N) 2 — Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.32

Point Spacing (m.) 0.16

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.08

First point is S/2 from the left bank

Compass Bearing: 218

1.82

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flack	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.58	70	0	Sa	110	1		X	X				X					X	
2	1.74	50	0	uc	170	1		X					X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		310	220	90	0	0	6			X		
Right		350	310	340	0	0	2			X		
Bank Particle Median Diameters (mm.)		Sa	Sa	uc	uc							
		Si	Si	Si	uc							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	DP
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD)	Transect # 19 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 0.32

Number of Transects 20 — Site Length (m.) 40

Number of Points/ Transect (N) 2 — Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 0.85

Point Spacing (m.) 0.43

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.21

First point is S/2 from the left bank

Compass Bearing: 200

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rounded Rock	Flat Rock	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.71	50	0	Si	230	2			X				X					X	
2	2.14	80	0	10	140	2			X				X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		370	200	230	560	0	8			X		
Right		390	350	110	250	0	6			X		
Bank Particle Median Diameters (mm.)		Si	uc	uc	uc							
		Si	uc	uc	uc							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	AP
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16	Year: 09	Sample #: 1	Date: 2009/07/13 (YYYY/MM/DD)	Transect # 20 of 20

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 0.32

Site Length / (Number of Transects – 1)

Number of Transects 20 — Site Length (m.) 40

Number of Points/ Transect (N) 2 — Transect Spacing (m.) 2.1

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.00

Point Spacing (m.) 0.50

Point Spacing, S = Active Width W (m.) / # Points per Transect = 0.25

First point is S/2 from the left bank

Compass Bearing: 240

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Rock Bedrock	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.75	60	0	10	135	1						X	X					X	
2	2.25	15	5	450	450	1			X				X					X	
3																			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		460	280	100	0	0	0			X		
Right		430	310	410	60	0	3			X		
Bank Particle Median Diameters (mm.)		100	620	140	uc							
		uc	uc	sa	uc							

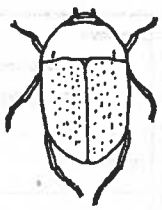
Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments: other cover = concrete Chunk

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/8	
Verified		
Corrected		

Ontario Benthos Biomonitoring Network Field Sheet: STREAMS



Date: May 13 2009
Time 2:00 pm
Agency:
Investigators: SR ? JS

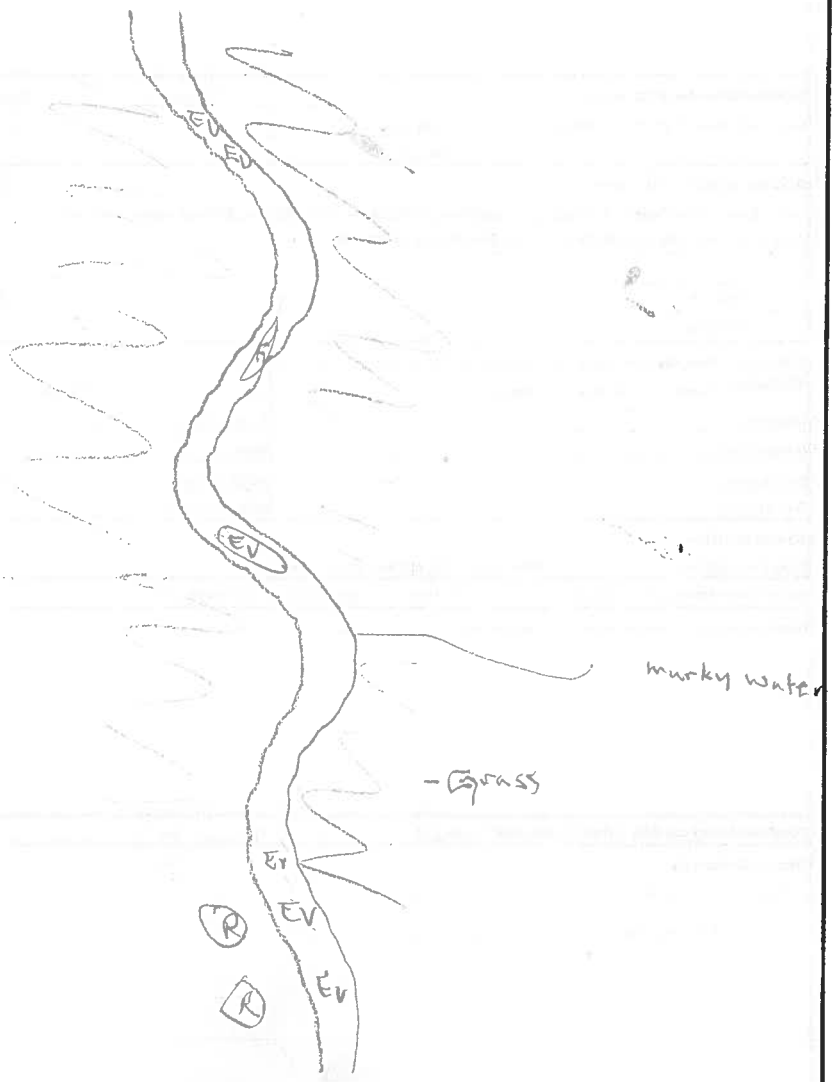
Stream name:
Site #: HW-16A
Location: centroid of 3 replicates; Lat/Long or UTM
North of small pond.
Elevation (m asl):
Datum/zone:

Water Quality
Water Temperature (°C): 14.5
DO (mg/l): 7.79
Conductivity (uS/cm): 1525
pH: 7.75
Alkalinity ~~(mg/l as $CaCO_3$)~~: TDS 770

Site Description and Map

Draw a map of the site (with landmarks) and indicate areas sampled. Attach photograph (optional)

Show north arrow.



Benthos Collection Method (circle one):
- Traveling Kick & Sweep
- Grab Sample
- Other (specify):

Gear Type (circle one)
- D-net
- Ponar
- Other (specify):
- Ekman
- Rock Baskets

Mesh Size: 500 micron (or specify)

Sub-samples	Sampling distance covered (m)	Time (min.)	Max. Depth (m)	Wetted Width (m)	Max. Hydraulic Head (mm)	# Grabs pooled per sample
Sample 1: Riffle (cross-over)	10	3	0.12	2.0	Ø	
Sample 2: Pool	10	3	0.24	1.1	Ø	
Sample 3: Riffle (cross-over)					Ø	

~ similar substrate / habitat

Substrate

Enter dominant substrate class and second dominant class for each sub-sample

	Sample 1	Sample 2	Sample 3
Dominant	1	1	
2nd Dominant	2	2	

Class	Description
1	Clay (hard pan)
2	Silt (gritty, < 0.06 mm particle diameter)
3	Sand (grainy, 0.06 - 2 mm)
4	Gravel (2 - 65 mm)
5	Cobble (65 - 250 mm)
6	Boulder (> 250 mm)
7	Bed Rock

Substrate Notes

Organic Matter-Areal Coverage		Sample 1	Sample 2	Sample 3
Use 1: Abundant, 2: Present, 3: Absent	Woody Debris	3	3	
	Detritis	1	1	

Riparian Vegetative Community

Use: 1 (None), 2 (cultivated), 3 (meadow), 4 (scrubland), 5 (forest, mainly coniferous), 6 (forest, mainly deciduous)

Zone (dist. From water's e	Left Bank	Right Bank (facing downstream)
1.5-10 m	3	3
10-30 m	3	3
30-100 m	3	2

% Canopy Cover (circle one)

(0-24) 25-49 50-74 75-100

If instrument used, record type:

Aquatic Macrophytes and Algae (Use: 1 (Abundant), 2 (Present), 3 (Absent). Circle dominant type.

Macrophytes	Sample 1	Sample 2	Sample 3
Emergent	1	1	
Rooted Floating	3	3	
Submergent	3	3	
Free Floating	3	3	

Algae	Sample 1	Sample 2	Sample 3
Floating Algae	3	3	
Filaments	3	3	
Attached Algae	3	3	
Slimes or Crusts	3	3	

Stream Size/Flow

Bank Full Width (m): 2'00 Discharge (m^3/s, optional, indicate method):

River Characterisation (circle one) (Perennial) Intermittent Unknown

Notes (esp. related to land-use, habitat, obvious stressors)

Candidate reference Site - Minimally Impacted? (circle one) Yes (No)

General Comments

- Stagnant, very low flow
- Uniform habitat throughout

Site Identification Form

Stream Name	Stream Code (Unique Code)	Site Code	Year	Sample
		14W-16A	2009	1

Uncorrected Grid (XX)	Easting (XXX,XXX)	Northing (X,XXX,XXX)	OR	Lati-tude	Deg (15-60)	Min (0-60)	Sec (0-60)	Long-itude	Deg (50-75)	Min (0-60)	Sec (0-60)
UTM Coordinates 17T	597549	4809146									
Corrected Grid (XXX)	Easting (XXX,XXX)	Northing (X,XXX,XXX)	Source of GIS Stream Layer used to correct UTM coordinate data (e.g. NRVIS 2)								
UTM Coordinates 17T	597509	4809154									
Source of Coordinates (OBM Map, GPS Unit, Differential GPS)			Datum of Coordinate Source: (NAD 27, NAD 83, WGS 84) (This can be found on the legends of maps or in set-up of GP3 units)								

Township/Municipality	Lot	Concession	MNR District	Watershed Code
Oakville			Aurora	

Access Route

North on Farm road from Dundas Rd. Walk west across the field (north of the large pond). Follow watercourse north-west to GPS point. (Pass small pond located west of watercourse

Site Description

watercourse flows through open meadow between a large gap in the property-line hedgerow.

Groundwater monitoring well at site; flag on small/mod Buckthorn.

Site Marker Description

Downstream Marker

Measure from Stake to Site Bearing (Degrees):	Distance (m.):	Photograph Numbers:	Looking Upstream:	Looking Downstream:

Description: Buckthorn on left/west bank.

Upstream Marker

Measure from Stake to Site Bearing (Degrees):	Distance (m.):	Photograph Numbers:	Looking Upstream:	Looking Downstream:

Description:

Crew	Recorder	Date (YYYY/MM/DD)
S. Rankin / J. Smith	S. Rankin	2009/05/13

Comments

Site adjacent to property line.

Site Length (m.)

Enter dates and initials when data entered in Computer.

	Date	Init.
Entered		
Verified		
Corrected		

Site Sketch Draw two sketches on the back of this sheet. First draw a map to the area of the site then draw a sketch of the site. Be sure to include enough detail to ensure that someone could find the site again, including a north arrow and the locations of all markers, as well as the locations of any noted features. The artist should also sign the sketches.

Site Features Form

Stream Name:	Stream Code:	Site Code:	Year:	Sample:	Date: (YYYY/MM/DD)
		14M1-16A	2009	1	2009/05/13

For each landuse, check off all boxes which apply. Be sure to include comments explaining the particulars, including names and numbers of contacts.

Site Features	Ongoing and Active	Historical Evidence	No Evidence but Reported	No Evidence	Unknown	Comments
Potential Point or Non-point Source Contaminant Sources	☐	☐	☐	☐	☒	
Major Nutrient Sources Upstream	☐	☐	☐	☐	☒	
Channel Hardening or Straightening	☐	☐	☐	☒	☐	
Adjacent Landuses That Destabilize Banks	☐	☐	☐	☒	☐	
Sediment Loading or Deprivation	☐	☐	☐	☐	☐	
Instream Habitat Modifications	☐	☐	☐	☒	☐	
Barriers and/or Dams in the Vicinity of the Site	☐	☐	☐	☒	☐	
High Fishing Pressure	☐	☐	☐	☒	☐	
Log Jam Deflectors	☐	☐	☐	☒	☐	
Springs or Seeps at the Site	☐	☐	☐	☒	☐	
Impervious Substrate Limiting Burrowing Depth of Fish	☐	☐	☐	☒	☐	
Other Activities That Could Influence Biota or Habitat	☐	☐	☐	☐	☐	

Temperatures

Water Temperature(°C): ° Date: 2009/05/13 Time: Air Temperature At Same Time (°C): °

Maximum Air Temperature (°C): ° Source of Maximum Air Temp: Maximum Water Temperature(°C):: °

Crew: S. Rankin / J. Smith Recorder: S. Rankin

Comments:

Sources of Information: ☒ Visual Immediate ☒ Visual Extended ☐ Interview ☒ Maps/Photos

Riparian Vegetation Community Only Check one box for each bank and zone

Riparian Zone	Dominant Vegetation Type: Left Bank None	Cultivated	Meadow	Scrubland	Forest	Right Bank None	Cultivated	Meadow	Scrubland	Forest
1.5-10m.	☐	☐	☒	☐	☐	☐	☐	☒	☐	☐
10-30m.	☐	☐	☒	☐	☐	☐	☐	☒	☐	☐
30-100m.	☐	☐	☒	☐	☐	☐	☒	☐	☐	☐

Entered dates and initial when data entered in computer

	Date	Init.
Entered		
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2004	Sample #: 1	Date: 2004/05/13 (YYYY/MM/DD):	Transect # 1 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length / (Number of Transects – 1)

Site Length (m.) 40

Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.4

Point Spacing (m.) 0.47

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 314

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, t, 2)	Types Present: Wood	Rock	Rock	Mac	Bank	Oth
1	1.73	105	⊗	C1	S1	2	☐	☐	☐	☒	☐	☐
2	2.2	~190	⊗	"	"	2	☐	☐	☐	☒	☐	☐
3	2.67	70	⊗	"	"	2	☐	☐	☐	☒	☐	☐
4							☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐

Point Number	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.) FL	AL	SS	MC	WC	GR	TR
1	☐	☐	☐	☐	☐	☒	☐
2	☐	☐	☐	☐	☐	☒	☐
3	☐	☐	☐	☐	☐	☒	☐
4	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐	☐	☐

Vegetation Types
FL = Filamentous Algae
AL = Non-Filamentous Algae
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)
Left		305	195	180	0	X	4
Right		275	200	200	⊗	X	7
Bank Particle Median Diameters (mm.)		C1	→	→	→		
		C1	→	→	→		

Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.	None	Cultivated	Meadow	Scrubland	Forest
Left	☐	☐	☒	☐	☐
Right	☐	☐	☒	☐	☐

Comments:

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	AR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009 | 05 | 13 (YYYY/MM/DD):	Transect # 2 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Site Length (m.) 40

Number of Points/ Transect (N) 3

Transect Spacing (m.) = Site Length / (Number of Transects – 1) = 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 2.3

Point Spacing (m.) 0.77

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 314

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flack	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.88	40	X	C1	5	2				X								X	
2	2.65	35	X	C1	5	X												X	
3	3.42	40	X	C1	5	2				X								X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		260	175	170	0	X	3			X		
Right		310	285	170	0	X	5			X		
Bank Particle Median Diameters (mm.)		C1										
		C1										

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	VR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 3 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.5 — 3.0

Point Spacing (m.) 0.5 — 0.25

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 310

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.75	70	ø	Cl	Si	2				X								X	
2	2.25	50	ø	Cl	Si	ø												X	
3	2.75	30	ø	Cl	Si	2				X								X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		330	115	215	0	X	4			X		
Right		320	290	170	0	X	3			X		
Bank Particle Median Diameters (mm.)		Cl										
		Cl										

Comments:

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	TR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 4 of 15

3.6
230

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0 — Site Length / (Number of Transects – 1)

Number of Transects 15 — Site Length (m.) 14

Number of Points/ Transect (N) 3 — Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.3

Point Spacing (m.) 0.43

0.72

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 350

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Particle Sizes (mm.) Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Rock Fluctk	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	2.52	200		C1	51	0													
2	2.95	210																	
3	3.38	130																X	
4																			
5																			
6																			

Vegetation Types
FL = Filamentous Algae
AL = Non-Filamentous Algae
SS = Moss
MC = Macrophytes
WC = Watercress
GR = Grass
TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		365	150	130	190	X	6			X		
Right		310	160	140	0	X	3			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Cover Quality
-99 = Not Measurable
0 = No Cover
1 = Embedded Cover
2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	SP
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 5 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.9

3.4

Point Spacing (m.) 0.63

0.32

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 310

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.82	⊘	⊘	cl	Si	⊘												X	
2	2.45	40		cl	Si	2				X								X	
3	3.08	40		cl	Si	⊘												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		330	195	170	0	X	7			X		
Right		310	170	240	⊘	X	3			X		
Bank Particle Median Diameters (mm.)		cl	cl	cl	cl							
		cl	cl	cl	cl							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/02	SR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 6 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0	Site Length / (Number of Transects – 1)
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)	
Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.0 (2.5)

Point Spacing (m.) 0.33 (0.17)

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 320

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Fiact	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.67	30	↓	C1	5i	2				X								X	
2	2.00	50	↓	↓	↓	↓												X	
3	2.33	20	↓	↓	↓	↓												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		230	230	140	110	X	1			X		
Right		245	170	150	100	X	3			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 7 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.0

Point Spacing (m.) 0.37

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 342

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Cover Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.67	150	⊘	C1	S1	⊘												X	
2	2.00	220	↓	↓	↓	⊘													→
3	2.33	140	↓			⊘												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		385	210	230	100	X	5			X		
Right		310	155	110	125	X	1			X		
Bank Particle Median Diameters (mm.)		C1	C1	C1	C1							
		C1	C1	C1	C1							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/01	AK
Verified		
Corrected		

Diagnostic Indicators of Channel Stability

1.9

Stream Name: Tributary of 14-mile Crk	Stream Code (Unique Code)	Site Code: 14W-16A	Year 2009	Sample #: 1	Date (YYYY/MM/DD) 2009/05/13	Transect # 8 of 15

Record these values only on the first transect — Site Length (m): 40 | Transect Spacing (m): 2.9

Crew: S. RANKIN, J. Smith

Comments

3.9

Obstructions to Flow (If none present, check "None Present" Otherwise check the applicable types.)

- [X] None Present
- [ ] Trampled Banks
- [ ] Wood Deflectors
- [ ] Inorganic Deflectors
- [ ] Armouring
- [ ] Inlets
- [ ] Others (List Types)

DISCHARGE APPROXIMATES BASEFLOW YES [X] NO [ ]

Channel Profile

Feature	Horiz. Loc. (m)	Vert Ht to Bankfull (mm)	Vert Ht* to Tape (mm)
Left BFD	⊗	⊗	
Right BFD	6.9	60	
Max Channel Depth	2.5	510	
Left Active Channel	1.9	360	
Right Active Channel	3.3	360	
Measurement 1	1.15	205	
2	3.45	270	
3	5.75	200	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

* This column is for recording data when the minimum width:depth ratio indicator is used and the bankfull level is NOT identified in the field.

Velocity Measurements (Recommended depth ratio from stream bottom is 0.4)

Water Depth (mm)	Observation Depth (mm)	Turns/ Min	Velocity (m/s)

Indicators Used to Locate Bankfull Level

	Left Bank	Right Bank
Inflection Point	[X]	[X]
Bank Material	[ ]	[ ]
Top of Point Bar	[ ]	[ ]
Vegetation	[X]	[X]
Minimum Width:Depth	[ ]	[ ]
Others (List Types)		

Entrenchment

Entrenchment Height = 2 X Maximum Channel Depth

Entrenchment Width = Horizontal distance from the location of the Maximum Channel Depth to the bank at the Entrenchment Height

Record either the Left and Right widths, or the Total Width

Left Entrenchment Width (m):

Right Entrenchment Width (m):

Total Entrenchment Width (m): >40

Channel Profile (continued)

Measurement	Horiz. Loc. (m)	Vert Ht to Bankfull (mm)	Vert Ht* to Tape (mm)	Velocity Measurements: Water Depth (mm.)	Observation Depth (mm)	Turns/ Min	Velocity (m/s)
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							

Transect and Point Layout

Use this table to provide guidance for selecting how many points per transect to measure, given the minimum width of the stream.

Minimum Width (m.)	Low variance in velocity or depth	High variance in velocity or depth
> 3.0	8 + 1 every 2 metre	10 + 1 every 1 metre
1.5 – 3.0	5	8
1.0 – 1.49	(3)	6
< 1.0	2	4

Active Width (W) (m.) 2.3

Point Spacing (S) (m.) = Active Width (W) (m.) / # Points per transect (N) 2.3

Point Spacing (S) (m.)

First point is S/2 from the left bank

Enter dates and initials when data entered in computer

	Date	Init.
Entered		
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/19 (YYYY/MM/DD):	Transect # 8 of 15

3.3 · 9

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.4

Point Spacing (m.) 0.476

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 300

0.83

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rrock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	2.23	105	⊘	C1	5	⊘													
2	2.59	110	⊘	↓	↓	⊘													
3	3.05	110	⊘	↓	↓	2				X								X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		365	265	205	165	X	6			X		
Right		340	240	250	230	X	4			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	AR
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 9 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Site Length / (Number of Transects – 1)

Minimum Width (m.) 1.0	
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.0 (2.5)

Point Spacing (m.) 0.33 (0.17)

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 310

| Point Number | Location (m.) | Measure depth and hydraulic head to nearest 5 mm. Depth (mm.) | Hydraulic Head (mm.) | Particle Sizes (mm.) Point | Maximum in Ring | Cover Quality (-99, 0, t, 2) | Cover Types Present: Wood | Rr Rr Rr

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/15 (YYYY/MM/DD):	Transect # 10 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Site Length / (Number of Transects – 1)

Number of Transects 15 | Site Length (m.) 40

Number of Points/ Transect (N) 3 | Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.1 2.6

Point Spacing (m.) 0.37 1.8

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 310

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Flat	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.68	60	X	C1	5	0													
2	2.05	175	X	C1	5	0													
3	2.42	80	X	C1	5	2				X						X			
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		390	250	175	0	X	5			X		
Right		330	170	150	90	X	7			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	5/08	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 11 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length / (Number of Transects – 1)

Site Length (m.) 40

Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.1 2.6

Point Spacing (m.) 0.37 0.18

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 294

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Bedrock	Macrophytes	Bank	Other	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.75	75	Ø	01	45	Ø												X	
2	2.15	50	Ø	01	51	2				X								X	
3	2.52	75	Ø	01	51	2				X								X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		460	130	110	0	110	8			X		
Right		350	155	170	100	X	6			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/08	
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 12 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length (Number of Transects – 1)

Site Length (m.) 40

Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.55 3.05

Point Spacing (m.) 0.52 0.26

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 296

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rrock	Flack	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.76	130	∅	C1	5	∅													
2	2.28	30	∅	C1	5	2				X								X	
3	2.80	130	∅	C1	5	∅												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		520	190	90	0	60	8			X		
Right		390	210	210	∅	X	9			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	9/08	dp
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 13 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.)	Site Length / (Number of Transects – 1)
Number of Transects	Site Length (m.)
Number of Points/ Transect (N)	Transect Spacing (m.)

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.3 — 2.8

Point Spacing (m.) 0.43 — 0.22

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 330

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Bedrock	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.72	200	⊘	C1	Si	⊘													
2	2.15	240	⊘	C1	Si	⊘													
3	2.58	120	⊘	C1	Si	2				X									
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		450	275	190	⊘	X	10			X		
Right		420	150	125	⊘	X	2			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	6/09	TH
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: 2009/05/13 (YYYY/MM/DD):	Transect # 14 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0

Number of Transects 15

Number of Points/ Transect (N) 3

Site Length / (Number of Transects – 1)

Site Length (m.) 40

Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.2 2.7

Point Spacing (m.) 0.4 0.2

Point Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 308

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum In Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rock	Bedrock	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.70	85	⊗	Cl	S.	2				X								X	
2	2.10	190	⊗	Cl	Si	⊗													
3	2.50	115	⊗	Cl	Si	⊗												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		440	430	200	0	X	3			X		
Right		400	185	160	0	L	8			X		
Bank Particle Median Diameters (mm.)		Cl	→	→	→							
		Cl	→	→	→							

Comments:

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/08	MH
Verified		
Corrected		

Channel Morphology Data Form

Stream Name:	Stream Code: (Unique Code):	Site Code: 14W-16A	Year: 2009	Sample #: 1	Date: (YYYY/MM/DD): 2009/05/13	Transect # 15 of 15

Transect and Point Layout

Use this table to determine the number of transects and points required, given the minimum stream width.

Minimum Width (m.)	# Transects at Site	Points / Transect (N)
> 3.0	10	6
1.5 – 3.0	12	5
1.0 – 1.49	15	3
< 1.0	20	2

Calculate the transect spacing from the site length and number of transects:

Minimum Width (m.) 1.0	Site Length / (Number of Transects – 1)
Number of Transects 15	Site Length (m.) 40
Number of Points/ Transect (N) 3	Transect Spacing (m.) 2.9

Particle Size Codes (Measure all particles between 2.00 mm and 1000 mm.)

Material	Size
Unconsolidated Clay	0.01
Consolidated Clay	0.011
Silt	0.05
Sand	0.10
Large Boulders	1001
Bedrock	1111

Active Channel Width (W) (m.) 1.0 — 2.5

Point Spacing (m.) 0.33 — 0.17

Point Spacing Spacing, S = Active Width W (m.) / # Points per Transect

First point is S/2 from the left bank

Compass Bearing: 320

Point Number	Location (m.)	Measure depth and hydraulic head to nearest 5 mm. Depth (mm.)	Hydraulic Head (mm.)	Particle Sizes (mm.) Point	Maximum in Ring	Cover Quality (-99, 0, 1, 2)	Types Present: Wood	Rr Ock nd	Flat k	Mac	Bank	Oth	Aquatic Vegetation Types Present (Put X in box if present, Put – if not.): FL	AL	SS	MC	WC	GR	TR
1	1.67	150	⊘	C1	5.	0													
2	2.00	160	⊘	C1	5.	⊘													
3	2.33	30	⊘	C1	5i	0												X	
4																			
5																			
6																			

Vegetation Types: FL = Filamentous Algae; AL = Non-Filamentous Algae; SS = Moss; MC = Macrophytes; WC = Watercress; GR = Grass; TR = Terrestrial Plants

Bank	Bank Angle: Bank to tape height; If a height is >2m enter X in box only, else enter values in proper observation points: > 2m	0 mm.	250 mm.	750 mm.	1500 mm.	Amount of Undercut (mm.)	# of Vegetated Squares on Bank (out of 16)	Dominant Vegetation Type: Put X in the box of the dominant type in the 1 x 2 m. area. Put – in all others.: None	Cultivated	Meadow	Scrubland	Forest
Left		375	60	105	⊘	X	3			X		
Right		350	255	190	⊘	X	6			X		
Bank Particle Median Diameters (mm.)		C1	→	→	→							
		C1	→	→	→							

Cover Quality: -99 = Not Measurable; 0 = No Cover; 1 = Embedded Cover; 2 = Unembedded Cover

Comments:

Enter dates and initials when data entered in computer

	Date	Init.
Entered	4/08	AM
Verified		
Corrected		

Station:	Project Number:	MMM GROUP
3, 4, 5	14.09222.001.EN2	Streams Sampling Form

Stream/Waterbody Name:	Stream Type:
14W-13 / 14W-14	Permanent ☐ Intermittent ☒
Watershed/Drainage: 14 mile creek.	

Easting:	Waterbody Type:	Station Length (m)	Date:
see note	Agricultural swale/tributary.	—	December 10, 2010
Northing: —	**Access Route:** Private laneway from Dundas Street, follow to GPS points north of pond.		**Time:**

Riparian Vegetation Community (facing upstream)

Distance from Water's Edge	*Left Bank*	*Right Bank*	*Comments*
1.5 – 10 m	Meadow/ Agri	Meadow/ Agri	
10 – 30 m	Agriculture	Agriculture	
30 – 100 m	Agriculture	Agriculture	

Water Clarity (Colourless) Turbid Blue/Green Yellow/Brown Other:

Instream Cover Present	*None*	*Sparse*	*Moderate*	*Dense*	*Comments*
Undercut banks	☒	☐	☐	☐	
Overhanging bank vegetation	☐	☐	☐	☒	
Woody debris	☒	☐	☐	☐	
Rocks/boulders	☒	☐	☐	☐	

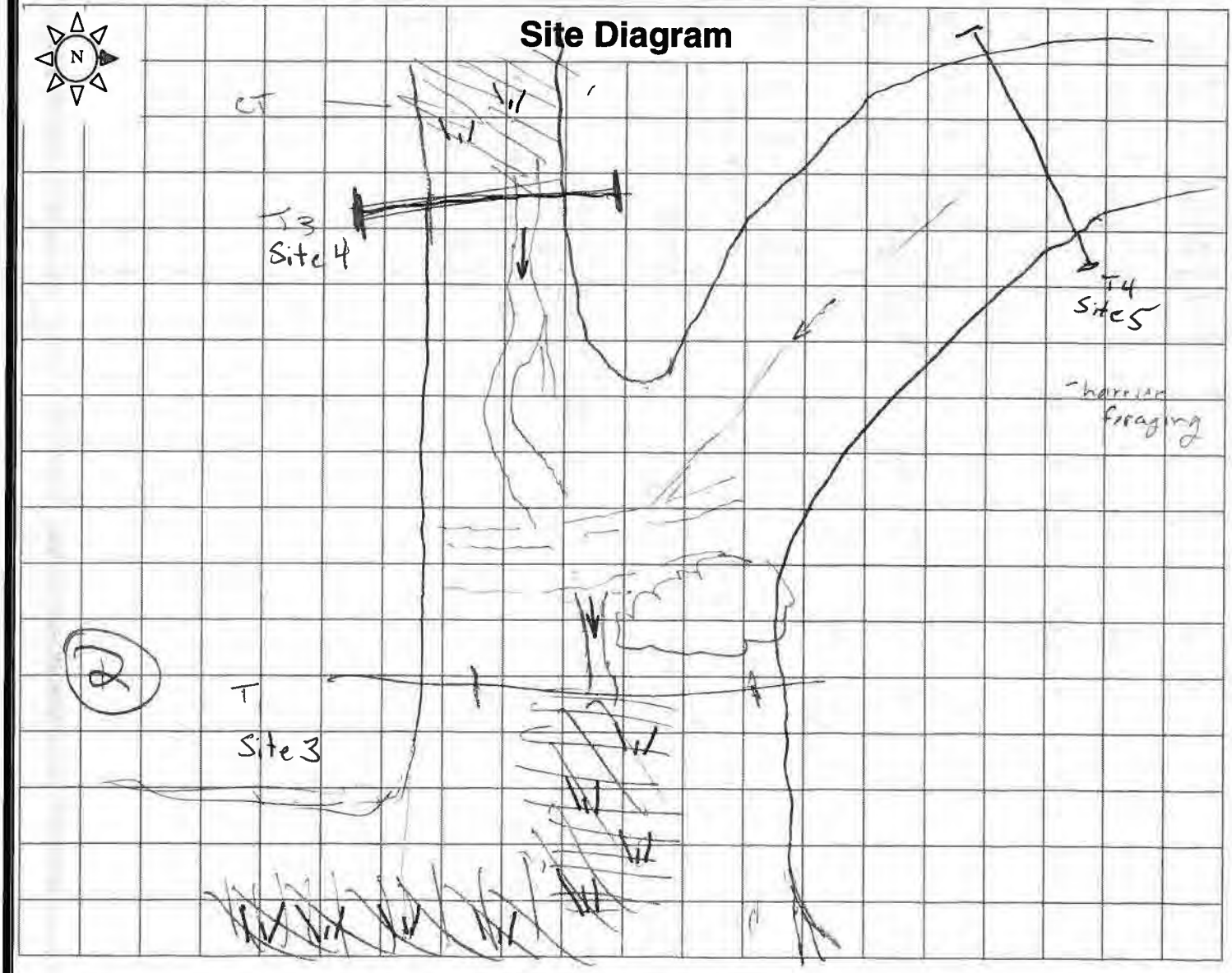
Notes:

Site #3 17T 597882 4809256
Site #4 17T 597856 4809257
Site #5 17T 597862 4809278

Cross Section Transects (Left to Right facing upstream)

Transect	Spacing	Bankfull Width	HT 1	HT 2	HT 3	HT 4	HT 5	Left Wetted	Right Wetted	Wetted Width	D 1	D 2	D 3
T1 Site 3	1.1	5.5	0.55	1.65	2.75	3.85	4.95	1.8	4.3	2.5	Max 410		
			180	250	230	230	125						
T2													
T3 Site 4	0.9	4.5	0.45	1.35	2.25	3.15	4.05	2.90	3.70	0.80	Max 3.5		
			150	165	180	180	210					400	
T4 Site 5	1.08	5.4	0.54	1.62	2.70	3.78	4.86	—	—	—			
			160	180	225	230	130	no channel		no water			
T5													

Site Diagram



Station:	Project Number:	MMM GROUP
1	14.09222.001.EN2	Streams Sampling Form

Stream/Waterbody Name:	Stream Type:
14W-12	Permanent ☒ Intermittent ☐
Watershed/Drainage: 14 Mile Creek.	

Easting: 17T 597891	Waterbody Type: Stream.	Station Length (m)	Date: Dec 10/2010
Northing: 4809142	Access Route: Private laneway from Dundas Street, walk upstream from field crossing culvert to GPS point.		Time:

Riparian Vegetation Community (facing upstream)

Distance from Water's Edge	*Left Bank*	*Right Bank*	*Comments*
1.5 – 10 m			
10 – 30 m			
30 – 100 m			

Water Clarity: (Colourless) Turbid Blue/Green Yellow/Brown Other:

Instream Cover Present	*None*	*Sparse*	*Moderate*	*Dense*	*Comments*
Undercut banks	☒	☐	☐	☐	- eroding banks.
Overhanging bank vegetation	☐	☐	☒	☐	
Woody debris	☒	☐	☐	☐	
Rocks/boulders	☒	☐	☐	☐	

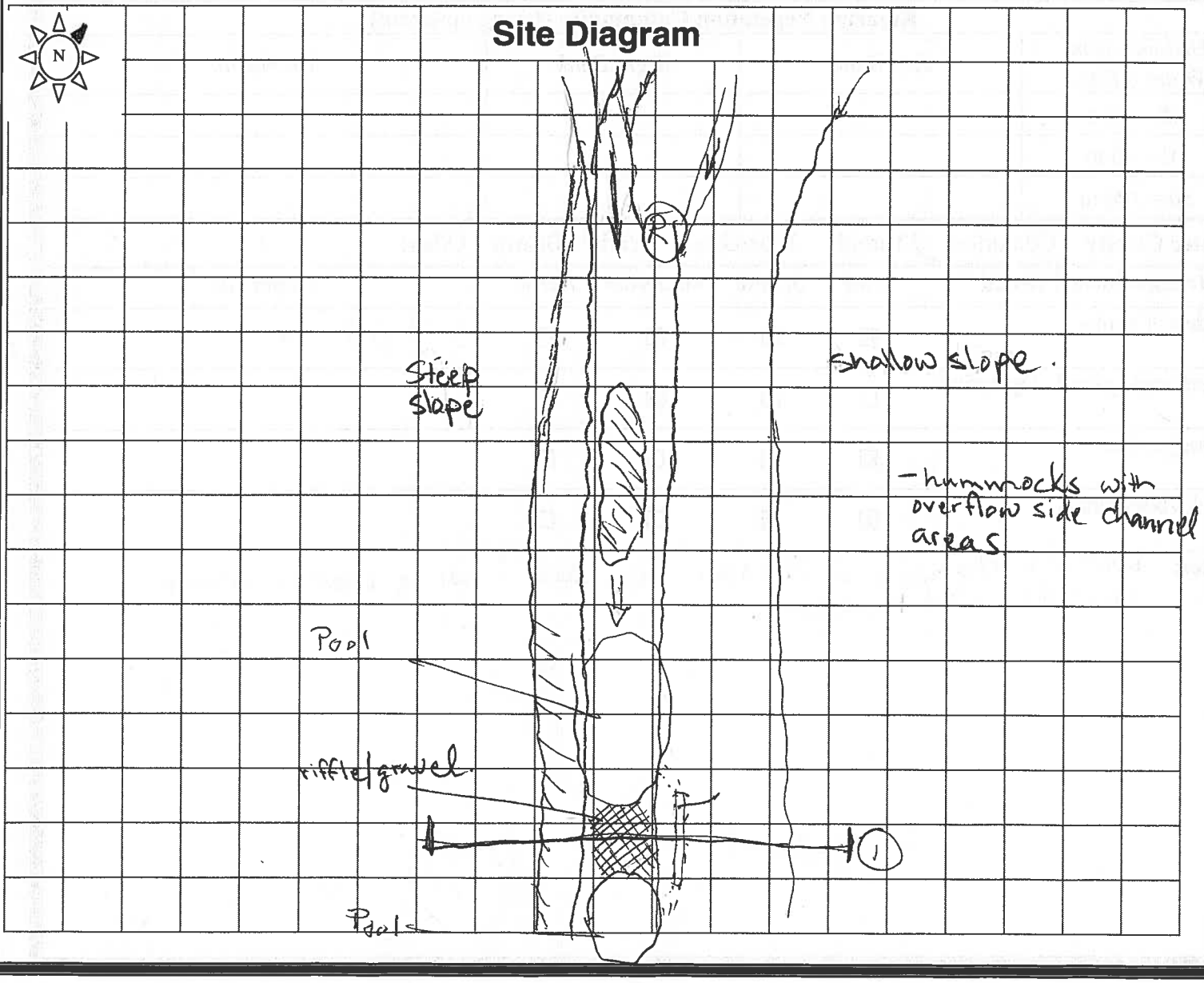
Notes: Water in channel is frozen. Limited flowing water when surface was broken.

6.10

Cross Section Transects (Left to Right facing upstream)

Transect	Spacing	Bankfull Width	HT 1	HT 2	HT 3	HT 4	HT 5	Left Wetted	Right Wetted	Wetted Width	D 1	D 2	D 3
T1 Site #1	1.22 +0.5	6.1	0.61	1.83	3.05	4.27	5.49	0.95	1.75	0.8	Max 1.80		
			330	500	530	250	180					740	
T2													
T3													
T4													
T5													

Site Diagram



Station:	Project Number:	MMM GROUP
2	14.09222.001.EN2.	Streams Sampling Form

Stream/Waterbody Name:	Stream Type:
MW-12A	Permanent ☐
Watershed/Drainage:	Intermittent ☒
14 Mile Creek.	

Easting: 17 T	Waterbody Type:	Station Length (m)	Date:
597878	Agricultural tributary.		December 10, 2010.
Northing:	**Access Route:**		**Time:**
4809219	Private laneway from Dundas St. Walk to GPS point		

Riparian Vegetation Community (facing upstream)

Distance from Water's Edge	*Left Bank*	*Right Bank*	*Comments*
1.5 – 10 m	Meadow	Meadow.	
10 – 30 m	Agriculture	Agriculture.	
30 – 100 m	Agriculture	Agriculture	

Water Clarity (Colourless) Turbid Blue/Green Yellow/Brown Other:

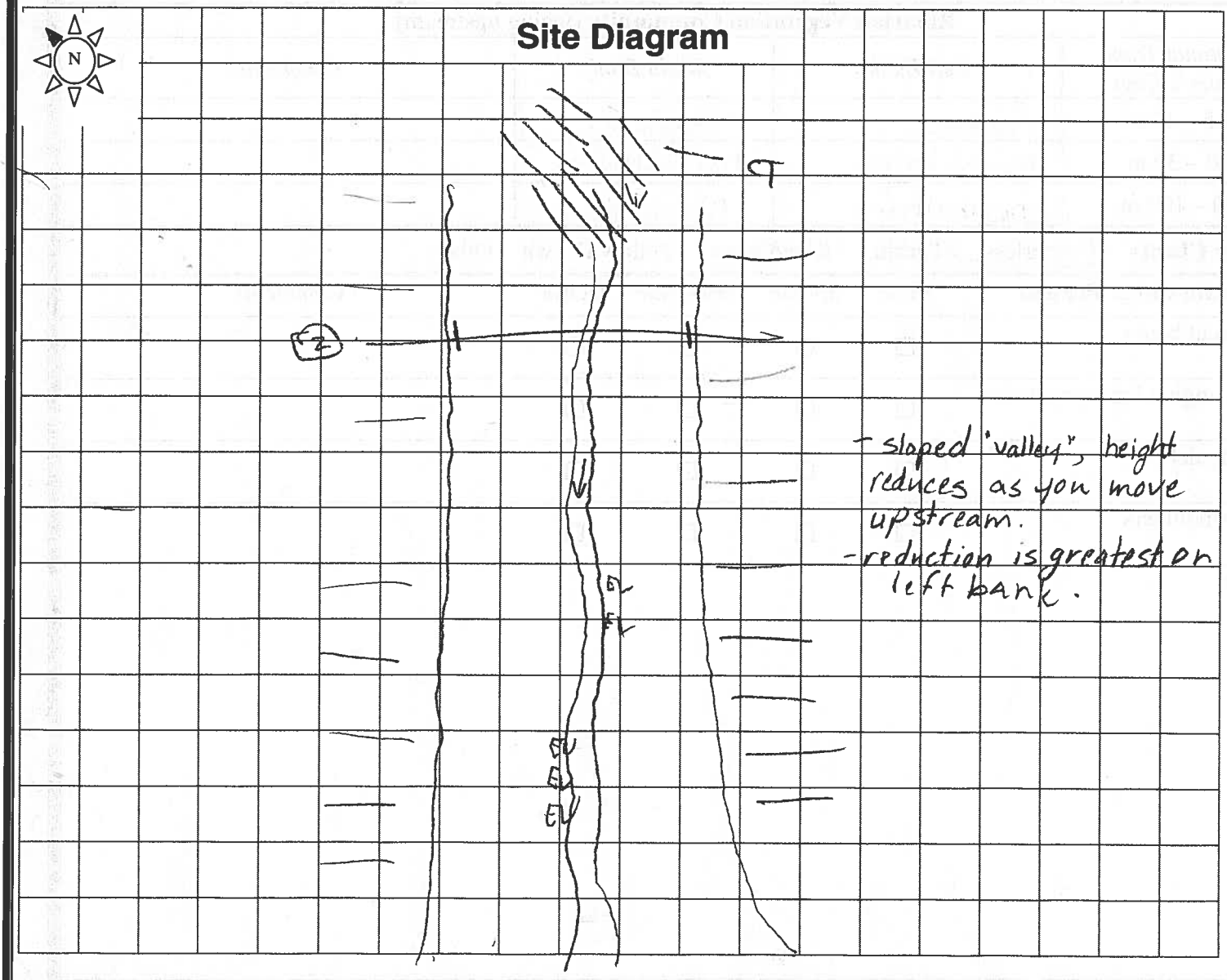
Instream Cover Present	*None*	*Sparse*	*Moderate*	*Dense*	*Comments*
Undercut banks	☐	☐	☐	☐	
Overhanging bank vegetation	☐	☐	☐	☐	
Woody debris	☐	☐	☐	☐	
Rocks/boulders	☐	☐	☐	☐	

Notes:

Cross Section Transects (Left to Right facing upstream)

Transect	Spacing	Bankfull Width	HT 1	HT 2	HT 3	HT 4	HT 5	Left Wetted	Right Wetted	Wetted Width	D 1	D 2	D 3
T1 Site #2	1.1	5.5	0.55	1.65	2.75	3.85	4.95	2.5	3.1	0.6	Max	3.80	
			160	155	381	90	1.48				(93.3		
T2													
T3													
T4													
T5													

Site Diagram



- sloped "valley", height reduces as you move upstream.
- reduction is greatest on left bank.

- 415 Heron
- dead C. Goose

Bentall July 30th

	14W-11A	14W-16	14W-12
TDS	475	586	444
Cond	980	1174	882
pH	7.95	7.77	7.79
D.O.	7.65	7.89	7.77
Temp	17.5	17.0	19.0
Time	9:38	10:12	10:42

Notes: standing water in one way; puddles.

14W-11A: lots of water (only depth in pool)

14W-16 = mud calf
- algae has greatly reduced
- water is very silty
- ground very saturated.

14W-13/14W-14 - water in channel, flowing
- pools at field crossings
- no fish observed

Junell

	14W-11A	14W-16	14W-12TL1	14W-TL55
Cond	1949	1317	1634	Removed
TDS	926	660	813	@ 0905
pH	7.31	7.12	7.54	Junell
DO	4.58	10.82	5.67	- channel dry. Logger was in the muck, which was slightly saturated
Temp	14.0	16.0	15.3	
Time		- choked with algae	- logger is in isolated pool - no flow and no connection	
- puddles		- WQ taken in open water over top of algae mat		

pupaies — open water over top of algae mat — connection

Bentall — June 20

176291

	14W-11A	14W-16	14W-12TL1
Cond	2285	1384	1850
TDS	1141	687	858
pH	7.42	8.04	7.74
DO	5.30	8.58	5.20
Temp	22.0	22.6	22.0
Time	11:08	11:30am	11:57am

10:47am
no flow
isolated pool
post heavy rain

- abundant algae
- not as dense as previous visit
- lowered water levels
- turbid
- no apparent flow

- temp logger becoming exposed

2

us of OSAR

W1-1 Temp → 13.9 Cond → 985

DO → 6.89 pH → 7.83 TDS → 493

DS @ 80m

(8) US - channel

(9) DS - channel

(10) US - marsh — west side

(11) DS - willow overview

(12) Inlet - DS

(13) Outlet - US

(14) DS from culvert

Bentall May 28

	14-11A-TL6	14W-TL5	MW-12-TL1	14W-16TL2	
DO	7.28	3.38	7.57	8.62	Algae!
TDS	896	639	815	862	
COND	1801	1286	1630	1714	-Higher
PH	7.75	7.53	7.90	789	water
T	15.7	13.8	13.9	13.1	-turbid

July 8 - Bentall
- Fish Community
  - pond 1
  - pond 2
  - 14W-11A
  - 14W-16

Culvert
- 14W-11A
- 14W-13
- 14W-14 - pooling d/s

Water Quality

	14W-11A	14W-16	14W-12
cond	—	1971	2062
pH	—	8.45	8.32
DO	—	6.35 ~~7.88~~	5.40
temp	—	22.0	21.0
TDS	—	988	1036
Time	0910	1240	2:20
	- dry - in mud	Remove to shock	- some flow from u/s & d/s
	- left in		- logger fully submerged

Sh1 - 2530 cond / 22.5°C / 8.40 pH / DO 4.84
40 Hz @ 150V 138 sec.
Y&Y - smaller than mesh size

110 100 90 80 - Creek

70 65 - Fathead Pik

70 65 - Blunt

65-60 ~~Fathead~~ - [illegible] (shiner) anal < dorsal slightly.

Sh2 - culvert 1m wide 20/150 Hz/ 100

cond ~~390~~ 3950 µs
Temp 19.2°C
pH 8.51
DO 2.5 mg/L
TDS 1987 ppm

YOY BSb

CC 70 75 90 - 70 BN -
Shiner 55 60 - 45 43 SHB - 1
FH 75 - 1
70 65
YOY - SB - 1

Sh3 (culvert) - no fish
- pooling in culvert
- check dam/ rock d/s ft to mountain
H_2O u/s
< 4 pix > 3 w/s 1 d/s
- roadside drainage contributes @ culvert outlet
- clay/muck, silt, algae.

Narrow CT dense
40/150 (33s)

Sh4
Cond 1228 us
TDS 613 ppm
pH 8.75
Temp. 26.4 °C
DO 4.60 mg/L

40/150
sec 203

- possible wash down
- same size as earlier visit

30 to 62/70 Brook - FH - 1
30

Lots of YOY Brook
Brook/FH

Small pond
Temp - 26.3°C
DO - 530 mg/L
Cond - 380 us
TDS - 189 ppm
pH - 9.3

40 LgM Bass

- deep centre
- clay, gravel sloped shoreline

settings
60/250 Hz ✓ 211 sec.

- shock perimeter of pond
- very dense mat of algae
- shocking poorly effective
- large bass congregate in centre of pond @ surface

2 pix concrete culvert u/s of OSAP site
- active field crossing.
@ burn pile east of creek.

exceed length

Lg Pond

Cond	745	
TDS	371	
DO	4.51	
pH	8.58	
Temp.	26.0	

60/250
West shore 368 sec
55-45 LMBass
31-36 Stickle

Pix @ the pond.

	14W-11A	14W-16	14W-12	14W-15
pH	7.85	8.05	8.00	7.97
TDS	796	935	785	726
Cond	1588	1875	1591	1454
DO	7.11	9.35	8.43	6.70
Temp	10.0	11.7	10.4	10.5
Logger Pulled	941	11:31	12:02	—
Time	9:39	11:29	12:00	11:36
Note.	1.8m W 13cm D	1.0m 24cm	2.33 27cm	

Photos — 21cm drop / debris base left

① 14W-11A outlet from forest N 407

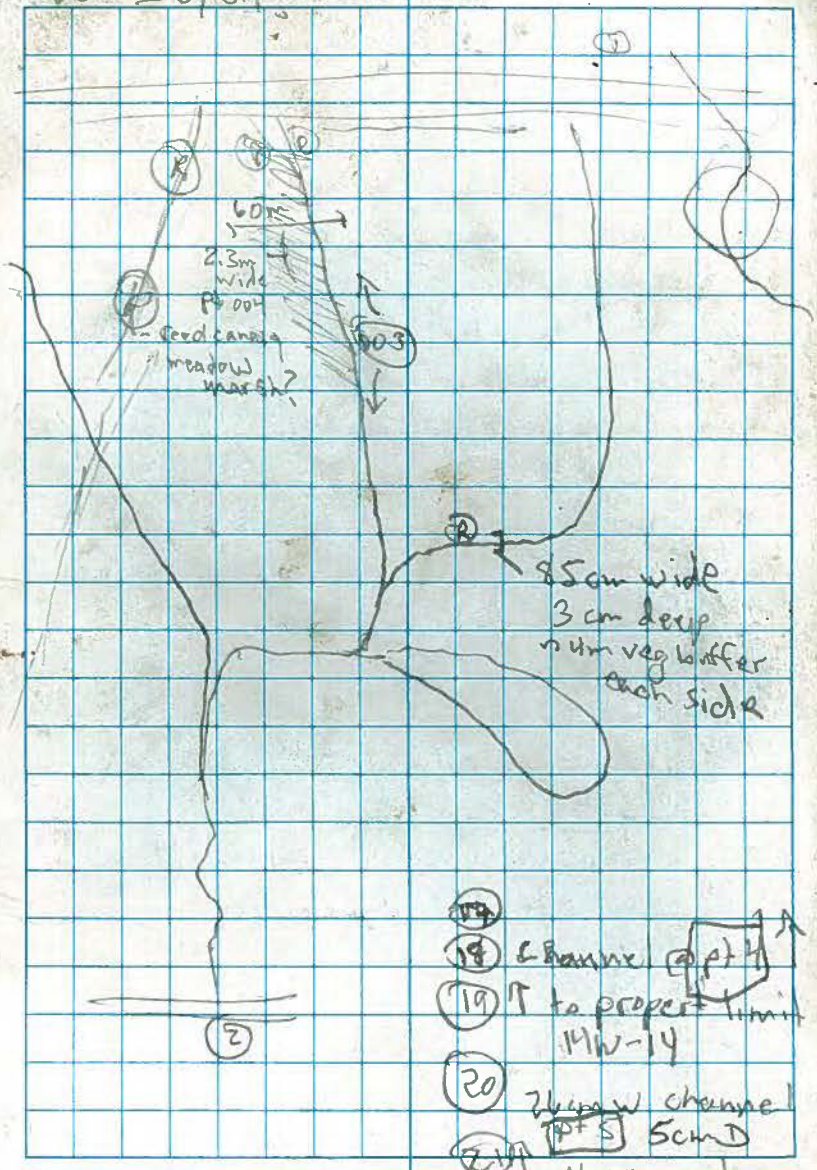
②③ 14W-14 N of 407 - water flowing to west of 3 culverts.

④-13 → D/S of 14W-12 S of Dundas.
perch 18cm
pool 29 cm deep / 4m wide
outlet of pool @ riffle 1.5m wide
20 cm deep.

⑭ Filler.

⑮ 14W-14 - N from pt 003 } overview
" - S " " }

Oct 30/09 — overcast - drizzle. — crop harvested



(22) u/s to triple culvert
EN @ CI, Phrag., RCG
→ → → →
- pooling u/s of pt 5
- silt / clay.
- turbid.

@ property 17cm deep
60cm wide } RCG

(23) - Filler
24-27 - Overview from west prop limit @ pt (6) N → S.

w/s OSNAP 2 site.
(24) ↑ @ bend in HW-16 @ property.
pt [7] - clay silt CRG
Goldenrod.
dec hedgerow cluster
1.5m w / 14cm dp.

(25) 34cm wide / 4cm d. pt [8]
- One channel - main discontinues thru CRG, Goldenrod
- Flow observed.

- 1.29m w/ 11cm d. - flow (in OSAP).
- 4cm wide - silt / clay
1cm dp.
- 29cm w (BF) vertical banks.
25cm D (BF) - riffle
- detritus
- clay.
- defined single flowing channel d/s of HW-16(2) OSAP
- abundance of gravel increases
- detritus ↓
- algae
the channel bordered by clay.
- pt 9 cattails w/ defined channel. right shoulder u/s of small pond
(26) - sm pond outlet @ confluence
10cm wide 2cm deep
shale rock
- juvenile
- u/s migration

pt ID - Fish shrub lined section 14W-16
d/s of sm pond.
W-1.4m; 12cm d (27) X

28 ↓ Field X'ing culvert to
29 ↑ " " " From ~~Depth~~ 116cm
30 ↓ " " " From ↓21cm

- cobble/debris @ Field X culvert

X raptor white rump patch
bar mark @ eye. Harrier?

(31) 14W-15 - water
14cm - 84cm W
4cm deep

pool old logger spot?
22cm deep
1m wider

14W-13/14 12cm D partially defined
24cm W

@log

⇒ 11-2pm w/ 30 min lunch
$16.96

- Blocked inlet of culvert
- kicked ? sweep for fish = NONE
- Blocked d/s of dig site
- re-kicked. = no fish.

* Saturated soils.

Bentall Aug 28 2009

overcast, windy.

	14W-11A	14W-16	14W-12
TDS	836	917	899
COND	1637	1808	1797
pH	7.33	7.86	7.89
D.O.	5.98	7.95	7.28
Temp.	16.4	18.5	20.9
Time	10:27	11:00am	11:35

photos

(1) - South/DS to 14W-11A culvert
- rock lined embankment
- roadside drainage / parallel 407

(2) - u/s @ culvert inlet - grasses, jewel weed.
Movie [1] surrounding ~360° u/s 14W-11A

(3) East parallel 407 u/s @ culvert

(4) West parallel 407 d/s inlet
↳ 51 cm eroded drop.

(5) D/s East roadside ditch @ exit to station w/ cattail patch 15 cm dry sinkel channel

(6) cattail channel facing west to truck station.

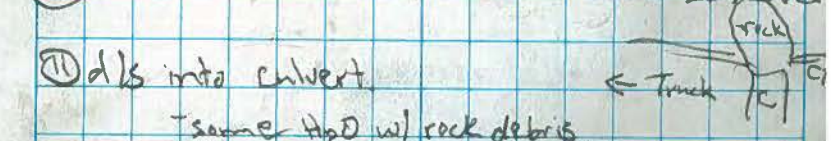
(7) 14W-13 @ us culvert view of inlet bed ↑

(8) west along ditch u/s to truck station

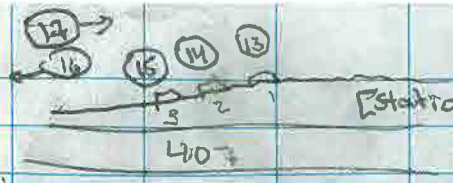
(9) East " u/s away from station

(10) to forest area u/s from culvert

(11) d/s into culvert.
- same HgD w/ rock debris.
Movie [2] 180° 14W-13 culvert u/s inlet



(12) 14W-14 3 culverts - u/s - agri field.
- veg on one side



- 3 d/s photos through culverts.

(19) - u/s from culv 3 pool 25cm deep.
- flow obstructed by veg & old silt fencing? 86cm wide
resembles a large rock, but is "squishy"

(19 20) @ fence (with ruler)
- 15 cm - 30 cm narrow channel with abundant overhanging veg.
- likely low flow channel.
- bankfull @ fence ~ 2m - 7m

(21) d/s from fence to triple culverts

(22) East to station N-L cattail (sparse) lined ditch w/ 6 cm depth 4:20

Movie [3] 360° overview of 14W-14.

(23) roadside ditch Truck station on ramp to 407 (u/s.

(24) - Filler/car mailbox.

(25) - along Tremaine to culvert and 407 @ #3287 driveway

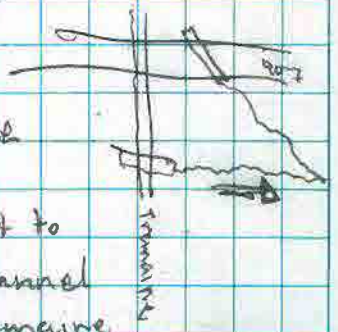
14W/14

(26) u/s into 10ft Ø culvert

(27) u/s outlet 12cm perch. +algae
- pool 2m d/s of culvert rock riprap 48 cm deep.

(28) d/s of culvert outlet.

(29) overview from top of culvert (d/s)



Movie [4] - 14W-14 tremaine ~ 340°

(30) from tremaine outlet to 407 crossing input channel

(31) - confluence from tremaine

(32) - 407 outlet overview from tremaine.

(33) - d/s overview

(34) - u/s overview @ tremain

(35) - " " @ " to 407

(36) - parallel Tremain on u/s side (away from 407)

37-38-39 14W-14 logger (@/u/s/d/s)

(40) - East to wetland/woodlot } u/s outlet

(41) - East to neighbour } d/s

(42) - u/s 14W/16 - water flowing
(43) - @ 14W - 16 - algae collected around
(44) - D/S 14W - 16 re-bar
- sparse/isolated algae growth.

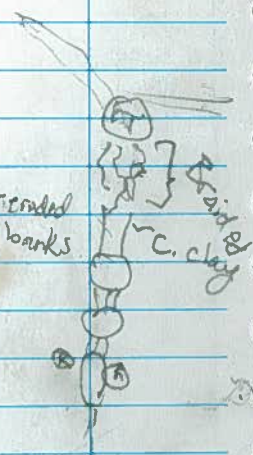
(45) D/S - confluence
(46) (47) 2 plant photos - wet soils.

Bentall Sept 10 WQ – transferred from loose sheet (Sept 14) – scanned.

Site	14W-11A	14W-16	14W-12
pH		7.86	7.72
Cond		1350	1484
TDS		676	740
D.O.		7.50	4.88
Temp		16.5	16.3
Time	9:13am	9:45am	10:25am
Note	- silty mud - No standing water @ logger	- H_2O levels lower - algae on crebar - algae covers bottom w/ silt cover - grasses overhang	- standing water - no flow or connection

Bentall Sept 30

	14W-11A	14W-16	14W-12
pH	7.80	7.83	7.57
Cond	1679	1795	1753
TDS	855	918	896
D.O.	8.40	8.89	7.25
Temp.	11.0	11.5	10.5
Time	9:32	10.07	10:38
Note	pooled water @ logger only	- water clear - algae died - silty sub. - no flow	



- disconnected pools
- possible refuge ← No fish observed
- algae causes silt to deposit at outlet of pools.



- 20m+ pool under bridge – trashes
- change in reach d/s of bridge / more tree cover ie willow
- at barn – woody debris

Location Lazy Pat Lands 14W-14A Date July 4/2011

Project / Client Bentall

Large pond monitoring

- several photos taken from south end of pond - by staff gage pt 015

Eckman
- 2 samples
  - pt 016 (A)
  - pt 018 (B)
- abundant "muck"
- pooled samples.

3 temp logger strings - bottom / middle / top
1, 2, 3 - 1.5 m

4, 5, 6 - 2 m

7, 8, 9 - 3 m.

- each location mark with GPS.

- underwater camera : video, transect attempted; water extremely turbid - video quality poor/bad.

- no water quality sample obtained - equipment malfunction.

Location Oakville Dundas + Boonte Date Aug 19 '11

Project / Client Bentall

Lazy Pat Lands 14W-14A

South Logger — Logger Set 3 South End.

D.O.		
1	6.89	23.3
2	6.23	21.4
3	5.88	20.7

Secchi Depth			
(1)	75 cm	60	(S)
(2)	60 cm	50	(Middle)
(3)	60	40	(N)

- swallows (shore/bank Barn)
- R.T. Hawk - calling circling
- Killdeer X

14W-14A Oakville Date 19-08-2011

Client Bentall.

mp/WL/Habitat

logger near surface

gger Set 2

Middle

.0	
5.36	26.9
0.18	25.7
	24.3
5.55	

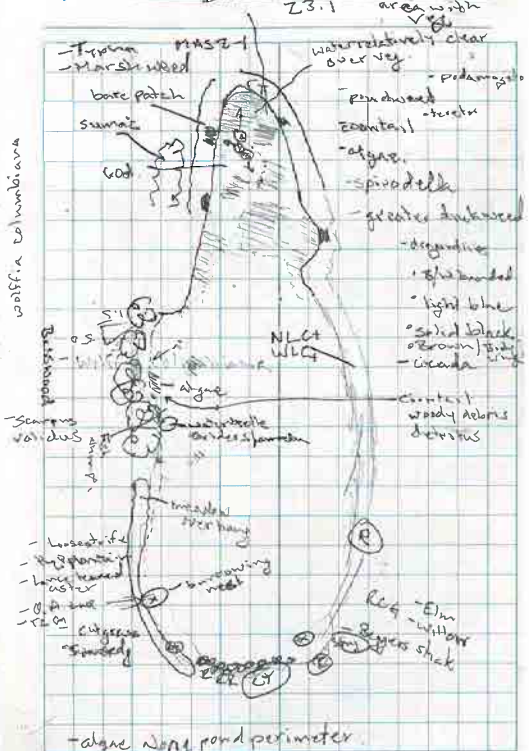
gger Set 1 — logger near surface

North

D.O	
.92	25.0
7.16	24.0
0.86	23.3

Location Oakville 14W-14A Date 19-08-2011 53

Project / Client D.O. 10.02 23.1


- surface
- in open area with veg
- Typha
- Marsh weed
water relatively clear over veg
bare patch
- pickerelweed
- arrowhead
- elodea
- algae
- pondweed
- coontail
- greater duckweed
- dragonfly
- bluegill
- largemouth bass
- sunfish
- crayfish
- snails
- leeches
- water boatmen
- damselfly
- dragonfly
- light blue
- solid black
- brown/tiger
- cicada
NLCA
WLCA
- algae
- coontail
- woody debris
- debris
- Canada goose
- mallard
- Red-winged blackbird
- Eastern kingbird
- Eastern phoebe
- Song sparrow
- Common yellowthroat
- Yellow warbler
- Red-eyed vireo
- Baltimore oriole
- Great blue heron
- Green heron
- Belted kingfisher
- Cedar waxwing
- Red-tailed hawk
- Elm
- Willow
- Spruce
- shrubs
- Cattails
- Sedges
- Rushes
- Grasses
- Goldenrod
- Asters
- Joe-pye weed
- Milkweed
- Boneset
- Vervain
- Meadowsweet
- Ferns
- Jewelweed
- Nettles
- Thistles
- Burdock
- Dandelion
- Plantain
- Clover
- Vetch
- Timothy
- Bluegrass
- Fescue
- Brome
- Wheat
- Corn
- Soybeans
- Alfalfa
- Hay
- Pasture
- Meadow
- Forest
- Hedgerow
- Fencerow
- Stonewall
- Barbed wire fence
- Split rail fence
- Post and rail fence
- Chain link fence
- Gate
- Barn
- House
- Shed
- Silo
- Windmill
- Water tower
- Power line
- Telephone pole
- Road
- Dirt road
- Gravel road
- Paved road
- Bridge
- Culvert
- Ditch
- Stream
- River
- Lake
- Pond
- Wetland
- Swamp
- Marsh
- Bog
- Fen

1WW-14A Date 6-10-2011

Client Bentall.

hrs Air 9.8 °C
, cold, light breeze.
lands
un on Oct 5, 2011

photo ①
- staff gauge
<355
- 75cm drop.

op Set 0915

minnow ⇒ 0924
cranches SW of staff gauge.
- moderate size fish
surfaced ½ way between
shore and South
buoy.

3
rap — 0932 @ path attached to
young tree

- Scum along South Shoreline

4
ck minnow - 0938
- woody debris
- no veg.

Location Date 6-10-2011 57

Project / Client

2

DO. T 14.5 pt 005
pH 10.31 photo ② holes in bank
cond 449 ③ waterline
TDS 246
- holes are 97cm from waterline

- Heron's @ north / shallow end

pt 006 ⇒ 1001 - no cover
Black minnow - algae adjacent

pt 007 — 1016
Black minnow - no cover
- shallow

pt 008
- Silver minnow - in the algae mats
— 1027 photo ④ west to trap

pt 009 - 46cm wide - CT
0.065m deep

Date

Client

- 45cm wide - meandering.
- 0.65 m deep - grasses.

- 1155 1259
- Black in algae
- attached to CT stump.

2 - 1206
- Black • AM shade from tree,
• Algae mat on shore

Location Date Oct 7 59

Project / Client

Secchi (2m)
58-52
1235 hr
D.O. 1
1 - T 23.9 2 - 86.8 % 3 - 82.9°
D.O. 91.5% 18.2 16.0
- Loggers pulled

Secchi - 52-51

1 - 98.8 2 91.2% 3 - 78.0%
16.7 16.2 15.5

Bentin end
1 90%
17.9 °C
Top
2. 134.5
16.9
near bottom

Date Oct 7/2017

Client

11
pumpkin
- 75

7 1310
crayfish
pumpkin
65

1320
crayfish (2)
pumpkin (6)
55-75

2 1330
7cm - in tree
45-75
P.S.

pt#6 1305
(15)
80
65 - 70
Pumpkin

pt#12 1315
1- crayfish
1- LMB 125
1- P.S. - 70,
70

1325 pt #1 77cm depth
P.S. - 130 100
B-Bull 165/150
1 crayfish

1345
pt 013 d-86
P.S. -
130, 120, 110, 140

B-Bull -
75, 100

C. Chub - 170/215
160

Location

Date Oct 7

Project / Client

61

pt #4
1350
1- cray Kept
P.S -
55-65

observed snake d/s of x'ing
- pools 12cm / 2' 3cm
- refuge pool clear

- B and D
- Sh/nests

Small
9.72 pH cond 505 d.o. 109.9
21.7°C ? TDS 252 22.2

D -
~3m (11ft)
- 8.2 ft 9.5 north
south

Date Oct 7

Client

pt 015
0.09 max w

25.0 500 750 1000 1025
15.0 27.5 260 21.0 11.5

016 no water
2.05
- (S) 29 No water
- (N) 32 no water

250 500 750 1.00 1.25
210 100 9.50 7.5 18.0

150 1.75
20.0 8.0

- 1.95 Max ~7cm
- 64cm

25 50 75 1.0 1.25
21.5 25.6 31 29.5 16.5

Location

Date Oct 7

Project / Client

63

1.50 / 1.75
10 / 10
dry

pt 018
95 BF no water
w 49cm ~12cm

25 50 75 95
12 12.5 9 0

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Pointail - Kennedy Project Number: 1409222001-EN3

Date: May 31/13 Start Time: 7:15 Observer: Pat Mahr

shifted to corner field

PC Number 1 Photo No.: 0419 UTMs: Easting 597524 Northing 4809851

Temp 22 Visibility clear km Cloud 15 % Precip yes (no)

Sky Code 1 Wind speed none Wind Direction none

General Habitat type: (Field) Hedgerow Fenceline Other:

Mostly forbs

General Vegetation Type: 80% Forb + 20% rcg white mustard, thistle, clover, ragweed

Vegetation Height (cm): 15-30 Presence of Litter?: yes / (no) Describe:

Estimated % Grass vs. Broad-leaved plants: 20 % grass 80 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
None				

Other Bird Species Observed: Brown Cowbird

Breeding Evidence Level:
Possible --- SH = Suitable Habitat SM = Singing Male
Probable --- T=Territory. A=Anxiety Behaviour. D=Display. P=Pair. N=Nest building. V=Visiting nest
Confirmed--- DD= Distraction. NE=Eggs. AE=Nest entry. NU=Used Nest. NY=Young. FY=Fledged young. FS=Food/Faecal Sack

NAAMP/ Beaufort Sky Codes
0 = clear (no cloud cover)
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3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall-Kennedy Project Number: 1409222001-ENS

Date: May 31/13 Start Time: 7:35 Observer: Pat Mohr

PC Number 2 Photo No.: — UTMs: Easting 597461 Northing 4809408

Temp 22 Visibility clear km Cloud 15 % Precip yes (no)

Sky Code 2 Wind speed Grass moves Wind Direction from West

General Habitat type: (Field) Hedgerow Fenceline Other: wet meadow

Grass

General Vegetation Type: All reed canary grass

Vegetation Height (cm): 90 Presence of Litter?: (yes) / no Describe: grass stems

Estimated % Grass vs. Broad-leaved plants: 95 % grass 5 % plants teasel

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
None				

Other Bird Species Observed: Horned lark, Red-winged BB, Ring-billed Gull, Tree Swallow

Breeding Evidence Level:
Possible --- SH = Suitable Habitat SM = Singing Male
Probable --- T=Territory, A=Anxiety Behaviour, D=Display, P=Pair, N=Nest building, V=Visiting nest
Confirmed--- DD= Distraction, NE=Eggs, AE=Nest entry, NU=Used Nest, NY=Young, FY=Fledged young, FS=Food/Faecal Sack

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6= Strong breeze, large branches in motion (40-50)

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall-Kennedy Project Number: 1409 222001-ENS

Date: May 31/13 Start Time: 7:50 Observer: Pat Mather

PC Number 3 Photo No.: 414-5 UTMs: Easting 597830 Northing 4809190

Temp 22 Visibility clear km Cloud 15 % Precip yes (no)

Sky Code 2 Wind speed grass moves Wind Direction from west

General Habitat type: (Field) Hedgerow Fenceline Other:

Grass

General Vegetation Type: Poa, Teasel, goldenrod

Vegetation Height (cm): 60 Presence of Litter?: (yes) / no Describe: Poa stalks

Estimated % Grass vs. Broad-leaved plants: 95 % grass 5 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
None				

Other Bird Species Observed: Red winged BB, Spotted Sandpiper

Breeding Evidence Level:
Possible --- SH = Suitable Habitat SM = Singing Male
Probable --- T=Territory, A=Anxiety Behaviour, D=Display, P=Pair, N=Nest building, V=Visiting nest
Confirmed--- DD= Distraction, NE=Eggs, AE=Nest entry, NU=Used Nest, NY=Young, FY=Fledged young, FS=Food/Faecal Sack

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6= Strong breeze, large branches in motion (40-50)

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall- Kennedy Project Number: 1409222001-ENS

Date: June 11/13 Start Time: 8:50 Observer: P. Mohr

PC Number MMPC1 Photo No.: 0670-2 UTMs: Easting 594448 Northing 4809834

Temp 19°C Visibility 2 km Cloud 60 % Precip yes no

Sky Code 1 Wind speed 4 in gusts Wind Direction from northeast

General Habitat type: (Field) Hedgerow Fenceline Other:

Forbs

General Vegetation Type: Mostly mustard

Vegetation Height (cm): 30 Presence of Litter?: (yes) / no Describe: dead stalks

Estimated % Grass vs. Broad-leaved plants: 5 % grass 95 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
None.				

Other Bird Species Observed:

European Starling, Red-winged Blackbird, American Woodcock, Cedar Waxwing

Breeding Evidence Level:

Possible --- **SH** = Suitable Habitat **SM** = Singing Male

Probable --- **T**=Territory, **A**=Anxiety Behaviour, **D**=Display, **P**=Pair, **N**=Nest building, **V**=Visiting nest

Confirmed--- **DD**= Distraction, **NE**=Eggs, **AE**=Nest entry, **NU**=Used Nest, **NY**=Young, **FY**=Fledged young, **FS**=Food/Faecal Sack

NAAMP/ Beaufort Sky Codes

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9 = thunderstorms

Beaufort Wind Scale

0 = calm, smoke rises vertically (0-2km/hr)
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6= Strong breeze, large branches in motion (40-50)

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall-Kennedy Project Number: 1409222001-ENS

Date: June 11/13 Start Time: 9:20 Observer: Pat Mohr

PC Number 21 Photo No.: 624 UTMs: Easting 597502 Northing 4809347

Temp 19°C Visibility 2 km Cloud 70 % Precip yes (no)

Sky Code 1 Wind speed 4 gusts Wind Direction from east

General Habitat type: (Field) Hedgerow Fenceline Other:

Grass with few forbs

General Vegetation Type: Reed Canary Grass, teasel, rumex

Vegetation Height (cm): 30-60 Presence of Litter?: (yes) / no Describe: dead grass

Estimated % Grass vs. Broad-leaved plants: 80 % grass 20 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
None				

Other Bird Species Observed:

Red winged Blackbird, European Starling, (Also White-tailed deer)

Breeding Evidence Level:

Possible ---	**SH** = Suitable Habitat			**SM** = Singing Male			
Probable ---	**T**=Territory,	**A**=Anxiety Behaviour,	**D**=Display,	**P**=Pair,	**N**=Nest building,	**V**=Visiting nest	
Confirmed---	**DD**= Distraction,	**NE**=Eggs,	**AE**=Nest entry,	**NU**=Used Nest,	**NY**=Young,	**FY**=Fledged young,	**FS**=Food/Faecal Sack

NAAMP/ Beaufort Sky Codes

0 = clear (no cloud cover)
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4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
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Beaufort Wind Scale

0 = calm, smoke rises vertically (0-2km/hr)
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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall-Kennedy Project Number: 1409222001 ENV

Date: June 11/13 Start Time: 9:45 Observer: Pat Mohr

PC Number 3 - corn sprigs (p27) This is adjacent meadow Photo No.: 678 UTMs: Easting 597846 Northing 4809196

Temp 19°C Visibility 2 km Cloud 95 % Precip yes (no)

Sky Code 1 Wind speed 4 in gusts Wind Direction from northeast

General Habitat type: (Field) Hedgerow Fenceline Other:

Grass

General Vegetation Type: Fescue + Brome; Vetch + Goldenrod

Vegetation Height (cm): 60 Presence of Litter?: (yes) / no Describe: grasses

Estimated % Grass vs. Broad-leaved plants: 95 % grass 5 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
None.				

Other Bird Species Observed: Song Sparrow, Red-winged Blackbird
Great Blue Heron, Wood Duck ♀ with young in pond (p31)

Breeding Evidence Level:
Possible --- SH = Suitable Habitat SM = Singing Male
Probable --- T=Territory, A=Anxiety Behaviour, D=Display, P=Pair, N=Nest building, V=Visiting nest
Confirmed--- DD= Distraction, NE=Eggs, AE=Nest entry, NU=Used Nest, NY=Young, FY=Fledged young, FS=Food/Faecal Sack

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Beaufort Wind Scale
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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall - Kennedy Project Number: 1409222001 - EN3

Date: July 4/31 Start Time: 7:45 Observer: Pat Mohr

PC Number 1 Photo No.: 1334 UTMs: Easting 597524 Northing 4809851

Temp 22°C Visibility 0.1 km Cloud 100 % Precip (yes) no ~~spotting~~ sporadic very light rain

Sky Code 2 Wind speed 2 gusts Wind Direction _____

General Habitat type: (Field) Hedgerow Fenceline Other:

General Vegetation Type: Forbs - mustard + tansy

Vegetation Height (cm): 40 Presence of Litter?: yes / no Describe: _____

Estimated % Grass vs. Broad-leaved plants: 5 % grass 95 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
NONE				

Other Bird Species Observed:
SOSP singing, deer tracks, MODO flyover

Breeding Evidence Level:
Possible --- **SH** = Suitable Habitat **SM** = Singing Male
Probable --- **T**=Territory, **A**=Anxiety Behaviour, **D**=Display, **P**=Pair, **N**=Nest building, **V**=Visiting nest
Confirmed--- **DD**= Distraction, **NE**=Eggs, **AE**=Nest entry, **NU**=Used Nest, **NY**=Young, **FY**=Fledged young, **FS**=Food/Faecal Sack

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6= Strong breeze, large branches in motion (40-50)

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall-Kennedy Project Number: 1409222 001-EN3

Date: July 4/13 Start Time: 8:10 Observer: Pat Mohr

PC Number 2 Photo No.: 1136-7 UTMs: Easting 597461 Northing 4809408

Temp 22°C Visibility 0.1 km Cloud 100 % Precip yes (no)

Sky Code 2 Wind speed 2 gusts Wind Direction _____

General Habitat type: (Field) Hedgerow Fenceline Other:

Between crop fields - depression. Plowed field to east

General Vegetation Type: Reed canary grass, teasel, vetch

Vegetation Height (cm): 90 Presence of Litter?: yes / no Describe: _____

Estimated % Grass vs. Broad-leaved plants: 60 % grass 40 % plants

Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
NONE				

Other Bird Species Observed:

SONG SPARROW sang; 10 killdeer; GBHE flew along 407

Breeding Evidence Level:

Possible --- **SH** = Suitable Habitat **SM** = Singing Male

Probable --- **T**=Territory, **A**=Anxiety Behaviour, **D**=Display, **P**=Pair, **N**=Nest building, **V**=Visiting nest

Confirmed--- **DD**= Distraction, **NE**=Eggs, **AE**=Nest entry, **NU**=Used Nest, **NY**=Young, **FY**=Fledged young, **FS**=Food/Faecal Sack

NAAMP/ Beaufort Sky Codes

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6= Strong breeze, large branches in motion (40-50)

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BOBO / EAME POINT COUNT (10 MINUTES)

Project Name: Bentall-Kennedy Project Number: 1409 222 001 - EN3

Date: July 4/13 Start Time: 8:30 Observer: Pat Mohr

PC Number 3 Photo No.: 1339-41 UTMs: Easting 597830 Northing 4809190

Temp 22°C Visibility 0.1 km Cloud 100 % Precip yes (no)

Sky Code 2 Wind speed 2 gusts Wind Direction _____

General Habitat type: (Field) Hedgerow Fenceline Other:

General Vegetation Type: Brome, Milkweed, vetch

Vegetation Height (cm): 60 Presence of Litter?: yes / no Describe: _____

Estimated % Grass vs. Broad-leaved plants: 40 % grass 60 % plants

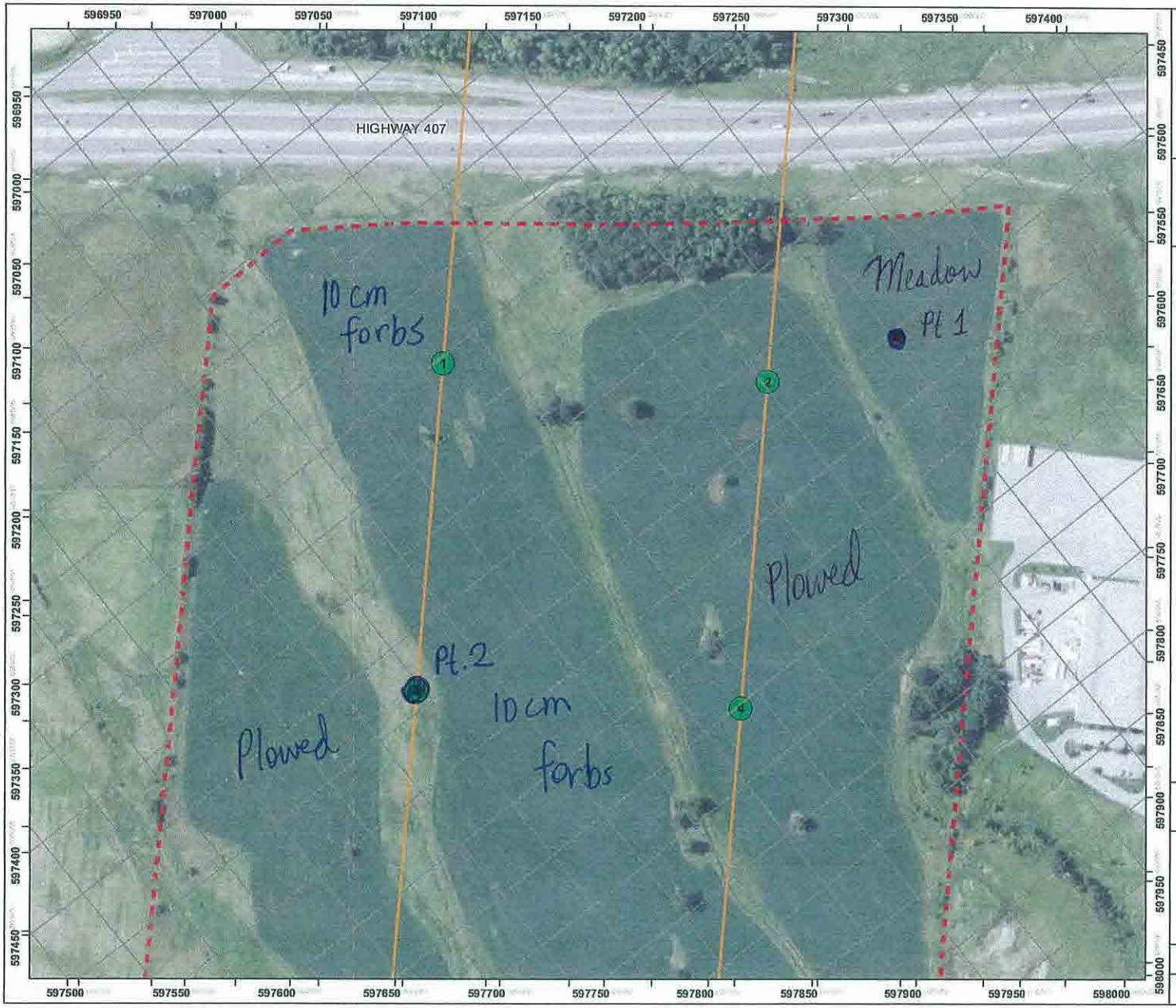
Species	Age	Sex	Behaviour	Breeding Evidence Level Codes
NONE				

Other Bird Species Observed:
RWBB, BRSW

Breeding Evidence Level:
Possible --- **SH** = Suitable Habitat **SM** = Singing Male
Probable --- **T**=Territory, **A**=Anxiety Behaviour, **D**=Display, **P**=Pair, **N**=Nest building, **V**=Visiting nest
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Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

Bobolink Transects (North)

LEGEND

- Subject Property
- Transect Lines
- Point Count Location

Point	X	Y
1	597304	4809570
2	597470	4809750
3	597487	4809400
4	597653	4809580

Scale: 0 25 50 100 150 200 m

Client: Bentall Kennedy

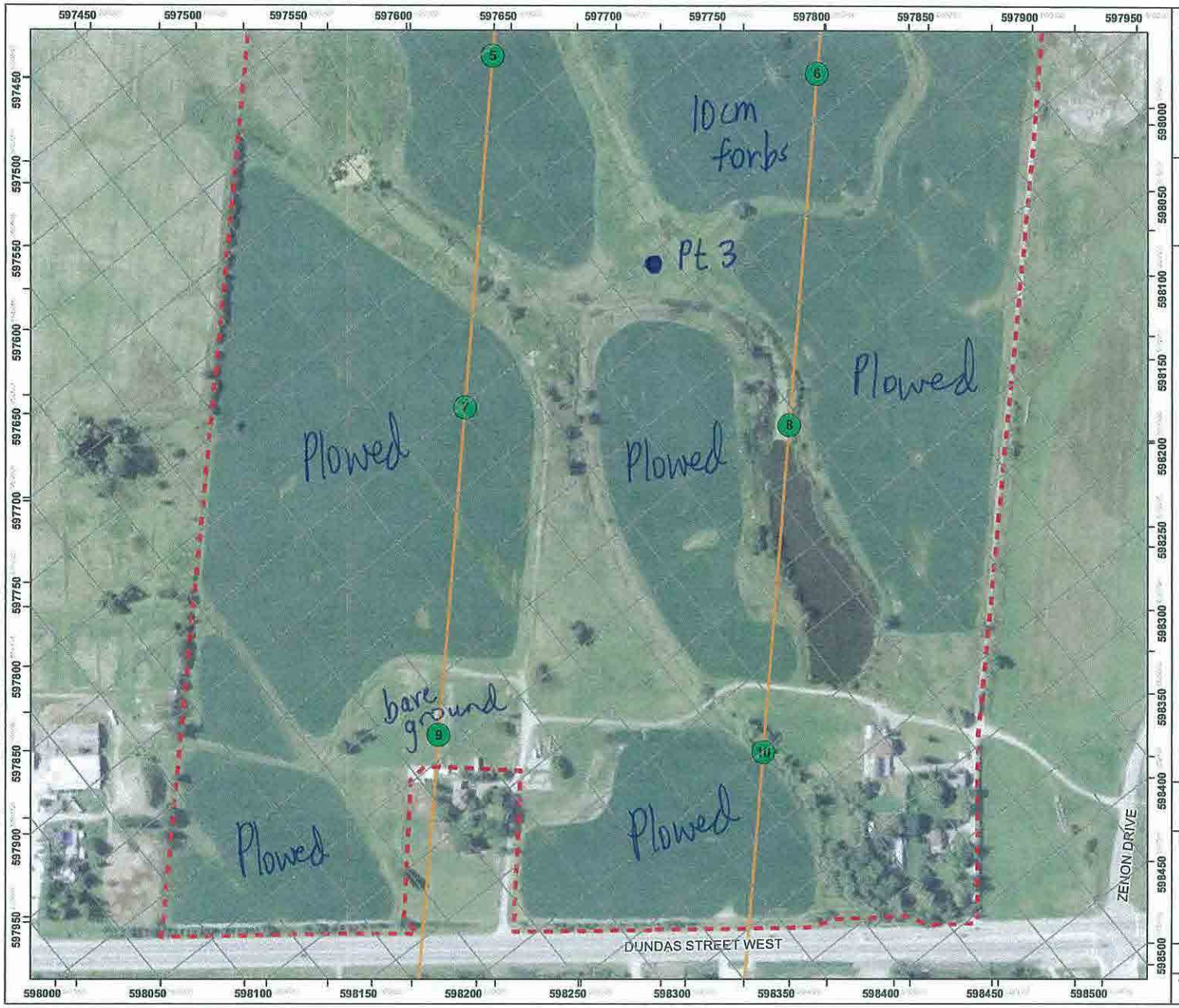
Prepared by: MMM GROUP

Date: May 29, 2012

Project No.: 1409222001

Aerial Photo: © DigitalGlobe, 2010, Google, 2009

Figure:



Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

Bobolink Transects (South)

LEGEND

- Subject Property
- Transect Lines
- Point Count Location

Point	X	Y
5	597656	4809240
6	597822	4809420
7	597852	4809050
8	598018	4809240
9	598035	4808880
10	598201	4809070

Scale: 0 25 50 100 150 200 m

Client: Bentall Kennedy

Prepared by: MMM GROUP

Date: May 29, 2012

Project No.: 1409222001

Aerial Photo: © DigitalGlobe, 2010, Google, 2009

Figure:

Figure 1. Bat Survey Approach



1 Building

Survey station

Survey No.	Buildling No.
1	1
2	2, 3
3	4, 5
4	1
5	6, 2
6	3, 4
7	5, 6

Aerial Image Source: http://maps.oakville.ca/gxmaps/

- hole in roof

Figure 1. Bat Survey Approach



1 Building

Survey station

Survey No.	Buildling No.
1	1
2	2, 3
3	4, 5
4	1
5	6, 2
6	3, 4
7	5, 6

Aerial Image Source: http://maps.oakville.ca/gxmaps/

- hole in roof

Nicki
channel 1 4 East
5M30331

Figure 1. Bat Survey Approach

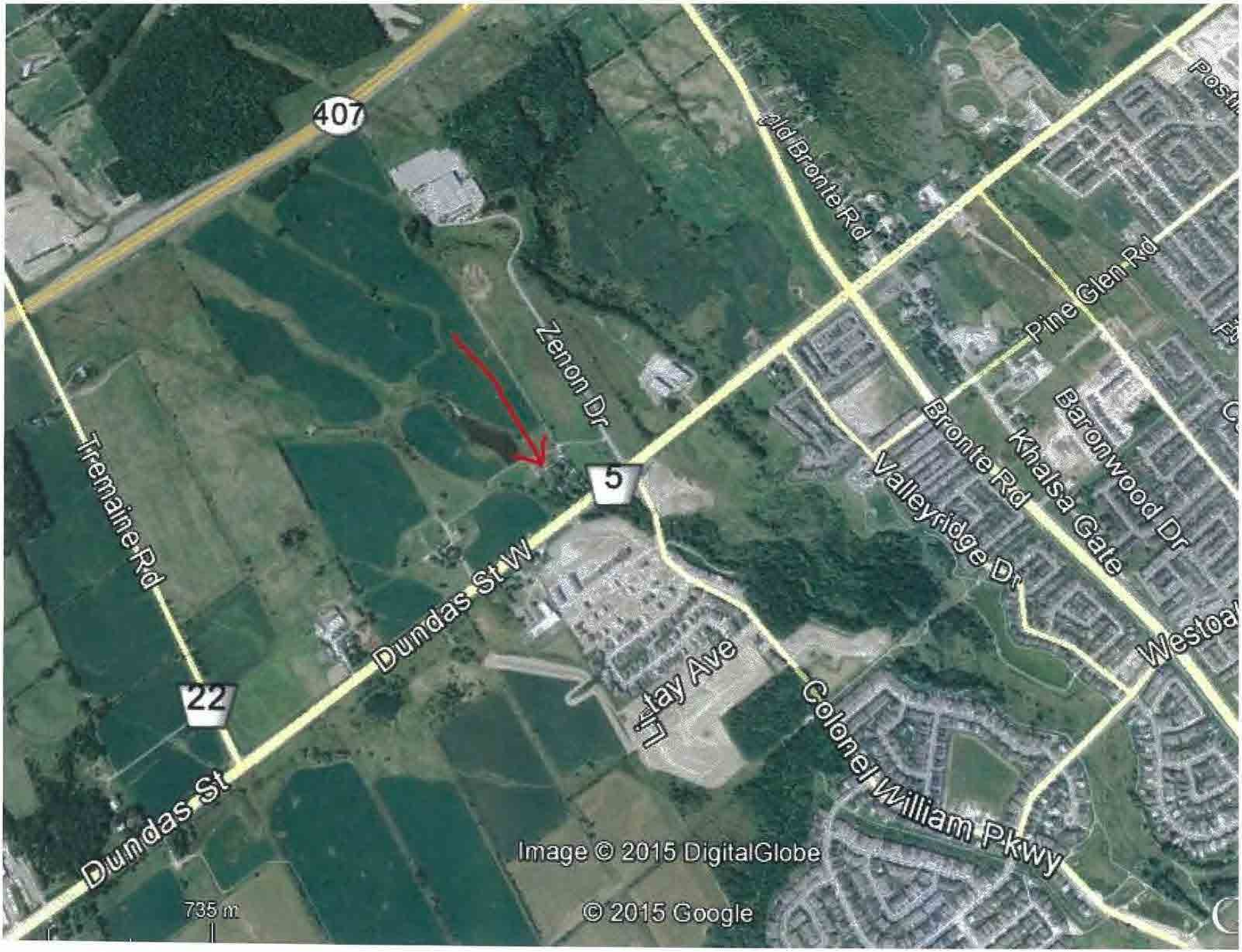


1 Building

Survey station

Survey No.	Buildling No.
1	1
2	2, 3
3	4, 5
4	1
5	6, 2
6	3, 4
7	5, 6

Aerial Image Source: http://maps.oakville.ca/gxmaps/


407
Old Bronte Rd
Pine Glen Rd
Zenon Dr
Tremaine Rd
5
Bronte Rd
Valleyridge Dr
Khalsa Gate
Baronwood Dr
Dundas St W
Tay Ave
22
Dundas St
Colonel William Pkwy
Image © 2015 DigitalGlobe
© 2015 Google
735 m

MMM GROUP

Maternity Roost Exit Survey

Project Number: 1490222 **Observers:** NC **Date:** June 5, 2015

Survey Start Time (HH:MM): 18:57 **Survey End Time (HH:MM)** 22:30

WEATHER CONDITIONS

Sky Code*	Start: 1	End: 1	Wind Code*	Start: 2	End: 2	Temperature (C)	Start: 16	End: 14

OBSERVATIONS OF EXITING BATS

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
West	1	21:36	appeared at centre of barn and flew out to N side

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:26	flying across face towards Dundas / swamp

*Beaufort weather codes are provided on reverse

Observations continued on reverse

Project Number:_____ Observers: _____ Date:_____

OBSERVATIONS OF EXITING BATS (continued)

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

(tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: moderate amount of highway noise

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP **Maternity Roost Exit Survey** Page 1 of 1

Project Number: 1490222 Lazy Pat **Observers:** C. Malcolm **Date:** June 4/15

Survey Start Time (HH:MM): 20:57 **Survey End Time (HH:MM)** 22:27

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 2	End: 2	Temperature (C)	Start: 16	End: 14

OBSERVATIONS OF EXITING BATS

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
S	·①	21:07	Flew S, Exited Top Window
S	·①	21:12	Flew down from Top Window, entered into doorway to wood pile
S	·①	21:18	Flew out of top window to peak of barn, then flew South
S	·①	21:26	Exited Top window, flew South
S	·①	21:31	Exited door to firewood pile, flew South

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
·①	21:24	Circled Mic,
·①	21:37	Bat flew around mic
·①	21:43	Bat flew from E to West at 5 feet above ground

*Beaufort weather codes are provided on reverse

Observations continued on reverse

Project Number: 1490222 Observers: C. Malcolm Date: June 4

OBSERVATIONS OF EXITING BATS (continued)

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

(tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: - High level of traffic to the south.
- Many birds flying around, 1 landed on Mic/setup @ 21:27
- 5 bats observed exiting the barn with 3 observed flying around.
- most bats exiting from Top Window

* ECO 041A MIC-CH 1

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
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3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
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4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Number: 1490222 Bentall/Lazy Pat **Observers:** JM, NC, EM, JE, CH.O **Date:** June 4

Survey Start Time (HH:MM): ~~[illegible]~~ 20:57 **Survey End Time (HH:MM)** 22:27

N truck S

WEATHER CONDITIONS

Sky Code*	Start: 4	End: 2	Wind Code*	Start: 2	End: 2	Temperature (C)	Start: 16°C	End: 14°C

OBSERVATIONS OF EXITING BATS

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
1	1	1	



BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	20:25	Flew east from south side of the barn

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Number: 14902a **Observers:** JM, CM, NC, JE **Date:** June 4

OBSERVATIONS OF EXITING BATS (continued)

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

(tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: - Barn cat present
- Grey tree frogs ~~present~~ in area east of the barn

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
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5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Number: 1409 0222 Lazy-Pat **Observers:** JE **Date:** June 4, 2015

Survey Start Time (HH:MM): 20:57 **Survey End Time (HH:MM)** 22:37

WEATHER CONDITIONS

Sky Code*	Start: 4	End: 0	Wind Code*	Start: 2	End: 1	Temperature (C)	Start: 16°C	End: 14°C

OBSERVATIONS OF EXITING BATS

Target cavity / opening # (N-W)	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
N	1	21:26	- headed west - exited large barn door
N	1	21:37	- headed north - from small barn.

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

*Beaufort weather codes are provided on reverse

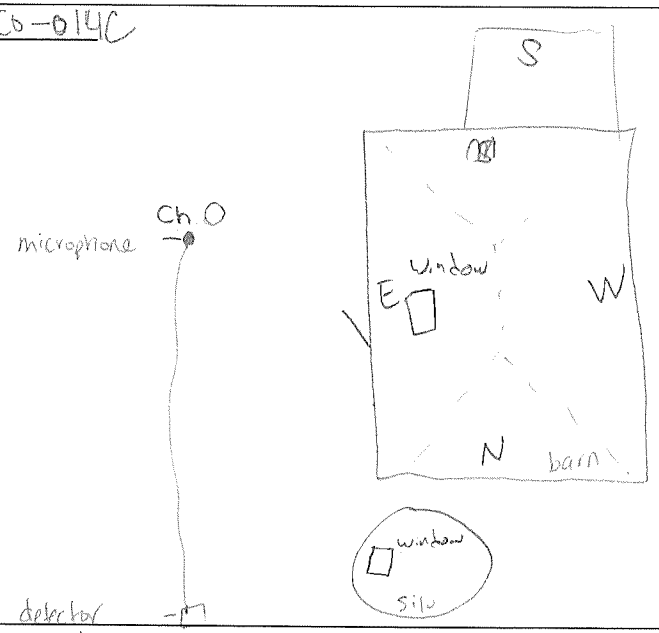
Observations continued on reverse

MMM GROUP

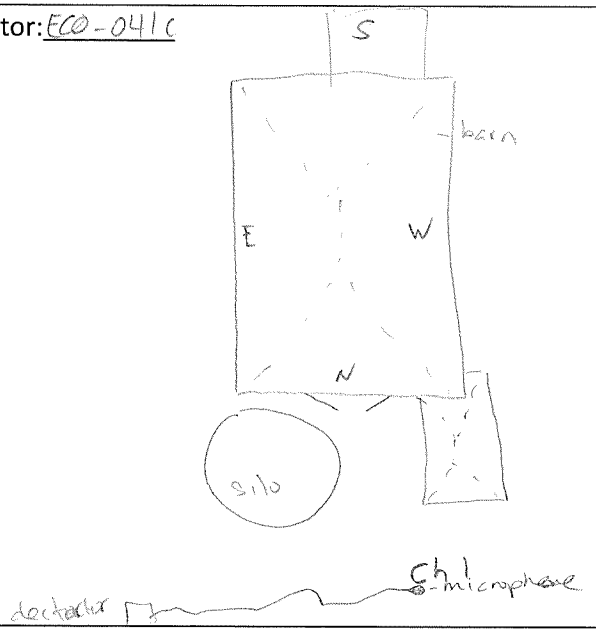
BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Site Sketches – show the position of each deployed detector and its microphone(s) relative to target trees/cavities and surroundings

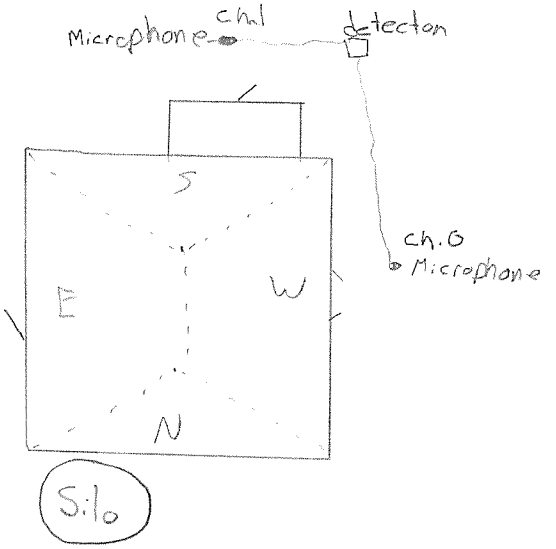
Detector: ECO-014C



Detector: ECO-041C



Detector: ECO_041A



Detector: _____

Bentall - Barn monitoring locations

Figure 1. Bat Survey Approach



Aerial Image Source: http://maps.oakville.ca/gxmaps/

MMM GROUP

BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Project Name: Bentall | **Project Number:** 1490222

WSU / ELC Unit number (if appl): Barn | **Observers:** VC, JM, JE, CM | **Date:** June 4, 2015

Sky Code:	Wind Code:	End temp:
2	2	14

SkyCode: 0 = clear (no cloud cover), 1 = partly cloudy (scattered or broken) or variable, 2 = cloudy or overcast, 3 = sandstorm, duststorm or blowing snow, 4 = fog, smoke, thick dust, or haze, 5 = drizzle or light rain, 6 = rain, 7 = snow or snow/rain mix, 8 = showers, 9 = thunderstorms

Start time: 20:57

WindCode: 0 = calm, smoke rises vertically (0-2km/hr), 1 = Light air movement, smoke drifts (3-5), 2 = Slight breeze, wind felt on face; leaves rustle (6-11), 3= Gentle breeze, leaves & twigs in constant motion (12-19), 4= Moderate breeze, small branches moving, raises dust & loose paper (20-30), 5= Fresh breeze, small trees begin to sway (31-39), 6= Strong breeze, large branches in motion (40-50)

End time: 22:27

Detector label	Mic #, channel	Height (m) of mic	Clutter[1] (no, low, med, high)	UTMs		Photo #	Tree(s) targeted / Building Cavity #	Deployment end date
ECO_041C	0	10	no	0598270	4809155	100-0858	~~south~~ east	June 4, 2015
"	1	~~10~~ 12	no	0598234	4809158	~~58~~ 60	~~south~~ north	"
ECO_041A	0	12	no	0598242	4809131	61	west	"
"	1	12	~~no~~ low	0598274	4809124	59	south	"

Notes (vandalism, equipment problems, notable weather events, etc.):

massive barn w numerous potential openings

*******PROVIDE SITE SKETCHES ON REVERSE*******

[1] Clutter level descriptions/examples

no clutter - a completely open environment such as a field

low clutter – e.g., edge habitat with the microphone oriented out into the largest volume of clear airspace

med clutter - at least a 10m wide travel corridor that is open above, e.g., a 2 lane roadway btw forests

high clutter - a path under a closed canopy or the forest opening around a cavity

MMM GROUP

Maternity Roost Exit Survey

Project Name: 1409022 Project #: Bentall Observer: JM Date: June 11, 15

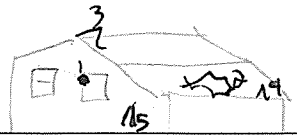
Survey Start Time (HH:MM): 20:30 Survey End Time (HH:MM) 22:30

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21.4	End: 21.1

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
				S to NE
				No bats exited small barn



BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	9:13	S to NE high over buildings
1	9:36	W to east

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat **Project #:** 1409222-001 **Observer:** JM **Date:** June 11/2021

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
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5= Fresh breeze, small trees begin to sway (31-39)
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4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

Cardinals, Robins, Swallows, Grey tree frog, RW Blackbirds

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat Project #: 1409202 Observer: CM Date: June 11/2015

Survey Start Time (HH:MM): 20:30 Survey End Time (HH:MM) 22:30

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21.4	End: 21.1

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
CH 0				
	NO BATS	Exited	Main	House on West side

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:10	Flew from North alagway of house towards South
1	21:12	Flew South to North at 30' above mic
1	21:19	Flew South to North at 10' above mic
2	21:28	Flew North to South at 30' abav mic
1	21:33	Flew North to South at 50' above mic

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat **Project #:** 1409022 **Observer:** CM **Date:** Jun 11/2015

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: -Main house - West side (Mic Location) 17T 0598328 4809134 (Building 4)

-Racoon Crawled off roof

Beaufort Wind Scale
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8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Cat - Bertball **Project #:** 14.09.022 **Observer:** Jenny **Date:** June 11, 201

Survey Start Time (HH:MM): 20:37 **Survey End Time (HH:MM)** 22:31

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21°C	End: 22°C

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3023522 O	3 N	1	21:11	-headed west -exit from NW corner of structure

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

*Beaufort weather codes are provided on reverse

Observations continued on reverse

& North of 2nd (middle building)

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat **Project #:** 1409222 **Observer:** JE **Date:** June 14, 2021

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
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8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall/Lazy Pat **Project #:** 1409222-001 **Observer:** C. Lorenz **Date:** June 11, 2015

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)** 22:30

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21.4°C	End: 21.1°C

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM303321 0	Building 2	0	—	—

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
III	21:20	Flying NE ~10m above small shed

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP **Maternity Roost Exit Survey**

Project Name: Bentall / Lazy Cat **Project #:** 1409222 **Observer:** CL **Date:** June 11/15

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
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Beaufort Sky Codes
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1 = partly cloudy (scattered or broken) or variable
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4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall / Lazy Pat **Project #:** 1409222-001 **Observer:** SCK **Date:** June 11, 2015

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)**

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 7	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21.5°C	End: 21.1°C

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3033221 Channel 1	3W	0	0	

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:11	looped around N → S
2	21:15	went N over house to barn.
1	21:50	flew into house (E)

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Rentall / Lazy Pat **Project #:** 1409222-001 **Observer:** SLK **Date:** June 11, 2015

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

- raccoon

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
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6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

East Side of House. 3

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat **Project #:** 1409222 **Observer:** EWA **Date:** 11/06/15

Survey Start Time (HH:MM): 20:30 PM **Survey End Time (HH:MM)** 22:30 PM.

WEATHER CONDITIONS

Sky Code*	Start: 1	End: 2	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21.4°C	End: 21.1°C

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
NO	OBSERVATIONS.			

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	9:12	flying over structure → NE. from SW
3	9:19	flight from SE to NW → group split north of structure

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name:_____ **Project #:**_____ **Observer:** _____**Date:**_____

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
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4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Number: 1409222-001 **Observers:** A/C **Date:** June 12, 2015

Survey Start Time (HH:MM): 20:31 **Survey End Time (HH:MM)** 22:31

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 0	End: 1	Temperature (C)	Start: 21.5	End: 21.1

OBSERVATIONS OF EXITING BATS

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
BE			NO OBS

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	9:22	Flying above house from west then south
1	9:35	" "

*Beaufort weather codes are provided on reverse

Observations continued on reverse

Project Number:_____ **Observers:** _____ **Date:**_____

OBSERVATIONS OF EXITING BATS (continued)

Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

(tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall/Lazy Pat **Project #:** 1409222-001 **Observer:** RL **Date:** June 10/2015

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)** 22:30

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 8	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 21.4°C	End: 21.1 °C

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
sm303319 Channel 1	4S	NO OBSERVATIONS		

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:10	flew a few circles in yard to South of main house then back N
1	21:28	came from N, flew circles to the W of main house.
1	21:33	fly over from N to S.
1	22:03	fly over from SE to NW

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name:_____ **Project #:**_____ **Observer:** RL **Date:**_____

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
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6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
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5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Project Name: Lazy Pat - Bentall | **Project Number:** 14.09.022

WSU / ELC Unit number (if appl): | **Observers:** JE, SLK, JM, CL, NC, RL, CoM | **Date:** June 11, 2015

Sky Code:	Wind Code:	End temp:
0	1	21.2°C

SkyCode: 0 = clear (no cloud cover), 1 = partly cloudy (scattered or broken) or variable, 2 = cloudy or overcast, 3 = sandstorm, duststorm or blowing snow, 4 = fog, smoke, thick dust, or haze, 5 = drizzle or light rain, 6 = rain, 7 = snow or snow/rain mix, 8 = showers, 9 = thunderstorms

Start time: 20:30

WindCode: 0 = calm, smoke rises vertically (0-2km/hr), 1 = Light air movement, smoke drifts (3-5), 2 = Slight breeze, wind felt on face; leaves rustle (6-11), 3= Gentle breeze, leaves & twigs in constant motion (12-19), 4= Moderate breeze, small branches moving, raises dust & loose paper (20-30), 5= Fresh breeze, small trees begin to sway (31-39), 6= Strong breeze, large branches in motion (40-50)

End time: 22:30

Detector label	Mic #, channel	Height (m) of mic	Clutter[1] (no, low, med, high)	UTMs		Photo #	Tree(s) targeted / Building Cavity #	Deployment end date
SM303322	0	3.5m	med.	177 0598301	4809177		3N	June 11
"	1	3.5m	high	177 0598304	4809164		3W	"
SM303321	0	3.5m	med.	177 0598310	4809196		2E	"
"	1	3.5m	low	177 0598292	4809187	Jenn's phone	2W	"
SM303319	0	3.5m	med	177 0598325	4809130	Courtney's phone	4W	"
"	1	3.5	med	177 0598343	4809125		4S	"
SM303311	1	3.5	med	177 0598345	4809145		4E	"
"	0	3.5	med	177 0598323	4809187		3E	"

Notes (vandalism, equipment problems, notable weather events, etc.):

*******PROVIDE SITE SKETCHES ON REVERSE*******

[1] Clutter level descriptions/examples

no clutter - a completely open environment such as a field

low clutter – e.g., edge habitat with the microphone oriented out into the largest volume of clear airspace

med clutter - at least a 10m wide travel corridor that is open above, e.g., a 2 lane roadway btw forests

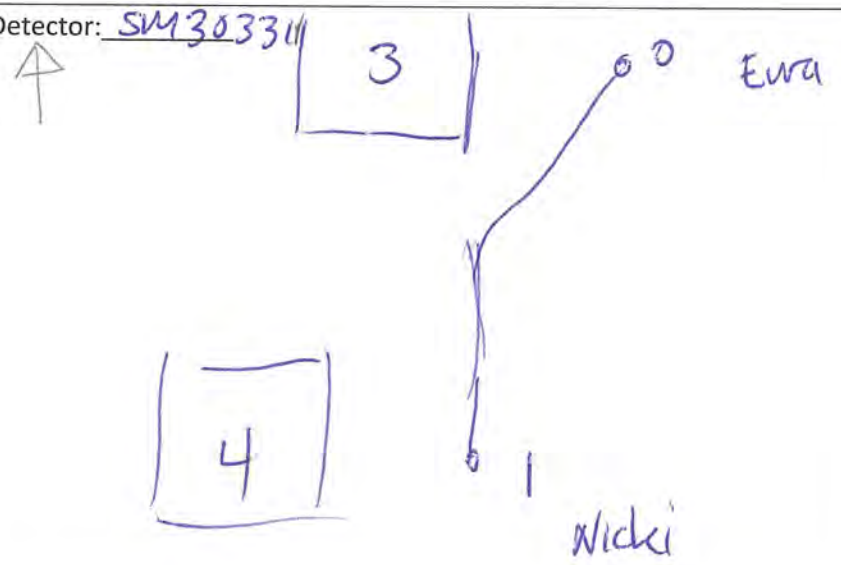
high clutter - a path under a closed canopy or the forest opening around a cavity

MMM GROUP

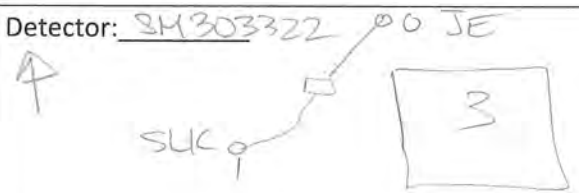
BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Site Sketches – show the position of each deployed detector and its microphone(s) relative to target trees/cavities and surroundings

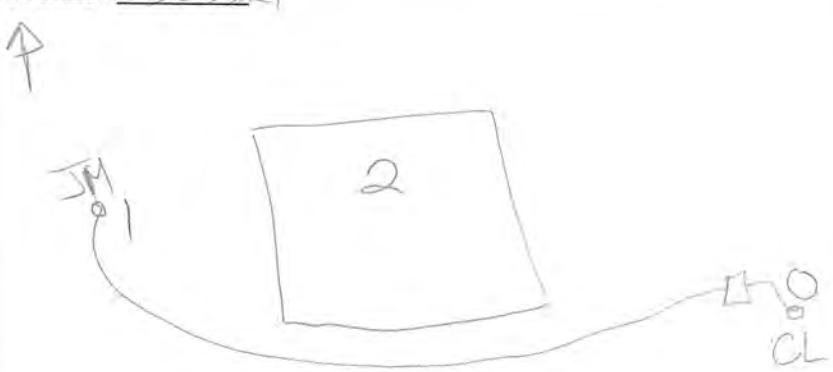
Detector: SM303311



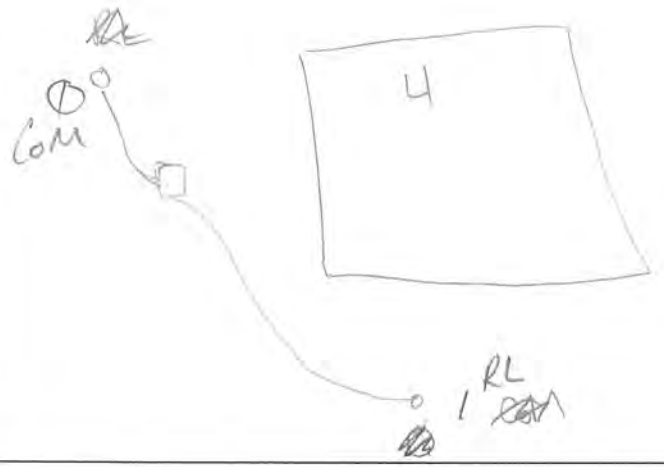
Detector: SM303322



Detector: SM303321



Detector: SM303319



MMM GROUP **Maternity Roost Exit Survey** - ENG Page 1 of 4

Project Name: Lazy Bat / Bentall **Project #:** 1409222-001 **Observer:** LNF **Date:** 6/16/15

Survey Start Time (HH:MM): 20:33 **Survey End Time (HH:MM)** 22:03 RH 55% RH 64%

WEATHER CONDITIONS

Sky Code*	Start: 0	End: 0	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 21.3	End: 18.6

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3033241 ch.0	NO Observations			

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
2	21:23	feeding
2	21:24	"
3	21:24	swooping low (2 meters)
3	21:25	swooping / foraging (vocalized and chased each other).
1	21:26	foraging low over lawn (2-5 m overhead).

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP **Maternity Roost Exit Survey** Page 2 of 4

Project Name: Lazy Pat / Bentall **Project #:** 1409222-001-ENG **Observer:** LJF **Date:** 6/16/15

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
		2	21:25	" " " "
			21:36	

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
3	21:27	foraging low (in from W).
3	21:29	chasing each other, feeding, vocalizing.
2	21:30	overhead every which way.
1	21:31	swooped low from NW to S
2	21:32	foraging over lawn.
1	21:33	swooped for food
1	21:34	" "

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP **Maternity Roost Exit Survey** Page 3 of 4

Project Name: Lazy Lat / Bentall **Project #:** 1409222-001 - ENG **Observer:** WF **Date:** 6/16/15

Survey Start Time (HH:MM): 20:33 **Survey End Time (HH:MM)** 22:03 RH start - 55%. END - 6

WEATHER CONDITIONS

Sky Code*	Start: ○	End: ◔	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 21.3	End: 18.6

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
2	21:35	foraging over lawn.
2	21:36	" "
1	21:38	" "
2	21:39	" " swooped low overhead.
1	21:40	from W swooping all over the place.

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat / Bentall **Project #:** 1469227-001 -ENG **Observer:** LSF **Date:** June 16/2015

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:45	higher flying (15+m). SW to N, foraging.
1	21:50	(maybe) just heard.
1	22:00	looked like it flew right at the mic pole / building window.

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
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3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazyfat / Bentall **Project #:** 1409222-001-ENV **Observer:** [illegible] **Date:** June 16/2015

Survey Start Time (HH:MM): 20:33 **Survey End Time (HH:MM)** 22:03 RH: 55% - 64% end

WEATHER CONDITIONS

Sky Code*	Start: 0	End: 0	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 21.3	End: 18.6

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
sm3033321 CH 1	MIC# 7	-	NO	Observations

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
(1)	21:21	Flew from the N towards S ~8" above mic
(2) occurances	21:23	Circling around - 2 different bats
(3)	21:24	Circling - 3 different bats
(3)	21:25	Circling - 3 different bats
(2)	21:27	Circling - 2 bats

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP **Maternity Roost Exit Survey** Page 2 of 3

Project Name: Lazy Pat / Bentall **Project #:** 1409222-001-ENG **Observer:** Cam **Date:** June 16/20

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
1:3	2			

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
(2)	21:30	2 different bats Circling
(1)	21:32	Flying from NE to NW
(1)	21:33	Flying from S towards N
(1)	21:34	Flying from S towards N
(1)	21:35	Flying from N towards S then E

Notes: Incidental Wildlife - Barn Swallow, GRTR, Catbird,

* Many bats circling but none observed exiting Pool/change room

- Dundas Street Traffic noise

Beaufort Wind Scale
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6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat / Bentall **Project #:** 1409222-00 -ENG **Observer:** Cam **Date:** June 16/20

Survey Start Time (HH:MM): 20:33 **Survey End Time (HH:MM)** 22:03

WEATHER CONDITIONS

Sky Code*	Start: 0	End: 0	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 21.3	End: 18.6

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM30332	1	CH 1	1	– No Observations

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
(1)	21:39	Flying from N towards SE
(1)	21:45	Flew Corner (NW) to Corner (SE) of pool

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name:_____ **Project #:**_____ **Observer:** _____**Date:**_____

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
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8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lady Pool / Bertrell Project #: 1409222 Observer: SL Date: June 16/2015

Survey Start Time (HH:MM): 20:33 Survey End Time (HH:MM) 22:03 start RH 59%

WEATHER CONDITIONS

Sky Code*	Start: 0	End: 0	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 21.3	End: 18.6

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3B3532 Channel 1	—	No Observations		

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
20	21:23 - 21:34	foraging overhead, circling from NW & SE
4	21:39 - 21:41	" "

*Beaufort weather codes are provided on reverse

Observations continued on reverse

UTM 17T 598301E 4589093N

MMM GROUP

Maternity Roost Exit Survey

Project Name: LazyPat / Bentall Project #: 1409222-001 -ENG Observer: SL Date: June 16/2015

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: GRTR - Calling from behind

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
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2 = Slight breeze, wind felt on face; leaves rustle (6-11)
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6= Strong breeze, large branches in motion (40-50)

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6 = rain
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8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat / Bentall **Project #:** 1409222-001 - ENG **Observer:** R LeCraw **Date:** June 16/2015

Survey Start Time (HH:MM): 20:33 **Survey End Time (HH:MM)** 22:03 RH: 55 end 6

WEATHER CONDITIONS

Sky Code*	Start: 0	End: 0	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 21.3	End: 18.6

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3033220 ch-0	Building 5-SE 0	NO	OBSERVATIONS	

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1 (1)	21:23	from field to N past to S. 2 or 3 times - largeish
1111 (4)	21:24	circling in field next to barn to N - constantly. (moved off by 21:40)
11 (2)	21:32	circling behind trees to W of building

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat / Bentall **Project #:** 1409222 **Observer:** R LeCraw **Date:** June 16/201

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: Spruce Tree overhanging station, mic, + roof line – hardly any sky backdrop to see bats.
- Great Blue Heron obs flying over

Beaufort Wind Scale
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2 = Slight breeze, wind felt on face; leaves rustle (6-11)
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7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Project Name: Lazy Pat / Bentall | **Project Number:** 1409222-001-ENG

WSU / ELC Unit number (if appl): N/A | **Observers:** RL, LF, SL, CoM | **Date:** June 16/2015

Sky Code:	Wind Code:	End temp:
0	1	18.6

SkyCode: 0 = clear (no cloud cover), 1 = partly cloudy (scattered or broken) or variable, 2 = cloudy or overcast, 3 = sandstorm, duststorm or blowing snow, 4 = fog, smoke, thick dust, or haze, 5 = drizzle or light rain, 6 = rain, 7 = snow or snow/rain mix, 8 = showers, 9 = thunderstorms

Start time: 20:33

WindCode: 0 = calm, smoke rises vertically (0-2km/hr), 1 = Light air movement, smoke drifts (3-5), 2 = Slight breeze, wind felt on face; leaves rustle (6-11), 3= Gentle breeze, leaves & twigs in constant motion (12-19), 4= Moderate breeze, small branches moving, raises dust & loose paper (20-30), 5= Fresh breeze, small trees begin to sway (31-39), 6= Strong breeze, large branches in motion (40-50)

End time: 22:03

Serial #	Mic #, channel	Height (m) of mic	Clutter[1] (no, low, med, high)	UTMs 17T (Easting)	UTMs (Northing)	Photo #	Tree(s) targeted / Building Cavity #	Deployment end date
SM3B3322	0	3.5	High	598316	4809120	Robins Com - 451	Building	June 16/15
" "	1	3.5	Med	598299	4809107	" " - 450	" "	" "
SM3B3321	1	3.0	Med	598334	4809092	" " - 452	" "	" "
" "	0	3.0	Med	598340	4809097	" " - 453-54	" "	" "

Notes (vandalism, equipment problems, notable weather events, etc.):

- Nothing noteworthy about weather events recently and no issues with the equipment setup or removal.

*******PROVIDE SITE SKETCHES ON REVERSE*******

[1] Clutter level descriptions/examples

no clutter - a completely open environment such as a field

low clutter – e.g., edge habitat with the microphone oriented out into the largest volume of clear airspace

med clutter - at least a 10m wide travel corridor that is open above, e.g., a 2 lane roadway btw forests

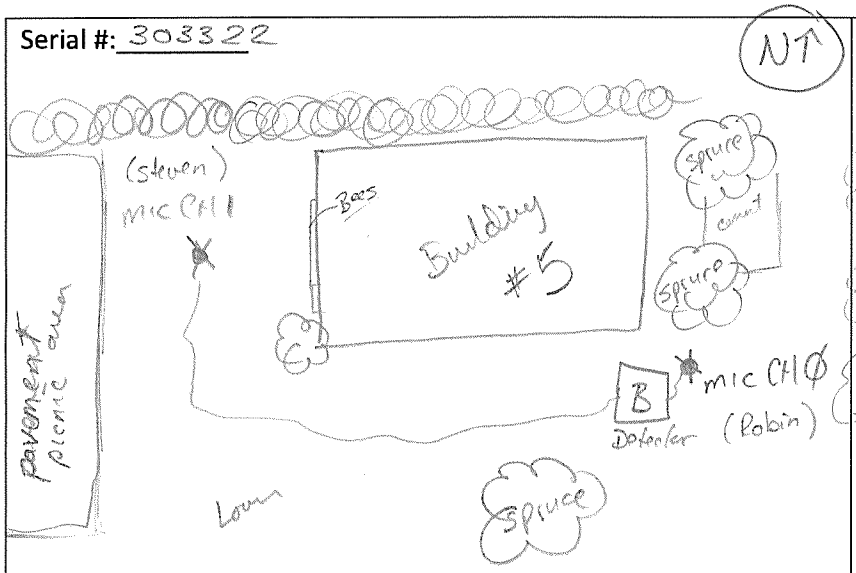
high clutter - a path under a closed canopy or the forest opening around a cavity

MMM GROUP

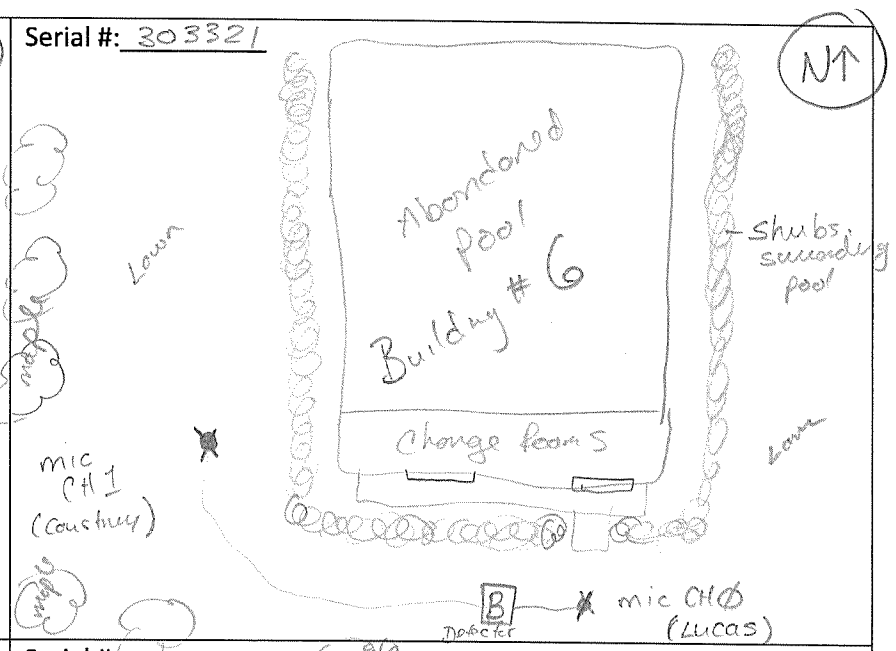
BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Site Sketches – show the position of each deployed detector and its microphone(s) relative to target trees/cavities and surroundings

Serial #: 303322



Serial #: 303321



Serial #: _____

Serial #: _____

MMM GROUP **Maternity Roost Exit Survey** Page 1 of 2

Project Name: Lazy Bat/Bonta **Project #:** 1409282 **Observer:** JM **Date:** July 13

Survey Start Time (HH:MM): 20:31 **Survey End Time (HH:MM)** 22:31

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 23	End: 22

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM 303319 CH0	House #3 Northside			

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:21	W to E in front of building
1	21:25	E to W around the building
1	21:31	SE to NW over building
1	21:38	"
1	21:42	Flying around N Ledge

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall / Lazy Pt **Project #:** 1409202 **Observer:** JM **Date:** July 13/15

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:48	W to E (looked as if it exited NW corner)
1	22:58	N to S above building (high)

Notes: 2 cardinals } - flying SE
1 Blue heron
Lots of barn swallows (2 nests in N door)
1 orange cat on east side

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall/Keay Rd Project #: 1409222 Observer: CM Date: July 13/15

Survey Start Time (HH:MM): 20:31 Survey End Time (HH:MM) 22:31

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 23	End: 22

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
sm303319 CH1	House - #3 EASTSIDE	1	21:25	Flew from house towards the north.

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:48	Flew from the North towards South

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP **Maternity Roost Exit Survey** Page 2 of 2

Project Name: Bentall / LazyRat **Project #:** 1409222 **Observer:** Cam **Date:** July 13/15

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: I was observing 2 stations @ #3 building (S + E) sides

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

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0 = clear (no cloud cover)
1 = partly cloudy (scattered or broken) or variable
2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP **Maternity Roost Exit Survey** Page 1 of 2

Project Name: Bentall / Lazy Pat **Project #:** 1409222 **Observer:** Cam **Date:** July 13/15

Survey Start Time (HH:MM): 20:31 **Survey End Time (HH:MM)** 22:31

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 23	End: 22

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
sm303322 CH1	House #3 Southside	NO OBS		

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
NO OBS		

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bonnell / Lazy Pat **Project #:** 1409222 **Observer:** CAM **Date:** July 13/15

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes: I observed 2 stations @ #3 building (S & Z) sides

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
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Beaufort Sky Codes
0 = clear (no cloud cover)
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6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Beatall / Lazy Dat **Project #:** 1409222 **Observer:** LF **Date:** 7/13/15

Survey Start Time (HH:MM): 20:31 **Survey End Time (HH:MM)** 22:31

WEATHER CONDITIONS

Sky Code*	Start: 2	End: 2	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 23°C	End: 22

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM-303322 CH 0	W SIDE HOUSE 3			

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:25	from NW, right by the mic. (low)
1	21:30	from S, flew over house and back. (higher than the house)
1	21:38	from S, 2-3x height of house.
1	21:46	from W, low over my head.
1	22:09	* thought I heard a bat...

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall / Lazy Pat **Project #:** 1409222 **Observer:** LF. **Date:** 7/13/15

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	22:27	from SW, very low and flew right at the building.

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
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0 = clear (no cloud cover)
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2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall Lazy Cat **Project #:** 1409222 **Observer:** RLeCraw **Date:** July 13/2014

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)** 22:30

WEATHER CONDITIONS

Sky Code*	Start: 1	End: 1	Wind Code*	Start: 0	End: 1	Temperature (C):	Start: 26°C	End: 24°C

OBSERVATIONS OF EXITING BATS

Serial #/ Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3B03311 Ch. 0	S	2	21:15	exited top + flew S.
		1	21:16	exited top + flew S
		1	21:17	"
		(2)	21:21	"
		(2)	21:22	"
		1	22:08	"

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

(tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:19	from E past barn + to S.
(2)	21:28	one from N to S. (W side of barn) are from E to S.
1	22:21	Returning from S to top opening
1	22:25	From E - circle around lawn

*Beaufort weather codes are provided on reverse

Observations continued on reverse

5

Project Name:_____ **Project #:**_____ **Observer:** _____**Date:**_____

OBSERVATIONS OF EXITING BATS (continued)				
Serial #/ Channel	**Target cavity / opening #**	**bats observed exiting (tally or #)**	**Time of observation (hh:mm)**	**Notes on flight path and behaviour**

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)		
(tally or #)	**Time of observation (hh:mm)**	**Notes on flight path and behaviour**

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
4= Moderate breeze, small branches moving, raises dust & loose paper (20-30);
5= Fresh breeze, small trees begin to sway (31-39)
6= Strong breeze, large branches in motion (40-50)

Beaufort Sky Codes
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4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall **Project #:** 1409222 **Observer:** MD **Date:** Jul. 13/2015

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)** 22:30

WEATHER CONDITIONS

Sky Code*	Start: 1	End: 1	Wind Code*	Start: 1	End: 0	Temperature (C):	Start: 23	End: 22

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM3 03311 ch. 1	1	1	21:34	SW
"	1	1	21:38	SE

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	22:24	flying 5m from barn, heading E

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name:_____ **Project #:**_____ **Observer:** _____**Date:**_____

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
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0 = clear (no cloud cover)
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2 = cloudy or overcast
3 = sandstorm, duststorm or blowing snow
4 = fog, smoke, thick dust, or haze
5 = drizzle or light rain
6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

Take a photo!

MMM GROUP

Maternity Roost Exit Survey

Project Name: Lazy Pat - Brattall **Project #:** 1469222 **Observer:** JE **Date:** July 13

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)** 22:32

WEATHER CONDITIONS

Sky Code*	Start: 1	End: 1	Wind Code*	Start: 1	End: 1	Temperature (C):	Start: 24°C	End: 23°C

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM303328 1	North Barn	0		None observed exiting

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	21:32	flying west

*Beaufort weather codes are provided on reverse

Observations continued on reverse

- Barn swallow
- Bull frogs

MMM GROUP

Maternity Roost Exit Survey

Project Name:_____ **Project #:**_____ **Observer:** _____**Date:**_____

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

Beaufort Wind Scale
0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
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6 = rain
7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

Take a photo of the set

MMM GROUP **Maternity Roost Exit Survey** Page 1 of 2

Project Name: Bentall / Lazy Pat **Project #:** 1409222 **Observer:** SL **Date:** July 13/2015

Survey Start Time (HH:MM): 20:30 **Survey End Time (HH:MM)** 22:30

WEATHER CONDITIONS

Sky Code*	Start: 1	End: 2	Wind Code*	Start: 2	End: 0	Temperature (C):	Start: 28	End: 21

OBSERVATIONS OF EXITING BATS

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour
SM303328 0	Barn East	1	21:21	-out lower door, flew E

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour
1	22:19	foraging over lawn E of Barn

*Beaufort weather codes are provided on reverse

Observations continued on reverse

MMM GROUP

Maternity Roost Exit Survey

Project Name: Bentall/Lazy Pat **Project #:** 1409222 **Observer:** SC **Date:** July 13/2015

OBSERVATIONS OF EXITING BATS (continued)

Serial # & Channel	Target cavity / opening #	bats observed exiting (tally or #)	Time of observation (hh:mm)	Notes on flight path and behaviour

BATS OBSERVED IN GENERAL AREA (NOT SEEN EXITING)

Tally or #	Time of observation (hh:mm)	Notes on flight path and behaviour

Notes:

- 3 cavities visible from this spot
- many BARS foraging around sunset

Beaufort Wind Scale

0 = calm, smoke rises vertically (0-2km/hr)
1 = Light air movement, smoke drifts (3-5)
2 = Slight breeze, wind felt on face; leaves rustle (6-11)
3= Gentle breeze, leaves & twigs in constant motion (12-19)
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7 = snow or snow/rain mix
8 = showers
9 = thunderstorms

MMM GROUP

BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Project Name: Bewtall / Lazy Pat **Project Number:** 1409222

WSU / ELC Unit number (if appl): **Observers:** SoM, LE, SL, JM, MD, RL **Date:** 7/13/15

Sky Code:	Wind Code:	End temp:
1	1	22°C

SkyCode: 0 = clear (no cloud cover), 1 = partly cloudy (scattered or broken) or variable, 2 = cloudy or overcast, 3 = sandstorm, duststorm or blowing snow, 4 = fog, smoke, thick dust, or haze, 5 = drizzle or light rain, 6 = rain, 7 = snow or snow/rain mix, 8 = showers, 9 = thunderstorms

Start time: 20:31

WindCode: 0 = calm, smoke rises vertically (0-2km/hr), 1 = Light air movement, smoke drifts (3-5), 2 = Slight breeze, wind felt on face; leaves rustle (6-11), 3= Gentle breeze, leaves & twigs in constant motion (12-19), 4= Moderate breeze, small branches moving, raises dust & loose paper (20-30), 5= Fresh breeze, small trees begin to sway (31-39), 6= Strong breeze, large branches in motion (40-50)

End time: 22:31

Serial #	Mic #, channel	Height (m) of mic	Clutter[1] (no, low, med, high)	UTMs (Easting)	UTMs (Northing)	Photo #	Tree(s) targeted / Building Cavity #	Deployment end date
SM3033319	0	3	low	17T 598299	4809178	7:55 x2	3	7/13/15
" "	1		low	598317	4809180	7:56 x2	3	"
SM303322	1		med	598320	4809168	7:59 + 8:00	3	"
" "	0		med.	598302	4809165	8:00 x2	3	"
SM303311	0		low	598273	4809121	8:03 x2	1	"
" "	1		low	598242	4809130	8:05 x2	1	"
SM303328	1		low	598236	4809155	8:06 x2	1	"
" "	0		low	598261	4809157	8:07 x2	1	"

5
6
7
4

Notes (vandalism, equipment problems, notable weather events, etc.):

*******PROVIDE SITE SKETCHES ON REVERSE*******

[1] Clutter level descriptions/examples

no clutter - a completely open environment such as a field

low clutter – e.g., edge habitat with the microphone oriented out into the largest volume of clear airspace

med clutter - at least a 10m wide travel corridor that is open above, e.g., a 2 lane roadway btw forests

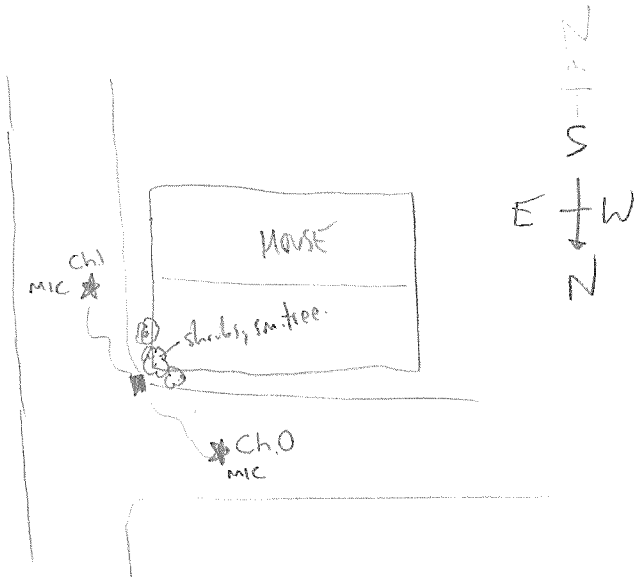
high clutter - a path under a closed canopy or the forest opening around a cavity

MMM GROUP

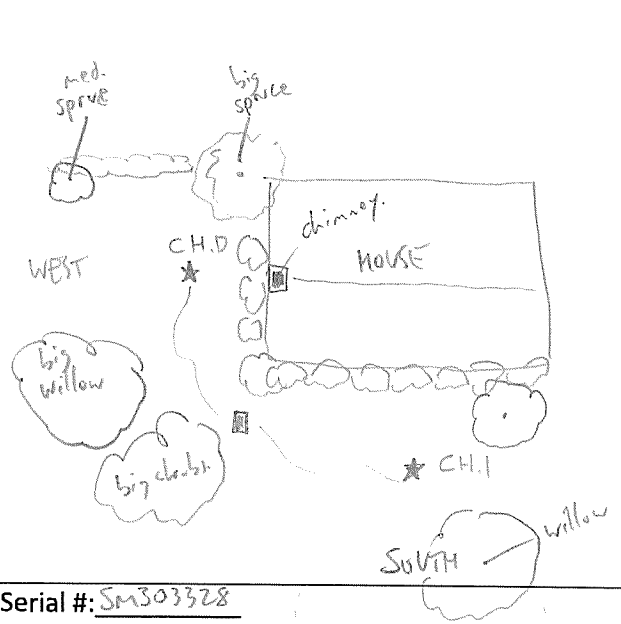
BAT DETECTOR DEPLOYMENT SUMMARY DATASHEET

Site Sketches – show the position of each deployed detector and its microphone(s) relative to target trees/cavities and surroundings

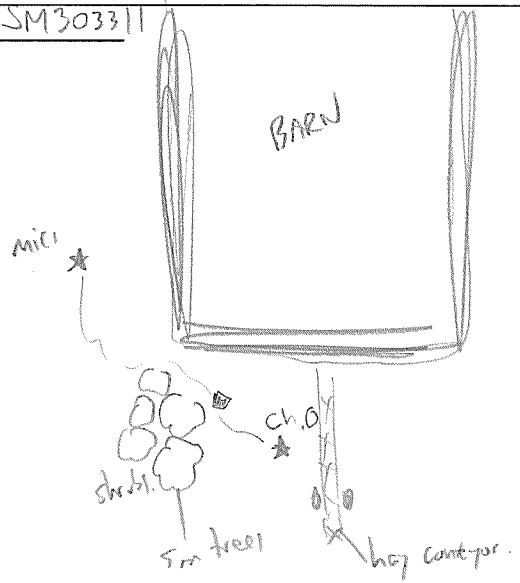
Serial #: SM303319



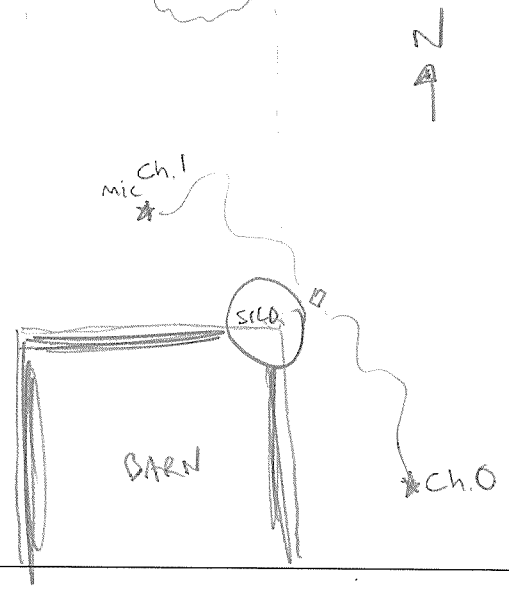
Serial #: SM303322



Serial #: SM303311



Serial #: SM303328



Appendix 5.8 – Selected Agency Communications

MMM GROUP

Contact Record

Telephone Conversation:

Details of the communication, including who called whom and the contact information for the person in the conversation

Kim Barrett-voicemail: requested call back regarding North Oakville Subwatershed management strategy. Mediation Item-temp/d.o.

Address:

Telephone: 9053361158 Ex. Fax Number:

E-mail Address:

Other (specify):

DATE:	30/03/2009	**TIME:**	
BETWEEN:	Sonia Rankin MMM	**AND:**	Kim Barrett CONSERVATION HALTON
SUBJECT:	Guidance: Bentall Property-water monitoring requirements		
KEYWORD(S):	Water Quality, Monitoring	**REF FILE:**	
COPIES TO:	Mark Cece		

Details of Discussion

Temperature & DO monitoring in an intermittent watercourse in reach 14W-12 (Fourteen Mile Creek)

Kim indicated that we should place the loggers in a location that will likely remain wet and allow the logger to be submerged throughout the season. Therefore, the furthest downstream in the watercourse to be sampled.

DO Monitoring can be accomplished through frequent sampling.

Frequent downloading of the loggers is recommended to ensure that they are not exposed.

MMM GROUP

Contact Record

Telephone Conversation:

Details of the communication, including who called whom and the contact information for the person in the conversation

Karen Bennett was called on Monday March 30, 2009

Samantha Mason returned the message on Tuesday March 31, 2009

Address:

Telephone: Ex. 267 Fax Number:

E-mail Address:

Other (specify):

DATE:	31/03/2009	**TIME:**	1308		
BETWEEN:	Sonia Rankin MMM			**AND:**	Samantha Mason HALTON CONSERVATION
SUBJECT:	Temperature and DO monitoring per the North Oakville subwatershed management strategy				
KEYWORD(S):				**REF FILE:**	
COPIES TO:	Mark Cece				

Details of Discussion

Discussed the level of reporting and monitoring that would be required to determine the temperature and DO levels in watercourses that have been determined to be intermittent.

Samantha indicated that temperature loggers would be ideal, installed in several locations, including an area downstream that is known to maintain flow throughout the summer. In addition to install loggers within pools or deeper areas within the intermittent sections of the watercourse.

Measuring DO levels should be conducted during "heat waves" to document the worst case scenario. This should be compared to conditions during higher flows to see the variance in DO levels.

Ontario

Ministry of
Natural Resources

Ministère des
Richesses naturelles

50 Bloomington Road West
Aurora, ON
L4G 3G8

Mark Cece
MMM Group Limited
100 Commerce Valley Drive West
Thornhill, Ontario
L3T 0A1

Dear Mr.Cece:

Please find enclosed a Licence to Collect Fish for Scientific Purposes # 1052019.

Please sign the enclosed licences in the space marked "Signature of Licencee" on both the licence and the attached conditions schedule. Your signature is acknowledgement that you understand and agree to the terms and conditions of the licence. Return both signed copies to our office. You will receive your copy of the licence once it has been issued. Please note the licence is not valid until you have received the issued copy..

If you wish to expedite the signing of our licence, you **must call in advance** to request an appointment with the appropriate representative.

Please note that all collections and sampling must be in compliance with the best management practices identified in the enclosed technical bulletin. A fish disease known as Viral Hemorrhagic Septicemia (VHS) has been confirmed in the lower Great Lakes and some inland tributaries. A map has been enclosed with your licence to assist you in determining the location of your work site(s) in relation to Ontario's VHS management zone where waters are considered to be VHS positive. Please feel free to contact us should you have any questions regarding the definition of VHS positive waters.

A completed Field Collection Record (FCR) is required for each sampling location. FCR's must be properly completed, including the site UTM coordinates. Incomplete forms will be returned and may delay the issuance of future licenses. A blank FCR is enclosed. Please copy the attached form as required and ensure that the Scientific Collector Licence number is marked on each page.

FCR's for licence # 1052019 must be submitted by January 31, 2010.

Please contact me if you have any questions.

Yours truly,

K. Golby

Karen Golby
Resource Management Clerk
Aurora District Office
Tel : (905-) 713-7403
Fax: (905-) 713-7361
karen.golby@ontario.ca

Ontario

Ministry of Natural Resources

Ministère des Richesses naturelles

Licence to Collect Fish for Scientific Purposes

Permis pour faire la collecte de poissons à des fins scientifiques

Licence No. / N° de permis	1052019
Local Reference No. / N° de référence local	
Issuer Account No. / N° de compte du delivreur de permis.	7491147

This licence is issued under Part I of the Fish Licensing Regulation made under the Fish and Wildlife Conservation Act, 1997 to:

Ce permis est délivré en vertu de la Partie I du règlement sur la délivrance de permis de pêche formulé conformément à la Loi sur la protection du poisson et de la faune de 1997 à:

	Last Name / Nom de famille	First Name / Prénom	Middle Name / Second Prénom
Name of Licencee / **Nom du titulaire du permis**	Mr. Cece	Mark	

Name of Business/Organization/Affiliation (if applicable) / Nom de l'entreprise/de l'organisme/de l'affiliation (le cas échéant)

MMM Group Limited

Mailing address of Licencee / *Adresse postale du titulaire du permis*

Street Name & No./PO Box/RR#/Gen. Del./ N° rue/C.P./R.R./poste restante

100 Commerce Valley Drive West

City/Town/Municipality / Ville/village/municipalité	Province/State / Province/Etat	Postal Code/Zip Code / Code Postal/Zip
Thornhill	ON	L3T 0A1

to collect the species, size and quantites of fish from the waters as set out below.

Pour faire la collecte des espèces suivantes (stade et nombre indiqués ci-dessous):

Species / Espèces	Eggs / Oeuf	Juvenile / Fretin	Adults / Adulte	Numbers / Nombre	Name of Waterbody / Nom de l'étendue d'eau
	X	X	X		
fish		X	X		Fourteen Mile Creek

Yes/Oui ☐ Additional species/Waterbody list attached / Liste d'espèces/d'étendue d'eau additionnelles ci-jointe

Purpose of collection / *But de la collecte*: fish community sampling

Licence Dates / *Dates du permis*

Effective Date / Date d'entrée en vigueur (YYYY-MM-DD)	Expiry Date / Date d'expiration (YYYY-MM-DD)
2009-06-22	2009-12-31

Licence conditions: This licence is subject to the conditions contained in Schedule A if included. / Ce permis doit respecter les conditions de l'annexe A si celle-ci est jointe.

Conditions du permis: Yes/Oui ☒ No/Non ☐ Schedule A included. / Annexe A ci-jointe

Issued by (please print) / Délivré par (veuillez écrire en caractères d'imprimerie)	Signature of Issuer / Signature du délivreur	Date of Issue/Date de délivrance (YYYY-MM-DD)
John Almond	John Almond	2009-06-22

Signature of Licencee / Signature du titulaire du permis	Date (YYYY-MM-DD)
	2009-06-22

Personal information contained on this form is collected under the authority of the Fish and Wildlife Conservation Act, 1997 and will be used for the purpose of licencing, identification, enforcement, resource management and customer service surveys. Please direct further inquiries to the District Manager of the MNR issuing district.

Les renseignements personnels dans ce formulaire sont recueillis conformément à la Loi sur la protection du poisson de la faune, 1997 , et ils seront utilisés aux fins de délivrance de permis, d'identification, d'application des règlements, de gestion des ressources et de sondage sur les services a la clientèle. Veuillez communiquer avec le chef du district du MRN qui délivré le permis si vous avez des questions.

FW0032 (04/00)

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1052019
No de permis

This licence is subject to the conditions listed below.

1. Licencee may collect fish in Fourteen Mile Creek West tributaries, north of Dundas, east of Hwy 25 above the confluence of the three tributaries, located in the City of Oakville, Regional Municipality of Halton.

2. This Licence is valid only for the persons, species, numbers, areas and calendar year indicated. A written report covering the operation of the preceding year must be submitted to the licence issuer within 30 days of the termination date, but in no case later than January 31 next following the year of issue. The report shall contain a statement outlining the objectives of the operations, the methods used, the number and species of fish caught and their fate as well as a map indicating where the collections took place. **A completed Field Collection record (FCR) must be submitted for each station where sampling occurred.** An analysis is not required. The submission of a satisfactory report and completed FCR's is a prerequisite to any subsequent renewals.

3. Before carrying out any operation under the licence in any area the licenced person shall inform the Area Supervisor or Lake Manager of his or her intentions at least a week before commencing work and include information as to the type of operation, location, duration, and the name or names of personnel involved.

4. A copy of the original licence must be carried by the licenced person when working at the designated sites. An assistant of the licenced person who is carrying out activities under this licence during the absence of the licenced person shall carry a copy of the licence on his or her person.

5. All collection gear shall be clearly marked with the licenced person's and the organization's name.

6. This licence is not valid in Provincial Parks, park reserves, or National Parks without the written permission from the authorized person in charge of the area concerned.

7. Capture gear shall be inspected regularly and live holding traps must be inspected at least once daily.

8. **The licencee shall follow the best management practices for the collection, handling, transportation and holding of fish identified in FS Bulletin 2008-01 (June 10, 2008) included with the licence in order to minimize the risk of spreading aquatic invasive species and diseases.**

9. Licencee must release all fish live at the capture site with the exception of any specimens required for identification purposes.

10. Licencee must photograph and release live any redside dace captured. The photographs must be forwarded to MNR's Aurora District office for identification confirmation.

11. Any person, while acting under the authority of this authorization, shall immediately report the capture of any invasive species (eg. Ruffe, tubenose goby,**round goby**, rusty crayfish, Asian carp, etc.) found outside its previously known range (as determined by the distribution information available at http://www.invadingspecies.com/indexen.cfm to the licence issuing office. Any such specimens captured outside of their established range (not already naturalized) **shall be euthanized**, not returned to the water and kept for identification purposes.

12. Licencee may fish with a backpack electrofisher, pot trap and minnow trap.

Signature of Licencee / Signature du titulaire du permis **Date**

June 29/09

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1052019
No de permis

13. Licencee may be assisted by Sonia Rankin, Joel Smith and Alexander Stettler.

Signature of Licencee / Signature du titulaire du permis

Date

June 29/09

COLLECTION OF FISH FOR SCIENTIFIC PURPOSES

The Ministry of Natural Resources is implementing control measures to slow and limit the spread of **Viral Hemorrhagic Septicemia (VHS)** into new waters. The virus that causes VHS can be destroyed by disinfection treatments, drying or heat. However, it is capable of surviving on any inanimate object that is not thoroughly dried between uses.

VHS Positive Waters include the waters of Lakes Ontario, Erie and Huron (including Georgian Bay), their connecting waterways and adjacent tributaries, up to the first impassable barrier for all fish species. Where fish are manually transferred over barriers or pass through a fishway, that barrier will not be considered to be impassable. Low head lamprey weirs or dams that do not normally stop salmonid passage also are not considered impassable.

VHS Management Zone includes the area bounded by provincial roads that encompasses VHS Positive Waters (see map at http://www.mnr.gov.on.ca/239480.pdf).

The Best Management Practices described in this document should be followed by all personnel involved in the collection, handling, transportation and holding of all fish for scientific purposes. Ministry staff will confirm through a risk assessment that appropriate control measures will be in place before authorizing scientific collection activities in the VHS Management Zone.

Collection and Handling of Fish Gametes

Where the purpose is to collect fish gametes for fertilization and rearing, please refer to MNR Fish Culture Technical Bulletin Best Management Practices BMP 2007-01, Egg Disinfection and Incubation Procedures. A public version of this document is also available on the internet *at* http://www.mnr.gov.on.ca/MNR_E001349.pdf

Collection and Handling of Fish

Fish should not be collected from the VHS Management Zone unless appropriate precautions are in place to ensure that the virus is not transferred to waters outside of the VHS Management Zone.

1. When cleaning/gutting fish at any site other than the site of capture, ensure that the waste products do not contact natural waterways – refer to treatment of holding water in this Bulletin.
2. If fish are not going to be transferred live to a research facility, they should be euthanized immediately and properly preserved or frozen.
3. All collected fish should be labelled with date, location of capture, name of licence holder and licence number.
4. Do not transfer fish that appear to be sick (exception - fish appearing sick may be transferred to an approved fish health lab or research facility for testing/research) – refer to disposal of fish in this Bulletin.

Disinfection of all Equipment and Clothing

The following measures are particularly important and must be followed if equipment will be used to collect fish from a waterbody in the VHS Management Zone and then used to collect fish in a waterbody that is not VHS positive.

1. CLEAN by removing all mud, aquatic plants and animals from all gear (including boats, boat motors, trailers, livewells, waders, gloves, nets, sampling equipment etc.) when leaving a body of water and prior to disinfecting gear.
2. DISINFECT all gear (including boats, boat motors, trailers, livewells, waders, gloves, nets, sampling equipment etc.) used during fish collection using at least one of the following (note: clean water means well, commercially bottled or municipally treated water):
    a. Chlorine bleach solution of 100mL per litre of clean water , or
    b. Iodophor solution of 100 mL of iodophor per litre of clean water, or
    c. **Complete** drying after each use (exposure to sunlight can help to speed the drying process).
3. TREAT holding water prior to discharge:
    a. Chlorine bleach solution of 100mL per litre of water,
    b. Exposure time of 1 hour,
    c. If water contains a lot of organic matter use 250 mL of bleach per litre of water and let sit for 1 hour.
4. DISPOSAL of treated fish holding water and treated wash water used for equipment cleaning should be done properly:
    a. in a municipal sewer system leading to a treatment facility, or
    b. on the ground well away from fish bearing waters. Care should be taken while disposing of this water, as chlorine bleach is toxic to fish and other organisms.

Movement of Live Fish to Research Facility

1. It is permissible to transport live fish within the VHS Management Zone.
2. It is permissible to transport live fish taken from waters that are not VHS positive to facilities in the VHS Management Zone.
3. Persons may transport live fish taken from the VHS Management Zone to areas that are not VHS positive subject to:
    a. Submission of a completed *Application for a Licence to Collect Fish for Scientific Purposes* (Form FW1031) which must be approved by MNR (or submission of information on planned collection activities for Fisheries and Oceans staff), and
    b. Submission of a completed risk assessment questionnaire which must be approved by MNR, and
    c. Adherence to the Best Management Practices outlined in this Bulletin, and
    d. Issuance of a *Licence to Collect Fish for Scientific Purposes* (Form FW0032) by MNR with appropriate conditions (or confirmation that collection activities may be undertaken with appropriate modifications for Fisheries and Oceans staff).
4. Water used to transport live fish to a research facility should be pathogen free and must not be taken from waters in the VHS Management Zone. Acceptable sources of water include:

a. Well water, or
b. Commercially bottled water, or
c. Municipally treated water (water safe for human consumption).

5. Persons holding fish taken from the VHS Management Zone in facilities outside of the VHS Management Zone must conform to the treatment and disposal practices of effluent and fish described in this Bulletin.

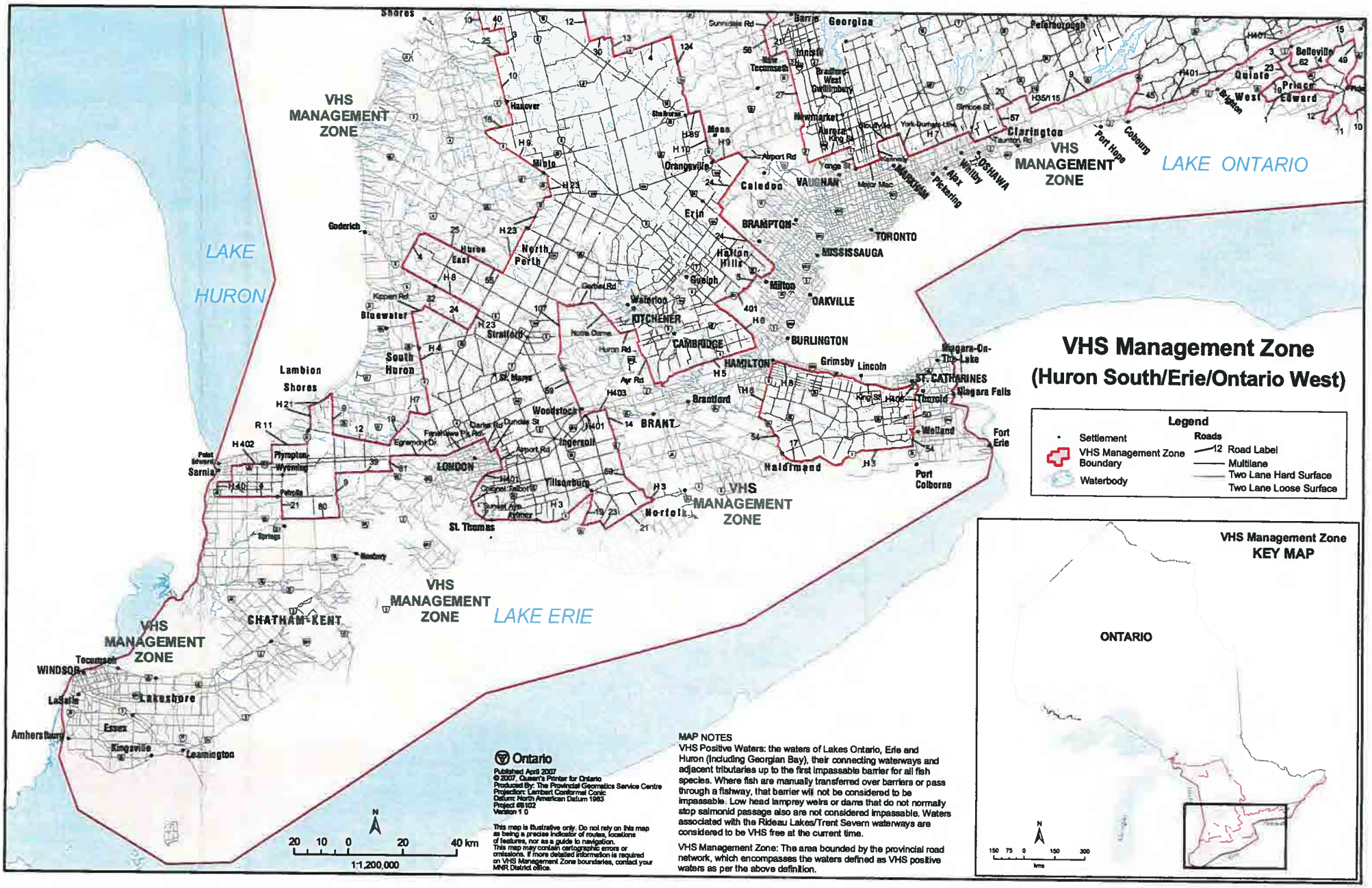
Treatment and Disposal of Facility Effluent

1. Facility effluent must be controlled to minimize impact on fish bearing waters.
2. Effluent from fish that may have been exposed to VHS should be disinfected with a 20% chlorine bleach solution and let sit until the chlorine dissipates before being discharged into a municipal sewer system leading to a treatment facility.
3. Dumping effluent into roadway drains is not acceptable.

Treatment and Disposal of Fish

The following precautions should be taken to dispose of fish.

1. Dispose of fish, internal organs, skin, scales, heads and tails in the garbage.
2. Do not release fish into a lake or river (**this activity is not authorized under a Licence to Collect Fish for Scientific Purposes**). Put them in the garbage or biohazard disposal.
3. Do not give away any fish collected under your licence (**this activity is not authorized under a Licence to Collect Fish for Scientific Purposes**).



MAP NOTES

VHS Positive Waters: the waters of Lakes Ontario, Erie and Huron (Including Georgian Bay), their connecting waterways and adjacent tributaries up to the first impassable barrier for all fish species. Where fish are manually transferred over barriers or pass through a fishway, that barrier will not be considered to be impassable. Low head lamprey weirs or dams that do not normally stop salmonid passage also are not considered impassable. Waters associated with the Rideau Lakes/Trent Severn waterways are considered to be VHS free at the current time.

VHS Management Zone: The area bounded by the provincial road network, which encompasses the waters defined as VHS positive waters as per the above definition.

From: Brenda Axon [mailto:baxon@hrca.on.ca]
Sent: Tuesday, August 17, 2010 10:40 AM
To: Leah Smith; Dinka, Stephen
Cc: Mark Cece; Robert Thun; Samantha Mason
Subject: RE: North Oakville- Milton West Wetland Complex

Hi,

I spoke with Emma Followes at MNR on Friday. She is prepared to amend the North Oakville- Milton West wetland complex to remove the two wetlands located on the blue stream.

Brenda

Brenda Axon
Manager, Watershed Planning Services
Conservation Halton
2596 Britannia Rd W.
Burlington ON L7P 0G3
Phone: 905.336.1158 x222
Fax: 905.336.7014
baxon@hrca.on.ca
www.conservationhalton.ca

From: Leah Smith
Sent: August 12, 2010 10:32 AM
To: 'Dinka, Stephen'
Cc: Mark Cece; Brenda Axon; 'Robert Thun'; Samantha Mason
Subject: RE: North Oakville- Milton West Wetland Complex

2

Hi Steve,

We have not yet heard back from the MNR on the PSW's. We have a meeting with them the last week of August so I will request that this item be added to the agenda. We still believe that the wetlands should only need to be staked if they are deemed PSW's or are contained within the red stream portion of the creek. As for fisheries, our fisheries ecologist is on vacation this week so I will talk to her about your request when she returns. Could you let me know what you would like to discuss with respect to fisheries? I agree that it is beneficial to discuss all items prior to the submission of the EIR/FSS for the site – could you let me know when you anticipate submitting this document? The Town of Oakville staff will also need to be present for all site visits so we should discuss this request with Rob Thun. I have copied him.

Thanks,

Leah Smith, M.E.S.
Environmental Planner
Conservation Halton
2596 Britannia Road West
Burlington ON L7P 0G3
905-336-1158 x283
fax: 905-336-6684
www.conservationhalton.ca

MMM GROUP

MEETING REPORT

Date:	October 5, 2010	**Project:**	Bentall Property, Land Development EIR
Date of meeting:	September 23, 2010	**Project Number:**	14.09222.001.EN2
Location:	On-site: Lazy Pat Lands	**Author:**	Rankin, S.
Purpose:	Discuss Onsite Aquatic Habitat and Introduce Preliminary Concept		

Attendees:	**E-Mail**	**Phone**	**Fax**
Leah Smith, HC (LS)	lsmith@hrca.on.ca	905-336-1158	905-336-6684
Samantha Mason, HC (SM)	smason@hrca.on.ca	905-336-1158	905-336-6684
Mark Cece, MMM (MC)	cecem@mmm.ca	905-882-1100	905-882-0055
Sonia Rankin, MMM (SR)	rankins@mmm.ca	905-882-1100	905-882-0055

DISTRIBUTION: MMM Group attendees and the following:

Chris Tyrrell, MMM	tyrrellc@mmm.ca	905-882-1100	905-882-0055
Randall Roth, MMM	rothr@mmm.ca	905-882-1100	905-882-0055

Overview

The focus of the site meeting was to provide an overview of the aquatic features on the site and introduce the preliminary concept plan to Halton Region Conservation Authority (HC). MMM provided this figure to HC along with the Figure NOW 2 “Land Use Plan” and the MMM preliminary concept plan (Figure 1b: June 14, 2010).

MMM (MC and SR) provided an overview of the ecological investigations conducted on the site, identified the constraint designation of the tributaries within the subject property and described the components of the methodology employed by MMM staff to collect data and document existing conditions on-site.

Stream Reaches

The limits of the reaches will have to be confirmed through consultation with HC. Specifically, the extent of the High Constraint (red) reach (14W-12) supporting Redside Dace extends upstream/north from Dundas Street to the confluence with 14W-16, at the pond inlet/outlet. It is the upstream section of the reach that flows in an east/west direction that is unlikely to provide Redside Dace direct habitat and as a result may not be considered a High Constraint (red) section. The attached figure illustrates the stream reaches within the property (Figure 1)

Flow Regime

The HC inquired if flow measuring devices were installed in the tributaries during field investigations to document the flow regimes within the tributaries. MC indicated that flow loggers had not been installed in the tributaries as our historic field investigations had identified these watercourses as intermittent. Furthermore, MMM Group’s biologists’ periodic field reconnaissance during the 2009 field season to document dissolved oxygen levels confirmed the intermittent flows. MC also indicated that a hydrogeological assessment was undertaken as part of the study and that the groundwater interactions with this watercourse would also provide information regarding the flow regime. HC requested that the EIR include the MMM Group biologist field information as well as the hydrogeological assessment to describe the permanency of the tributaries and groundwater contribution. This will include flow monitoring data collected in the main channel (14W-16 & 14W-12).

Thermal Regime

During the field investigations SM inquired to the thermal regime of the watercourses as the water in tributary 14W-12 (west tributary) was cold to the touch. MC indicated that the temperature was likely due to the season as night temperatures were approximately 9 degrees at night. Furthermore, this and the other reaches often dried in the summer suggesting that there was insufficient groundwater to provide base flow let alone coldwater thermal regimes. SR/MC provided additional information from the 2009 temperature monitoring program (between May 2009 and October 2009) indicating that the upstream reach of Tributary 14W-16 provides coolwater habitat with Tributary 14W-12 providing warmwater habitat. The remaining tributaries that discharge into 14W-12 were predominantly dry during the summer months and were therefore not monitored for temperature. The thermal regime in 14W-12a could not be assessed using the Wherly et. al. methodology as the feature was dry by June 2009. HC requested that the EIR include the MMM Group biologist field information as well as the water temperature assessment to describe the thermal regimes of the watercourses.

Stream Realignments

MC described the proposed stream realignment of 14W-13 and 14W-14 to maximize the usable land within the subject property, using the preliminary concept plan. The plan indicates that the two tributaries will be realigned along the northern limit of the property, and then be aligned along the western property limit. The flow conveyed within the realigned channel will discharge into stream reach 14W-16. SM/LS requested details on the realignment and indicated that based on the concept the realignment proposed stream length of the realigned channel did not appear to meet the drainage densities requirements identified in the NOCSS. MC indicated that this would be addressed in the EIR by Water Resources staff.

MC indicated that the large pond is included in the preliminary concept plan however, from a fisheries perspective; ponds are typically taken off-line to improve the thermal regime of the watercourses and inquired if HC had a preference. LS/SM indicated they would consult with staff and provide a response at a later date.

Stream Buffers

LS indicated that the buffers indicated on the preliminary concept plan do not appear to account for the stream corridor widths (combination of meander belt widths, environmental setback allowance and the erosion setback) identified in the NOCSS for these tributaries. SM indicated that Table 6.3.4a in the NOCSS identifies the acceptable setbacks and that fisheries setbacks are included in those corridor widths.

General Discussions

LS/SM recommended that MMM make arrangements to attend a stakeholder (Town, Region and Conservation Authority) meeting held on the 3rd Monday each month to discuss the preliminary concept plan, potential impacts, proposed mitigation measures and general design plans for the land development, in advance of the submission of the EIR. Having this meeting would facilitate the review of the EIR. LS indicated that they (HC) may be able to make arrangements to hold a meeting on an alternate day, between the regularly scheduled monthly meetings.

80 Commerce Valley Drive East, Thornhill, ON L3T 7N4 | t: 905.882.1100 | f: 905.882.0055 | w: www.mmm.ca


14W-13
14W-14
14W-12A
14W-16
14W-12
407
Trafalgar Rd
Dundas St W
5
© 2009 Tele Atlas
Image © 2009 DigitalGlobe

Figure 1

MMM GROUP

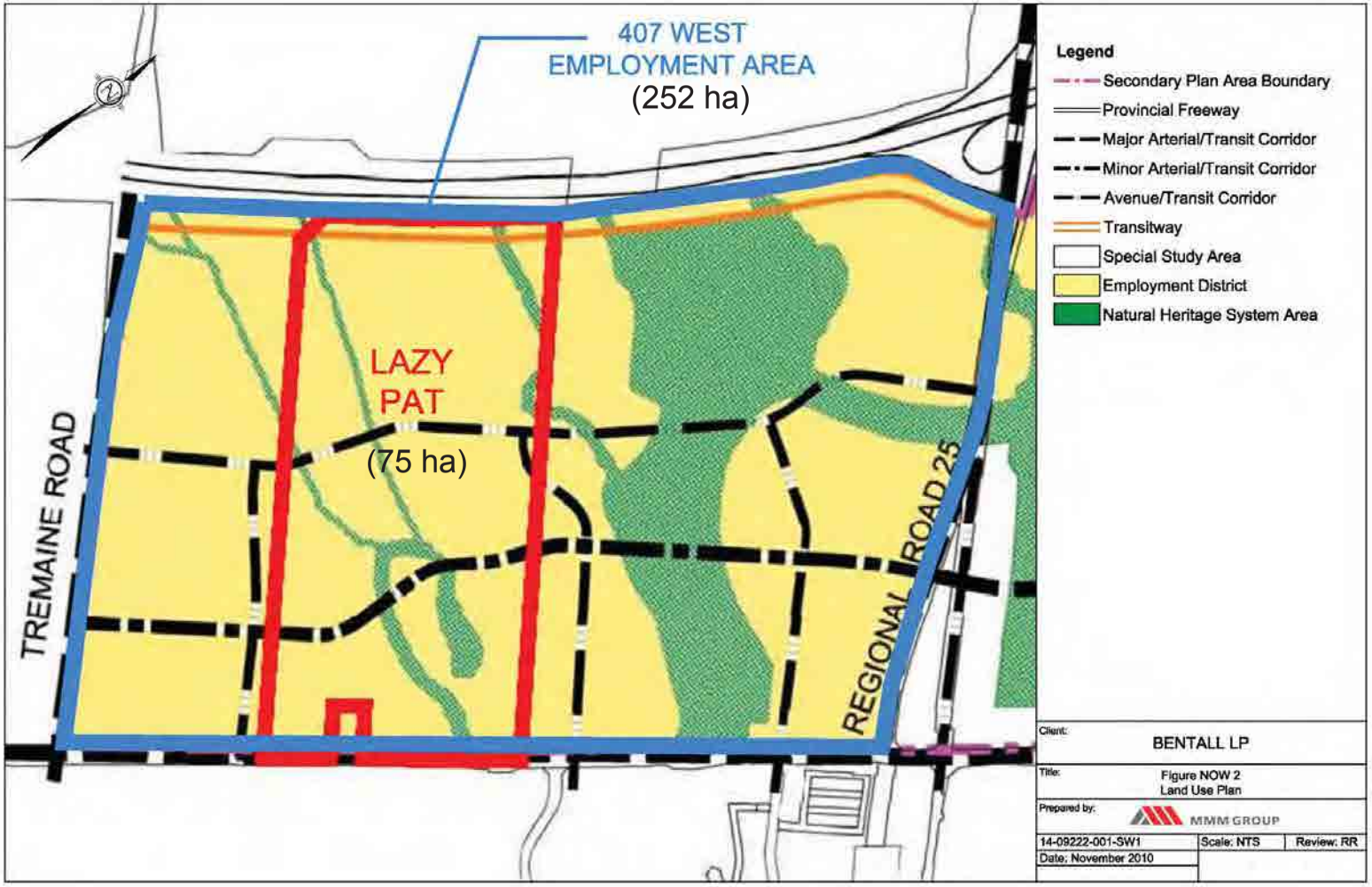
407 West Employment Lands, 3269 Dundas Street (Lazy Pat) Oakville

North Oakville Agency Review Meeting – EIR/FSS

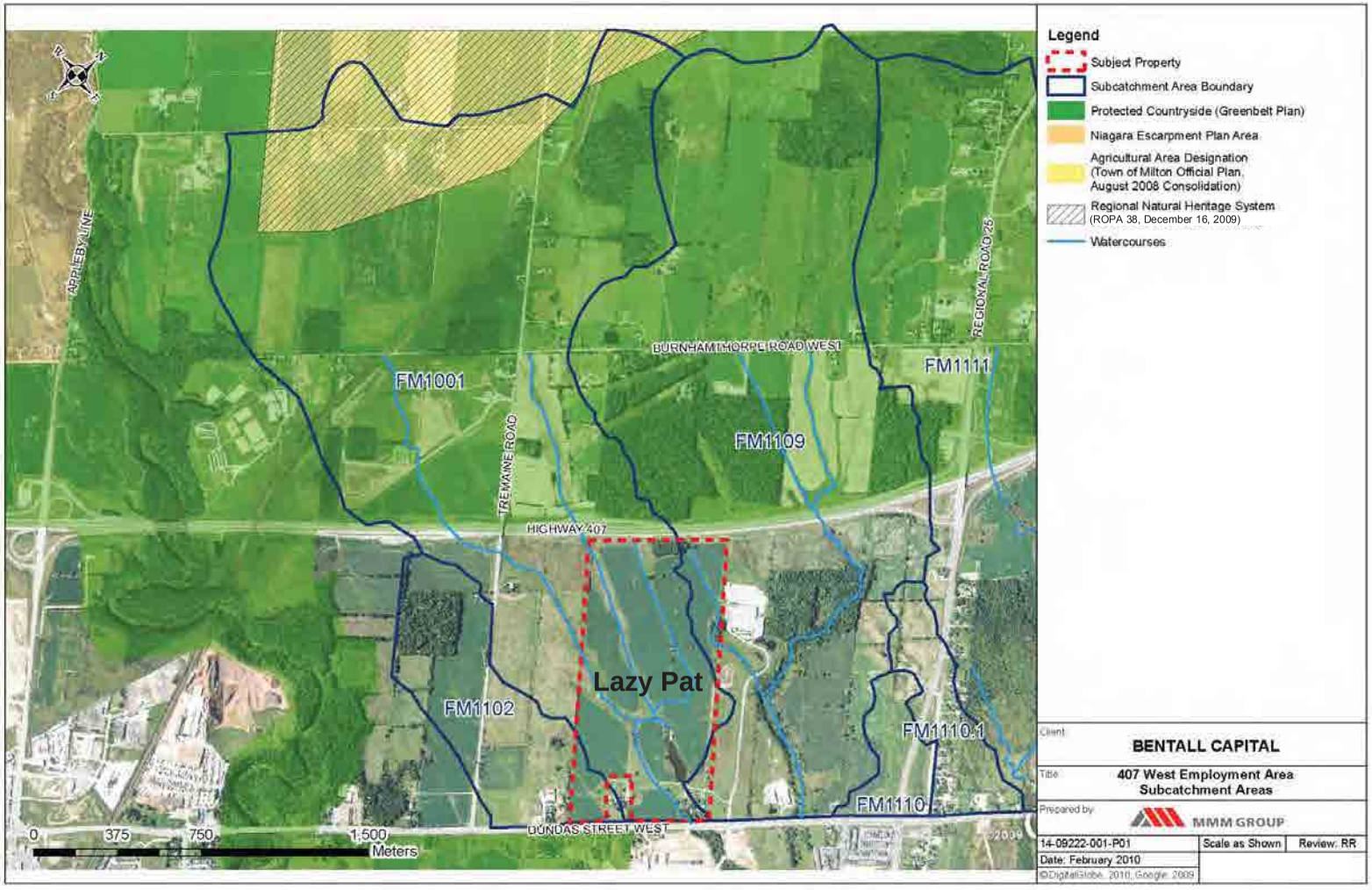
COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

November 15, 2010

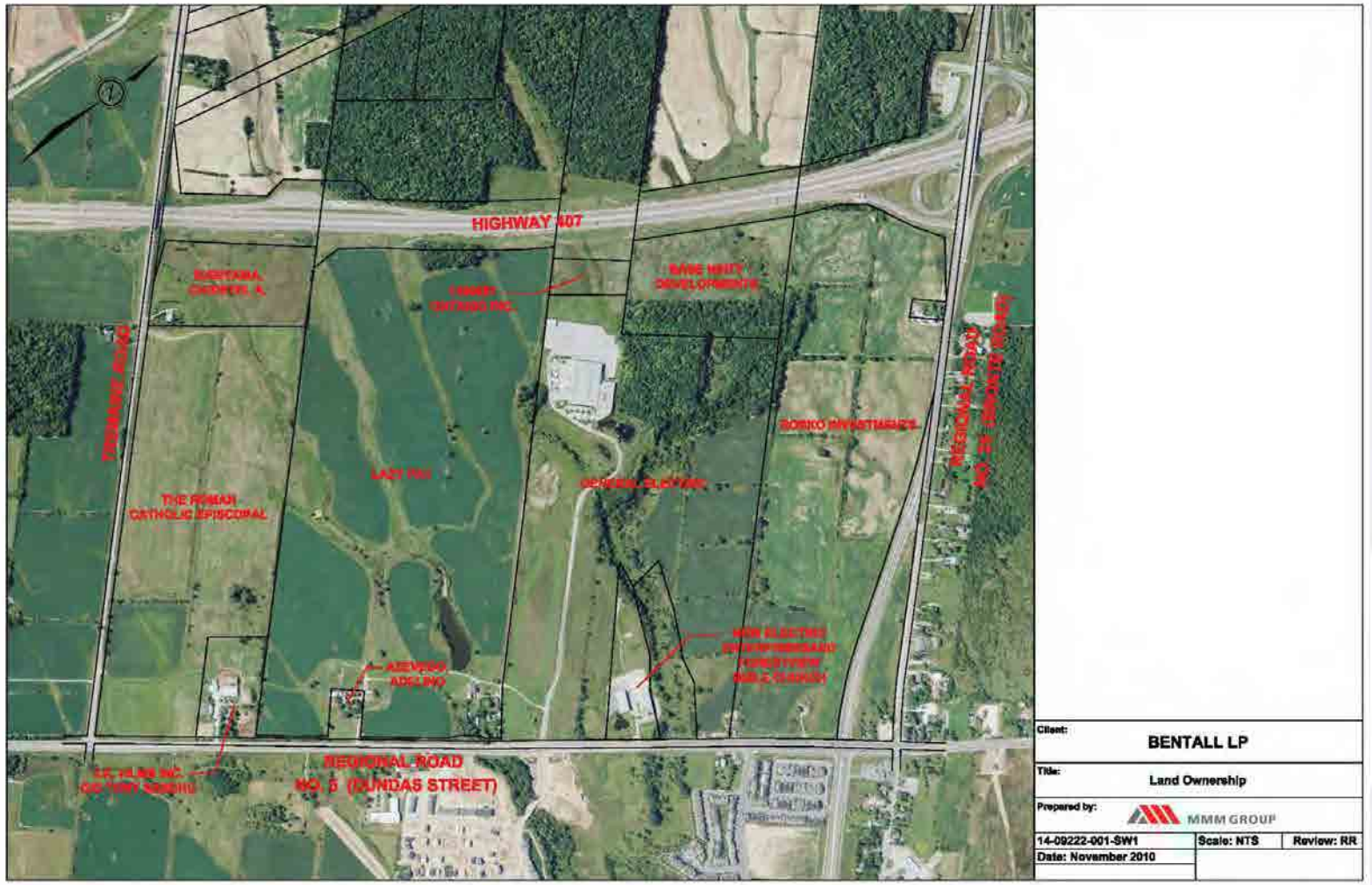
North Oakville West Secondary Plan – Land Use Plan



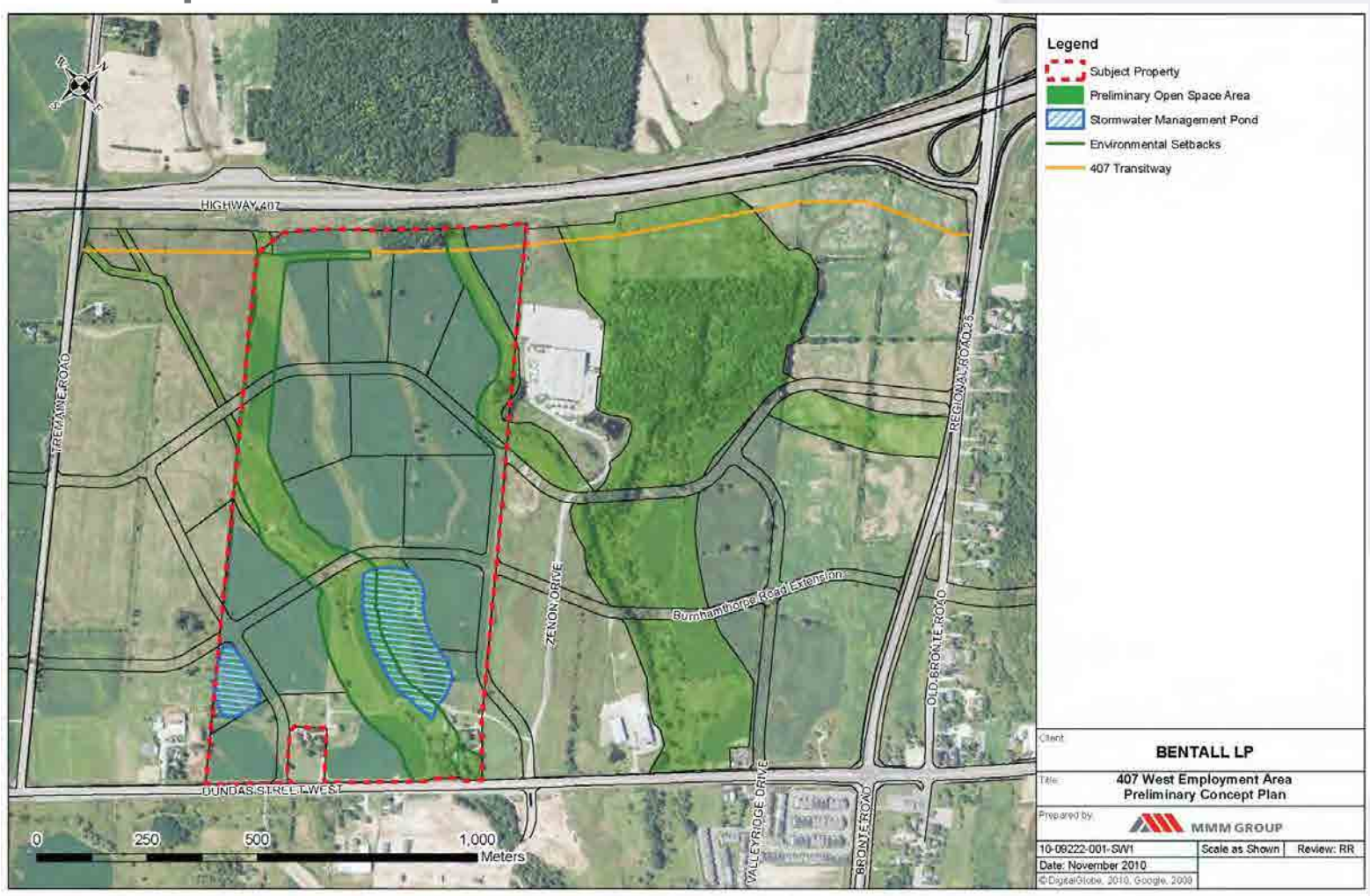
Subcatchment Areas



Land Ownership



Development Concept Plan

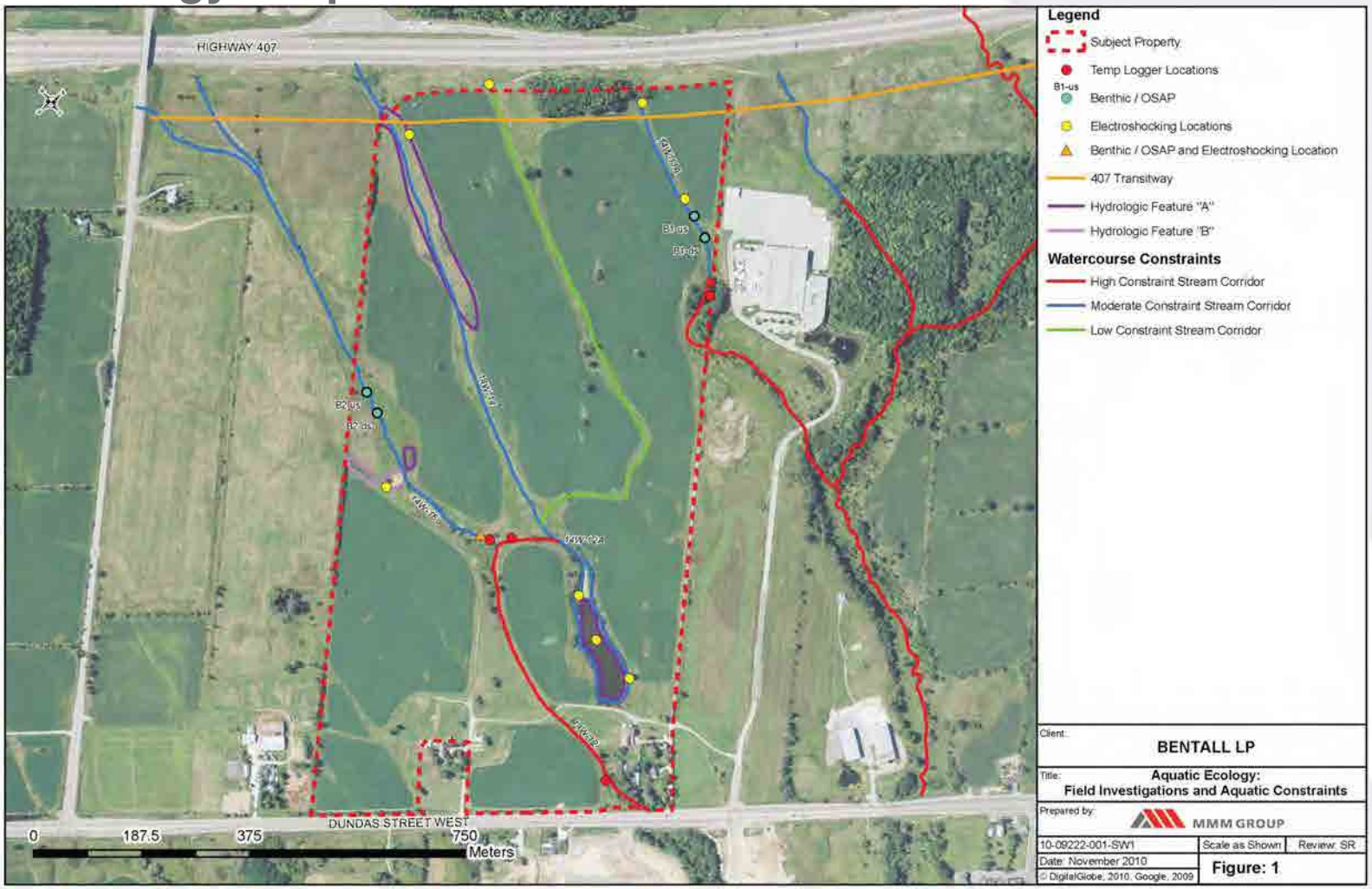


Ecology/Hydrogeology

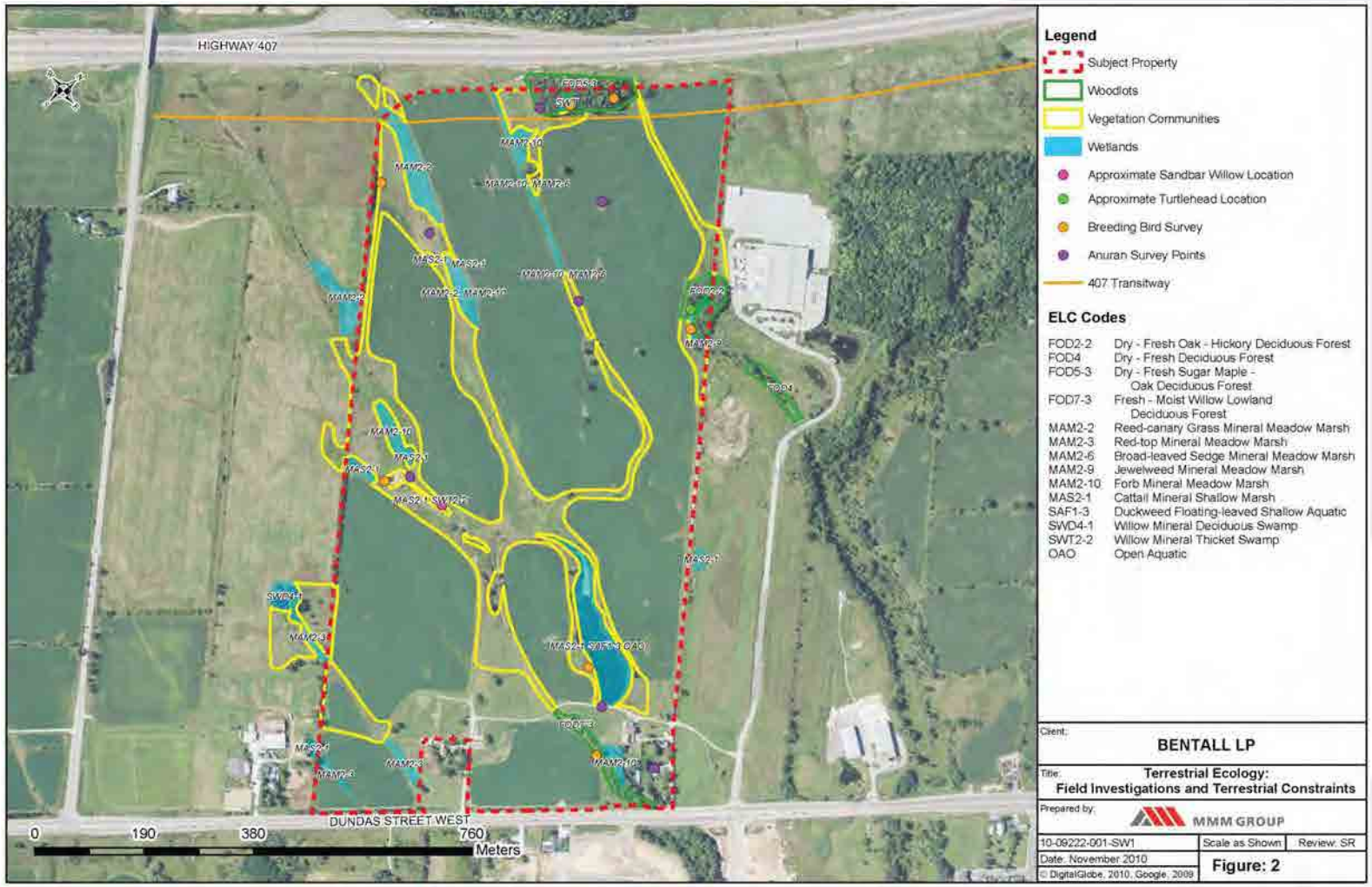
Issues:

1. Woodlot Setbacks
2. Wetland Setbacks
3. Channel Realignment
4. Online Pond
5. Redside Dace Reach Delineation
6. Water Balance – pre-development vs. post-development infiltration

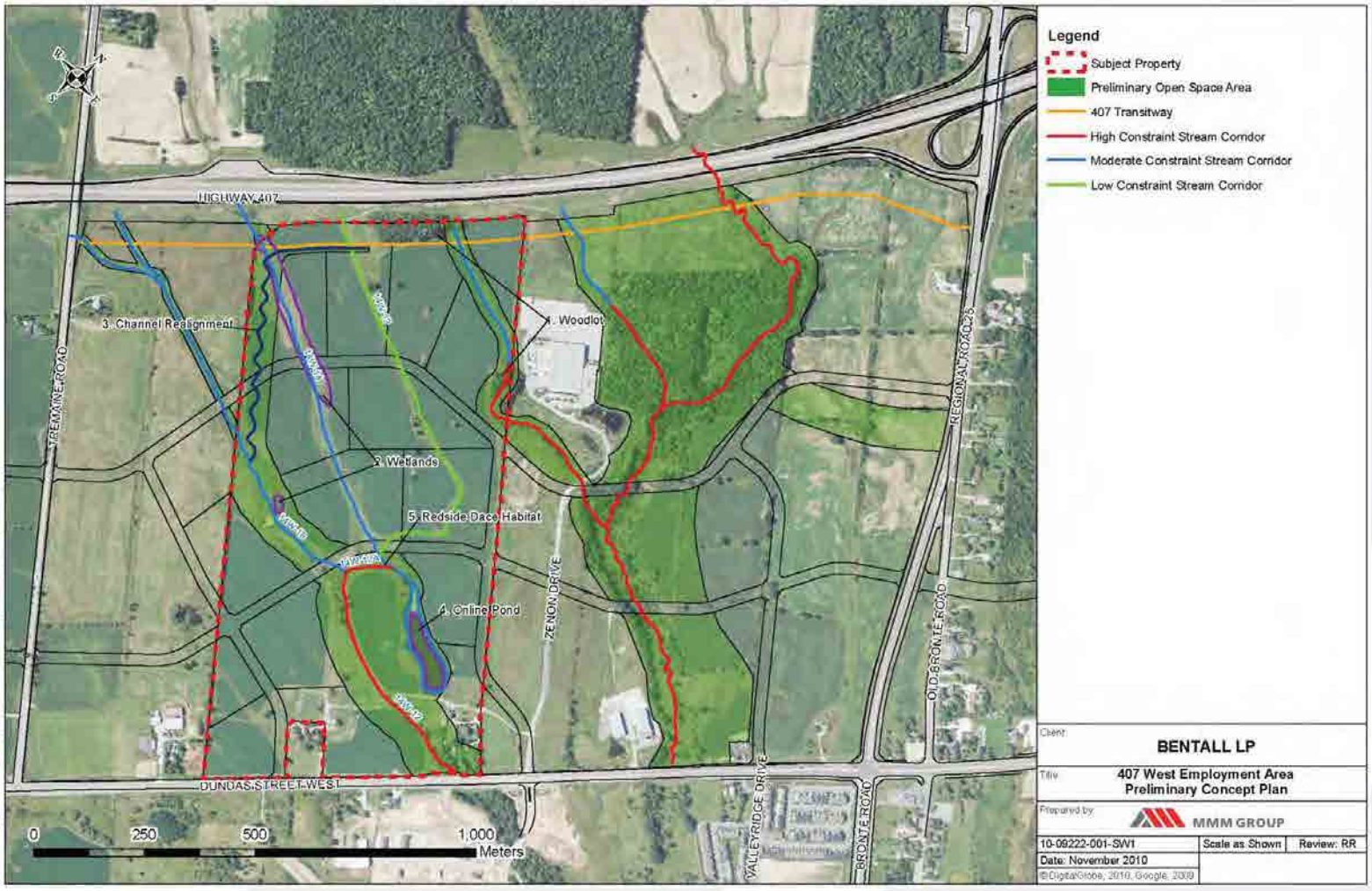
Ecology - Aquatic



Ecology - Terrestrial



Ecology – Issues Summary



Water Resources

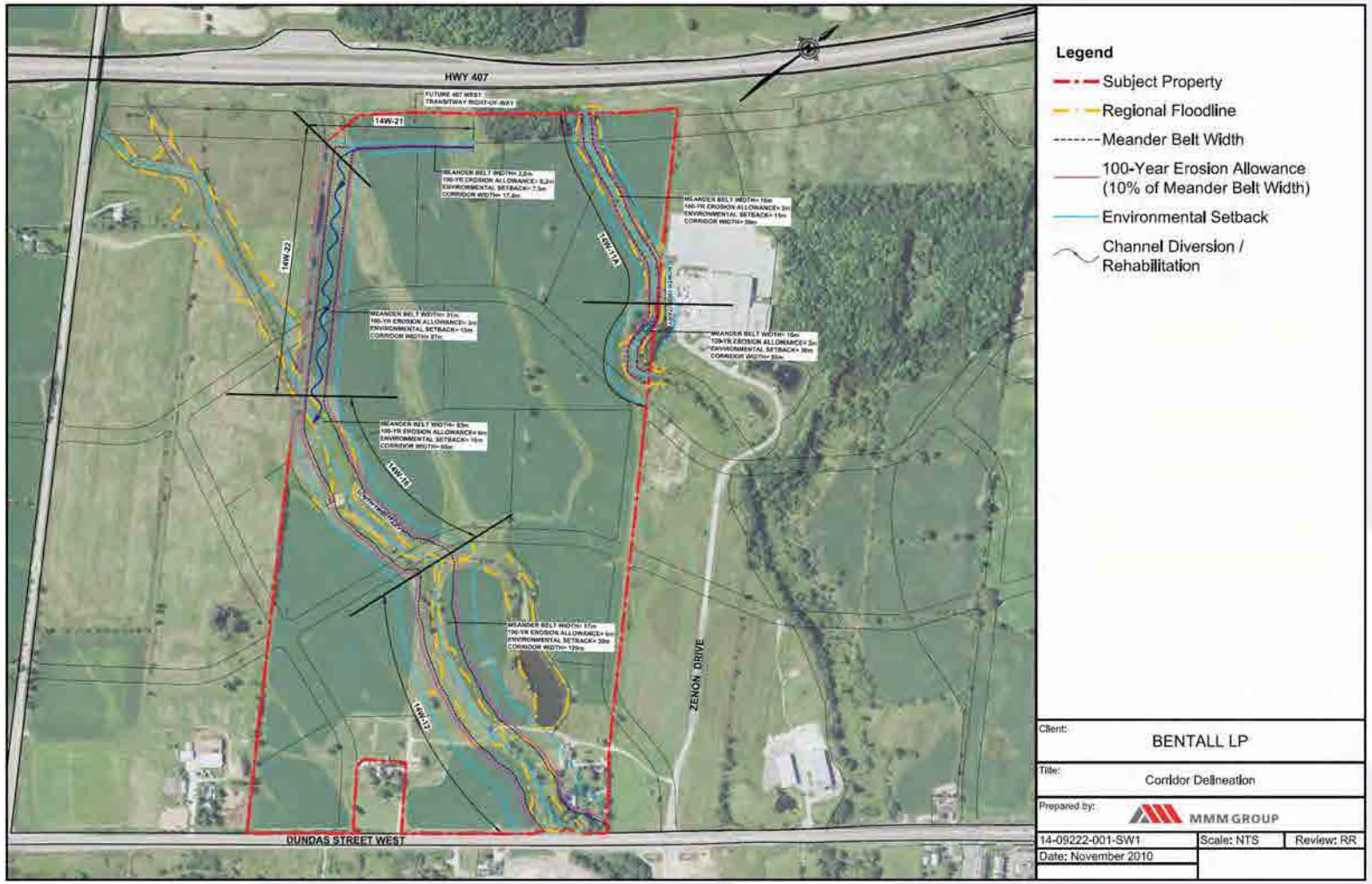
Issues:

1. Watercourse Relocations / Drainage Density / Meander Belts

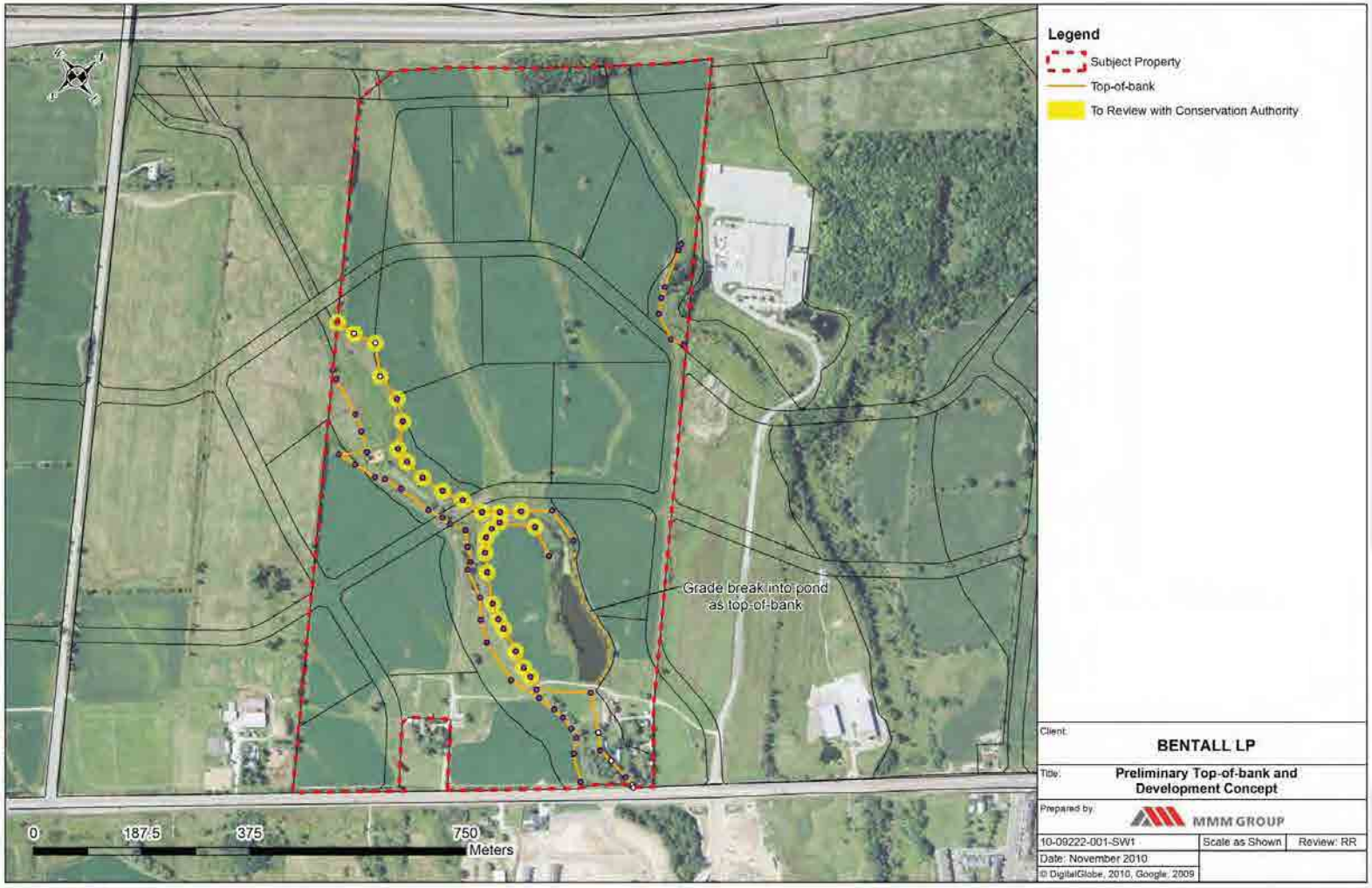
2. Stormwater Management Facilities

3. Top of Bank

Water Resources – Corridor Delineation



Water Resources – Top of Bank



Other Issues

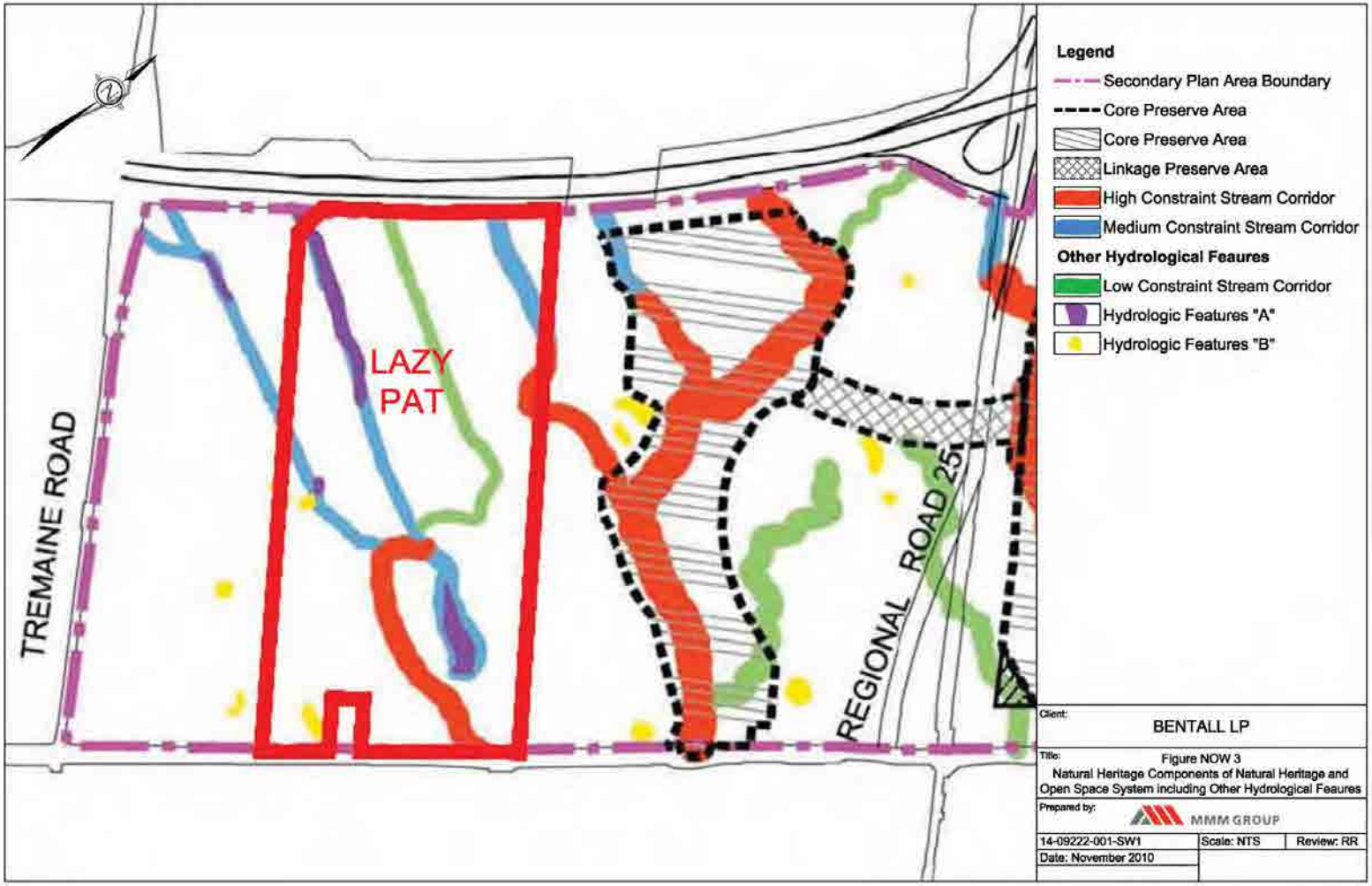
Transportation:

- Burnhamthorpe Road – timing of road extension.

Servicing:

- Required Regional projects and timing.

North Oakville West Secondary Plan – Natural Heritage



PROTECTING THE NATURAL ENVIRONMENT FROM LAKE TO ESCARPMENT

2596 Britannia Road West
Burlington ON L7P 0G3
905.336.1158 Fax 905.336.7014
conservationhalton.ca

January 20, 2011

Chris Tyrrell
MMM Group
100 Commerce Valley Drive West
Thornhill ON L3T 0A1

Dear Mr. Tyrrell:

RE: Bentall/Lazy Pat Lands
3269 Dundas Street West
Town of Oakville
EIR/FSS Pre-Consultation
CH File: MPR 562

Staff has reviewed the pre-consultation materials presented on November 15, 2010 and would like to offer the following high-level comments to assist in your preparation of the EIR/FSS.

1) The EIR/FSS should clearly follow the Terms of Reference prepared by the Town of Oakville (August 2, 2007), and should meet all the requirements of the *North Oakville Creeks Suwatershed Study* (NOCSS).
2) The EIR component of the document should be completed for Subcatchment FM1001. Sufficient information within the EIR must also be provided for Subcatchment FM1102 and FM1109 as necessary to ensure that appropriate servicing can be provided for the subject lands and neighbouring lands without negative impacts on the Natural Heritage System. The FSS component should be completed for all of the subject lands within the limits of the proposed Draft Plan of Subdivision, but must also take into consideration lands beyond the limits of the Draft Plan as necessary to ensure that neighbouring lands can be adequately serviced without negative impacts to the Natural Heritage System. Staff would like to further highlight that erosion threshold flow rates and necessary erosion controls typically must be determined on a subcatchment basis for all subcatchment areas impacted by the proposed development.
3) Staff notes that there are two high constraint reaches, four medium constraint reaches and one low constraint reach on the subject property. Staff would like to note the following points based on the concept plan provided:
   High Constraint Reach 14W-12 – Staff notes that this reach has been identified as habitat for Redside Dace, which has been designated as an Endangered Species under the *Endangered Species Act* (ESA). Habitat for this species is defined by a 30-metre wide naturally vegetated buffer on either side of the meander belt. On this basis, staff notes that the current location of the SWM pond may not be feasible. Further discussion on this proposal and any permitting requirements under the ESA should be discussed with the Ontario Ministry of Natural Resources, in conjunction with Conservation Halton and the Department of Fisheries and Oceans. Furthermore, the EIR/FSS must demonstrate that

any proposed works will not affect the redside dace corridor. Please note that additional plantings/vegetated buffers are recommended for redside dace in NOCSS (Table 6.3.4).

High Constraint Reach 14W-11 – This reach has been identified as a reach requiring rehabilitation. Please discuss the proposed rehabilitation measures in the EIR/FSS.

Medium Constraint reaches – Staff notes that the northern medium constraint reach is proposed to remain in place. Staff notes however, that the remaining three reaches are proposed to be relocated. While it is possible to relocate a medium constraint reach, please note that for all three of these reaches NOCSS requires that these streams are preserved as riparian corridors considering their environmental, geomorphologic, hydrologic and hydrogeologic functions. Based on the concept plan provided, it does not appear that the full stream length and functions of both reaches 14W-14 and 14W-16, and the reach containing the pond (14W-14A) have been accounted for in the proposed realignments. Staff notes that the realigned segment of the medium constraint stream appears to connect to the high constraint steam mid-reach, which would cut off flows from the top end of 14W-12. Staff will also require further information on how the form and function of the pond (reach 14W-14A) is being duplicated in this concept plan (also identified as a Hydrologic Feature A, see below), as NOCSS does not permit a medium constraint reach or a Hydrologic Feature A to be replaced through a SWM pond. While it is permissible to relocate this medium constraint reach, staff notes the habitat management recommendation (Table 6.3.4) is to leave the pond undisturbed and consider supplementing the riparian zone with woody vegetation. In summary, staff is concerned that the proposed concept will not be able to replicate all of the features and functions provided by the existing four blue streams, and that the proposed diversions could result in negative impacts to the existing red stream. The proposed concept presented will require further discussion with CH, DFO, Town of Oakville and MNR staff.

4) A geotechnical assessment must be prepared to identify the location of the stable top of bank for the high constraint stream reaches that are confined valley systems.
5) Conservation Halton staff cannot provide comment on the limits of the meander belt allowances or Regional Storm flood plain shown on Slide 11 without all supporting documentation. Please ensure that all analyses are in keeping with NOCSS requirements and Ministry of Natural Resources Technical Guidelines. Please note that all hazards must be delineated for existing and proposed conditions, and the 7.5 metre allowance from each hazard is plotted on all drawings.
6) Slide 11 indicates a meander belt, 100 year erosion allowance and environmental setback for the channel designed to divert watercourse reach 14W-12's (low constraint/green stream) upstream drainage area to 14W-14 (blue stream). While this diversion would not be regulated by Conservation Halton, it should be designed to convey the appropriate flood standard in addition to the erosion hazard, as established in conjunction with Town of Oakville and Conservation Halton staff.
7) Please identify the location of all reach breaks as per NOCSS. Please note that NOCSS would only permit minor reach break changes within the order of a few metres.
8) The MNR has confirmed that the wetlands on site are not considered Provincially Significant Wetlands (PSW's). The only wetlands to remain on site are located within the red stream corridors. Staff notes that the required redside dace setbacks should adequately protect these wetlands, however please note that a setback of 30 metres is required from the limit of these wetlands.

9) Staff notes that there are three Hydrologic Features A on the subject property. As per NOCSS, the form and function of these features must be duplicated if they are proposed for removal.
10) Further to Slide 7, we note that a portion of the Hydrologic Feature B located primarily at 3445 Dundas Street may extend onto the subject property and should also be assessed as part of the EIR/FSS.
11) Staff are concerned that consolidation of stormwater management into only two ponds as shown on Slide 5 will not allow for the preservation of drainage areas to the various watercourse reaches and will result in negative impacts to these reaches. While staff recognizes that the number and location of SWM facilities will be determined through the EIR/FSS process, we note that the North Oakville West Master Plan envisioned six stormwater management facilities within the subject parcel, including a SWM facility outletting to watercourse reach 14W-11. Staff further notes that at least four of the SWM facilities would appear to be servicing lands outside of the subject lands. As such, coordination and consideration of adjacent landowners must be accounted for within the EIR/FSS to ensure that appropriate servicing concepts for the entire area can ultimately be developed.
12) Regarding the proposed road alignments on the concept plan, staff notes that both the new Burnhamthorpe extension and the road to the north do not appear to have the most optimal alignment to protect the red streams, nor do they appear to be in keeping with the secondary plan.

We trust the above is of assistance. If you require additional information please contact the undersigned at extension 283.

Yours truly,

Leah Smith
Environmental Planner
LS/

cc. (by email) Rita Juliao, Town of Oakville, Planning and Development Services
Rob Thun, Town of Oakville, Planning and Development Services
Doug Corbett, Region of Halton, Planning
John Pisapio, Ontario Ministry of Natural Resources
Mark Cece, MMM Group
Andrew Kulin, MMM Group

MMM GROUP

MEETING REPORT

Date:	February 1, 2011	**Project:**	407 West Employment Lands
Date of meeting:	January 25, 2011	**Project Number:**	14.09222.001.EN2
Location:	Halton Conservation	**Author:**	Mark Cece
Purpose:			

Attendees:	**E-Mail**	**Phone**	**Fax**
John Pisapio (JP) – MNR Biologist	john.pisapio@ontario.ca	905-713-7387	N/A
Aurora McAllister (AM) - MNR Assistant Species at Risk Biologist	aurora.mcallister@ontario.ca	905-713-6010	N/A
Samantha Mason (SM) – HRCA Senior Aquatic Ecologist	smason@hrca.on.ca	905-336-1158	N/A
Randall Roth (RR) – MMM Group Senior Planner	rothr@mmm.ca	905-882-1100	N/A
Mark Cece (MC) – MMM Group Senior Fisheries Biologist	cecem@mmm.ca	905-882-1100	N/A
DISTRIBUTION:			
Mike Reel, Bentall LP	mreel@bentall.com	416-674-3584	N/A
Chris Tyrrell, MMM Group	tyrrellc@mmm.ca	905-882-1100	N/A
Joe Sframeli, MMM Group	sframelij@mmm.ca	905-882-1100	N/A

Item	Details
A	**Introduction**
A.1	MC introduced the project as it relates to the Endangered Species Act (ESA) and presented the concept plan.

a. JP/AM indicated that although ESA permitting will not likely be issued until the detail design phase of the project they are pleased to be involved early in the process as opposed to solely at the permitting stage to ensure their input is incorporated in the design. This will minimize the potential that revisions are required later in the process where potential implications are greater.

b. JP/AM indicated that due to the scale of works and the potential impacts to ESA regulated species (Redside Dace and Bobolink) an ESA Schedule 17(c) permit will likely be required.

B	**Redside Dace**
B.1	JP/AM provided general comments to the concept with more detailed comments to follow once a formal submission was made.

Item	Details

B.2 AM expressed concern with the number of road crossings of watercourses and proximity of the Burnhamthorpe Road extension to Reach 14W-12A.

a. RR noted that the proposed road network is required to allow development of Lazy Pat lands to go forward with minimal participation of the adjacent landowners due to different development schedules.

b. RR also noted that the Burnhamthorpe Road extension alignment has been moved north of what is shown in the Secondary Plan in order to minimize effects to this reach.

B.3 JP/AM expressed concern regarding the number and locations of SWM facilities.

a. AM indicated that larger SWMP typically have a greater effect to water temperature inputs than smaller SWMP.

b. JP also stated that location of the SWMP in the southern portion of the lands has a potential to affect fish habitat with less water directed to the upper reaches of the channel.

c. JP would like to see quality and quantity controls in the headwaters area (north of the High Constraint stream corridors) to improve the conditions/contributions to the streams.

d. JP noted that Draft RSD Habitat Regulations are anticipated in February 2011 with the Draft Development Guidelines for RSD (including SWMP) also expected to be released at that time.

B.4 MC inquired to the actual delineation of the Redside Dace (RSD) Occupied Reach(es) on the Lazy Pat lands.

a. JP indicated that the actual Occupied Reach does not extend as far upstream as identified by the High Constraint (Red) reach in NOCSS, however that Redside Dace (RSD) habitat on the Lazy Pat lands is generally consistent with the High Constraint Stream mapping as the Endangered Species Act (ESA) General Habitat Protection provision includes all habitat that directly and indirectly supports ESA species. This would mean that all works potentially affecting Redside Dace (i.e. headwater realignment, stormwater management, etc.) would be reviewed by MNR under the ESA.

b. MC indicated that the habitat present in Reach 14W-12A does not provide suitable RSD habitat and as a result questioned the classification of the stream as High Constraint (Red). The current classification has a direct impact on the proposed development concept if maintained. JP indicated that a site visit would be required in order to comment on the reclassification of 14W-12A as it relates to RSD. A site visit will be scheduled for end of April.

B.5 AM indicated that it would be helpful if, in addition to the current concept plan, MMM would provide additional channel realignment options to the MNR for review and comment.

a. JP indicated that remaining watercourses on site proposed for realignment/consolidation would also be reviewed during the April site visit.

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Item	Details
B.6	JP indicated that the consolidation of streams (realignment proposed) would require a presentation of evidence that would discuss the pre- vs. post-development conditions of the aquatic habitat
B.7	JP suggested a separate submission (including raw data obtained during field investigations) to MNR with circulation to Melinda Thompson Black, JP and AM that is specific to ESA species to confirm permitting requirements. MC indicated that the raw data that will be provided includes dissolved oxygen, water temperature, benthic macroinvertebrate community, fish community, Ontario Stream Assessment Protocol.
B.8	SM indicated that the development concept did not appear to conform to the NOCSS, with specific reference to the drainage densities. MC indicated that MMM had recently received Conservation Halton's Jan 20, 2011 comments regarding their concerns associated with NOCSS conformance and would address those separately. JP indicated the MNR would also be interested in maintaining the drainage density targets as it relates to species protection.
B.9	SM inquired whether pond bathymetry and substrate information had been collected by MMM Group and JP inquired whether a detailed study of the aquatic vegetation of the pond had been undertaken. MC indicated that he would look into this to confirm.
B.10	SM noted that DFO indicated they would like to review alternative development concept plans as they relate to channel realignments.
C	**Bobolink**
C.1	MC presented the location of bobolink observations as well as timing of surveys and adjacent crops when observed (soy and corn). AM requested observation data including GPS coordinates, date of observations, number of individuals observed.
C.2	MC indicated that due to the type of natural habitat present (riparian) and limited amount that the individuals may be foraging rather than nesting in those locations. a. AM noted that while bobolink has ESA General Habitat protection they do not have specific habitat regulations yet or mapping. As a result the habitat where they were observed would be protected under the ESA as General Habitat protection includes all habitat that directly and indirectly (i.e. foraging) supports ESA species.
C.3	The permitting for RSD and bobolink would be included under the same permit.
D	**Next Steps**
D.1	MC to provide raw data and information to MNR for review and to determine permitting requirements.
D.2	A site visit was recommended for the third week of April to review the stream conditions.
D.3	AM noted that additional surveys may be required with respect to Bobolink, specifically to document breeding activity for this species.

Any omissions or errors in these notes should be forwarded to the author immediately.

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DRAFT MEETING REPORT

Date:	April 29, 2011	**Project:**	Bentall Property, Land Development EIR
Date of meeting:	April 19, 2011	**Project Number:**	14.09222.001.EN2
Location:	On-site: Bentall Lands	**Author:**	Mark Cece
Purpose:	Agency Consultation-Concept Plan		

Attendees:	**E-Mail**	**Phone**	**Fax**
Leah Smith, HRCA (LS)	lsmith@hrca.on.ca	905-336-1158	905-336-6684
Samantha Mason, HRCA (SM)	smason@hrca.on.ca	905-336-1158	905-336-6684
Geza Gaspardy, Halton Region (GG)	Geza.Gaspardy@halton.ca	905-825-6000	
John Pisapio, MNR (JP)	john.pisapio@ontario.ca	905-713-7387	416-681-3405
Mike Reel, Bentall Kennedy (MR)	MReel@Bentallkennedy.com	416-674-3584	
Robert Thun, Town of Oakville (RT)	rthun@oakville.ca	905-845-6601	905-338-4414
Mark Cece, MMM Group (MC)	cecem@mmm.ca		
Chris Tyrrell, MMM Group (CT)	tyrrellc@mmm.ca	905-882-1100	905-882-0055
Steve VanHaren, MMM Group (SV)	vanharens@mmm.ca		
Randall Roth, MMM Group (RR)	rothr@mmm.ca		

DISTRIBUTION: All Attendees and the following:

Rita Juliao, Town of Oakville	rjuliao@oakville.ca	905-845-6601	905-338-4414

Overview

MC identified the objective of the meeting was to review the proposed concept plan as it related to aquatic habitat, specifically the watercourses identified as potentially supporting Redside Dace.

Reach 14W-14A (Pond)

- MC indicated that the proposed stormwater management pond (SWMP) will incorporate the existing pond.

- RT indicated that the pond is part of the Natural Heritage System and that there were differences of opinion whether or not the existing pond could be used as a stormwater management facility. Furthermore, the number of ponds currently proposed (2) differed from the number of ponds proposed in NOCSS.
    - SV indicated that the location of the pond has been selected as it is an existing low point capable of containing water with existing storage capacity. Furthermore, the larger size provides the opportunity for longer retention time thereby providing potential for increased sediment removal.
    - Furthermore, the matter of incorporating stormwater ponds into the Natural Heritage System was addressed in our e-mail to RT of March 31, 2011.

- SM inquired whether the improved water quality included water temperature.
    - SV indicated that the incorporation of the pond into the SWMP would provide the opportunity to modify the existing outlet by discharging water from the bottom of the pond (cooler) versus the existing outlet that draws the warmest water from the surface.

SV further indicated the overall enhanced water quality benefits anticipated to the ESA habitat from a single larger water quality facility versus distributed facilities as outlined in the NOCSS due to the related longer hydraulic residence times associated with the larger facility. JP expressed interest in seeing further discussion on this subject.

- SM/LS indicated that the pond functions as fish habitat and NOCSS indicated that the form and function of this feature (if relocated) would require replication of form and function including the drainage density.
    - MC requested that Halton Conservation (HC) provide guidance related to the specific form and function that they would like replicated. The removal of ponds discharging to coolwater/coldwater habitat, especially those supporting a species at risk (Redside Dace) is generally considered an enhancement to aquatic habitat.
    - LS indicated that HC will provide guidance regarding the form and function they are looking to have replicated.

- SM inquired whether the pond received groundwater inputs.
    - MC indicated that the groundwater monitoring to date indicated that there was no connection from the deeper (bedrock) groundwater source; instead, the groundwater contribution was limited to the shallow contributions through the fractured till layer, this soil layer will be modified during site development.

- GG inquired whether water temperature data (thermal stratification) and dissolved oxygen was collected during field investigations.
    - MC indicated water temperature and dissolved oxygen data consisted of spot recordings during field investigations and that the data collected indicated the pond functioned as warmwater habitat.

- GG inquired whether there were mini-piezometers installed in the pond.
    - MC indicated that the groundwater monitoring for the pond was based on a monitoring well located to the immediate east of the pond.

Reach 14W-12

Stormwater Management Pond - Redside Dace Riparian Habitat

- MC indicated that the preliminary sizing of the two SWMPs to the east and west of Reach 14W-12 will result in encroachment into the setback (meanderbelt plus 30 m) associated with this reach identified in NOCSS as well as Redside Dace (riparian) habitat.

    JP indicated that any encroachment into Redside Dace habitat will require the proponent to demonstrate that alternatives were evaluated in order to minimize adverse effects to Redside Dace. MC indicated that an assessment of alternatives will be provided at the permitting stage.

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Classification of Northern Section Originating At Reach 14W-14A (Pond)

- MC indicated that the section of this reach is completely different in form and function to the remainder of 14W-12 as it is a constructed feature that was built to convey flows from the pond (14W-14A). The visible difference suggests that this section of the reach may have been misclassified and as a result further review of this section of Reach 14W-12 is warranted.
    - LS indicated that NOCSS does not allow for the re-classification of reaches instead refinement of in the order of a few meters and as a result its reclassification will not be permitted.
    - JP indicated that the restoration of this reach could potentially be considered an Overall Benefit to Redside Dace.

Reach 14W-14 – Realignment

- MC indicated that the concept plan proposes the realignment of Reach 14W-14 along the western property limit with flow from 14W-13 redirected to this reach as well. This realignment will require that the channel connect to Reach 14W-16 upstream of its current connection location thereby requiring the stabilization of this section of the channel from the new connection point to Reach 14W-12.
    - Additional benefits resulting from the stream realignment and restoration works in this reach will include the improvement to fish passage through the removal of existing field crossing structures and channel renaturalization.

- LS/SM asked whether the proposed realignment will fulfill the drainage density requirements identified in NOCSS.
    - SV indicated that the current concept is based on a preliminary assessment; however, with the proposed stream corridor and realignment of the channel, the drainage density requirements will be achieved. MC indicated that the channel will be designed to create improved habitat diversity over the existing feature. It is anticipated that the realignment will improve aquatic habitat with an objective to expand Redside Dace habitat that is currently unavailable in the existing Reach 14W-14.

- SM indicated that although the channel length can be maintained by meandering, the realignment should maintain the same gradient as existing to ensure that the realignment maintains the form and function of the existing channel.
    - SV indicated that the intent of the natural channel design was to achieve this objective.

Reach 14W-11A - Realignment

- MC indicated that the proposed concept plan calls for the realignment of Reach 14-11A along the eastern property limit connecting to the same location of Reach 14W-11. The channel will also be designed to create improved habitat diversity over the existing feature and as a result of its proposed realignment will create additional stream length.

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- LS inquired whether the restoration was incorporating the NOCSS restoration recommendations. MC confirmed it would.

- MC indicated that Reach 14W-11 was classified as a High Constraint Stream Requiring Rehabilitation and inquired whether the rehabilitation was a requirement for the proponent during the development stage.
  - LS confirmed that the rehabilitation was a requirement for the proponent to undertake during on-site development works only and that Halton Conservation could provide specific measures.

Concept Plan – Road Alignment

- MC indicated that the Secondary Plan identified that the proposed Burnhamthorpe Road alignment had the potential to encroach within the setback for the northern section of Reach 14W-12 that conveys flow from the pond (Reach 14W-14A)
  - JP indicated that if this reach is considered to be Redside Dace habitat this encroachment would have to be justified by the description of what alternatives were assessed to minimize potential adverse effects to Redside Dace.

Redside Dace – Occupied Reach

- MC asked what the MNR considered to be Redside Dace occupied reach given that Dundas Street culvert functions as a barrier to fish passage due to the perched outlet and sheet flow over concrete.
  - JP indicated that the MNR did not consider the Dundas Street culvert to function as a barrier to fish passage. Future road works along Dundas Street are anticipated to result in improvements to fish passage through this crossing.
  - JP also indicated the delineation of Redside Dace habitat was under refinement and would be supplemented by observations made during the site meeting. JP also indicated that he would like to return in mid-May to observe the watercourses later in the spring season.

- MC inquired about timelines for Guidelines as it is uncertain how the proponent is to undertake planning works when the extent of Redside Dace habitat has not yet been determined and when this determination would be made.
  - JP indicated that the Redside Dace Development Guidelines would be issued soon and that will assist the proponent in their planning activities.

Bobolink Habitat

- MC identified the locations where Bobolink had been observed during field investigations.
- MC requested guidance on how the proponent is to proceed with planning works with respect to the potential interaction with Bobolink habitat in agricultural lands and what the timelines are for the MNR to issue more information for this species.

- JP indicated that in the near future the MNR would be coming out with direction regarding Bobolink. However, this information for Bobolink is not anticipated to have a significant impact on the concept plan.

Wetland Habitat

- LS indicated that although wetland delineation (i.e. staking of the wetland edge) was not previously required by HC as it was assumed that the stream corridor setbacks would be sufficient to include the wetlands and associated 30 m setback. Since the development concept is proposing realignments and rehabilitation, HC requested the proponent undertake wetland delineation.
  - MC indicated that this has been assessed through a desktop review at this stage

Next Steps

- JP to coordinate with MC to schedule a site visit in mid to late May to examine flows in Redside Dace occupied reaches.
- MC/LS to coordinate the scheduling of a site visit to undertake wetland delineation (staking).

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Sonia Rankin

From: Dinka, Stephen [SDinka@ecoplans.com]
Sent: Tuesday, September 21, 2010 2:19 PM
To: Mark Cece; Sonia Rankin
Subject: FW: North Oakville- Milton West Wetland Complex

Hi Sonia/Mark,

As requested, below is the email from Conservation Halton regarding MNRs decision to unclassify the PSW.

Cheers,

Steve

Stephen Dinka, MSc.
Ecologist
Ecoplans Limited

72 Victoria Street South, Suite 100 | Kitchener ON N2G 4Y9
Phone: (519) 741.8850 Ext. 2262 | Fax: (519) 741.8884
Email: sdinka@ecoplans.com| www.ecoplans.com

Please consider the environment before printing this email.

From: Brenda Axon [mailto:baxon@hrca.on.ca]
Sent: Tuesday, August 17, 2010 10:40 AM
To: Leah Smith; Dinka, Stephen
Cc: Mark Cece; Robert Thun; Samantha Mason
Subject: RE: North Oakville- Milton West Wetland Complex

Hi,

I spoke with Emma Followes at MNR on Friday. She is prepared to amend the North Oakville- Milton West wetland complex to remove the two wetlands located on the blue stream.

Brenda

Brenda Axon
Manager, Watershed Planning Services
Conservation Halton
2596 Britannia Rd W.
Burlington ON L7P 0G3

Phone: 905.336.1158 x222
Fax: 905.336.7014

baxon@hrca.on.ca
www.conservationhalton.ca

From: Leah Smith
Sent: August 12, 2010 10:32 AM
To: 'Dinka, Stephen'
Cc: Mark Cece; Brenda Axon; 'Robert Thun'; Samantha Mason
Subject: RE: North Oakville- Milton West Wetland Complex

Hi Steve,

We have not yet heard back from the MNR on the PSW's. We have a meeting with them the last week of August so I will request that this item be added to the agenda. We still believe that the wetlands should only need to be staked if they are deemed PSW's or are contained within the red stream portion of the creek.

As for fisheries, our fisheries ecologist is on vacation this week so I will talk to her about your request when she returns. Could you let me know what you would like to discuss with respect to fisheries? I agree that it is beneficial to discuss all items prior to the submission of the EIR/FSS for the site – could you let me know when you anticipate submitting this document? The Town of Oakville staff will also need to be present for all site visits so we should discuss this request with Rob Thun. I have copied him.

Thanks,

Leah Smith, M.E.S.
Environmental Planner
Conservation Halton
2596 Britannia Road West
Burlington ON L7P 0G3
905-336-1158 x283
fax: 905-336-6684
www.conservationhalton.ca

From: Dinka, Stephen [mailto:SDinka@ecoplans.com]
Sent: Monday, August 09, 2010 1:01 PM
To: Leah Smith
Cc: Mark Cece
Subject: RE: North Oakville- Milton West Wetland Complex

Hi Leah,

We would also like to invite Conservation Haltons Fisheries/aquatic biologist to meet us on site during the wetland/dripline flagging to discuss the project further with our fisheries biologist Mark Cece. This could be a great opportunity to "kill 2 birds with one stone" and identify any potential issues prior to submission of the EIR. I know your likely still waiting for a response from MNR but we`ve identified several potential dates that could work:

August 18 or 19th.

One day the week of August 23rd through 27th.

Please let me know if this works for your team.

Thanks in advance,

Steve Dinka

Stephen Dinka, MSc.
Ecologist
Ecoplans Limited

72 Victoria Street South, Suite 100 | Kitchener ON N2G 4Y9
Phone: (519) 741.8850 Ext. 2262 | Fax: (519) 741.8884
Email: sdinka@ecoplans.com| www.ecoplans.com

Please consider the environment before printing this email.

From: Leah Smith [mailto:lsmith@hrca.on.ca]
Sent: Tuesday, August 03, 2010 11:32 AM
To: Brenda Axon
Cc: Dinka, Stephen
Subject: FW: North Oakville- Milton West Wetland Complex

Hi Brenda,

Have you heard back from the MNR on this?

Thanks,

Leah Smith, M.E.S.
Environmental Planner
Conservation Halton
2596 Britannia Road West
Burlington ON L7P 0G3
905-336-1158 x283
fax: 905-336-6684
www.conservationhalton.ca

From: Dinka, Stephen [mailto:SDinka@ecoplans.com]
Sent: Tuesday, August 03, 2010 11:28 AM
To: Leah Smith
Subject: RE: North Oakville- Milton West Wetland Complex

Hi Leah,

Just wondering if you have had any luck with the MNR?

Thanks,

Steve

Stephen Dinka, MSc.
Ecologist
Ecoplans Limited

72 Victoria Street South, Suite 100 | Kitchener ON N2G 4Y9
Phone: (519) 741.8850 Ext. 2262 | Fax: (519) 741.8884
Email: sdinka@ecoplans.com| www.ecoplans.com

Please consider the environment before printing this email.

From: Leah Smith [mailto:lsmith@hrca.on.ca]
Sent: Friday, July 16, 2010 2:42 PM
To: Dinka, Stephen
Subject: FW: North Oakville- Milton West Wetland Complex

Hi Steve,

Our staff has followed up with an email message to the MNR. I'm not sure what the timing will be but I'll get back to you as soon as we hear from them.

Leah

Leah Smith, M.E.S.
Environmental Planner
Conservation Halton
2596 Britannia Road West
Burlington ON L7P 0G3
905-336-1158 x283
fax: 905-336-6684
www.conservationhalton.ca

From: Brenda Axon
Sent: Thursday, July 15, 2010 4:54 PM
To: Tom Farrell (E-mail) (tom.farrell@mnr.gov.on.ca); John Pisapio (MNR) (john.pisapio@ontario.ca); Followes, Emma (MNR)
Cc: Leah Smith; Kim Barrett; rthun@oakville.ca
Subject: North Oakville- Milton West Wetland Complex

Hi Tom, John, and Emma,

Our staff have had a request to stake the limits of two wetlands on the Bentall property in North Oakville. These two wetlands (Wetland units 2 and 3 of the North Oakville-Milton West Wetland Complex) (see attached map) are located on a blue stream. Recognizing that changes were made to the PSW east of the Sixteen Mile Creek to remove wetlands that were on blue streams, it is questioned whether MNR intends to take a similar approach for these wetlands as well.

We would appreciate knowing your position on this matter.

Brenda

Brenda Axon
Manager, Watershed Planning Services
Conservation Halton
2596 Britannia Rd W.
Burlington ON L7P 0G3 (New!)

Phone: 905.336.1158 x222
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www.conservationhalton.ca

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Sonia Rankin

From: Mark Cece
Sent: Tuesday, November 23, 2010 11:11 AM
To: Sonia Rankin; Stephen Dinka
Subject: FW: North Oakville
Attachments: MMM-Nov22-2010.pdf

From: Thompson-Black, Melinda (MNR) [mailto:Melinda.Thompson-Black@ontario.ca]
Sent: Tuesday, November 23, 2010 10:58 AM
To: Mark Cece
Subject: RE: North Oakville

Please accept the attached response to your request.

Melinda Thompson-Black, B.A.Hon., M.Sc.
Species at Risk Biologist
Aurora District, Ministry of Natural Resources
50 Bloomington Rd Aurora, ON L4G 0L8
Tel. (905) 713-7425
Fax.(905) 713-7360
melinda.thompson-black@ontario.ca

Please consider the environment before printing this email.

From: Mark Cece [mailto:CeceM@mmm.ca]
Sent: November 17, 2010 2:42 PM
To: Thompson-Black, Melinda (MNR)
Cc: jlawrence@hrca.on.ca
Subject: North Oakville

Melinda

We recently attended a North Oakville Agency Review meeting (including Conservation Halton staff) on Nov 15, 2010 to discuss our project in North Oakville located west of Bronte Road (Reg Rd 25) and north of Dundas St. The North Oakville Streams Subwatershed Study (NOCSS) has identified a reach within our study area as a High Constraint due to the presence of Redside Dace habitat. During the meeting CH indicated that MNR should be involved in the discussions related to the proposed site development as the current development concept includes channel realignment of a reach upstream of the High Constraint stream as well as the desire to confirm the extent of Redside Dace habitat as there is some question regarding the classification of a tributary as Redside Dace habitat.

Can you please let me know your availability to discuss the project and earliest availability to see the site as I suspect that a field visit would be required to examine the tributary that is in question and with the snow approaching we may be in a bit of a crunch.

RED – Site Boundary
BLUE- High Constraint Stream (Approx.)
ORANGE – High Constraint Stream (tributary) in question (Approx.)



Thanks

Mark Cece, B.Sc.
Senior Fisheries Biologist
Ecology Deprtment
MMM Group Limited
100 Commerce Valley Drive West
Thornhill, Ontario, Canada L3T 0A1
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Kouther Kouider
Aurora District Office
50 Bloomington Road West
Aurora, ON L4G 0L1

Ontario

Ministry of Natural Resources
Ministère des Richesses Naturelles

November 4, 2015

Mark Pearce, Senior Fisheries Biologist
MMM Group Limited
' 00 Commerce Park Drive West
Thornhill, ON L3T 7A1
Dear Mr. Pearce,

RE: Redside Dace – North Oakville

This letter is in response to your request for information regarding the Redside Dace (*Clinostomus elongatus*) in the vicinity of the proposed Trafalgar Road Corridor Class Environmental Assessment (EA) study area, located between Dundas Street and Highway 407 in the Town of Oakville, Regional Municipality of Halton.

Redside Dace are known to occur in the Sixteen Mile Creek watershed, including the Morrison Creek subwatershed. Redside Dace are listed as endangered under the Ontario Endangered Species Act, 2007 and are protected from killing, harming, harassing, capturing or taking, as well as possession, transport, collection, trade and sale. Redside Dace are also protected from damage and destruction to their habitat.

Based on the information provided, it is the opinion of the Ministry of Natural Resources and Forestry (MNRF) that the proposed Trafalgar Road Corridor Class EA study area is within the habitat of Redside Dace. Redside Dace habitat is defined as the areas adjacent to the extent of occurrence that contribute directly to the species' survival, including areas that provide food, shelter, and water, and areas that are used for movement, reproduction, hibernation, migration or any other life process.

Please be advised that the MNRF considers the Trafalgar Road Corridor Class EA study area to be habitat for Redside Dace. Any activities undertaken within the habitat of Redside Dace must be reviewed by the MNRF to ensure that they do not contravene the Endangered Species Act, 2007. Please contact the MNRF Aurora District Office to discuss your proposed activities and to determine if you require authorization under the Endangered Species Act, 2007.

If you have any questions regarding the above comments, please contact me at the number below.

Sincerely,

Melinda Thompson-Black

Melinda Thompson-Black
Species at Risk Biologist
Ministry of Natural Resources and Forestry

PROTECTING THE NATURAL ENVIRONMENT FROM LAKE TO ESCARPMENT

2596 Britannia Road West
Burlington ON L7P 0G3
905.336.1158 Fax 905.336.7014
conservationhalton.ca

September 6, 2011

Robert Thun
Town of Oakville, Planning Services Department
1225 Trafalgar Road, P.O. Box 310
Oakville ON L6J 5A6

Dear Mr. Thun:

RE: Area Servicing Plan – 407 West Employment Area, North Oakville West
Town of Oakville
CH File: MPR 574
Related Files: MPR 562, 24T-11001, Z.1333.01

Staff has reviewed the *Area Servicing Plan, 407 West Employment Area, North Oakville West*, prepared by MMM Group, dated May 2011, and offers the following comments.

General

Staff appreciated the inclusion of the plan and profile view drawings.

Staff note that the locations of the Natural Heritage System, creeks, roadways and SWM ponds as well as the culvert sizes assumed may change through the preparation and approval of the EIR/FSS documents. The ASP should be updated, if necessary, if these changes are significant enough to impact the recommendations of the ASP with respect to the proposed water and wastewater servicing.

Water Servicing

Along Dundas Street – Conservation Halton staff previously approved the general alignment of the proposed watermain along Dundas Street through the Region's Master Servicing Plan and are currently working with the Region on detailed design. It is our understanding that the Ministry of Natural Resources has determined that the proposed crossings of the West and Main Branches of Fourteen Mile Creek will not require a permit under the *Endangered Species Act* (ESA) as long as the crossings continue to cross overtop of the existing culverts and a number of other criteria are met. On Drawing No. P-1, a regulated watercourse crosses Dundas Street immediately west of Tremaine Road, which is not reflected on the profile view. While it is understood that this is located outside of the Study Area, staff recommend that it would be beneficial to include the existing culvert on the drawing to ensure that the 900 mm watermain will enter into the study area at the elevation assumed.

Internal Servicing – Conservation Halton staff have no objections in principle to the proposed internal servicing. It is our understanding that the final watermain locations will be finalized in

conjunction with locating the proposed roadways which will be finalized within the applicable EIR/FSS documents. It should however be noted that Avenue 2 is located further to the east then the location illustrated in the North Oakville West Master Plan, necessitating an additional crossing of the West Branch of Fourteen Mile Creek in close proximity of the Burnhamthorpe Road crossing. Staff will require that Avenue 2 be located west of the West Branch of Fourteen Mile Creek unless adequate justification for its current location can be provided. In the event that Avenue 2 is permitted to cross the creek, Drawing P11 should be updated to reflect the proposed creek location where Avenue Two and the proposed watermain will cross the Natural Heritage Area. Staff also note that the location of Avenue One relative to the Main Fourteen Mile Creek valley system must be assessed in the field and may require relocation. We would further advise the applicant, that additional discussion on road alignments is required with the Ministry of Natural Resources regarding ESA requirements.

Wastewater Servicing

Along Dundas Street – Conservation Halton staff previously approved the general alignment of the proposed trunk sewer along Dundas Street (from Tremaine Road to Colonel William Parkway) through the Region's Master Servicing Plan, but have not been involved in any detailed design discussions to-date. The proposed trunk sewer proposed from Avenue Four to Colonel William Parkway was not identified in the Master Servicing Plan but Conservation Halton staff have no objections in principle to this additional sewer crossing of the Main Fourteen Mile Creek as it is shown crossing overtop of the existing culvert.

Internal servicing – In principle, Conservation Halton staff have no objections to the proposed internal servicing. Staff noted that on Drawing No. P8 that MH116A is located east of the existing driveway. As staff anticipate that the purpose of MH116A is to service the development lands located between Fourteen Mile Creek tributaries 14W-9 and 14W-11, staff are unclear why the manhole would not be located along the existing driveway. Staff are satisfied that this issue can be addressed within the applicable EIR/FSS. It is our understanding that the final sewer locations will be finalized in conjunction with locating the proposed roadways which will be finalized within the applicable EIR/FSS documents. It should however be noted that Avenue 2 is located further to the east then the location illustrated in the North Oakville West Master Plan, necessitating an additional crossing of the West Branch of Fourteen Mile Creek in close proximity to the Burnhamthorpe Road crossing. Staff will require that Avenue 2 be located west of the West Branch of Fourteen Mile Creek unless adequate justification for its current location can be provided. Staff also notes that the location of Avenue One relative to the Main Fourteen Mile Creek valley system must be assessed in the field and may require relocation.

We trust the above is of assistance. If you require additional information please contact the undersigned at extension 283.

Yours truly,

Leah Smith
Environmental Planner
LS/

cc. (by email) Rita Juliao, Town of Oakville
Doug Corbett and Stan Holiday, Region of Halton
John Pisapio and Melinda Thompson-Black, Ministry of Natural Resources

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OAKVILLE

Development Engineering Department
Preliminary Comments

To: Rob Thun, Planning Services

From: Rita Juliao, P. Eng.

Date: September 16, 2011

Re: 3269 Dundas Street, Lazy Pat Farms, EIRFSS Preliminary Comments

We have had the opportunity to review the following information:

1. Powerpoint presentation slide deck, prepared by MMM Group, dated November 15, 2010;
2. EIR/FSS for Fourteen Mile Creek West and the Lazy Pat Farm Property, Figure 1 and 2, dated February 25, 2011;
3. Letter to Ms. Leah Smith, prepared by Mr. Tyrrell, MMM Group, dated March 1, 2011;
4. Preconsultation Comments, prepared by Conservation Halton, dated January 20, 2011;
5. Response to Preconsultation Comments, prepared by MMM Group, dated March 1, 2011; and
6. **14 Mile Creek West and Lazy Pat Farm Property, EIR/FSS, May 18, 2011.**

Based on our review of the above noted information, we offer the following preliminary comments:

1. We note that the Lazy Pat Farm Property is mostly located within the Fourteen Mile Creek subcatchment area FM1001 and partially in FM1102 and FM1109, as defined by the EIR Subcatchment Plan, Appendix 7.2, mediation agreement dated June 29, 2007. The EIR and FSS should be completed for all of Subcatchment FM 1001. Sufficient information should be provided for FM1102 and FM1109, including preliminary level servicing and grading, stormwater management facility sizing and analysis for the ultimate development scenario design of stream modifications and trunk servicing design.

2. We note that the Unit Flow Rate Target Locations, Figure 7.4.7 of the NOCSS Implementation Report identifies two possible culvert outlets for Subcatchment FM 1101, FM-D2 and FM-D3. The Bronte Creek Community, Phase 5B (Monarch) subdivision storm sewer network south of Dundas Street was sized to pick-up 13.44 hectares of external, pre-development flows (runoff coefficient of 0.25) and convey these flows to the Pineberry stormwater management facility. Flows in excess of the above mentioned capacity are conveyed overland through the provincial park to the "W2 tributary" of Fourteen Mile Creek. We wish to make the applicant aware that a portion of this channel has failed and is currently being redesigned by Stantec Consulting. The Town and Conservation Halton have not yet accepted the proposal to rehabilitate this portion of the stream. Consideration should be given to the capacity of the downstream systems. Furthermore, consideration should be given to the EIR/FSS should provide stormwater management in accordance with the unit target flow rates set out in the mediation agreement, respecting the drainage areas and thresholds of the receiving downstream systems.

3. Further to comment #2, we note that the future flows from lands west of Tremaine Road should be considered in the analysis at Dundas Street and downstream tributaries of Fourteen Mile

Creek. How will the development of ultimate stormwater management strategy ensure that flows from external SWM ponds will not exceed the erosion thresholds and flow capacities of the receiving systems? How has the interim condition (prior to development of the land west of Tremaine) been accounted for in the post-development modeling? Further discussion in the EIR/FSS is required.

4. We note that the Erosion Control Analysis provided in Section 7.7 and Appendix 7.1 is incomplete. In keeping with the EIR/FSS Terms of Reference, we feel that the erosion threshold analysis should be completed to support the proposed stormwater management strategy for SWM Ponds 1 through 4. As such, we recommend that the work prepared by Water's Edge be expanded to include the tributaries downstream of culverts D2 and D3, as described in staff's earlier comments as tributaries W2 and W3, respectively. We recommend that the analysis consider the portion of W2 which requires rehabilitation.

5. Furthermore, the approach to Erosion Threshold Analysis should be in keeping with the approach set out in the EIR/FSS Terms of Reference (ToR), including continuous modeling of the pre and post development conditions with an evaluation of critical threshold exceedences. Based on Staff's review of the Water Edge report and Figure 2, Appendix 7.1, it would appear that the West and East Branches of Fourteen Mile Creek were only evaluated to one stream length downstream of Dundas. We believe that each stream (including W2 and W3 mentioned above) should be evaluated to the next stream confluence, in accordance with EIR/FSS ToR.

6. While staff are generally supportive of optimizing the number of stormwater management ponds within the EIR/FSS study area, we recognize that such optimization usually results in larger stormwater management ponds. The level of detailed provided in Section 7.0 and Figures 8.5 (SWM Plan) and Figure 8.6 (Grading Plan) is insufficient to evaluate the location and size of the proposed SWM Ponds and support Draft Plan approval. We recommend that Section 7.0 be expanded to include preliminary sizing of the SMW ponds, consistent with the grading plan, Town standards for SWM pond sizing (see Development Engineering Manual) and EIR/FSS Terms of Reference, particularly Topographic Depression Storage analysis.

7. Furthermore, Figure 8.6 should be supported by a Preliminary Grading Plan, prepared on a standard A1 drawing sheet (594mm x 841mm) and in accordance with the specifications set out in the Town's Development Engineering Manual, Section 3.2.6.

8. Similarly, the Stormwater Drainage Plan, Figure 8, should be consistent with the grading plan and reflect the requirements set out in Section 3.2.5 of the Development Engineering Manual to the extent possible. Staff would appreciate clarification on the drainage area to each SWM pond either on Figure 8.5 and/or Figure 7.3.

9. Subsequent submissions of the EIR/FSS should label stream 14W-14A on Figure 2.1.

10. Staff are not supportive of the replacement of stream 14W-14A with a stormwater management pond. This stream is classified in the North Oakville Creeks Subwatershed Study as a Blue (Medium Constraint) stream and while it may be modified and/or relocated with the subcatchment area, the form and function of the stream are to be maintained. The EIR/FSS and Draft Plan should be revised accordingly.

11. Similarly, we feel that Section 6.0 should be updated to include a compete evaluation of stream 14W-14A, including the discussion presented in Section 6.4.7 as stream length are to be maintained on a subcatchment basis under post-development conditions.

12. Staff would appreciate more information on the condition of the existing pond, including a detailed survey/bathymetry to evaluate the condition of the pond bottom and locate any structural features prior to commenting on the appropriateness of incorporating the existing pond (as-is) into a stormwater management facility. As noted earlier, preliminary pond design drawings are required for Pond 3 and all other SWM ponds to ensure that the pond can be accommodated within the SWM Block.

13. The North Oakville Creeks Subwatershed Study identifies the aquatic and riparian habitat management recommendations for each stream reach in Table 6.6.4. With respect to stream reach 14W-14A, the management recommendation is to leave the pond undisturbed and consider supplementing the riparian zone with wood vegetation. We do not feel that this recommendation is being upheld in the proposal. How is this being addressed?

14. Staff have reviewed Appendix 7.2 with respect to Regional Storm Control in stormwater management ponds. We will continue to rely on our partners at Conservation Halton to conduct a complete review, however we wish to raise the following concerns:
    a. We assume that all SWM ponds shown on Figure 8.5 represent 100-year design storm ponds. It would appear that the drainage area to Pond 2 will be diverted to culvert FM-D3 and as such, we recommend that downstream analysis of the Fourteen Mile Creek W2 tributary be included in the evaluation.
    b. Given the flood-prone sites identified by the Town-wide Flood Study (May 2007) along Fourteen Mile Creek, south of QEW, staff are not convinced that any increased risk in these areas is acceptable.
    c. Staff require digital copies of the hydraulic and hydrologic models used in the analysis of Regional Storm Control.

MMM GROUP

MEETING REPORT

Date:	November 24, 2011	**Project:**	**Bentall EIR/FSS** Lazy Pat Lands, Oakville
Date of meeting:	October 20, 2011	**Project Number:**	14.09222
Location:	Lazy Pat Lands; Oakville	**Author:**	Sonia Rankin
Purpose:	Agency Meeting with MNR, CH & DFO. Regulatory Requirements for Aquatic Features (Lazy Pat Lands)		

Attendees:	**E-Mail**	**Phone**	**Extension**	**Fax**
Samantha Mason, CH (SM)	smason@hrca.on.ca	905-336-1158	267	905-336-6684
Rick Kiriluk, DFO (RK)	Rick.kiriluk@dfo-mpo.gc.ca	905-639-6378	-	905-639-3549
John Pisapio, MNR (JP)	John.pisapio@ontario.ca	905-713-7387	-	905-713-7360
Mark Cece, MMM (MC)	cecem@mmm.ca	905-882-4211	6861	905-882-0055
Randall Roth, MMM (RR)	rothr@mmm.ca	905-882-4211	6833	905-882-0055
Sonia Rankin, MMM (SR)	rankins@mmm.ca	905-882-4211	2295	905-882-0055
DISTRIBUTION: All Attendees and the following:				
Michael Reel, Bentall	mreel@bentallkennedy.com	416-674-3584	-	416-681-3405
Rita Juliao, Town of Oakville	rjuliao@oakville.ca	905-845-6601	3025	905-338-4414
Robert Thun, Town of Oakville	rthun@oakville.ca	905-845-6601	3029	905-338-4414
Chris Tyrrell, MMM	tyrrellc@mmm.ca	905-882-7303	-	905-882-0055

Item	Details	Action By	Action Date
1	**Introduction**		

MC identified the goal of the site walk was to introduce DFO to the site as well as discuss the proposed development plan, specifically the incorporation of the farm pond (Reach 14W-14A) into the stormwater management (SWM) facility, the proposed realignment of Reach 14W-14 (including the consolidation of Reach 14W-13 and the proposed stabilization of Reach 14W-16).

The small pond associated with Reach 14W-16 was not examined during the site visit as originally requested by CH (SM) as MC confirmed that the pond will not be removed as part of the development plan for the site.

RK/JP discussed the focus of each agencies review of the site. RK indicated that his role in the process will be to focus on the fish habitat concerns, while he would rely on MNR (JP) to manage the fishery.

All watercourses were observed by SM and RK; however, due to a scheduling conflict JP was unable to see Reaches 14W-11/14W-11A. JP indicated that a subsequent site visit may be required to observe this feature and he would contact MMM if/when this was required to coordinate with the landowner.

2	**Project Background and General Overview**		

MC provided a project overview and outlined the purpose of the meeting to observe the fish habitat present on site that has the potential to be affected by the proposed development. The meeting involved discussions relating to Reaches 14W-12, 14W-16, 14W-14, 14W-13, 14W-11, 14W-11A and the farm pond (Reach 14W-14A).

Item	Details	Action By	Action Date
	MC identified fieldwork undertaken to date including fish community sampling, fish habitat, benthic macroinvertebrate sampling, and installation of temperature loggers on-site to monitor water temperatures in the tributaries and farm pond. MC provided a summary of groundwater monitoring results, which indicated that although there is insufficient contributions to maintain base flow in the watercourses there is a limited amount of groundwater contributing to the lower sections of Reaches 14W-14, 14W-16 and in 14W-12. JP indicated that the groundwater conditions are understood in the Dundas Street area based on ongoing studies and previously reviewed projects to the south. JP directed MMM to be mindful of groundwater conditions in this area with a recommendation to be proactive with development design considering the groundwater conditions as previous studies did not appear to fully understand groundwater interactions. MC agreed to provide groundwater map contours to JP. MC described the flows in Reaches 14W-16, 14W-12 and the upper reach of Reach 14W-12 (Informally referred to as 14W-12A in the EIR Submitted in May 2011) based on field investigations from 2009 to present. MC provided a detailed description of the tributary confluence at 14W-14, 14W-13, 14W-12 and 14W-14A for context, specifically the historic modifications (construction of pond/Reach 14W-14A) that result in the current drainage pattern.		
3	**Redside Dace**		
	JP indicated that the MNR has been recently involved in determining Redside Dace habitat in the North Oakville area and in addition to Reach 14W-12, Reach 14W-16 has also been identified as Redside Dace habitat and is afforded the same protection (i.e. meander belt plus 30 m setback). The stabilized section of Reach 14W-16 and realigned Reach 14W-14 (as it would become suitable for Redside Dace to inhabit) would both be subject to protection under the ESA. JP indicated that the stream realignment within Reach 14W-16 is required to have a buffer that extends to the meanderbelt plus 30 m. JP stated that this setback is a legal requirement thereby over riding other guidelines and regulations. MMM to verify whether the application of the meanderbelt plus 30 m setback would change development setbacks proposed in the EIR. MC indicated that MMM will update the corridors associated with the natural features SM suggested referring to the ***Guidance for Development Activities in Redside Dace Protected Habitat*** to determine water quality targets as well as assist in directing design and construction plans.	***MMM***	
4	**Stream Realignments**		
	MC described the proposed channel works including realignment of Reaches 14W-11A, and 14W-14 (including consolidation with Reach 14W-13) as well as the stabilization of a section of Reach 14W-16 to accommodate additional flows associated with the realigned Reach 14W-14. RK indicated that MMM is to prepare a Risk Assessment Matrix for Fish and Fish habitat for the proposed realignment/stabilization works and provide to CH for review. Due to CH's Level 2 agreement with DFO to review projects under Section 35(1) of the Fisheries Act, CH will consult with DFO as required. Direct DFO feedback is unlikely to be required (per RK).		

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Item	Details	Action By	Action Date

Stream Realignment of Reach 14W-11A

JP was unavailable to visit this area of the property to view the existing conditions in Reach 14W-11A. JP requested to view this feature at a later date when his schedule permits to be coordinated by MMM.

SM indicated that the concept of the realigned section of Reach 14W-11A was very angular. MC indicated that the preliminary alignment is an early conceptual alignment and will be designed to create a stable channel. Furthermore, the block identifies the area in which the channel will be located but does not necessarily indicate that the channel will be subject to a 90 degree turn as it will be a meandering naturalized channel.

RK provided a preliminary assessment of the potential for the proposed works to result in the Harmful Alteration Disruption, Destruction (HADD) of fish habitat. RK indicated that based upon the fish community, permanency/resilience and intensity of the proposed impacts to this feature, the proposed realignment is likely to pose a Low risk of resulting in a HADD and a *Fisheries Act* Authorization is unlikely to be required. SM supported this assessment.

Reach 14W-14

JP indicated that this feature lacks a channel capable of directly supporting Redside Dace, thereby providing contributing Redside Dace habitat. JP and SM were in agreement with the evaluation of this tributary.

Similar to Reach 14W-11A, RK indicated that the proposed realignment is likely to pose a Low risk of resulting in a HADD and a Fisheries Act Authorization is unlikely to be required. SM supported this assessment.

JP indicated that the proposed realignment including the consolidation with Reach 14W-13 would likely result in increased permanence in flow and may result in the channel directly supporting Redside Dace. As a result, the watercourse will be subject to the meanderbelt plus 30 m setback associated with Redside Dace.

Reach 14W-16

JP indicated that the proposed channel stabilization would provide the opportunity for improved habitat diversity suitable to improve habitat for Redside Dace including the increased flow anticipated from the realignment of Reach 14W-14. SM and RK were supportive of this approach.

Similar to Reach 14W-11A, RK indicated that the proposed stabilization is likely to pose a Low risk of resulting in a HADD and a Fisheries Act Authorization is unlikely to be required. SM supported this assessment.

JP also indicated that the entire Reach (14W-16) was considered by the MNR as Redside Dace habitat and as a result, the watercourse is subject to the meanderbelt plus 30 m setback associated with Redside Dace.

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Item	Details	Action By	Action Date
5	**Reach 14W-14A (Farm Pond)**		
	MC identified the proposed development plan includes the incorporation of the pond into the stormwater management facility.		
	MC provided a detailed description of the fisheries assessment (thermal, clarity, water quality, fish community, benthics), groundwater monitoring and bathymetric survey for the large pond to date. Based on the results of the groundwater monitoring as well as the water temperature data it appears that groundwater input into the pond appears to be minimal and likely shallow through flow during the spring freshet and precipitation events.		
	JP recommended caution when assessing and characterizing groundwater interactions given historic misinterpretations/mischaracterization in the area to the south. MMM was cautioned to consider the history of downstream groundwater interaction issues in their assessment. MC indicated that MMM is currently addressing groundwater comments issued by CH associated with the EIR/FSS		
	JP indicated he would like to review the data gathered to date related to the pond. MMM to provide information to MNR (JP).	***MMM***	
	SM suggested assessing the water temperature data using the thermal stability protocol authored by Cindy Chu (Trent University). This method is used by CH and will allow data to be reviewed in a familiar/comparative context. CH to provide protocol.	***CH (SM)***	
	MMM will analyze the farm pond temperatures using the provided protocol for CH review.	***MMM***	
	SM/RK identified that the removal of on-line ponds is a benefit to fish and fish habitat; however, this feature is a by-pass pond and will require a better understanding of the existing conditions and further discussions between CH/MNR/DFO following MMM's submission of 2011 monitoring data. MC indicated that the by-pass pond has a similar effect to cold/coolwater habitats and according to DFO literature (*Fish Habitat & Constructing Ponds, DFO 2003*) is unlikely to be approved if the construction of a pond of this nature was proposed. Furthermore, the removal of these types of ponds is typically considered a benefit to fish and fish habitat.		
	MC requested further guidance from the CH regarding the functions of the pond they would like recreated as in its current form it was contributing warmwater inputs into coolwater habitat (Reach 14W-12) that supports Redside Dace. CH will provide their decision, but they are waiting on support/information from the MNR/DFO as well as MMM monitoring data submitted in response to CH comments.	***CH (SM)***	
	SM indicated that the large pond functions as a headwater wetland features that are typically beneficial to downstream habitats by providing nutrients, woody debris, etc. It is believed that the large pond provides a similar benefit to the downstream habitat that is considered to support Redside Dace. MC indicated that unlike headwater wetlands that contribute groundwater, this pond acts as storage for water and that is often severed from downstream habitat. When a connection is present during the summer period it is during/following precipitation events with the discharge from the pond consisting of the warmer top layer resulting in warmwater inputs to coolwater Redside Dace habitat. The pond also appears to function as a sink rather than a source for sediment and organic material (i.e. leaves twigs) due to the downstream connection.		
	Comments related to the pond were deferred by CH/MNR/DFO until a later date as they felt it was necessary to discuss further.	***CH/MNR/DFO***	

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Item	Details	Action By	Action Date
6	**Natural Channel Designs**		
	SM requests that the channel realignments proposed on the subject property be designed and constructed in such a way to avoid over-stabilization of the feature. Watercourses must be able to change over time and migrate within the floodplain thereby allowing for natural erosion of fine materials to maintain the downstream sediment inputs. In addition, these realignments must not be so stable that they become terrestrial features, dominated by cattails and upland species when they are to provide mitigation to current aquatic/fish habitat.		
7	**Flow Capacity – Stream Realignments**		
	MMM to maintain existing flow and match or exceed the existing stream length in the realigned watercourses, based on previous and current recommendations by CH.		
	CH/DFO and MNR recommend flow monitoring in tributaries to be realigned, to ensure there is an understanding of the flow regime when flows are combined.		
	MMM to confirm the location of flow gauges and provide details to CH regarding the existing flows and capacity of the watercourses.		
	SM showed concern with the design of the realignment of Reach 14W-14 and the loss of Reach 14W-13 and the ability of the new channel to handle the combined flows from the existing features. This has been addressed in the responses to CH comments (September 6, 2011).		
8	**Concept Plan / Road Alignments**		
	RR provided rationale for the location of the Burnhamthorpe Road extension along the current alignment. The road alignment was conceptually identified in the Secondary Plan. Under the current plan, the alignment was selected to avoid multiple crossings of high constraint watercourses identified in NOCSS, thereby minimizing potential impacts to identified Redside Dace habitat in the upper reach of Reach 14W-12.		
	JP considers this approach to be reasonable at the time as the delineation of Redside Dace habitat did not extend beyond Reach 14W-12. JP did indicate that MMM should review the alignment of this section of road and the location of the proposed intersection to minimize encroachment into Redside Dace habitat (including Reach 14W-16).	***MMM***	
9	**Stormwater Management**		
	MMM to provide justification to CH (SM) why the current plan reduces the number of SWM ponds from the 5 recommended in NOCSS to the 2 in the EIR/concept plan.	***MMM***	
10	**Next Steps**		
	JP to contact MMM to co-ordinate follow-up site visit to view Reaches 14W-11/14W-11A.	***MNR (JP)***	
	MMM to prepare response to CH comments associated with the EIR/FSS report.	***MMM***	
	CH, MNR and DFO to discuss the farm pond (Reach14W-14A) and provide a response to MMM following the submission of responses to CH EIR comments.	***CH (SM)***	

Ministry of
Natural Resources
Aurora District Office
50 Bloomington Road
Aurora, Ontario L4G 0L8

Ministère des
Richesses naturelles

Telephone: (905) 713-7409
Facsimile: (905) 713-7361

Ontario

RECEIVED
By Sonia Rankin at 2:52 pm, Sep 26, 2011

September 19, 2011

Sonia Rankin
MMM Group Limited
100 Commerce Valley Drive West
Thornhill, Ontario
L3T 0A1

Dear Ms. Rankin:

Please find enclosed a Licence to Collect Fish for Scientific Purposes #1064904. Please sign both copies of the enclosed licence in the space marked "Signature of Licencee" on the licence and each page of the attached conditions schedule. Your signature is acknowledgement that you understand and agree to the terms and conditions of the licence.

Return one signed copy to the issuing office at the address above. You and your assistants are required to carry a copy of this licence with you at all times while collecting specimens.

As noted in the conditions, you must complete a two-part Mandatory Report for fish collected under this licence. MNR has developed a new electronic report form to facilitate efficient reporting. The Mandatory Report, user guide and field definitions will be sent to you by email. The completed mandatory report for licence #1064904 must be submitted by December 30, 2011 to Karen Golby at karen.golby@ontario.ca.

Please note that all collections and sampling must be in compliance with the best management practices identified in the enclosed technical bulletin. A fish disease known as Viral Hemorrhagic Septicemia (VHS) has been confirmed in the lower Great Lakes and some inland tributaries. A map is attached to assist you in determining the location of your work site(s) in relation to Ontario's VHS management zone where waters are considered to be VHS positive. Please feel free to contact us should you have any questions regarding the definition of VHS positive waters.

Please contact me if you have any questions.

Yours truly,

K. Golby

Karen Golby
Business Services Clerk
Aurora District Office
Tel: (905) 713-7403, Fax: (905) 713-7361

Ontario

Ministry of Natural Resources

Ministère des Richesses naturelles

Licence to Collect Fish for Scientific Purposes

Permis pour faire la collecte de poissons à des fins scientifiques

Licence No. / N° de permis	1064904
Local Reference No. / N° de référence local	
Issuer Account No. / N° de compte du délivreur de permis.	7491147

This licence is issued under Part I of the Fish Licensing Regulation made under the Fish and Wildlife Conservation Act, 1997 to:

Ce permis est délivré en vertu de la Partie I du règlement sur la délivrance de permis de pêche formulé conformément à la Loi sur la protection du poisson et de la faune de 1997 à:

Name of Licencee / Nom du titulaire du permis	Last Name / Nom de famille	First Name / Prénom	Middle Name / Second Prénom
	Ms. Rankin	Sonia	

Name of Business/Organization/Affiliation (if applicable) / Nom de l'entreprise/de l'organisme/de l'affiliation (le cas échéant)

MMM Group Limited

Mailing address of Licencee / *Adresse postale du titulaire du permis*	Street Name & No./PO Box/RR#/Gen. Del./ N° rue/C.P./R.R./poste restante		
	100 Commerce Valley Drive West		
	City/Town/Municipality / Ville/village/municipalité	Province/State / Province/État	Postal Code/Zip Code / Code Postal/Zip
	Thornhill	ON	L3T 0A1

to collect the species, size and quantites of fish from the waters as set out below.
Pour faire la collecte des espèces sulvantes (stade et nombre indiqués ci-dessous):

Species / Espèces	Eggs / Oeuf	Juvenile / Fretin	Adults / Adulte	Numbers / Nombre	Name of Waterbody / Nom de l'étendue d'eau
	X	X	X		
fish		X	X		Farm Pond located on Lazy Pat Lands (see attached Schedule A)

Yes/Oui ☐ Additional species/Waterbody list attached / Liste d'espèces/d'étendue d'eau additionnelles ci-jointe

Purpose of collection / *But de la collecte*: fish community sampling

Licence Dates / *Dates du permis*	Effective Date / Date d'entrée en vigueur (YYYY-MM-DD)	Expiry Date / Date d'expiration (YYYY-MM-DD)
	2011-09-19	2011-11-30

Licence conditions / *Conditions du permis*: This licence is subject to the conditions contained in Schedule A if included. / Ce permis doit respecter les conditions de l'annexe A si celle-ci est jointe.

Yes/Oui ☒ No/Non ☐ Schedule A included. / Annexe A ci-jointe

Issued by (please print) / Délivré par (veuillez écrire en caractères d'imprimerie)	Signature of issuer / Signature du délivreur	Date of Issue/Date de délivrance (YYYY-MM-DD)
John Almond	John Almond	2011-09-19

Signature of Licencee / Signature du titulaire du permis	Date (YYYY-MM-DD)
Sonia Rankin 2011-09-26	2011-09-19

Personal information contained on this form is collected under the authority of the Fish and Wildlife Conservation Act, 1997 and will be used for the purpose of licencing, identification, enforcement, resource management and customer service surveys. Please direct further inquiries to the District Manager of the MNR issuing district.

Les renseignements personnels dans ce formulaire sont recueillis conformément à la Loi sur la protection du poisson de la faune, 1997 , et ils seront utilisés aux fins de délivrance de permis, d'identification, d'application des règlements, de gestion des ressources et de sondage sur les services a la clientèle. Veuillez communiquer avec le chef du district du MRN qui délivré le permis si vous avez des questions.

FW0032 (04/00)

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1064904
No de permis

This licence is subject to the conditions listed below.

1. Licencee may collect fish in a farm pond located on Lazy-Pat lands (Lot: 33 & 34) Concession 1 at 3269 & 3271 Dundas Street West (Regional Road 5) in the Town of Oakville, Regional Municipality of Halton.

2. This Licence is valid only for the persons, species, numbers, areas and calendar year indicated. A Mandatory Report documenting the sampling conducted under this licence must be submitted to the licence issuer within 30 days of the termination date, but in no case later than January 31 next following the year of issue. The Mandatory Report form (Part 1) must be completed for each sampling program and the Site.Collection Reports (Part 2) must be completed for each collection site. A map clearly indicating the location of each collection site must be attached to the Site Collection Reports. Submit the Mandatory Report (Part 1) and the Site Collection Reports (Part 2 & maps) electronically by email karen.golby@ontario.ca.The submission of a satisfactory report is a prerequisite to any subsequent renewals.

3. Before carrying out any operation under the licence in any area the licenced person shall inform the Area Supervisor or Lake Manager of his or her intentions at least a week before commencing work and include information as to the type of operation, location, duration, and the name or names of personnel involved.

4. A copy of the original licence must be carried by the licenced person when working at the designated sites. An assistant of the licenced person who is carrying out activities under this licence during the absence of the licenced person shall carry a copy of the licence on his or her person.

5. All collection gear shall be clearly marked with the licenced person's and the organization's name.

6. This licence is not valid in Provincial Parks, park reserves, or National Parks without the written permission from the authorized person in charge of the area concerned.

7. Capture gear shall be inspected regularly and live holding traps must be inspected at least once daily.

8. **The licencee shall follow the best management practices for the collection, handling, transportation and holding of fish identified in FS Bulletin 2008-01 (June 10, 2008) included with the licence in order to minimize the risk of spreading aquatic invasive species and diseases.**

9. Licencee must release fish live at the capture site with the exception of any specimens required for identification purposes.

10. Licencee must photograph and release live any redside dace captured. The photographs must be forwarded to MNR's Aurora District office for identification confirmation.

11. Any person, while acting under the authority of this authorization, shall immediately report the capture of any invasive species (eg. Ruffe, tubenose goby,**round goby**, rusty crayfish, Asian carp, etc.) found outside its previously known range (as determined by the distribution information available at http://www.invadingspecies.com/indexen.cfm to the licence issuing office. Any such specimens captured outside of their established range (not already naturalized) **shall be euthanized**, not returned to the water and kept for identification purposes.

12. Licencee may fish with minnow and pot traps, trap netting, electrofishing and/or seine netting.

Signature of Licencee / Signature du titulaire du permis **Date**

Sonia Rankin 2011-09-26

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1064904
No de permis

13. Licencee may be assisted by Joel Smith, Alex Stettler, Mark Cece and Stephen Dinka.

Signature of Licencee / Signature du titulaire du permis **Date**

Sonia Rankin 2011-09-26.

Ontario

Ministry of Natural Resources

Ministère des Richesses naturelles

Licence to Collect Fish for Scientific Purposes

FILE COPY

Permis pour faire la collecte de poissons à des fins scientifiques

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Name of Licencee / Nom du titulaire du permis	Last Name / Nom de famille	First Name / Prénom	Middle Name / Second Prénom
	Ms. Rankin	Sonia	

Name of Business/Organization/Affiliation (if applicable) / Nom de l'entreprise/de l'organisme/de l'affiliation (le cas échéant)

MMM Group Limited

Mailing address of Licencee / *Adresse postale du titulaire du permis*	Street Name & No./PO Box/RR#/Gen. Del./ N° rue/C.P./R.R./poste restante		
	100 Commerce Valley Drive West		
	City/Town/Municipality / Ville/village/municipalité	Province/State / Province/État	Postal Code/Zip Code / Code Postal/Zip
	Thornhill	ON	L3T 0A1

to collect the species, size and quantites of fish from the waters as set out below.
Pour faire la collecte des espèces suivantes (stade et nombre indiqués ci-dessous):

Species / Espèces	Eggs / Oeuf	Juvenile / Fretin	Adults / Adulte	Numbers / Nombre	Name of Waterbody / Nom de l'étendue d'eau
	X	X	X		
fish		X	X		Farm Pond located on Lazy Pat Lands (see attached Schedule A)

Yes/Oui ☐ Additional species/Waterbody list attached / Liste d'espèces/d'étendue d'eau additionnelles ci-jointe

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	2011-09-19	2011-11-30	

Licence conditions: This licence is subject to the conditions contained in Schedule A if included. / Ce permis doit respecter les conditions de l'annexe A si celle-ci est jointe.

Conditions du permis: Yes/Oui ☒ No/Non ☐ Schedule A included. / Annexe A ci-jointe

Issued by (please print) / Délivré par (veuillez écrire en caractères d'imprimerie)	Signature of issuer / Signature du délivreur	Date of Issue/Date de délivrance (YYYY-MM-DD)
John Almond	John Almond	2011-09-19

Signature of Licencee / Signature du titulaire du permis	Date (YYYY-MM-DD)
Sonia Rankin 2011-09-26.	2011-09-19

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Schedule A - Licence Conditions
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8. **The licencee shall follow the best management practices for the collection, handling, transportation and holding of fish identified in FS Bulletin 2008-01 (June 10, 2008) included with the licence in order to minimize the risk of spreading aquatic invasive species and diseases.**

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Signature of Licencee / Signature du titulaire du permis **Date**

Sonia Rankin 2011-04-26

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1064904
No de permis

13. Licencee may be assisted by Joel Smith, Alex Stettler, Mark Cece and Stephen Dinka.

Signature of Licencee / Signature du titulaire du permis **Date**

Jessica Rankin 2011-09-24.

MMM Group Limited
Planning & Environmental Design
100 Commerce Valley Drive West,
Thornhill, Ontario, L3T 0A1
t: 905.882.1100 | f: 905.882.0055

www.mmm.ca

March 30, 2012
File No. 14.09222.001

Robert Thun, B.Sc., MCIP, RPP
Senior Planner, Current Planning - West District
Town of Oakville, Planning Services
1225 Trafalgar Road
Oakville ON L6H 0H3

Dear Mr. Thun,

Subject: Bentall Kennedy (Canada) LP - Lazy Pat Farms
3269 and 3271 Dundas Street West, Oakville
Zoning By-law Amendment (Z.1333.01) and Draft Plan of Subdivision (24T-11001)
EIR/FSS Comments

We appreciate the comments on the above noted applications, in relation to the Environmental Implementation Report and Functional Servicing Study (EIR/FSS). These comments include the following:

- Town of Oakville, Development Engineering Department, September 16, 2011 (EIR/FSS); and
- Conservation Halton, September 6, 2011 (EIR/FSS).

MMM Group Limited (MMM) has had the opportunity to review these comments and we wish to offer the following responses to what we believe are the key issues. Further to the Conservation Halton (CH) email dated August 5, 2011 from Ms. Leah Smith, MMM has also undertaken additional investigations as requested by CH, which are presented herein. Attachment A provides a more detailed response to each of the comments in a tabular format, which is further supported by the appended technical memos:

- Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat;
- Technical Memorandum HG#1 – Hydrogeological;
- Technical Memorandum – Corridor Width Delineation;
- Technical Memorandum – HEC-RAS Model River Reach Flood Flow Estimation;
- Technical Memorandum – Meander Belt Width Estimation;
- Technical Memorandum – Topographic Depression Volume Analysis; and
- Technical Memorandum – Stream Length and Drainage Density Requirements.

MMM GROUP

Key Issues

The following summarizes what we believe are the key issues/comments and our response:

1. Pond (Reach 14W-14A) and Use as a Stormwater Management Facility

The comments suggest that the existing pond should be retained and the use of the pond as a SWM (Stormwater Management) pond is not supported. The proposed use of the pond as a SWM pond is strongly supported by science and policy, and represents the preferred land use planning solution for the redevelopment of the subject property. The draft MESP prepared by MMM in 2002, provided the basis and rationale for the use of the pond as a SWM pond, and informed the preparation of the North Oakville Creeks Subwatershed Study (NOCSS) and the North Oakville West Secondary Plan (NOWSP).

The ecological basis for the retention of the pond is principally fisheries based in terms of its perceived independent fish habitat function as well as its contribution to downstream habitat. The main items of contention in the CH comments include the thermal regime (water temperature), fish habitat and fish community of the pond. The remaining items including phytoplankton/zooplankton, sediment and organic material contribution, are generally deemed to merit some additional consideration in the assessment; however, not to the same level of detail as the thermal regime, fish species and habitat discussion. The supplemental data requested by CH as well as detailed assessment of the data and CH comments related to the pond are presented in the response table as well as Technical Memorandum NH#1.

The data collected in 2011 supports our opinion, as presented in the EIR, that the pond is functioning as warmwater habitat. Furthermore, this constructed feature appears to be sustained principally by surface water contributions rather than groundwater inputs that would assist in moderating temperatures. Given that the pond is sustained principally by surface water, its connection to downstream habitat is intermittent and limited to periods when surface water levels are elevated and thus the contributions are not consistent and largely cut off during low flow periods. Furthermore, when flow is conveyed to Reach 14W-14 it is as diffuse flow through dense cattail growth. This dense cattail growth would likely limit the transport of sediment, organic material (twigs, leaves, etc.) as well as potentially fish passage during certain times of the year.

The function of the pond as warmwater habitat in isolation is not necessarily an adverse condition. Yet when combined with the nature of Reach 14W-12 that is considered coolwater habitat, the contribution of the pond must be re-examined. Reach 14W-12 is an intermittent channel that has been classified as coolwater habitat based largely upon its ability to support Redside Dace, a Provincially Threatened Species. Given the intermittent nature of the receiving watercourse, with the fish community on the Lazy Pat lands sustained in refuge pool habitat during the summer period, the thermal effects of the pond periodically discharging warmwater into this reach is contrary to the management of Reach 14W-12 as coolwater habitat and more significantly Redside Dace habitat.

This opinion is supported by the Department of Fisheries and Oceans Canada (DFO's) Working Around Water? Factsheet Series (Ontario Edition). As stated in the EIR, the Fact Sheet states that

bypass ponds "… *are also prone to dissolved oxygen and water quality problems, increases in water temperature, and sediment accumulation problems. Proposals for bypass ponds on coldwater streams are generally not approved due to the potential that downstream water temperatures may increase beyond levels that coldwater fish need to survive".* The removal of pond habitat (i.e. by-pass, on-line) specifically those contributing to cool/coldwater habitats, is anticipated to improve water quality (i.e. water temperature) related to fish habitat. This would continue to suggest that the removal of this feature should be considered a benefit to fish and fish habitat rather than a detriment to the natural heritage system. We continue to inquire what specific features CH considers worthy of retention considering the apparent detrimental effects to downstream water temperature.

As a SWM pond, the facility would be ideally situated in a centralized location providing the greatest amount of treatment and control for the adjacent habitat, and its conversion provides the opportunity to address the negative impacts of the current pond. A SWM pond would also be subject to similar conditions that the pond is subjected to including warming during the summer. However, the ability to design the SWM pond with measures including bottom draw outlets, planting plans and outlet features would assist in mitigating these effects.

Hydrogeological data collected at monitors constructed at the pond and on the lands adjacent to the pond following the submission of the EIR/FSS report also reaffirms our conclusion that the pond is not being supported by groundwater inputs. As the measured water levels of the pond have always been at higher elevations than the groundwater elevations recorded at the monitors surrounding the pond, the pond is losing water into the ground rather than receiving groundwater inputs.

An onsite meeting was held on October 20, 2011 and attended by DFO, the Ministry of Natural Resources (MNR) and Conservation Halton (CH) to discuss the aquatic habitat on site. Specifically the development process as it relates to the review of the project under the *Fisheries Act* and *Endangered Species Act.* Minutes of the meeting were prepared and distributed to the attendees on November 7, 2011. During the meeting MMM identified the proposed development plan for the subject property including the incorporation of the pond (Reach 14W-14A) into a stormwater management facility. The MNR and DFO/CH were silent on their opinion of the pond feature in terms of its function as fish habitat and would comment once the supplemental data collected in 2011 had been reviewed, which is appended to this letter.

2. Consolidation/Relocation of Stream Corridors

Overall, the proposed realignment will produce a slightly lower drainage density in subcatchment FM-1001. However, drainage densities for the subcatchment will remain above the target drainage density recommended in the NOCSS. A technical memorandum on stream length and drainage density requirements is attached discussing the drainage density calculations, overall hydraulic corridor modifications, related impacts and resulting overall improved aquatic habitat. These findings are consistent with other MMM Group proposals that have received approvals under the *Fisheries Act* and within other Conservation Authority jurisdictions.

During the same October 20, 2011 onsite meeting attended by DFO, MNR and CH, the proposed watercourse relocations were discussed as it relates to the review of the project under the *Fisheries*

Act and *Endangered Species Act.* This information is also summarized in the minutes of the meeting which were prepared and distributed to the attendees on November 7, 2011. Generally, the relocations were supported by MNR and DFO/CH (contingent on review of detail design submission) as the realigned reaches were viewed as improvements over the existing features. DFO indicated that given the habitat present in the watercourses to be relocated, and the preliminary assessment that adverse effects to fish habitat can be mitigated through design/construction that CH would take the lead for reviewing the projects under the *Fisheries Act* through their Level 2 agreement with DFO.

Of note was that the MNR indicated that following the relocation of Reach 14W-13 that would result in an extension of Redside Dace habitat, this reach would be subject to a wider setback (Red - High Constraint Stream Corridor setback) than that identified in NOCSS (Blue - Medium Constraint Stream Corridor setback). The MNR also mentioned that Reach 14W-16 was considered Redside Dace habitat and as such would require a wider setback (Red – High Constraint Stream Corridor setback) than currently identified in NOCSS.

CH has taken the position that the realignment does not meet the "drainage density" targets for this and as a result is not consistent with the NOCSS. In our professional opinion, the NOCSS recommended drainage densities have been maintained for the subwatershed, and are only slightly reduced from predevelopment conditions (as discussed in the technical memorandum). The proposed channel and habitat improvements are sufficient to mitigate the loss of channel length and is considered a net improvement to the overall aquatic habitat.

3. Reconfiguration of Avenue One and Avenue Two

The proposed road alignments have been identified in order to minimize the number of watercourse crossings and the extent of the natural heritage area crossings in comparison to the conceptual road network identified in the NOWSP, particularly the Burnhamthorpe Road extension which has been shifted north to avoid crossing the existing High Constraint Stream Corridor.

The attached Figure - Factors Limiting Road Configuration, illustrates the proposed road configuration in relation to the conceptual road alignment identified in the NOWSP. The figure illustrates the existing and future constraints which impact the road configuration and alignment, including the existing natural heritage areas, High Constraint Stream Corridors, existing development and related facilities (i.e., GE Water Campus), and issues affecting the spacing of intersections, and fixed intersection locations.

The road network identified in the NOWSP does not provide a sufficient arterial road network to accommodate appropriate access to larger sized employment blocks. MMM has provided various comments to the Town in relation to the NOWSP road pattern. Based on past discussions with the Town it was recognized that the road network is conceptual and may be further refined, this is further supported by the policies of the NOWSP. The alignment of Avenue Two and additional stream crossing was proposed to provide sufficient access and support the larger employment block configuration. The alignment of Avenue Two, Avenue One, and Burnhamthorpe Road extension will be further reviewed in consultation with the Town and CH to minimize the number and extent of stream crossings while providing an efficient road pattern which supports the

development of the employment area, in addition to addressing landowner coordination issues related to the Avenue Two road location and alignment.

The alignment of Avenue One, was designed to minimize the length of required crossings and potential impacts to the Zenon Forest from that identified in the NOWSP, and minimize impacts to the existing GE Water Campus, while shifting the road north to provide sufficient access to the northern portion of the property and facilitate suitably sized employment blocks.

The road crossings will be prepared to minimize disruption to the streams, through appropriate construction practices. MNR also recommended during the on-site meeting (October 20, 2011) that the location of intersections also be reviewed to minimize encroachment into Redside Dace Habitat (Burnhamthorpe Road extension).

4. Top of the Bank Assessment for Reach 14W-11A – SVH

A slope stability analysis on reach 14W-11A was performed by Exp Services Inc. and examined two slope sections approximately 55m from each other. Each section was analysed under static and seismic conditions. The sections were found to possess sufficient safety factors against sliding and rotational failure to be considered stable under their own weight during static conditions. Under seismic conditions, safety factors were reduced to levels where a 1.25m offset from the physical top of bank was recommended to establish a stable top of slope. The offset distance to the stable top of slope is well within the offsets established to protect aquatic habitat under ESA regulations. Therefore, no adjustments to the development limits are recommended as a result of the slope stability analysis. A copy of the Exp Services Report is appended.

5. Additional Geomorphic Field Surveys

The project's subconsultant, Water's Edge, performed a field investigation of the indicated locations. The reaches in question could not be identified in the field and any connected hydraulic structures are buried, plugged or otherwise hydraulically inactive. Therefore, further geomorphic field surveys are premature until a channel alignment can be identified. We request a field investigation between CH staff and MMM/Water's Edge to identify the channel reaches in the field and to further scope the study requirements.

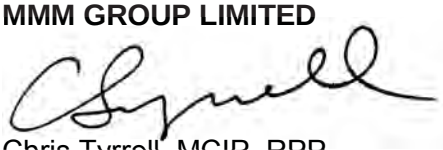
MMM GROUP

Conclusion

We appreciate the opportunity to submit these comments and additional investigations and look forward to discussing these matters with you. Following your review, we wish to set-up a meeting to discuss these comments and our next steps moving forward, prior to preparing revised documents. Please contact me at 905.882.7303 to coordinate a meeting at your earliest convenience.

Yours very truly,

MMM GROUP LIMITED



Chris Tyrrell, MCIP, RPP
Manager, Planning & Environmental Design
Partner

CC: Mike Reel, Bentall Kennedy (Canada) LP
Rita Juliao, P. Eng., Town of Oakville, Development Engineering Department
Leah Smith, Environmental Planner, Conservation Halton
Doug Corbett, Region of Halton, Planning
Stan Holiday, Region of Halton, Community Planning
John Pisapio, Ontario Ministry of Natural Resources

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ATTACHMENT A - Response to Comments

The following table outlines each comment and provides our detailed response for your review and consideration, and is further supported by the appended technical memos.

Comment/Issue	MMM Response
A1) Town of Oakville, Development Engineering Department, September 16, 2011 (EIR/FSS)	
1. EIR/FSS should be completed for all of Subcatchment FM1001 with sufficient detail for FM1102 and FM1109.	The EIR/FSS has been prepared on this basis. Subcatchments FM 1102 and FM 1109 have been considered in the EIR/FSS along with FM 1001. Sufficient details consistent with the NOCSS requirements for subcatchments FM 1102 and FM 1001 are provided with respect to Stormwater Management. Only a small development area encroaches the existing subcatchment FM1109 in the southwest corner of the site, as such we have not provided a detailed analysis of subcatchment FM1109. Additional details for FM 1109 will be provided as planning details for this subcatchment become available.
2. Unit Flow Rates in relation to failed downstream channel.	Our stormwater management strategy has maintained allowable unit flow rates at each Dundas Street culvert per NOCSS recommendations. As the reason for the failure of the downstream channel has not been determined to date, and is not under the control of our client, reassessment of allowable flow rates at the project outlets is premature. In addition, regardless of the outcome of a study into the causes of the watercourse failure, our proposed strategy incorporates robust peak flow control, erosion control and fluvial geomorphological components (consistent with NOCSS recommendations) that maintain an effective flow regime at Dundas St. that is largely consistent with pre-development (i.e. undeveloped) conditions. Therefore, it is not anticipated that development on the subject property is likely to exacerbate the failure causes of the downstream channel.
3. Should consider future flows from west of Tremaine Road.	Our analysis is based on future conditions recommended by the *Tremaine and Dundas Secondary Plan Subwatershed Study, 2001*. The SWM Pond west of Tremaine Road shall be designed according to the erosion threshold values recommended by the above mentioned study. We will look into the interim conditions (no development west of Tremaine Road) in the revised report.
4. Erosion Control Analysis should support SWM strategy for Ponds 1 through 4. Request additional analysis.	During the site visit by Water's Edge, the tributaries W2 and W3 downstream of culvert FM-D2 and FM-D3 could not be identified. We will revisit these locations with the Town and CH to identify these reaches and update our Erosion Threshold Analysis to include them.

Comment/Issue	MMM Response
5. Erosion Threshold Analysis approach.	The Erosion Threshold analysis utilized is similar to the process used in several similar studies, and is recognized as an equivalent methodology to the one proposed in the NOCSS. It may be viewed as a more robust methodology as the long-term meteorological data for the nearest AES station does not necessarily contain storm events likely to demonstrate stream forces that exceed the erosion thresholds in a manner that facilitates predictive recommendations for the watercourses. The utilized methodology utilizes IDF curve information to definitively include sufficient stream power to arrive at recommendations for future anticipated storm flows. We recommend that the utilized methodology be reconsidered under the NOCSS requirements.
6. Require additional details to evaluate the location and size of SWM ponds.	Section 7 of EIR/FSS provides sufficient information on sizing SWM ponds considering water quality and quantity controls, and SWM pond block area, considering all design parameters recommended by MOE guidelines. We recommend that additional details of the SWM facilities be provided, once the location/sizing of the ponds has been generally agreed by the Town and CH, as this has a significant influence on the overall grading of the site. We suggest that such additional detail is premature, until the pond locations have been confirmed.
7. Request preliminary grading plan	Noted. A preliminary grading plan will be provided in accordance with the Town's Engineering Manual. However, we do need to have an agreement with the Town and CH with respect to SWM Pond location, road alignment and the natural heritage boundary. We suggest that such additional detail is premature, until the pond locations and road alignments have been confirmed.
8. Stormwater Drainage Plan should provide more details.	Noted. The stormwater management plan will be consistent with the grading plan and meet the requirements of the Town's Engineering Manual. However, we do need to have an agreement with the Town and Conservation Authority with respect to SWM Pond location, road alignment and the natural heritage boundary. We suggest that such additional detail is premature, until the pond locations and road alignments have been confirmed.
9. Label 14W-14A on Figure 2.1.	Noted.
10. Not supportive of replacement of 14W-14A with a SWM pond.	Although it is understood the NOCSS classifies this pond as a Medium Constraint stream, there is a concern/question related to its function as fish habitat as well as its contribution to downstream fish habitat. This is a human-made feature that has naturalized over time due to disuse as agricultural infrastructure rather than a conscious effort to create natural habitat. A detailed assessment of the pond as fish habitat is provided in *Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat* under

Comment/Issue	MMM Response
	separate cover. This assessment addresses CH request for additional information principally associated with Reach 14W-14A indicating the ponds function as a warmwater feature discharging into coolwater habitat supporting Redside Dace habitat.
11. Update to provide a complete evaluation of stream 14W-14A (retain steam length).	Please refer to the attached Technical Memorandum – Stream Length and Drainage Density Requirements.
12. Provide more information on the condition of the existing pond.	A detailed assessment of the pond as fish habitat is provided in *Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat* under separate cover. Generally the pond appears to be functioning as warmwater habitat with a poor connection to downstream habitat. This warmwater feature when hydraulically connected to Reach 14W-12 during the precipitation events contributes warmwater inputs into coolwater habitat supporting provincially regulated Redside Dace.
13. Stream reach 14W-14A and management recommendations to leave pond undisturbed.	Noted. However, as mentioned in comment 10, this feature is an artificially created feature with a primarily agricultural focus rather than ecological. As a result, its construction and function do not entirely complement the function of the downstream fishery including Redside Dace habitat. It is expected that the existing vegetation conditions within the stream reach can be replicated or enhanced within the SWM pond block through landscape plantings comprised of locally sourced native species suited to site conditions and/or natural regeneration of wetland vegetation and succession of woody species. Report to be revised.
14. SWM ponds (Appendix 7.2) and preliminary concerns.	See response 62 under Conservation Halton.
A2) Conservation Halton, September 6, 2011 (EIR/FSS)	
1. General – provide list and contacts of professional/ technical staff.	A list identifying the technical staff involved in the preparation of the EIR/FSS will be provided.
2. Executive Summary	The Executive Summary will be updated to reflect the changes to the EIR/FSS from addressing the comments.
3. S.1.2 FSS study area to coincide with	Agreed.

Comment/Issue	MMM Response
Subject Property.	
4. S.2.1 High Constraint Corridor Areas	Bullet 2 – noted. Will revise text.
4. S.2.1 Medium Constraint Corridor Areas	Bullet 2 – The consolidation of Medium Constraint (blue) Streams was mistakenly referenced as originating from NOCSS. This statement is made in the North Oakville West Secondary Plan (S. 8.4.7.1 e)): "*These* (Medium Constraint) *watercourses may be deepened and/or relocated and consolidated with other watercourses provided that the watercourse feature, as well as the function of the watercourse, is maintained in accordance with the directions established in the North Oakville Creeks Subwatershed Study and Federal, Provincial and Conservation Authority regulations, and natural channel design is used*." The text will be revised to reference the NOWSP. We will revise the Report to address the other comments.
5. S.2.2 Permitted Uses in the NHS.	The farm pond in question (Reach 14W-14A) is a constructed feature that was created to service an agricultural purpose and has naturalized over time and its current state is due to lack of management as a farm pond rather than as active management as a fish/wildlife feature. Once again as we have requested in the past during our April 19, 2011 site meeting, please identify what specific functions of this feature you would like to have recreated in a relocated feature as it is our opinion that the some of the current functions of the pond including thermal impacts, are not beneficial to the downstream habitat. Consultation with the MNR is underway. MNR/CH/DFO met with MMM on-site on October 20, 2011. Comments related to the pond are deferred by CH/MNR/DFO until after submission of the responses to comments and further discussions between the agencies.
6. S.3.2 Trail Planning must include layout and conceptual grading plans.	In the absence of the North Oakville West Trails Master Plan, we have not prepared more detailed layout and conceptual grading plans for the trails, at this time. We wish to discuss this matter further with the Town to better understand their proposed trail network for North Oakville West.
7. Figure 3.1 407 West Concept Plan – Reconfiguration of Avenue One and Two to minimize NHS crossings.	The proposed road alignments have been identified in order to minimize the number of crossings and the extent of the natural heritage area crossings in comparison to the conceptual road network identified in the NOWSP, particularly the Burnhamthorpe Road extension which has been shifted north to avoid crossing the existing High Constraint Stream Corridor. The road network identified in the NOWSP does not provide a sufficient

Comment/Issue	MMM Response
	network to accommodate appropriate access to larger sized employment blocks, particularly to the north of the planning area. MMM has provided various comments to the Town in relation to the NOWSP road pattern. Based on past discussions with the Town it was recognized that the road network is conceptual and may be further refined, this is further supported by the policies of the NOWSP. The alignment of Avenue Two and additional stream crossing was proposed to provide sufficient access and support the larger employment block configuration. The alignment of Avenue Two, Avenue One and the Burnhamthorpe Road extension will be further reviewed in consultation with the Town and CH to minimize the number and extent of stream crossings while providing an efficient road pattern which supports the development of the employment area, in addition to addressing landowner coordination issues related to the Avenue Two road location and alignment. The alignment of Avenue One, was designed to minimize the length of required crossings from that identified in the NOWSP, and minimize impacts to the existing GE Facility, while shifting the road north to provide sufficient access to the northern portion of the property and facilitate suitably sized employment blocks. The road crossings will be prepared to minimize disruption to the streams, through appropriate spannings and bridge construction practices. MNR also recommended during the on-site meeting (October 20, 2011) that the location of intersections also be reviewed to minimize encroachment into Redside Dace Habitat (Burnhamthorpe Road extension).
8. S.4.4 (Hydrogeology and Geology) Impacts of proposed development.	Report should address impacts of re-aligning reaches 14W-14A (existing Pond) and 14W-16 (main channel after all upstream channels converge): The existing pond is not considered to provide ecological benefits to downstream reaches, and indeed may be detrimental to the downstream habitat. As explained in the accompanying *Technical Memorandum HG#1 - Hydrogeology*, from a hydrogeological perspective, the pond does not receive groundwater inputs and so replacing it with a SWM pond will not result in a loss of cool water inputs to the natural system. Regarding the Main Channel, please refer to Section 4.4.4.6/Figure 4.9 of the report where there is discussion about there being very little effect to changes in groundwater contributions to this reach, and following development there is potential for a positive effect during the summer months by addition of water via infiltration swales to be located at the edges of the valley features (bottom page 4-35 - top of page 4.36). Bedrock groundwater levels are also not expected to be affected by

Comment/Issue	MMM Response
	development so the small bedrock groundwater contributions to the watercourse are expected to continue following development. We will add a section discussing the potential hydrogeological impacts to the proposed re-aligned watercourses.
9. S. 4.4.2 Climate and Water Surplus	The climate station used in our study (Oakville Gerard) is located approximately 7 km southeast of the subject property, whereas the Hamilton Royal Botanical Garden (HRBG) station is located about 17 km southwest from the site, along the edge of Hamilton Harbour. Oakville Gerard is located closer to the site, and furthermore this weather station is also not located immediately adjacent to the lake (thereby experiencing less climatic lake effect potential). MMM considers data from this weather station to be more representative of climatic conditions at the bcIMC site.
10. S.4.4.3 Inputs to Water Balance	We will re-examine the interpretation of the soil classification but do note that clay component of the soils was significant and so any upward revision of the soil factor will likely result in a factor closer to 0.1 rather than 0.2 as suggested. Additional discussion is presented in the accompanying *Technical Memorandum HG#1 - Hydrogeology.*
11. S.4.4.4 and Appendix 4.7 Water Balance	This question was posed to Environment Canada as this is where the data originated and the reason provided by Environment Canada for the discrepancy is as follows. The values provided in the tables used for the water balance analysis are based on averages over a 17-year period (1990-2006). If the soil moisture reaches 400 mm (forested areas in the example cited by HRCA) it cannot increase anymore. For some months during the 17-year period, the November soil moisture was already at 400 mm, but the overall average soil moisture is calculated at less than 400 mm. Therefore, some years the full value of RAIN + MELT - AE (also calculated as 17-year averages) could not be added since the soil was already saturated.
12. S.4.4.4.2 Post-Development Water Balances	1st and 2nd bullets: Best efforts for infiltration at each lot will be extremely limited and likely non-effective, except at lots bordering upon non-disturbed natural environment areas – those lots would have opportunity to direct a portion of “clean” roof runoff to infiltration swales cut into undisturbed native soils and use surficial fracturing/weathered zones to convey water into ground and towards watercourse (as already proposed in report). For interior lots infiltration potential will be extremely limited since lots constructed in areas with cut as unweathered silt/clay soils will be encountered at ground surface (i.e., the more permeable weathered zone will be removed), and in areas with fill, where heavily compacted silt/clay soils will be present at surface. Future landowners of these lots may wish to incorporate water features into

Comment/Issue	MMM Response
	their landscape plans (designed to promote infiltration) but we have been working on the premise that lot coverage will be 90% impervious, leaving very little "green" space for such initiatives, given the nature of the proposed land uses (large employment buildings with extensive surface parking areas). It has also been our experience with other projects that infiltration swales within the meander belt plus 30 m setback are considered by the MNR to be suitable mitigation measures applicable to Redside Dace habitat. Future consultation with the MNR will include this item.
13. S.4.4.4.6 Discussion of Potential for Base Flow Reductions to Watercourses	Mitigation of reductions in infiltration to the groundwater system will be limited to the periphery of the natural environment areas where native soils will remain undisturbed (e.g., the watercourses) and will maintain their pre-existing secondary permeability characteristics (with flow through fractures). The interior lands of the site will either be cut or filled (engineered fill) following site grading and these unweathered and heavily compacted clay-rich soils will be poor choices for constructing mitigation measures. While the water balance analysis indicated a 49% reduction in groundwater infiltration at the site, this is on an overall watershed basis reduced to an 18% reduction. As discussed in the EIR/FSS the streams are recognized as being predominantly runoff driven rather than maintained by groundwater base flow and the streams are "dry" roughly 4 to 5 months of the year (no base flow) during the summer months. The proposed mitigation measures (infiltration swales) are calculated to add water to the shallow system during these 4 to 5 months compared to the pre-development condition, and as also stated in the EIR/FSS, the limited groundwater contributions to the watercourses from the bedrock system are not anticipated to be affected by the developments. Additional discussion is provided in the accompanying *Technical Memorandum HG#1 - Hydrogeology.*
14. S.4.4.4.7 Dewatering Potential	Comment noted.
15. S.4.4 On-site Monitoring Locations	Data for MP-04 is found with other mini-piezometer data on Table SWL-2 – we note this mini-piezometer was destroyed over the winter of 2009-2010 and was not replaced.
16. S.5.0 Natural Heritage (general)	Bullet 1 – Noted Bullet 2 – Noted, will consider the recommendation.

Comment/Issue	MMM Response
17. S.5.1.3 Agency Consultation	Noted, will revise.
18. S. 5.2.1.5 Hydrologic Features A and B	We will update Figure 5.1 to reflect all these features.
19. S.5.2.3 HRCA Regulation 162/06 and Wetland Policy	Noted.
20. S. 5.3.3.1 Species at Risk	An on-site meeting was held on October 20, 2011 with Fisheries and Oceans Canada (DFO), the Ministry of Natural Resources (MNR) and Conservation Halton (CH) in attendance. The purpose of the meeting was to discuss the watercourses on site as it relates to the review of the project under the *Fisheries Act* and *Endangered Species Act.* Minutes of the meeting were prepared and distributed to the attendees on November 7, 2011. During the meeting MMM identified the proposed development plan for the subject property including the realignment of Reaches 14W-16 and 14W-13 as well as incorporation of the pond (Reach 14W-14A) into a stormwater management facility. The proposed watercourse realignments were generally supported by MNR and DFO/CH (contingent on review of detail design submission) while comment on the conversion of the farm pond (Reach 14W-14A) by MNR/DFO/HC was withheld until such time that the additional requested information was submitted and reviewed. A detailed assessment of the pond as fish habitat is provided in *Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat* under separate cover.
21. S.5.3.3.3 Regionally Rare/ Uncommon Species	The Halton Natural Areas Inventory (2006) was consulted. Based on the rankings provided therein applied to the plant list for the property: Five (5) species considered uncommon (HU) in Halton Region were observed – Coontail (*Ceratophyllum demersum*), Eastern Red Cedar (*Juniperus virginiana*), Fringed Sedge (*Carex crinita*), Torrey's Rush (*Juncus torreyi*), and Narrow-leaved Spring Beauty (*Claytonia virginica*). One (1) species considered rare (HR) in Halton Region was observed: Swamp White Oak (*Quercus bicolor*). One species with a rank of H? (more information needed) was observed: Common Evening-primrose (*Oenothera biennis*). Two species that were not listed in the inventory were observed: Northern Wild-raisin (*Viburnum cassinoides*) and Corn-marigold (*Chrysanthemum segetum*). The Halton Natural Areas Inventory ranks will be added to the revised EIR document and plant list. We will revise the report.
22. S.5.3.4.4 Aquatic Habitat Reach 14W-11A, 14W-11, 14W-13, 14W-14	The opportunity to walk these watercourses was available during the September 23, 2010, April 19, 2011 and August 4, 2011 site meetings attended by Leah Smith and Samantha Mason (September 23, 2010 and April 19, 2011 only). The most recent opportunity to observe the watercourses on site was during the October 20, 2011 site meeting attended

Comment/Issue	MMM Response
	by DFO, MNR and CH.
23. S.5.3.4.4 Aquatic Reach 14W-14	During the October 20, 2011 site meeting the proposed watercourse realignments were generally supported by MNR and DFO/CH (contingent on review of detail design submission) while comment on the conversion of the farm pond (Reach 14W-14A) was withheld until such time that the additional requested information was submitted and reviewed. A detailed assessment of the pond as fish habitat is provided in *Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat* under separate cover.
24. S.5.3.4.4 Aquatic Reach 14W-14A	Monitoring has been undertaken with the detailed assessment of the pond as fish habitat is provided in *Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat* under separate cover.
25. S.5.3.4.4 Aquatic Reach 14W-16	Similar to Reach 14W-14A, this is a constructed feature that may be subject to *Fisheries Act* but has marginal function as fish habitat, considering it is a stocked pond (Largemouth Bass) and functions similarly to 14W-14A. In the event that there is a need to remove this feature it is anticipated that the removal of this pond will require a review under the *Fisheries Act* and standard mitigation measures including a fish removal will be required if the pond is removed.
26. S.5.3.4.4 Aquatic Reach 14W-12	Our assessment is consistent with the NOCSS Characterization Report that states "*On the second branch of Fourteen Mile Creek West, 14W-12 was the only reach observed to have a defined channel. This definition occurred immediately upstream of Dundas Street and evolved into a poorly defined swale at the upstream extent of the reach. Channel disturbances consisted of the Dundas Street crossing, concrete revetments and farm crossings. Surrounding land use was agricultural and livestock were noted as having access to the stream. The primary geomorphic processes influencing this reach were aggradation and widening. Fallen and leaning trees, exposed tree roots, poorly formed bars, siltation in pools and riffles and accretion on point bars were noted at the site.* *The remaining reaches (*excluding 14W-1, 1a, 2, 3, 4, 6, 7, 9, 9a, 10 discussed in previous paragraphs*) on Fourteen Mile Creek were poorly defined vegetated swales. The majority of these reaches showed signs of straightening and agricultural influences. In general, substrate consisted of silt and sand with some clay. Riparian vegetation consisted of scrubland and agriculture."* (NOCSS Characterization Report p. 4W-105) We will revise the text to state that this is a constructed feature associated with the constructed pond and its trapezoidal valley does contain a narrow incised channel downstream of the cattail growth originating at the pond (Reach 14W-14A) inlet/outlet.

Comment/Issue	MMM Response
	The comments regarding the concrete revetment are noted, and will be considered in the recommendation.
27. S.5.3.4.4 Aquatic Reach 14W-12A	We agree with the potential habitat as seasonal fish habitat as indicated by our habitat assessment of *"…it appears to provide negligible direct fish habitat*" (EIR p.5-32). We will revise the text to add the following *"…it appears to provide **marginal** direct **seasonal** fish habitat*" We continue to disagree with its classification as High-Constraint habitat associated with Reach 14W-12 as it is an artificially created feature constructed to combine flow from 14W-13 and 14W-14 as well as overflow from the pond (14W-14A) it is not directly affected by Reach 14W-16 that has contributed to the form and function of the remainder of Reach 14W-12.
28. S.5.3.5.1 Vegetation Approach	The modified ELC approach completed for the study delineates and classifies communities smaller than 0.5 ha to fully document small natural features, and uses additional feature names not specified in the ELC to better describe cultural landscape features (e.g. 'tree cluster', 'pasture'). It also acknowledges that it is often possible to classify and delineate communities to the most detailed level of the ELC classification system (Ecotype) without a full soils analysis. At the subject property, plant species composition and site characteristics facilitated clear distinction between the 'dry-fresh' and 'fresh-moist' forest ecotypes and the various wetland and cultural ecotypes, therefore it was only necessary to determine if wetland soils were mineral or organic to classify all communities present to Ecotype. Considering CH request for additional soils data, soils documentation within the ELC communities will be undertaken in the Spring of 2012. All species are not necessarily listed on the submitted ELC data sheets. Please refer to the plant list provided in the EIR for the complete list. That list identifies a total of 120 vascular plant species on the subject property and was developed through three season botanical inventory over a two year period and was conducted by qualified field botanists. This does not include 6 species identified during field visits in 2011 (after submission of the EIR) which will be included in the revised EIR plant list. The relatively low diversity reflects the high level of disturbance and ongoing agricultural activities on the site, and based on our experience is typical of similarly disturbed agricultural sites in Southern Ontario.
29. S.5.3.7 Hydrogeology	The pond (Feature 14W-14A) is losing water to the ground and is not maintained by groundwater inputs. Refer to our response 8 (S.4.4) in this letter and the accompanying *Technical Memorandum HG#1 - Hydrogeology*. Monitoring data collected to date from these new monitoring wells (July to

Comment/Issue	MMM Response
	January 2012) indicates that the shallow groundwater levels at these monitors are at or below the approximate channel bed elevation of Reach 14W-16 at its closest approach to these monitors. These findings do not contradict anything previously reported in the EIR/FSS for as noted in Section 4.3.3. of the EIR/FSS report, the watercourses receive most of their groundwater contributions during the late fall to late spring through horizontal flow in the upper fractured zone of the till soils as well as limited contributions from the shale bedrock. We do not believe that constructing additional monitors in the vicinity of Reach 14W-16 will provide any additional interpretive information not already available from the boreholes and monitoring wells already in place across the site.
30. S.5.9.2 Fish Habitat Compensation Concepts, Removal of Reach 14W-14A (Pond)	Once again we would like to emphasize that this is an agricultural pond that has naturalized over time due to a lack of management as agricultural infrastructure rather than a conscious decision to manage it as fish and wildlife habitat. There appears to be an undue amount of emphasis placed on a constructed feature that is less than 55 years old and functions as a source for warmwater inputs into a coolwater system. Notwithstanding the NOCSS classification of this feature, it is our opinion that there is an undue amount of significance placed upon a farm pond that was constructed to facilitate agricultural operations and not enhance the natural heritage system. The detailed assessments of this feature are well beyond the typical data required for other similar studies in the GTA. We trust the supplemental information is sufficient to address HC comments related to the function of the pond and its significance. A detailed assessment of the pond as fish habitat is provided in *Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat* under separate cover. Below is a brief summary of the data provided in the aforementioned memorandum: *Self-sustaining Coolwater Fish Population* – The fish community present is a combination of warmwater and coolwater species with the coolwater species tolerant to temperatures associated with warmwater habitat. Considering the tolerance of the coolwater species present, the presence of warmwater species including largemouth bass and brown bullhead and the water temperature data, the pond appears to function as warmwater habitat and as a result the community more appropriately referred to as warmwater. *Self-sustaining Phytoplankton/Zooplankton Populations* – phytoplankton and zooplankton are likely present in this pond; however, considering the poor connectivity to downstream habitat as well as the relatively small size of the pond its contributions to downstream habitat are likely limited. Furthermore, considering the proposed construction of a SWM pond, the function will likely be replicated in a similar manner. *Sediment Source* – Agreed that bedload (sediment) is an important resource; however, the pond does not function as a source of sediment. Rather it is a sink where sediment settles out of the water column as water is

Comment/Issue	MMM Response
	stored in the pond. *Organic Material Source* – Similar to the zooplankton/phytoplankton discussion, the poor connectivity to downstream habitat as well as its relatively small size limit its contributions. Furthermore, the proposed restoration of the valley lands will replicate the function in question. *Function as a Headwater Wetland* – The main functions of interest that are provided by a headwater wetland as identified by HC include: fish community, water quality, water quantity, wildlife habitat and flood regulation. In the pond the fish community consists of a (presumed) stocked top predator (largemouth bass) with a potentially detrimental relationship with Redside Dace downstream, the water (warmwater) inputs during the summer period are likely detrimental to the downstream Redside Dace population, water quantity and flood regulation will be addressed through the SWM facilities and wildlife habitat is minimal considering the relatively small size. *Littoral and Pelagic Habitat – It is questionable that this feature provides pelagic habitat and the mere nature of having an open water feature such as a pond would provide some type of littoral habitat. This would also mean that all other open water features on the landscape (i.e. SWM ponds, farm ponds, etc.) would also provide this habitat and would presumably be reviewed in a similar manner.* *Water Temperature Data* – Water temperature data indicates that the pond (with the exception of a small deep area) functions as warmwater habitat. Considering the manner in which the pond is connected to downstream habitat it only discharges water when the surface water elevation reaches a certain elevation. During the summer when water levels reach this point, the warmest water (from the surface) is discharged downstream to coolwater Redside Dace habitat. As we have requested in our March 1, 2011 response to CH January 20, 2011 comments and during the subsequent April 19, 2011 and October 20, 2011 site meetings, please identify what specific functions of this feature CH would like to have recreated in a relocated feature as it is our opinion that current function of the pond including thermal impacts, are not beneficial to the downstream habitat. The results of data collected to date related to the pond (14W-14A) are included in Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat.
31. S.5.9.2 Fish Habitat Compensation Concepts (14W-11)	Nothing has been proposed in Reach 14W-11 as the channel is located within the Unit 5a, Dry-Fresh Oak-Hickory Deciduous Forest, FOD2-2, a provincially uncommon community (S3S4, Bakowsky 1996/NHIC 2010). As a result, encroachment into this feature to facilitate enhancement works

Comment/Issue	MMM Response
	along the channel would likely necessitate impacts to this vegetation community (i.e. machinery/equipment, staff, etc). We will examine other, less intrusive, measures that could be proposed in this reach and update the report.
32. Table 5.10 Summary of Potential Impacts to Aquatic Resources	Bullet 1 – Noted. Report will be revised to reflect that Reach 14W-11 is "*High Constraint Requiring Rehabilitation*". Bullet 2 – Recommendation noted. Bullet 3 – We will examine this relationship and provide the requested clarification. MNR consultation underway with MNR providing comments related to the road alignment during the October 20, 2011 site meeting. Residual Effects – Noted that an open bottom culvert preferred to a box culvert.
33. Table 5.12 Summary of the Potential Impacts to Wildlife	The EIR will be revised to recommend that "Living the Green Life – Oakville's Guide to Environmental Stewardship" be distributed to property owners/tenants as part of the mitigation strategy for wildlife.
34. Figure 5.2 EIR Vegetation Communities	The FOD2-2 community and associated floodplain marsh will be retained in full and protected with setbacks as described in the EIR. A meeting with Town and CH staff will be arranged to discuss the area. The EIR will be revised to include a more detailed recommendation on how the feature will be accommodated within the proposed development plan.
35. S.5.9.5 Monitoring	A comprehensive natural heritage monitoring plan will be developed for the subject property in accordance with the NOCSS and will include pre, during and post-development monitoring of vegetation, amphibians, birds and benthic invertebrates at select locations. A monitoring study Terms of Reference including a figure identifying proposed monitoring locations will be developed and submitted to CH and the Town of Oakville, and the agreed upon monitoring plan will be appended to the revised EIR. We will provide a monitoring plan to assess the performance of SWM facilities and watershed according to NOCSS.
36. S.5.10 Conclusions and Recommendations	Infiltration of stormwater to support baseflow seepage to the Redside Dace community is not possible without the use of porous soils. The suggested methods are effective at abstracting storm runoff volume from controlled discharges to the watercourses, but have a negative effect on baseflow maintenance by diverting volume to evapotranspiration. The suggested approaches are classified as "at-source" SWM controls which will be explored and implemented at subsequent design stages.

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37. S. 6.3.1.1 Meander Belt Widths	Please refer to the attached Technical Memorandum – Meander Belt Width Estimation.
38. S.6.3.2 Regulatory Floodplain	We will provide a digital copy of all hydraulic models. We have developed the hydraulic models for all red and blue streams within the study area. We have not provided existing floodplain mapping to the blue reach 14W-14 to be relocated. We will include the existing floodplain mapping to the blue stream 14W-14 to be relocated. As we have mentioned in Section 6.3.2 of the EIR/FSS Report, the regulatory floodplain for the rehabilitation reaches and diversion reaches will be delineated during the detailed design stage when we have more information. We also have mentioned that diversion channels and rehabilitation channels will be designed such that the floodplain is within the proposed corridor widths. We will produce the floodplain mapping in a scale of 1:1000. Road crossings also will be included during the detailed design stage when we have more information.
39. S.6.3.3 Top of Bank	A Top of bank analysis for reach 14W-12 has been carried out by Exp Consultants. A copy of the Report is attached. The analysis concludes that the long-term stable top of bank in general coincides with physical top of bank, except one area where 1.5 m setback from the top of bank is required. The top of bank and the 1.5m setback remain well within the development offsets for the meander belt on this high constraint stream Similarly, a 30 m setback from the limit of meander belt is provided for Reach 14W-11. This setback envelope includes the physical top of bank and the riparian woodlot. Therefore, a geotechnical analysis to establish stable top of bank location is not required as per CH comments.
40. S.6.3.5 Setback and Buffer Requirements	Setback and buffer requirements are provided as per NOCSS recommendations and according to Figures 6.3.15a, 6.3.15b and 6.3.15c of NOCSS. Section 6.3 of the EIR/FSS report discusses each of setback and buffer requirements. A Technical Memorandum: Corridor Width Delineation is provided.
41. S.6.3.6 Hydrologic Feature A	Storage capacity of the Hydrological Feature 'A' located within Reach 14W-14 is 21 m^3 based on the detailed topographic surveying carried out by the MMM in 2011. This flood storage capacity will be provided within the realigned channel 14W-21 in the form of online wetlands. Please refer comment 1 in the main letter regarding the replacement of existing pond with

Comment/Issue	MMM Response
	a SWM pond.
42. S.6.3.7 Corridor Widths	The corridor widths have been updated taking account of the CH comments. Updated table is attached.
43. Figure 6.3 Corridor Delineation	Corridor delineation on detailed topographic mapping is provided in Figure 6.3 in 1:5000 scale. For the high constraint streams or Redside Dace habitat streams, 30 m setback is provided from the meander belt. Attached Technical Memorandum: Corridor Width delineation provides details of corridor width delineation.
44. S.6.4.1 Conceptual Natural Channel Design – Design Criteria	. In the Section 6.4.1 Design Criteria, we have listed all applicable natural channel design criteria and one of them is “a step /pool system is required to provide fish passage for steeper channels.” We have designed diversion/rehabilitation channels with riffle/pool system as step/pool system is not applicable for the study area stream diversions/rehabilitations.
45. S.6.4.3Proposed Channel Morphology	The proposed channel diversion/rehabilitation design parameters are selected based on the guidelines provided in “Adaptive Management of Stream Corridors in Ontario”. Specifically, Section G1. Natural Channel Systems: An Approach to Management and Design and Section G2. Morphologic Relationships of Rural Watercourses in Southern Ontario and Selected Field Methods in Fluvial Geomorphology. The proposed channel hydraulic geometry, width, depth, slope, velocity and friction, has been designed based on fluvial-geomorphologic principles. These hydraulic geometric values are functionally related to equilibrium state of the channel and selected to achieve a stable condition in which it is capable of transporting a bankfull water and a certain amount of sediment.
46. S.6.4.4 Road Crossings	Avenue Two – Request it be located further west to avoid additional creek crossing in proximity to the Burnhamthorpe Road intersection, or require adequate justification. Refer to Comment No. 7. Avenue One – Noted. The alignment of Avenue One, was designed to minimize the length of required crossings (east of the subject property), and minimize impact on the existing GE Water Campus by shifting the road south in this location, from that identified in the NOWSP. On the subject property, the road was shifted north to provide sufficient access to the northern portion of the property and facilitate suitably sized employment blocks, while eliminating the need for additional and inefficient local roads. Although the Burnhamthorpe Road extension encroaches into the environmental setback including Redside Dace habitat, the proposed road alignments have been designed to minimize the number of crossings in comparison to the conceptual road network identified in the NOWSP. In

Comment/Issue	MMM Response
	particular the Burnhamthorpe Road extension has been shifted north to avoid crossing the existing High Constraint Stream Corridor identified in NOCSS. The MNR is being consulted due to the encroachment into Redside Dace habitat. The alignment of Avenue Two, Avenue One, and Burnhamthorpe Road extension will be further reviewed in consultation with the Town and CH to minimize the number and extent of stream crossings while providing an efficient road pattern which supports the development of the employment area, in addition to addressing landowner coordination issues related to the Avenue Two road location and alignment. Once road crossings locations are finalized, we will carry out detailed hydraulic analysis. At this preliminary stage, preliminary culvert sizing will be provided.
47. Figures 6.4A to 6.4D Alignment and Planform Drawings	The road alignments on these Figures will be updated accordingly to reflect any proposed changes and further discussions with the Town, CH, MNR and DFO.
48. Figure 6.4A Fourteen Mile Creek Natural Channel Design and Planform Key Plan	The proposed meandering channel 14W-16 will carry more flows in post-development conditions due to Reaches 14W-14 and 14W-13 diversion. Therefore sedimentation is not an issue due to flattening of slope. Moreover, the proposed channel hydraulic geometry, width, depth, slope, velocity and friction, has been designed based on fluvial-geomorphologic principles. These hydraulic geometric values are functionally related to equilibrium state of the channel and selected to achieve a stable condition in which it is capable of transporting a bankfull water and a certain amount of sediment.. For stream length requirements, Refer the Technical Memorandum: Stream Lengths and Density Requirements.
49. Figure 6.4E Diversion Channel 14W-23 Alignment and Planform	Diversion channel 14W-23 will be straightened out to avoid tight angles and associated erosion problems. The revised channel alignment is provided. The proposed corridor width consists of meander belt width, 6 m erosion buffer and 7.5 m setback as per NOCSS recommendations. The proposed bend will also be stabilized using riprap and natural vegetation to prevent the erosion along the bend transition.
50. Figure 6.5 Channel Corridor Section Typical for 14W-22	We will incorporate a 3 m erosion allowance into the floodplain. The revised channel cross-section is provided.
51. S.6.4.5 Hydraulic Analysis	We will include all road crossings in the hydraulic analysis once the crossing locations are finalized.

Comment/Issue	MMM Response
	We will update the Manning's n in the hydraulic analysis to account for future vegetation. We will provide a digital of the hydraulic model. Okay.
52. S.6.4.6 Maintenance and Riparian Storage	We have not presented the floodplain analysis for the diverted Reaches 14W-14 and 14W-13, but we have carried out floodplain analysis for the Reaches 14W-14 and 14W-13 for riparian storage analysis. We will provide pre- and post-development flood storage-discharge conditions for each reach in the revised Report. A flood storage-discharge analysis will be carried out for the proposed realignment of Reach 14W-11a. Noted. We will redesign the Open Space Blocks in order to keep existing flood storage for all storm events within realigned channel. We will assess the human-made flood conditions due to the Dundas Street Culvert. We will provide flood storage volumes based on detailed grading information during the detailed design stage.
53. S.6.4.7 Stream Length Requirements	A Technical Memorandum – Stream Length and Drainage Density Requirements is attached to address these comments.
54. Appendix 6.1 Regional Floodplain Analysis, 14 Mile Creek	Digital copy of the hydraulic and hydrologic models and a hard copy of the input and output hydrologic files will be provided.
54.a) S.1.1 Regulatory Floodplain	We will present floodplain mapping for all existing and future medium and high constraint streams.
54.b) S.1.1.12 Flood Discharges	We confirm that the pre-development flows presented in the Table 6-1.1 of Appendix 6.1 are based updated drainage areas. Table 6-1.2 of Appendix 6.1 provides the post-development flow rates based on GAWSER hydrologic modeling and are less than pre-development flow rates.
54.c) S.1.1.1.3 Topographic Data	A detailed topographic mapping for the study area is completed by MMM on 2011. We will update hydraulic modeling with detailed topographic data.

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54.d) S.1.1.2.2.2 Manning's Roughness	We will update the Manning's n for post-development condition hydraulic analysis to account for future vegetation conditions.
54.e) S.1.1.2.3 Reach Discharges	A Technical Memorandum: HEC-RAS Model River Reach Flood Flow Estimation is provided describing how the river reach flood flows were estimated is provided.
54.f) Figure 6-2.1 Hec-Ras Cross Sections	We will provide floodplain mapping on a detailed topographical survey map.
54.g) S.1.1.3 Results	We will provide floodplain mapping drawing SW1.
54.h) Other	We will include all proposed road crossings within the proposed conditions hydraulic model once the locations of the crossings are finalized.
55. S.7.4 Proposed Stormwater Management Approach	Section 4.4.4.4 of EIR/FSS Report discusses the post-development water balance with mitigation. It is recommended that 13 mm/year (7,825 m^3/year) of runoff need to be infiltrated through proposed mitigation measures. The proposed mitigation measures include infiltration swales to infiltrate roof runoff located at the edge of the buffers to the natural features. We will discuss areas that will not be diverted to end-of-pipe SWM facilities. We will discuss servicing and grading implications on the land located on the north side of Dundas Street between Avenue 2 and Block 2.
56. S.7.4.1 Existing Drainage Boundaries	A detailed topography survey was carried out for the site and drainage boundaries are shown on a detailed topography mapping are provided in Figure 7.1 in 1:6000 scale. We have followed the drainage boundary provided in the NOCSS (Figure 5.1.1).
57. S.7.4.3 Preliminary Grading Plans and Post-Development Drainage Boundaries	Bullet #1 - We will provide sufficient grading information and identify areas that directly drain to the Natural Heritage System. Bullet #2 - Both subcatchments 3070 and 3080 will direct the major flows to the right-of-ways which have been graded to direct the flows to Pond 3. The minor flows will be collected in the proposed storm sewer system and directed to Pond 3, there is currently sufficient cover to allow for the storm sewer to cross overtop of the proposed culvert structure. It should be noted that the storm sewers and overland flow routes will need to be re-evaluated with any rearrangement of the road network or pond locations. Bullet #3 - We will identify areas directly drain to the Natural Heritage System during detailed design stage.

Comment/Issue	MMM Response
	Bullet #4 - We will include the Dundas Street ROW within the post-development drainage boundary and will provide stormwater management controls for any future road widening. Bullet #5 - Agreed. Bullet #6 - We will update Table 7.3 to reflect interim conditions (i.e. no developments west of Tremaine Road). Bullet #7 and #8 - We will discuss potential impacts in watercourses to the proposed diversions and internal diversions between subcatchments.
58. S.7.5 Post-Development Hydrologic Analysis	Bullet #1 - We will consider two future conditions 1) interim conditions representing no developments west of Tremaine Road and 2) ultimate conditions representing developments west of Tremaine Road. The two scenarios, interim and ultimate conditions, will be taken in account for designing stormwater management facilities. Bullet #2 - Flow rates at the upstream end of the realigned 14W-14 are provided below: 2 Yr – 0.94 m^3/s 5 Yr – 1.50 m^3/s 10 Yr – 1.83 m^3/s 25 Yr – 2.34 m^3/s 50 Yr – 2.68 m^3/s 100 Yr – 3.02 m^3/s Regional Storm – 7.60 m^3/s Flow rates at the upstream end of the rehabilitated reach 14W-16 are provided below: 2 Yr – 2.22 m^3/s 5 Yr – 3.56 m^3/s 10 Yr – 4.32 m^3/s 25 Yr – 5.49 m^3/s 50 Yr – 6.34 m^3/s 100 Yr – 7.14 m^3/s Regional Storm – 17.9 m^3/s Bullet #3 - Okay. Bullet #4 - Post-development hydrologic modeling will be updated based on the comments from CH, Town and MNR.

Comment/Issue	MMM Response
59. S.7.6 Stormwater Management Facilities	Bullet #1 - Refer to response 57. Bullet #2 - Figure 7.4 showing catchment boundaries for each proposed SWM ponds are provided. Bullet #3 - We will provide flow rates for the reaches in pre- and post-development condition. Bullet #4 - Pond # 1 and # 2 drainage areas are rounded to 30.9 ha and 15.5 ha respectively in the report. But we have used 30.88 ha and 15.45 ha in our pond release rate estimation. Pond will be designed according to MOE's preferred criteria where it is possible. Bullet #5 - We will provide preliminary grading plans for Pond # 2 and #3 once the pond locations are finalized. Bullet #6 – Noted. Bullet #7 - Detailed design of the SWM ponds will be provided once the pond locations are finalized. Bullet #8 - Noted.
60. S.7.7 Erosion Control Analysis	See response 4 and 5 in relation to the Town of Oakville comments.
61. S.7.8 Topographic Depression Volumes	Topographic depression analysis has been revised and provided in the Technical Memorandum – Topographic Depression Volume Analysis
62. S.7.9 Downstream Impacts for Regional Storm	We will provide digital copies of hydrologic and hydraulic models as well as hard copy of the hydrologic input and output files for post development conditions. We will also provide hard copy of floodplain mapping at a scale that allows for a review of impacts. We will need to obtain topography mapping for downstream area to develop floodplain mapping.
63. Appendix 4.6 Groundwater and Surface Water Quality	The locations from where surface samples were obtained will be added to a figure in the updated EIR/FSS report.
64. Appendix 5.6 Water Temperature Monitoring Data	Noted. Will revise graphs.
65. Appendix 8.3, Figure A	Noted. We will revise.

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66. Appendix 8.4	Refer to comments/response in relation to the ASP.
67. Deficiencies in the EIR/FSS	Recommendations are to be made on preferred crossing locations, and configurations, road design standards, and mitigative measures to minimize impact on the NHS. We will revise the report.
67.a) S.3.3.3 ToR Detailed Studies	We will augment our revised report to address this and provide additional information on our investigations regarding the pond. As noted elsewhere, additional monitoring of the human made pond (14W-14A, Hydrologic Feature A) indicates that the pond is not receiving groundwater inputs and is losing water into the ground.
67.b) S.3.3.3.3 Stream Modification/ Rehabilitation Measures (ToR)	The noted items will be addressed in the revised document.
67.c) Guidance for Development Activities in Redside Dace Protected Habitat (MNR Feb. 2011)	Noted. We will coordinate a meeting to discuss.

PROTECTING THE NATURAL ENVIRONMENT FROM LAKE TO ESCARPMENT

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August 16, 2012

Rob Thun
Town of Oakville Planning Services Department
1225 Trafalgar Road
Oakville ON L6H 0H3

Dear Mr. Thun:

RE: Bentall Kennedy (Canada) LP – Lazy Pat Farm Property
3269 and 3271 Dundas Street West
Town of Oakville
Zoning By-law Amendment and Draft Plan of Subdivision: 24T-11001, Z.1333.01
CH File: MPR 562

Staff has reviewed the March 2012 (CH date stamped April 12, 2012) submission from the MMM Group and offers the following comments. For ease of review we have used the numbering provided in the March 30, 2012 response letter from the MMM Group.

1. **General** - Remains outstanding – will be provided within updated EIR/FSS.

2. **Executive Summary** - Remains outstanding – will be provided within updated EIR/FSS.

3. **Section 2.1, EIR Subcatchment Area and FSS Study Area** - While the proponent agrees with our comment, this item remains outstanding until revised within updated EIR/FSS.

4. **Section 2.1, Natural Heritage System Components** –
   - **High Constraint Corridors** - Both bullet points remain outstanding. Response only indicates that Bullet #2 will be revised in updated EIR/FSS. Both comments must be addressed in updated EIR/FSS.
   - **Medium Constraint Corridors** – Bullets #1, #3 and #4 remain outstanding and must be addressed within updated EIR/FSS.

5. **Section 2.2, Permitted Uses in the Natural Heritage System** - The criteria that were previously provided on Pages 2-3 to 2-4 of the EIR/FSS (as taken from the NOWSP) meets most engineering requirements; however, the proposed design concept submitted to-date does not meet these criteria. The proposed SWM pond is not located outside the meander belt plus factor of safety plus erosion/access allowance or the 100 year floodline associated with Reach 14W-14A. It is also the opinion of staff that the previous EIR/FSS does not demonstrate that there will be no loss of flood storage and conveyance associated with Reach 14W-14A. In addition to these criteria, the length of all medium constraint watercourses must be maintained in order to maintain the overall Regional drainage density within North Oakville. Based on previous direction provided by the Town's original Subwatershed Study (SWS) team, Conservation Halton staff are of the opinion that it is not appropriate to substitute a SWM facility for medium constraint watercourses as drainage density was developed on a

Regional basis across North Oakville. Further comments on the farm pond (Reach 14W-14A) are provided under comment 24 below.

6. **Section 3.2, Trail Planning** – Staff looks forward to hearing the results of these discussions with Town staff.

7. **Figure 3.1, 407 West Employment Concept Plan** –Staff will provide further comment on the proposed location of Avenue 2 once we have had an opportunity to discuss the proponent's justification with Town of Oakville staff. Conservation Halton staff still require a site visit to view the proposed location of Avenue 1 relative to the Main Fourteen Mile Creek valley.

8. **Section 4.4, (Hydrogeology and Geology) Impacts of the Proposed Development** – Conservation Halton are satisfied with the information presented in Technical Memorandum HG#1 regarding groundwater contributions and the existing pond; however, our previous comments were regarding assessing impacts related to the realignment of the various watercourse reaches which was not addressed satisfactorily in the response and remains outstanding. It is our understanding from the response table that additional discussion regarding the potential hydrogeological impacts to the proposed re-aligned watercourses will be provided within the updated EIR/FSS.

9. **Section 4.4.2, Climate and Water Surplus** - Conservation Halton staff are satisfied with the justification provided with respect to the use of the Oakville Gerard station instead of the Royal Botanical Gardens (RBG). As the Town's original SWS team had recommended the use of the RBG station, Conservation Halton staff recommends that the Town contact the SWS team to determine if they have any concerns in this regard.

10. **Section 4.4.3, Inputs to Water Balance** - It is our understanding that the consulting team will re-examine the interpretation of the soil classification. Based on the information provided in Technical Memorandum HG#1, staff are satisfied that it is reasonable for the soil factor to be closer to 0.1 rather than the 0.2 previously suggested by Conservation Halton.

11. **Section 4.4.4 & Appendix 4-7, Water Balance** - Addressed.

12. **Section 4.4.4.2, Post-Development Water Balances** – It is the intention of Conservation Halton staff to discuss further with Town of Oakville staff what constitutes reasonable "Best Efforts" in North Oakville. Staff will provide further direction in this regard once it is available. Staff also note that the Ministry of Natural Resources will likely have infiltration requirements under the *Endangered Species Act* (See comment 13 below). As noted in our previous comments, all infiltration works such as infiltration swales must be located outside of the 7.5 metre regulated allowance. The installation of infiltration swales within the larger buffer areas would be assessed on a case by case situation in conjunction with the MNR. Staff further notes that a discussion is required regarding the configuration of these swales given the trails and plantings that are also required in this area. The above, along with MNR requirements, should be reflected in the updated EIR/FSS.

13. **Section 4.4.4.6, Discussion of Potential for Base Flow Reductions to Watercourses** – Previous comments about water balance were made with respect to the subject property, not to the overall watershed area. Water balance for this site refers to changes in pervious cover within this property, not to the entire drainage area. The target fish community for the creeks in this project site is Redside Dace. Redside Dace require cool, clear water that is sustained by groundwater inputs. Research has shown that changes to the hydrology of watercourses that occur as a result of urbanization (which includes an increased area of impervious cover) are

detrimental to the continued survival of Redside Dace. As such, staff would recommend that it is imperative that water balance on the site either match or exceed pre-development conditions to comply with ESA regulations. The Ministry of Natural Resources will provide further input in this regard.

14. **Section 4.4.4.7, Dewatering Potential** – Once pond details are available, it should be verified that the SWM ponds can be fully completed within the clayey silt till overburden or the EIR/FSS should be updated accordingly.

15. **Figure 4.4, On-Site Monitoring Locations** – Thank-you for providing clarification on the piezometer data.

16. **Section 5, Natural Heritage** – Staff trust that the updated EIR/FSS will take into account our previous comments.

17. **Section 5.*1.3*** – This item will be revised in the EIR/FSS.

18. **Section 5.4.1.5, Hydrologic Features 'A' and 'B'** - Remains outstanding – will be provided within updated EIR/FSS.

19. **Conservation Halton Regulation 162/06 and Wetland Policy** – Staff trust the revised wording will be included in the updated EIR/FSS.

20. **Section 5.3.3.1, Species at Risk** - While staff appreciates that on site discussions have occurred with respect to Redside Dace, the original comment requested an update to the presence of Bobolink on the site which has not been provided in the response comment. Staff recommends that discussions with Melinda Thompson of the Aurora District MNR office be initiated given the high number of Bobolink observed during the breeding bird surveys. Please provide an update on this issue within the EIR.

21. **Section 5.3.3.3, Regionally Rare/Uncommon Species** - Staff trust the revised NAI rankings will be included in the updated EIR/FSS.

22. **Section 5.3.4.4 Aquatic Habitat Reach 14W-11A, 14W-11, 14W-13, 14W-14:** Staff appreciate the proponents' efforts to meet with agency staff on the Lazy Pat Property.

23. **Section 5.3.4.4 Aquatic Habitat Reach 14W-14:** This channel is considered to provide direct fish habitat, however the removal of the channel is considered to be a low risk harmful alteration, disruption or disruption to fish habitat at this time and will not require a *Fisheries Act* Authorization.

24. **Section 5.3.4.4 Aquatic Habitat Reach 14W-14A:** Staff have received this monitoring information and appreciate the proponents' efforts to collect and submit it (further comments on this memo are provided at the end of this correspondence). Based on the data provided, Conservation Halton staff does not object to the removal of the farm pond, provided the stream length is relocated in keeping with the requirements of North Oakville Creeks Subwatershed Study (NOCSS) for Medium Constraint Stream reaches. It is our preference that the stream length is relocated and designed as a natural channel/riparian corridor, however the ultimate feature should be selected based on the NOCSS requirements that environmental, geomorphic, hydrologic and hydrogeologic functions are duplicated.

Further, The NOCSS document requires that the form and function of Hydrologic Features "A" be considered through an EIR-FSS. This is not considered to have been undertaken adequately for 14W-14A. Offline vernal pools are not considered to replicate the hydrological and ecological functions that the existing large pond is currently providing as there is concern that the new creek channel will meander into the offline wetlands, potentially creating large pools that could have a negative thermal impact on the creek and could initiate a large sediment slug that could migrate downstream. As such, it is suggested that the environmental form and function (wetland and aquatic habitat) lost by the elimination of 14W-14A could be addressed by the naturalization of other portions of the property. We would recommend that the applicant schedule a meeting with Town of Oakville, Conservation Halton and Ministry of Natural Resources staff to discuss viable options for the relocation of this reach.

DFO has indicated that neither an Authorization, nor compensation or monitoring, will be required for the relocation of this reach.

25. **Section 5.3.4.4 Aquatic Habitat Reach 14W-16**: The pond feature (Hydrologic Feature B) appears to be protected within the creek block (e.g. Figure 6.3). Please explain why the pond would be removed as there appears to be an opportunity to leave this feature on the landscape.

26. **Section 5.3.4.4 Aquatic Habitat Reach 14W-12:** Comment addressed.

27. **Section 5.3.4.4 Aquatic Habitat Reach 14W-12A:** The stream segment that the proponents are referring to as 14W-12A is characterized as a red constraint watercourse because of its connectivity with 14W-12 and the potential that Redside Dace could use this channel. The reach breaks identified in NOCSS were finalized during the Secondary Plan process and refinements are expected to be within the order of a few metres (NOCSS, pg 7-16).

28. **Section 5.3.5.1 Vegetation Approach** – Staff appreciate the clarification provided, though we do caution that the approach taken does not constitute the use of Ecological Land Classification (ELC) for Southern Ontario, rather a different classification system has been provided using a non-standardized approach. Given that the property was assessed as part of NOCSS using the full ELC study protocols, there are no Cores or Linkages present on the subject property (though present in the subcatchment), and as the EIR Terms of Reference indicates that at the EIR level of detail only preliminary field review of features is required rather than at the draft plan level of detail which does require appropriate field surveys, staff has no further requirements with respect to ELC.

29. **Section 5.3.7 Hydrogeology:** Based on the data submitted in the Technical Memorandum NH number 1 – Reach 14W-14A Aquatic Habitat (e.g. Figure 7 Water Temperature at Maximum Pond Depth: 2-3m Depth 14W-14A), and the data submitted in the Technical Memorandum HG number 1 – Hydrogeology (Figures SWL-16 to SWL-18), it would appear to indicate that groundwater is influencing 14W -14A in the deepest section of the pond. Notwithstanding the above, staff does not object to the relocation of Reach 14W-14A. Staff appreciate the effort, time and cost the proponents contributed to the collection of this data.

30. **Section 5.9.2 Fish Habitat Compensation Concepts, Removal of Reach 14W-14A**: Please see comment 24 above.

31. **Section 5.9.2, Fish Habitat Compensation Concepts:** Please see comment 34 below.

32. **Table 5.10, Summary of Potential Impacts to Aquatic Resources** – We trust that these recommendations and revisions will be incorporated into the updated EIR/FSS.

33. **Table 5.12, Summary of Potential Impacts to Wildlife** – This comment has been addressed subject to the updated EIR/FSS.

34. **Figure 5.2, EIR Vegetation Communities** – Staff looks forward to this discussion. We will provide further comments once this meeting has occurred.

35. **Section 5.9.5 Monitoring** - This comment has been addressed subject to the updated EIR/FSS.

36. **Section 5.10, Conclusions and Recommendations** - The infiltration of stormwater to support baseflows is possible using a variety of approaches including the following:
    - Installation of soakaways (infiltration trenches) can be constructed under granular trails/pathways in landscaped areas and parks.
    - Incorporation of bioretention areas, rain gardens, biofilters, constructed wetlands into landscaped areas. Depression storage entails the roof water being directed to lawns.
    - Use of permeable pavement in low and medium traffic areas.
    - Incorporation of bioretention areas, vegetated filter strips, and swales to treat parking lot and road runoff.

    As noted previously, Conservation Halton staff will discuss the concept of "Best Efforts" as it applies to NOCSS with Town staff and provide further direction/recommendations on these approaches. Staff understands that Ministry of Natural Resources staff will also provide further direction on ESA requirements in this regard.

37. **Section 6.3.1.1 Meander Belt Widths** - The labels for proposed reaches 14W-21 and 14W-22 are reversed in Table 1 of the Technical Memorandum: Meander Belt Width Estimation. The 2-year peak flow given for Reach 14W-11A would appear to be a typographical error (staff are satisfied that the correct value, 0.31 m^3/s, was utilized in the calculations). Conservation Halton staff have no objections to the meander belt widths calculated for existing conditions as provided in Table 1. Staff request that post-development conditions for Reach 14W-14/Reach 14W-22 be revisited as Table 1 indicates that the drainage area will decrease even though Reach 14W-13 will be diverted to Reach 14W-14 under post-development conditions. Staff also note that the 2 year peak flow given in Table 1 (0.74 m^3/s) is different from the 2 year flow provided in the response table to Comment #58 (0.94 m^3/s).

38. **Section 6.3.2, Regulatory Floodplain** – All previous comments remain outstanding and must be addressed within the updated EIR/FSS in order for Conservation Halton to support Draft Plan approval. Staff are not supportive of deferring these issues to detailed design as the FSS must verify that the proposed Open Space Blocks will provide adequate flood storage and conveyance for the full range of storm events.

39. **Section 6.3.3, Top of Bank** – The November 18, 2011 Slope Stability Analysis Report prepared by exp Services Inc. assessed slope stability along Reach 14W-12 for approximately 100 metres upstream of Dundas Street. Conservation Halton did not require a geotechnical evaluation of this reach but did require a geotechnical evaluation of Reach 14W-11, which remains outstanding. Staff note that due to the scale of Figure 6.3, we cannot advise at this time whether or not we would be supportive of waiving this requirement on the basis that it will be contained within the 30 metre setback from the meander belt. While staff did not require the subject geotechnical evaluation for reach 14W-12, we did undertake a review of

the document submitted. While staff have no concerns with the technical analysis completed on the sections that were analyzed we were unclear why the two locations assessed were selected. If this document is to be utilized further in the future, it should be expanded to include topographical survey information for the entire confined reach of the channel along with the location of all sections assessed. Based on a review of our survey information, we would anticipate that additional sections would be required on the east side of the watercourse. Staff further note that it is our opinion that a toe erosion allowance would be applicable on the subject site as the watercourse is located within weathered shale-till complex and not competent soft bedrock. Please note that since the life span of the existing retaining wall is unknown, it must be discounted in the analysis and the native soils utilized in determining the appropriate toe erosion allowance. Notwithstanding these observations, we anticipate that this will not likely impact the location of the stable top of bank due to the distance between the watercourse and the toe of slope.

40. **Section 6.3.5, Setback and Buffer Requirements** – Staff appreciate the updated table provided within the Technical Memorandum: Corridor Width Delineation. Staff note that in accordance with NOCSS Figure 6.3.15b, the 7.5 metre setback is applied to the greater of the meander belt allowance or the Regional Storm flood plain. This table should be updated accordingly. Staff also notes that only a minimum 3 metre factor of safety (or 10% of the meander belt, whichever is greater) on both sides of the meander belt is required and not the 6 metres currently noted in the table.

41. **Section 6.3.6, Hydrologic Feature 'A'** – It is our understanding from the Technical Memorandum: Topographic Depression Volume Analysis that the 21 m^3 of storage required to replicate the Hydrologic Feature 'A' located within Reach 14W-14 will be provided within realigned channel Reach 14W-22 and not Reach 14W-21 as noted in the response table. As noted above, there are fisheries concerns with the offline wetlands. Conservation Halton continues to require that the active storage of the existing farm pond to be maintained within the medium constraint corridor associated with Reach 14W-14A.

42. **Section 6.3.7, Corridor Widths** – See comment 40 above.

43. **Figure 6.3, Corridor Delineation** – Staff found the scale of the drawing made it difficult to review and continue to request that the drawing be submitted at a scale of 1:2000 or better. Due to the scale of this figure, staff cannot confirm that we are prepared to waive the geotechnical assessment on Reach 14W-11. Staff also noted that the physical top of bank staked in the field would not appear to reflect the physical top of bank suggested by the contour lines. This may be due to the scale of the Figure, however, we request that it be verified that the contour information is accurately geo-referenced to the legal survey of the property and staked top of bank. For areas to be altered, separate mapping will be required in conjunction with proposed grading information.

44. **Section 6.4.1, Conceptual Natural Channel Design – Design Criteria** - Addressed.

45. **Section 6.4.3, Proposed Channel Morphology** – Addressed with respect to EIR/FSS. The specific equations, etc. utilized should be included within the detailed design brief that will be required in conjunction with the detailed design of the channel.

46. **Section 6.4.4, Road Crossings**
    - Bullet #1 - Staff will provide further comment on the proposed location of Avenue 2 once we have had an opportunity to discuss the proponent's justification with Town of Oakville staff.

- Bullet #2 - Conservation Halton staff still require the opportunity to review the proposed location of Avenue 1 relative to the Main Fourteen Mile Creek valley within the field.
- Bullet #3 - Staff await the opportunity to review the updated hydraulic modeling once it is ready.

47. **Figures 6.4A to 6.4D, Alignment and Planform Drawings** – Addressed on Figures 6.4A to 6.4D, although additional/modified details may be required as discussions on road alignments, etc. progress.

48. **Figure 6.4 A, B and C:** Please note that the Conservation Halton will require an alternative to rip rap in the final detailed design.

    Channel 14W-21 – As noted above, Conservation Halton staff's preference would be to avoid the use of floodplain pools/offline wetlands as there is concern with channel migration moving towards these dug out pools, which could lead to an enlarged pool in the channel which would likely result in a relatively large sediment release. Furthermore, the larger pool feature could lead to thermal warming of the surface water.

    Staff would prefer to see the channels configured in such a way that natural channel design implementation results in the construction of a Rosgen "E" channel cross section either immediately after construction, or shortly after channel construction through the growth of adjacent native grasses in the riparian zone and through channel adjustments occurring after channel construction. It is suggested that under-excavating the channel forms may provide an opportunity for the watercourse to refine an "E" channel form at some point shortly after (5 – 15 years) the channel is constructed.

    These types of channel forms are advantageous because the steep side banks of the channel provide shade and channel undercuts that provide hiding places for fish. The steep side banks of the channel need to be vegetatively controlled with grasses native to southern Ontario that have deep rooting systems, which will provide vegetative stability of the channels. The channels will need to be excavated and planted with the native grasses ideally one growing season prior to the introduction of water to the new channel.

    While we recognize that the Secondary Plan allows for some consolidation of Medium Constraint Watercourses, staff has concerns regarding the consolidation of three intermittent channels into one and a half channels due to the high volumes of water observed in these channels. 14W-16A was observed to convey large amounts of water during a runoff event in the fall of 2011. Much more flow was observed than what would be expected given the size of the channel. There is anticipated to be large amounts of flow conveyed in the new channel, since it will be carrying the flow that three tributaries carried previously. As such, there is concern that there will be a desire to line the channel with rock material that is larger than the existing substrate.

    As discussed, the desired fish community for these creek channels is Redside Dace. Redside Dace are typically found in channels with sand or fine gravel sediments. It is imperative that the new realigned channel is not lined with any substrate larger than this to ensure suitability for habitation by Redside Dace. As such, it is recommended that the design of the channel incorporate erosion control measures other than large rock bedding materials. Suggested erosion control measures for the new channel include:

    - A channel length that enables an ideal overall channel slope that will prevent erosion prone areas from developing. The longitudinal slopes that the channels will ideally exhibit are between 0.5% and 1.0%. There is a fine balance to be achieved. It is

important that the slope of the channels be greater than 0.5% to prevent aggradation and encroachment of species such as cattails that can fully preclude fish passage from occurring in these watercourses.

- Enhanced sinuosity to dissipate the energy of the flowing water.
- Excellent connectivity of the creek channel to its flood plain.
- Dense plantings of native prairie grasses in the riparian zones of the channel.

We note that the channel design must advance sufficiently at the draft plan stage to determine the appropriate size and location of the creek blocks/NHS.

49. **Figure 6.4 E** – See above.

50. **Figure 6.5, Channel Corridor Sections Typical for 14W-22** – Addressed. Staff note that only a minimum 3 metre factor of safety (or 10% of the meander belt, whichever is greater) on both sides of the meander belt is required and not the 6 metres currently noted on the figure.
    There is concern with the channel cross sections proposed for a few reasons:
    a) The wider width of the channel and shallow depth will increase thermal warming of the channel and may lead to frequent presence of algae in the newly constructed channel.
    b) The shallow channel depth and wider channel width may make fish passage difficult during periods of low flow.

51. **Section 6.4.5, Hydraulic Analysis** - Remains outstanding – will be provided within updated EIR/FSS.

52. **Section 6.4.6, Maintenance of Riparian Storage** – All comments remain outstanding – will be provided within updated EIR/FSS.

53. **Section 6.4.7, Stream Length Requirements** - Further to the Technical Memorandum: Stream Length and Drainage Density Requirements; it is the opinion of Conservation Halton staff that it is not appropriate to utilize SWM facilities to compensate for Medium Constraint watercourse features (Reach 14W-14A) and there should be no loss in total channel length of the High and Medium Constraint watercourses. This is based on our understanding from the Town's Subwatershed Study (SWS) team, that drainage density was developed on a Regional basis across North Oakville and that even though there is a surplus in one subcatchment area this cannot be reduced as other subcatchments have a deficit.

54. **Appendix 6.1, Regional Floodplain Analysis, 14 Mile Creek – General Comments** - Remain outstanding – will be provided within updated EIR/FSS.
    a. **Regulatory Floodplain** - Remains outstanding – will be provided within updated EIR/FSS.
    b. **Flood Discharges** – Staff are generally satisfied with the pre-development flow rates provided in Table 6-1.1, however, these will need to be revisited in conjunction with finalizing the issue of drainage area mapping (see Comment 56). Post-development flow rates will need to be confirmed in conjunction with finalizing the stormwater management plan for the site (including receipt of digital copies of all hydrologic models).
    c. **Topographic Data** - Remains outstanding – will be provided within updated EIR/FSS.
    d. **Manning's Roughness** - Remains outstanding – will be provided within updated EIR/FSS.
    e. **Reach Discharges** – Addressed.

f. **Figure 6-2.1, HEC-RAS Cross-Sections** - Remains outstanding – will be provided within updated EIR/FSS.
g. **Results** – Remains outstanding – will be provided within updated EIR/FSS.
h. **Other** – Remains outstanding – will be provided within updated EIR/FSS.

55. **Section 7.4, Proposed Stormwater Management Approach**
- Bullet #1 - It is the intention of Conservation Halton staff to discuss the proposed infiltration goal of 13 mm/year for all developable lands with Town of Oakville staff. We will provide further direction in this regard once it is available. As noted in our previous comments, all infiltration works such as infiltration swales must be located outside of the 7.5 metre regulated allowance and that installation of infiltration swales within the larger buffer areas would be assessed on a case by case situation.
- Bullets # 2 & 3 - Remain outstanding – will be provided within updated EIR/FSS.

56. **Section 7.4.1, Existing Drainage Boundaries** – Figure 7.1 is not drawn at a scale that allows for the labeling of contour information so that staff can review the subcatchment areas and refinements. The response table indicates that the NOCSS drainage boundaries have been followed; however, staff noted at least one location where the drainage boundaries are different. We also noted that the total drainage areas to the culverts at Dundas Street are different between NOCSS and the current document, suggesting other refinements.

57. **Section 7.4.3, Preliminary Grading Plans and Post-Development Drainage Boundaries -**
- Bullets #1, #3, #6, #7 & #8 - Remain outstanding – must be provided within updated EIR/FSS. Staff notes that bullet point #3 indicates this information will be provided at detailed design. Please note, as per the Terms of Reference for the EIR/FSS (Section 3.4.3, Preliminary Grading and Drainage Plan), a preliminary detailed grading plan for the proposed development is required. This must include any increase or decrease in drainage area to the NHS, though it is intended that existing drainage characteristics will be maintained. Changes in grades adjacent to the NHS must be identified and the direction of NOCSS must be followed as it relates to grading adjacent to the NHS (NOCSS Section 6.3.5.3).
- Bullets #2 & #4 – Comments addressed in principle however will need to be evaluated in conjunction with outstanding grading plan, etc. as part of updated EIR/FSS.

58. **Section 7.5, Post-Development Hydrologic Analysis** –
- Bullet #1 - Comments addressed in principle however will need to be evaluated in conjunction with outstanding grading plan, etc. as part of updated EIR/FSS.
- Bullet #2 – Staff appreciate the provision of the flow rates at the top end of the realigned 14W-14 and 14W-16. It should be ensured that these key nodes and any other key locations are summarized clearly within the updated EIR/FSS.
- Bullet #4 – Remains outstanding - will be provided within updated EIR/FSS.

59. **Section 7.6, Stormwater Management Facilities -**
- Bullets #1 – Comment addressed in principle however will need to be evaluated in conjunction with outstanding grading plan, etc. as part of updated EIR/FSS.
- Bullet #2 – Staff appreciate the provision of Figure 7.4.
- Bullets #3, #6, #7 & #8 - Remain outstanding – will be provided within updated EIR/FSS.
- Bullet #4 - Staff continue to calculate slightly different required release rates for Ponds #1 and #2 from those provided in Tables 7.6 & 7.7 based on the unit area target flow

rates provided in Table 7.2 and the drainage area to the SWM ponds provided in the response table.

- Bullets #5 & #9 – Remain outstanding.

60. **Section 7.7 & Appendix 7, Erosion Control Analysis & Appendix 7 –**
    - Bullet #1 – Remains outstanding – will be addressed within updated EIR/FSS. Staff look forward to the opportunity to visit the site to investigate tributaries downstream of culverts FM-D2 and FM-D3.
    - Bullets #2 & #3 – Remains outstanding.
    - Bullet #4 – Conservation Halton staff were unclear why the methodology utilized would be more conservative and it would not appear that the methodology assesses changes in the frequency of erosion threshold exceedances. Conservation Halton staff continue to recommend that methodology required by the EIR/FSS Terms of Reference also be undertaken. Alternatively, the Town of Oakville may wish to obtain or require the proponent to obtain a Peer Review of the proposed erosion threshold methodology to determine if this alternative methodology is acceptable. We recommend that the Peer Review be completed by the original Subwatershed Study Team (Parish Geomorphic).

61. **Section 7.8 Topographic Depression Volumes** – The Technical Memorandum: Topographic Depression Volume Analysis indicates that depression storage analysis will not be undertaken on the Hydrologic Feature 'A' located on Reach 14W-16 (ID 6) as it will be kept in its original condition. Figure 6.4A however indicates that the Avenue 2 would be located on top of this hydrologic feature. Reach 14W-16 is also proposed to be realigned through this reach. As such, depression volume analysis will be required within the EIR/FSS for this feature unless the updated report clearly indicates that the feature will be left undisturbed. The updated EIR/FSS should also demonstrate on its grading plan and/or through other drawings that Hydrologic Features 'B' ID7 and ID8 will be left undisturbed or the topographical depressional storage analysis should be updated accordingly.

62. **Section 7.9 & Appendix 7.2, Downstream Impacts for Regional Storm:** Remains outstanding - will be addressed within updated EIR/FSS. Staff note that the response table does not indicate that it will account for no Regional Storm controls within any development upstream of Dundas Street within the Fourteen Mile Creek watershed. Staff re-iterate that this is a requirement that must be met in order to ensure fairness to all developers. The response indicates that topographical mapping will be obtained to develop the floodplain mapping. It should be noted that if the intent is to plot the flood elevations predicted by the converted HEC-2 model onto the topographical mapping, additional modeling updates will be required if there is any noticeable difference between the topographical information utilized in the model from that provided on the mapping. The consultant team is required to undertake the verification steps and provide the supporting documentation in this regard. As noted previously, localized updates may also be required to reflect recent changes in the watershed.

63. **Appendix 4.6 Groundwater and Surface Water Quality:** Remains outstanding – will be provided within updated EIR/FSS.

64. **Appendix 5.6 Water Temperature Monitoring Data**: Please refer to comments on Technical Memorandum # 1 – Reach 14W – 14A Aquatic Habitat.

65. **Appendix 8.3, Figure A**: Remains outstanding – will be provided within updated EIR/FSS

66. **Appendix 8.4**: The April 3, 2012 MMM Group response letter to Halton Region regarding the Area Servicing Plan for the 407 West Employment Area does not discuss Conservation Halton's previous comments. As our previous comments largely reflected our above noted concerns regarding various road alignments, we are satisfied that the outstanding issues with the Area Servicing Plan will be addressed in conjunction with resolving the above concerns.

67. **Deficiencies in the EIR/FSS**: Remains outstanding – will be provided within updated EIR/FSS.

Comments on Technical Memorandum NH # 1 – Reach 14W – 14A Aquatic Habitat, Prepared by MMM Group. March 28, 2012.

Staff appreciate the time and effort expended to collect and synthesize the data presented in the report.

68. **Sect. 3.1 Fish Community Survey (Pg. 3)**: Please provide detail on the design and methodology used to collect fish entitled "pot traps". Staff are disappointed that the deeper sections of the pond were not sampled during the additional monitoring. Staff are concerned that additional fish species and potentially a significantly larger amount of biomass of fish may be present in the pond, which has not been identified at this time due to insufficient sampling. The Department of Fisheries and Oceans has indicated that an authorization will not be required for the removal of the pond, as such, further fish community monitoring will not be required.

69. **Sect. 3.3 Supplemental Fish Habitat Documentation Pg. 9 Water Quality Monitoring, Dissolved Oxygen**: The interpretation of the dissolved oxygen monitoring data was not comprehensive. The raw data collected is requested to be submitted for Conservation Halton's files.

70. **Sect. 3.4 Water Temperature (Pg. 11):** Staff appreciates the effort to calculate the linear trend line equations pertaining to the surface water temperature data. This information was helpful. Staff request that the raw surface water temperature data is provided in Microsoft Excel format if possible.

71. **Sect. 3.5 Thermal Impacts of Proposed Conversion of Farm Pond to a SWMP (Pg. 15):** Staff appreciate and concur with ideas to mitigate thermal warming of the pond posed by enlargement of the facility. These ideas included the use of cooling towers and floating vegetated islands.

72. **Sect. 3.6 Phytoplankton/Zooplankton Production (Pg. 15):** There could be changes in the type and extent of phytoplankton and zooplankton contributed to the downstream watercourse depending on the configuration of the SWM pond outlet. For example, if an underground cooling trench or exfiltration trench is used as the SWM facility outlet, it is likely that no zooplankton and possibly no live phytoplankton would be released into the downstream creek.

73. **Sect. 3.7 Sediment Source**: Staff suggest that the pond could act as a sediment source for the downstream watercourse during larger runoff events such as the spring freshet.

74. **Sect. 3.8 Organic Material Source**: Staff suggest that the existing pond would provide a source of coarse organic material to the downstream watercourse during large runoff events such as the spring freshet. It is agreed that riparian planting would help replace this function.

75. **Sect. 3.9 Headwater Wetland Function**: Staff concur that the pond was originally constructed to meet agricultural needs and has naturalized over time. It appears that the more permeable weathered shale layer was punctured when the pond was excavated and that is allowing groundwater to enter at that location at the bottom of the pond.

    Based on the observed water level elevations, as well as those presented in the hydrogeology technical memorandum, the water level in the pond appears to be relatively stable. Since there is only one inlet/outlet to the creek and the watercourse at this inlet/outlet is intermittent, it is logical to assume that the water level in the pond is being augmented to a fair extent by groundwater inputs. The pond clearly sustains a permanently wet pond, as evidenced by the presence of submergent aquatic vegetation such as coontail (*Creratophyllum demersum).* The pond is likely having a moderating effect on the hydrology of the downstream watercourses, similar to how headwater wetlands function.

76. **Sect. 4.0 Conclusions (Pg. 16):** Staff are not in a position to agree with the conclusion that the pond is functioning as warm water habitat. The negative correlation calculated between air temperatures and the water temperatures collected at the deepest location in the pond (2 m below water surface), certainly implies that groundwater must be having an influence on the cooler water temperatures observed at the bottom of the pond. It is thought that this groundwater is helping to provide both summer and winter refuge habitat for coolwater fish species in the pond. Please note that the Department of Fisheries and Oceans have indicated an Authorization under the *Federal Fisheries Act* is not required for the relocation of the pond reach. As noted previously, we will coordinate with the Ministry of Natural Resources staff regarding any ESA requirements for the relocation of the Medium Constraint stream.

77. **Figure 1 Bathymetric Survey/Approximate Fish Community Sampling Locations**: There is concern that the deeper water and cooler water sections of the ponds have not been sampled. The oxygen concentrations measured in the deepest sections of the pond have not been comprehensively communicated in this report. There is concern that additional biomass of fish and additional species of fish may be present in the pond, but were not sampled because these important habitat areas were not sampled. Staff does not require further sampling, however please provide some discussion in this regard.

78. **Figure 3 Pond Cross Section**: Staff appreciates the work undertaken to analyze the surface water temperature data as presented in this figure. Staff are not in a position to agree or disagree with the depiction of the thermal regimes as depicted in these graphs without seeing the raw surface water temperature points.

79. **Figures 4 -7, Water Temperature Comparisons at a variety of Water Depths**: Staff appreciates the effort in presenting the data in this graphical format. Staff also request that the raw numerical data be submitted to CH. Figure 7 "Water Temperature at Maximum Pond Depth: 2-3 m Depth" indicates a negative correlation between water temperature (at the deepest portion of the pond) and air temperature. It is noted that water temperature is generally observed to decrease as air temperatures increased. It is noted that on a day when air temperatures were recorded to reach 38 degrees Celsius, the water at the bottom of the pond remained at less than 21 degrees Celsius, which is cold enough to sustain Brook Trout.

We trust the above is of assistance. If you require additional information please contact the undersigned at extension 283.

Yours truly,

Leah Smith
Environmental Planner
LS/

cc. (by email) Rita Juliao, Town of Oakville
Doug Corbett and Stan Holiday, Region of Halton
John Pisapio and Melinda Thompson, Ministry of Natural Resources
Randall Roth, MMM Group

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Sonia Rankin

From: Sonia Rankin
Sent: Wednesday, January 09, 2013 2:54 PM
To: lsmith@hrca.on.ca
Subject: Bentall Kennedy (Canada) LP - Lazy Pat Farm Property: 2011 Technical Memorandum NH#1 Data (MMM) - Reach 14W-14A
Attachments: MMM Minnow and Pot Traps.pdf; (MMM) Raw Data_14W-14A-BentallKennedy.xlsx

Hello Leah,

In response to the comments received from Conservation Halton on August 16, 2012 we wish to provide information of the sampling equipment used to capture fish in the pond and provide the raw data collected during the 2011 water quality monitoring of Reach 14W-14A, per your request. The attached files are provided with respect to the following comments:

68 – Sect. 3.1 Fish Community Survey (Pg. 3): "Please provide detail on the design and methodology used to collect fish entitled 'pot traps'."

69 – Sect. 3.3 Supplemental Fish Habitat Documentation Pg. 9 Water Quality Monitoring, Dissolved Oxygen: "The interpretation of the dissolved oxygen monitoring data was not comprehensive. The raw data collected is requested to be submitted for Conservation Halton's files."

70 – Sect. 3.4 Water Temperature (pg. 11): "Staff appreciates the effort to calculate the linear trend line equations pertaining to the surface water temperature data. This information was helpful. Staff request that the raw surface water temperature data is provided in Microsoft Excel format if possible."

If you have any questions about the data provided in the spreadsheet or require assistance with the file please contact me at your earliest convenience.

Thank you,
Sonia

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PROTECTING THE NATURAL ENVIRONMENT FROM LAKE TO ESCARPMENT

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March 21, 2013

Rob Thun
Town of Oakville Planning Services Department
1225 Trafalgar Road
Oakville ON L6H 0H3

Dear Mr. Thun:

RE: Bentall Kennedy (Canada) LP – Lazy Pat Farm Property
3269 and 3271 Dundas Street West
Town of Oakville
Zoning By-law Amendment and Draft Plan of Subdivision: 24T-11001, Z.1333.01
CH File: MPR 562

Staff has reviewed the December 2012 submission from the MMM Group and offers the following comments. For ease of review we have used the numbering provided in the March 30, 2012 response letter from the MMM Group. New comments are identified under points A-Y.

December 19, 2012 MMM Group Cover Letter

Staff appreciated the inclusion of the Summary of Key Modifications and Issues.

A. **Section 2.0 a) 1 – Pond (Reach 14W-14A) and Use as a Stormwater Management Facility** – Staff did not indicate that the on-line pond could be used for a stormwater management facility but rather that we would not object to the stormwater management facility being located at the same location as the existing pond as long as the medium constraint corridor was relocated and replicated elsewhere as a fully protected stream corridor. This important distinction is also relevant to statements made in Sections 2.0 b) 10 & 11.

   We further note that a function of the existing pond is to assist in the maintenance of regional drainage densities.

B. **Section 2.0 a) 2 – Consolidation/Relocation of Stream Corridors** - While staff are prepared to consider some consolidation and relocation of stream corridors, it is our opinion that the current EIR/FSS does not provide sufficient justification for the current proposal. Conservation Halton staff continue to have concerns with respect to channel slope, proposed flow regime, loss of stream channel length, maintenance of riparian storage, etc.

   With respect to stream density, Section 6.3.4.1 of NOCSS indicates that **regional** stream density targets could be achieved for all of North Oakville based on protection of the red and blue streams. This along with other factors then led to the implementation strategy requiring the protection of **all** red and blue streams as outlined in Section 7.4.3.1 while allowing for the potential elimination of green streams. As per personal communication with the SWS team, it was not the intent of the SWS authors to suggest that SWM facilities could be used to substitute for blue streams but rather their

inclusion on Page 6-53 of NOCSS was to provide additional justification why it should be considered acceptable to allow for the loss of green streams as well as the reduction in drainage density within some individual subcatchments (as long as all red and blue streams are protected). All figures within NOCSS identified Reach 14W-14A as a blue/medium constraint corridor. As such, we continue to be of the opinion that Section 6.3.4.1 supports the position that the length of all blue/medium constraint stream corridor systems must be protected/replicated. Given the above, we note that it is not appropriate to consider the loss of a single blue stream independent of the rest of the North Oakville Natural Heritage System, rather it must be considered in the context that this is a significant change to the NOCSS and Secondary Plan process. A piecemeal approach to altering the stream designations identified in NOCSS could result in a potentially significant reduction in the regional stream density targets.

C. **Section 2.0 a) 5, Additional Geomorphic Field Surveys** - It is not sufficient to assess only the ditch downstream of Culvert FM-D2. The western tributary of Fourteen Mile Creek must also be investigated in order to establish the appropriate erosion controls for Subcatchment 1102. As the erosion control requirements for these lands could potentially be determined independently of the Subject Property and as they may be best assessed in conjunction with the development west of Tremaine Road, no additional assessment may be required at this time, as long as the proposed diversions are demonstrated to be appropriate (see Section 5, 6 and 7 comments). In the event that it is determined that additional analysis is not required at this time, we recommend that the need for additional erosion threshold analysis for this area be clearly identified within the current EIR/FSS.

D. **Section 2. b) 7, Infiltration and Water Balance** – MNR's Redside Dace Guidelines were released after NOCSS. As such, it is not appropriate to consider that the MNR guidelines defer to NOCSS (subwatershed plan) (i.e. this statement within the guidelines only applies to subwatershed plans written after the guidelines were released). That being said, staff concur that the MNR guidelines do recognize that there can be limitations to infiltrating the 5 to 15 mm rainfall event based on soil permeability. As such, staff are generally satisfied with the proposed LID measures subject to modifications as per the comments provided below and with the understanding that additional measures will be implemented wherever it is identified as being feasible through the detailed design of the SWM Blocks and the individual Site Plans.

E. **Section 2.0 b) 8, Erosion Threshold Analysis** – It is our opinion that the current stormwater management concept does not meet NOCSS requirements with respect to erosion controls and is therefore not supported.

F. **Section 2.0 b) 9, Flood Plain Model** – It is our opinion that the flood plain modeling remains insufficient to support Draft Plan approval.

G. **Section 2.0 b) 10, Location and Size of Stormwater Management Facilities** – It is our opinion that the current EIR/FSS has not demonstrated that the proposed stormwater management plan will have no detrimental impacts on the Natural Heritage System or adjacent landowners.

H. **Section 2.0 b) 12, Channel Forms** – It is our opinion that an accepted channel gradient for the watercourse realignments must be agreed to by all parties at the current level of planning as channel gradients cannot be substantially altered in the future without affecting channel length and potentially other channel parameters.

I. **Section 2.0 b) 13, Downstream Impacts** – Conservation Halton staff agree that a zero increase in peak flow rates and water elevations is not the only way to waive the requirements for Regional Storm controls. Conservation Halton staff however do not agree that the analysis provided shows a

negligible increase in risk to downstream landowners/public. We also do not agree that the predicted increases are within levels considered to be of "no noticeable increase". There are several downstream areas that consist of privately owned lands, including homes and businesses that are flood susceptible. There are also several road crossings that are overtopped during the Regional Storm condition. As such, any increases in these specific locations have the potential to adversely affect the landowners and the land uses as a result of increased flood damage, reduced access/egress, reduced development potential, etc. In accordance with the EIR/FSS Terms of Reference, the submission must clearly demonstrate that there would be no adverse effect on the landowners and the land uses. We also continue to be of the opinion that the analysis must assume that all landowners within the Fourteen Mile Creek catchment area downstream of Highway 407 will not provide Regional Storm controls.

EIR/FSS

As noted above, the numbering below is consistent with our August 16, 2012 correspondence.

1. Addressed.

2. **Executive Summary** – Should be updated as necessary to address the above and following comments.

3. Addressed.

4. **Section 2.1, Natural Heritage System Components, Page 2-2 – Medium Constraint Corridors** – Staff continue to be of the opinion that the discussion on the proposed watercourse alterations is out of place in this section. Please see Section 5 and 6 comments below for our more detailed comments on the proposed watercourse alterations. Please however note that Conservation Halton staff do not agree with the statement that the proposed stream relocations are in keeping with the NOWSP policies for Medium Constraint Stream Corridor Areas.

5. **Section 2.2, Permitted Uses in the Natural Heritage System, Page 2-3** – While Conservation Halton staff have no objection to the placement of the stormwater management facility in the same location as the existing pond (Reach 14W-14A), we do not support the elimination of this reach without full replication of its functions outside of the stormwater management block. This stream reach must be maintained and placed within a publicly owned Natural Heritage System Block.

6. **Section 3.2, Trail Planning** – We note that an updated Trails Plan, Trails standards and revised EIR/FSS Terms of Reference for trails are currently being prepared by the Town of Oakville. Please contact Town staff to ensure the EIR/FSS has included the most up-to-date information regarding trails.

7. **Figure 3.1, 407 West Employment Concept Plan** – Due to the potential impacts on Main Fourteen Mile Creek Valley, the Provincially Significant Wetlands and Woodlands on the adjacent GE owned lands, Conservation Halton staff still require the opportunity to review in the field the proposed location of Avenue 1 relative to this valley system prior to endorsing the 407 West Employment Area Concept Plan. Staff request that the proponent contact Conservation Halton staff at their earliest convenience in this regard to arrange for a site visit.

Section 4 – Hydrogeology

The following new comments are provided by Conservation Halton's Hydrogeologist. Responses to our previous comments related to Section 4 are found below under points 8-14.

J. Section 4.3.2.1 discusses soil sample grain size analyses and hydraulic conductivity estimates using the Hazen method. In general, this is a rather crude approximation of soil hydraulic conductivities. This method is suitable for sandy types of soils characterized by grain size distribution $d_{10} > 0.1$ mm. The clayey type of soils, which are found throughout the site, are outside of the practical range of using this method. The results as reported in Table 4.2 should not be used for any site specific analysis.

K. The report states that the human-made pond is conclusively shown to be maintained by surface water inflow rather than from groundwater contributions. Although, the pond was investigated as required based on the Terms of Reference and requests made by Conservation Halton staff; the locations of some of the instrumentation is not ideal. It would be more informative to install shallow and deep monitoring wells on the upstream side of the pond. A cross section along the longer axis of the pond would be useful.

L. For future work, water level hydrographs should be shown with larger vertical exaggeration. It is difficult to depict 0.1 metre events on a 20 metre vertical scale.

M. Percolation testing identified soils with higher than anticipated infiltration. This information does not seem to be used in the water balance estimates.

N. A discussion about potential discharge areas along the watercourses is useful, however a figure identifying the discharge zones should be provided.

O. What computer model has Environment Canada used to calculate the actual evapotranspiration and water surplus for soils with different water holding capacities (page 4-25, first paragraph)?

P. Water balance: The reported actual evapotranspiration (71 to 74 % of the annual average precipitation) seems high. The MOE Stormwater Planning and Design Manual (2003) referenced in the report multiple times reports evapotranspiration in the range of 55 to 59 percent of the total precipitation. Some of it could be attributed to the lower precipitation which was used for this assessment vs. what the MOE used. Also, the Oakville Gerard meteorogical climate station was located close to Lake Ontario. The reported temperature for this station could be influenced by the lake. It should be noted that the Thornthwaite-type monthly water balance models are very sensitive to **monthly** average input temperatures.

Water Survey of Canada reports an average flow of 0.337 m^3/sec for the Fourteen Mile Creek at Oakville HYDAT station No. 02HB027 (based on 8 years of continuous flow monitoring). This amounts to 0.43 m/year per the station's catchment unit area and equals to 53 % of the total annual precipitation as reported in the EIR/FSS. That only leaves a maximum of 47% of precipitation for the actual evapotranspiration. Some of the increased run-off is associated with the urbanized portion of the watershed. I think these differences merit revisiting in the Water Balance Section to make sure that it represents the available measured data.

Please note that the water balance should be updated accordingly based on any changes made to the plan as a result of these comments.

Q. As recommended on page 4-42, last bullet: Additional mitigation measures to improve post development water balance at the lot scale should be incorporated.

R. Construction impacts: Groundwater dewatering discharge water quality is not addressed anywhere; however, this could be addressed at detailed design.

S. Staff supports the recommendation that baseline groundwater level monitoring should be continued.

T. As shown in Monitoring Well MMM-09-10, and shown on Figure FWL-10 in Appendix 4-5 there is groundwater discharge to 14W-14. As such, staff would recommend realigning the watercourse in the same general location.

8. **Section 4.4, (Hydrogeology and Geology) Impacts of the Proposed Development, Page 4-23** – This section of the report does not discuss the potential impacts (and potential mitigation measures) related to the realignment of the various watercourse reaches as requested.

9. Addressed.

10. Addressed.

11. Addressed.

12. **Section 4.4.4.2, Post-Development Water Balances, Page 4-30** – Staff appreciate the additional efforts taken by the proponent in an effort to improve the post-development water balance for the site while respecting Conservation Halton setback requirements. See comments under Section 7.0 (Stormwater Management) for specific technical details but in general we are supportive of the concepts presented provided further efforts are made to match post-development infiltration to pre development infiltration at detailed design.

    Conservation Halton had previously recommended that the infiltration swales be relocated outside of our regulated area and the additional required lands dedicated to the Town of Oakville for stormwater management purposes. The current proposal does propose the relocation of swales outside of the regulated area but does not propose additional land dedication to the Town where the swales cannot be located within the ESA buffer. Staff continue to recommend that these additional lands be dedicated to the Town of Oakville in order to ensure the ongoing protection and maintenance of these SWM facilities, however, we defer a final decision in this regard to Town of Oakville staff. Further, MNR staff must confirm whether or not infiltration swales can be located within the 30m ESA buffer which includes undisturbed natural areas.

    As requested in Conservation Halton's August 16, 2012 correspondence, please provide a discussion and conceptual figure to determine/demonstrate how the proposed infiltration swales would fit into the buffer given the location of the trails and plantings.

    Staff did note that in Table WB-4-1001 in Appendix 4-7 that the table indicates that there will be more runoff generated from the property then what the "available volume of roof water" minus monthly infiltration capacity would suggest. We have assumed that this is because the monthly infiltration capacity includes the subsurface gravel wetland (which does not receive roof top runoff) as well as the infiltration swales. Staff do not anticipate that this will affect the outcome of the report's recommendations/findings however we request confirmation that our assumption is correct or clarification on this matter.

13. **Section 4.4.4.6, Discussion of Potential for Base Flow Reductions to Watercourses** – See above comments.

14. **Section 4.4.4.7, Dewatering Potential, Page 4-43** – In addition to utilizing a clay liner where the SWM ponds intercept the Shale Bedrock, it is suggested that a clay liner should also be applied where groundwater enters into the pond through localized sand seams. If this suggestion is carried forward this should also be noted in the Conclusions section (Section 4.5).

15. Addressed.

16. **Section 5, Natural Heritage** – It is the opinion of staff that the potential implications of the proposed stormwater management plan as outlined in Section 7.0 has not been fully discussed within Section 5.0. For example, while Section 7.0 does not provide a summary of the proposed flow regime at key node locations throughout the development area, it would appear that Reach 14-12A will experience a significant reduction in flows while Reach 14W-11/11A/23 will experience some reduction in flows. The changes within Reach 14W-12 upstream and downstream of the proposed SWM pond outlets is unknown. Once Section 7.0 has been updated to clarify the proposed flow regimes within each of the watercourse reaches relative to existing conditions these changes should be addressed within Section 5 with respect to natural heritage features and functions (fisheries, fluvial geomorphology, terrestrial ecology, etc.).

17. Addressed

18. **Section 5.2.1.5, Hydrologic Features 'A' and 'B', Page 5-9 & Figure 5.1** - The text does not identify the Hydrologic 'B' feature located on the Subject Property immediately west of 3367 Dundas Street West. Figure 5.1 indicates some features such as Provincially Significant Wetlands and Cores beyond the Subject Property limit but not the Hydrologic Features A and B. We recommend that Figure 5.1 include all Hydrologic Features shown in NOCSS whether they are located within the Subject Property or not to ensure consistency.

19. Addressed.

20. **Section 5.3.3.1 (Species at Risk)**- While staff appreciate that discussions with MNR with respect to ESA requirements for Bobolink, Barn Swallow, Eastern Meadowlark, Redside Dace are ongoing, it should be noted that a decision from MNR on the identification of habitat of endangered and threatened species as per the PPS also remains outstanding. In the absence of such information, staff are unable to advise the Town as to whether the proposal is consistent with provincial policy.

21. **Section 5.3.3.3, Regionally Rare/Uncommon Species** – Addressed.

22. **Section 5.3.4.4 – Aquatic Habitat Reach 14W-11A, 14W-11, 14W-13, 14W-14** – Addressed

23. **Section 5.3.4.4, Aquatic Habitat Reach 14W-14** – No further comment required.

24. **Section 5.3.4.4, Aquatic Habitat Reach 14W-14A** – Concerns over the proposal to compensate for feature 14W-14A with on line wetlands remains outstanding. Constructed on line wetlands at a local channel realignment project were inspected recently; these wetlands were observed to grow thick vegetation (e.g. cattails) through the thalweg of the creek channel during dry years leading to barriers to fish passage and potentially the loss of fish habitat. As such, online w netlands as a component of a natural channel design (where consistent water flow could be a limiting factor) are discouraged. A

meeting with the proponents to discuss various aspects of the natural channel design elements and issues related to this property is requested.

25. **Section 5.3.4.4, Aquatic Habitat Reach 14W-16** – Discussion of location for deposit of fish from pond is necessary; the site for relocation of fish should be approved by CH and MNR staff. This can be determined at the detailed design stage.

26. Addressed.

27. **Section 5.3.4.4, Aquatic Habitat Reach 14W-12A** - Staff do not agree that this channel would only support generalist species due to the repeated occurrences of Redside Dace in the downstream sections of this watercourse and the lack of barriers to fish passage between the upstream and downstream sections of this watercourse.

28. Addressed.

29. **Section 5.3.7, Hydrogeology** – Addressed.

30. **Section 5.9.2, Fish Habitat Compensation Concepts, Removal of Reach 14W-14A** – This section appears to be missing from the updated document. Staff maintain concerns regarding the construction of a stormwater management pond primarily due to the feasibility of mitigating thermal impacts on downstream Redside Dace communities – see further comments below.

31. **Section 5.9.2, Fish Habitat Compensation Concepts** – See above.

32. **Table 5.10, Summary of Potential Impacts to Aquatic Resources** – Table 5.10 in previous EIR-FSS is now numbered as 5.11 Summary of Potential Impacts to Aquatic Resources:
    - Bullet # 1 addressed.
    - Bullet # 2 addressed and will need to be revisited at the detailed design stage.
    - Bullet # 3 It is requested that for the distance that the road encompasses or crosses a watercourse that is not to be realigned, that the same distance upstream and downstream of the watercourse be planted with appropriate native vegetation. For example, if a 20 meter wide road is proposed to cross a watercourse that is not to be realigned, then appropriate vegetation could be planted both upstream and downstream of the proposed road crossing structure. This would need to be coordinated with the MNR regarding Redside Dace requirements.
    - The following comments need to be added to this table regarding surface water drainage diversions:
        - lack of flow to Reach 14W-12A is of significant concern;
        - potential reductions of surface water flow to Reach 14W-23/11 are of concern;
        - there is not enough information to assess the changes to Reach 14W-12;
        - Please address the impacts that these proposed water diversions will have on the fish communities and fish habitat in the above noted watercourses.
    - RE: Column Entitled Residual Effects: It is maintained that open bottom road crossings over watercourses are preferred. Given the extent to which groundwater is entering the watercourses on the property through clay till soils that are cracked and fissured, open bottom culverts will help maintain groundwater inputs to these watercourses as well as recharge functions. With respect to road crossings over Redside Dace streams, MNR's Draft Guidance for Development Activities in Redside Dace Protected Habitat document provides the following recommendations:
        - New/replacement crossings in unconfined valleys (i.e., undefined valleys), stream crossings should be open bottom culverts designed to span the meander belt of the

stream. The length of the culvert should be minimized by using retaining walls vs. longer culverts to minimize disruption to riparian habitat.

33. Addressed.

34. **Figure 5.2 (EIR Vegetation Communities)**- At this time, it is staff's understanding that no works are proposed within the S3S4 Dry Oak – Hickory Deciduous Forest Type (FOD2-2), located within the portion of the red stream identified for rehabilitation (14W-11) . Should this change, we recommend that a meeting be convened with the Town of Oakville, Region of Halton, Conservation Halton and the proponent in order to determine a compatible treatment for this area.

35. **Section 5.8.6 (formerly Section 5.9.5, Monitoring)**- MMM's March 30, 2012 response document indicated the following with respect to monitoring:
    - "A comprehensive natural heritage monitoring plan will be developed for the subject property in accordance with the NOCSS and will include pre, during and post-development monitoring of vegetation, amphibians, birds and benthic invertebrates at select locations. A monitoring study Terms of Reference including a figure identifying proposed monitoring locations will be developed and submitted to CH and the Town of Oakville, and the agreed upon monitoring plan will be appended to the revised EIR."

    As such, staff request that the Terms of Reference be provided for our review as indicated. Further, the last paragraph indicates that additional monitoring for SWM facilities will be presented in Section 6. Staff could not locate this information within the report.

    Consistent with MNR's document entitled Draft Guidance for Development Activities in Redside Dace Protected Habitat, it is requested that a target of 24^0C for surface water temperatures, 7 mg/L for dissolved oxygen levels and total suspended sediment levels that are less than 25 mg/L above background levels be set as a target for stormwater effluent and water quality across the property. The recommendation for total suspended sediment levels is consistent with the level recommended by the Canadian Aquatic Water Quality Guidelines for the Protection of Aquatic Life for Total Particulate Matter.

36. **Section 5.10, Conclusions and Recommendations** - Staff are appreciative of the demonstrated efforts to infiltrate stormwater on the subject property.

    It is noted that the bulk hydraulic conductivity of the soils near the surface on the property were measured to be 10^{-3} to 10^{-5} based on percolation tests (Section 4.3.2.2.1), which is significantly higher than what the monitoring well testing indicated (Section 4.3.2.2) and is more similar to the hydraulic conductivities expected for sand. As such, the potential exists for greater infiltration on the subject site then what the water balance predicts. We are satisfied however that this can be best addressed at the detailed design stage as noted in Sections 7.3.2.1 and 7.3.2.2 of the report. **Staff request that Town Subdivision review staff convey to their Site Plan technical review staff the importance of re-assessing the feasibility of additional LIDs on every site within the subject area.**

37. **Section 6.3.1.1 Meander Belt Width, Page 6-2 & Appendix 6.7**
    - Reach 14W-12A is not included within Table 1 within Appendix 6.7. Staff anticipate that the values provided for this reach in Table 6.1 on Page 6-3 will be acceptable for pre-development conditions based on information available elsewhere in the report but request an update to Table 1 in Appendix 6.7 to verify the recommended value.
    - This section or another section of the report should provide recommended post-development meander belt widths considering the post-development hydrologic regime for the various watercourses (See Section 7 comments below).

- Staff agree that Reach 14W-12A is hydraulically distinct from the remainder of 14W-12, however, we disagree with the statement that Reach 14W-12A will continue to receive controlled discharge from SWM Pond 3 which is proposed to outlet directly to Reach 14W-12.

38. **Section 6.3.2, Regulatory Floodplain, Page 6-3** –
    - A digital copy of the hydraulic models for **all** reaches are required to complete our review. Conservation Halton staff will not be providing any further comments on flooding hazards unless digital copies of the models are submitted.
    - Hard copy model and mapping remains outstanding for Reach 14W-14A.
    - Reach 14W-11 and 14W-11A floodlines are not shown on Figures 6-2.1A (existing) and 6-2.1B (proposed).
    - Hard copy model remains outstanding for Reach 14W-11 & 14W-11A.
    - The hydraulic section locations shown on Figure 6-2.1A do not match those utilized in Appendix 6.1 for Reaches 14-12A, 14W-13, and 14W-14. These should be made consistent to facilitate future reviews and prevent confusion.
    - See also Comment #55 below regarding Appendix 6.1.

39. **Section 6.3.3, Top of Bank, Page 6-4** – Conservation Halton staff look forward to receiving the outstanding slope stability assessment for Reach 14W-11. Staff note that there is a typographical error at the end of this section that directs the reader to the incorrect Appendix.

40. **Section 6.3.5, Setback and Buffer Requirements, Page 6-5** – This section has not been updated to clarify what the proposed setback and buffers are applied to nor does it reflect the correct setbacks. Further, we would like to note that watercourse 14W-11 A meets the definition of Redside Dace habitat in the ESA's Ontario Regulation 293/11. As such, this watercourse should receive an appropriate setback (meander belt width + 30 m).

41. **Section 6.3.6, Hydrologic Feature 'A', Page 6-5**
    - The text incorrectly references Reach 14W-12 instead of Reach 14W-16 with respect to one of the Hydrologic Feature 'A's. The potential impacts to this Hydrologic Feature 'A' as a result of the proposed reconstruction of the bankfull channel should be discussed.
    - See Comment #53 below regarding the riparian flood storage analysis. Staff are not satisfied that the analysis demonstrates to-date that the storage associated with the Hydrologic Feature 'A' associated with Reach 14W-14A has been replicated.

42. **Section 6.3.7, Corridor Widths, Page 6-6 & Appendix 6.5** –
    - Reach 14W-11 details should be included within Table 6.3 on Page 6-6.
    - Table 6.3 should clarify the 7.5 and 15 metre setback/buffer with respect to what they are based on (fisheries or hazards) and if they are applied to the meander belt, erosion hazard or other.
    - Staff note that the values in Table 6.3 do not always match those provided in Appendix 6.5 or on Figure 6.3. All three sources should be consistent.
    - Table 6.3 and Appendix 6.5 should be clarified where corridor widths are being recommended for existing conditions, proposed or both conditions. Table 6.3 appears to be covering existing conditions whereas Appendix 6.5 appears to be covering proposed conditions (though without taking in account the proposed flow regime changes).
    - Footnote 'b' in the Appendix 6.5 table is incorrect and should reference 3 m instead of 6 metres as Column 7 notes that the Factor of Safety is to be multiplied by 2.
    - For clarity, it would be helpful if this section noted those areas where the corridor width must be extended in order to encompass the floodplain/top of bank plus 7.5 metre allowance.

- Appendix 6.5 states that a stable top of bank analysis is not required for Reach 14W-11 while the cover response letter and Section 6.3.3 indicates that a stable top of bank assessment will be submitted.
- Once all of the outstanding issues have been resolved, it should be ensured that the Draft Plan of Subdivision is updated accordingly.

43. **Figure 6.3, Corridor Delineation –**
    - 'Top of Bank 7.5 m Buffer' would be more accurately named '7.5 m Hazard Allowance' as it can apply to the flood plain, meander belt or top of bank. Staff noted one location on Reach 14W-11A where the 7.5 metre allowance has not been applied to the Regional Storm floodline.
    - 'Environmental Setback' would be more accurately named '30m Redside Dace Setback'.
    - The solid black line should be included within the Legend. We have assumed that this line represents the future limits of the Open Space and SWM Block lines.
    - A 'Regulated Area Buffer' is not required on Reach 14W-21. This will not be a feature regulated by Conservation Halton in the future. Any buffers required on this reach will be determined by Town of Oakville staff and should be referenced accordingly.
    - All pond grading within the regulated habitat of Redside Dace must be discussed with the Ministry of Natural Resources.

44. **Section 6.4.1, Conceptual Natural Channel Design** - Concerns regarding the inclusion of a step/pool system to enable the passage of fish up the steeper channel reaches as part of the design criteria have not been addressed. It is understood that step/pool systems are not being proposed therefore reference to them should be removed from the report.

U. **New Comment, Section 6.4.2, Hydrology, Page 6-7** – The drainage areas listed for Reaches 14W-11A, 14W-16 and 14W-22 are slightly higher than what would be suggested by Figures 7.1 and 7.3. Is this because Hwy 407 drainage areas are included within Table 6.4 but not shown on the figures? Please revisit/correct/clarify.

45. **Section 6.4.3, Proposed Channel Morphology, Page 6-8** - It is noted that the average channel slope for 14W-22 is 0.32%. There is concern that this slope is too flat to maintain enough energy in the channel to allow the water flow to continue to scour a clear channel and to prevent the overgrowth of vegetation in the watercourse. If the channel becomes overgrown with vegetation, this will result in a loss of fish passage and fish habitat. It is preferred that the average slope of the channel be a minimum of 0.5%. When the channel slope is too flat, water is observed to remain in the channel in a stagnant form; this situation leads to the overgrowth of algae.

    It is noted that the average channel slope for 14W-23 is 0.40 %. It is preferred that the channel slopes be steepened to a slope of at least 0.50 %.

    Please add "meanderbelt width" to the list of parameters in Table 6.5 – Morphological Parameters for Channel Diversion and Rehabilitation.

    Further, once post-development drainage areas, stormwater management concepts and hydrologic conditions have been finalized and clearly documented, this section of the report will need to be revisited.

    The specific equations, etc. utilized should be included within the detailed design brief that will be required in conjunction with the detailed design of the channel.

46. **Section 6.4.4, Road Crossings, Page 6-9**

- Conservation Halton staff continue to require the opportunity to review the proposed location of Avenue 1 and Burnhamthorpe Road relative to the Main Fourteen Mile Creek valley within the field.
- A hydraulic analysis has now been submitted for the proposed crossings. **Staff require a digital copy of the hydraulic models in order to complete our review**, however, we provide the following preliminary comments on the information that was provided:
  1. **Section 6.4.4.1, Design Criteria** – In addition to meeting MTO design standards, Conservation Halton staff require that all new roads be designed to provide full access and egress under Regional Storm conditions, and preferably flood free access. Staff note that the current design would meet these criteria as no road overtopping is proposed under Regional Storm conditions. Fluvial geomorphological requirements must also be addressed.
  2. **Section 6.4.4.2, Modelling & Analysis** – Flow rates utilized in the analysis need to be supported. See Section 7 comments below.
  3. **Section 6.4.4.3, Summary** – This section states that the flood lines plotted are based on existing contour lines. Flood lines should be based on proposed grades in those areas where the flood plain is proposed for alterations (i.e. Reaches 14W-22, 14W-23 and potentially Reach 14W-16).
- MNR's *Draft Guidance for Development Activities in Redside Dace Protected Habitat* provides the following advice regarding stream crossings in Redside Dace watercourses in unconfined watercourses:

  The location of new stream crossings should be chosen to:
  - Minimize the width of the crossings
  - Cross over straight sections of the stream where there is less likelihood for bank erosion
  - Cross at areas that have already been disturbed and avoid initiating disturbances in new areas of the stream

  For new/replacement crossings in unconfined valleys (i.e., undefined valleys), stream crossings should be open bottom culverts designed to span the meander belt of the stream. The length of the culvert should be minimized by using retaining walls vs. longer culverts to minimize disruption to riparian habitat.

  In addition to the BMPs listed above, any construction activity that must occur in the stream should also incorporate the BMPs outlined for indirect habitats (i.e., upstream areas) below. This includes restoring any temporary disturbances within the riparian habitat (i.e., 30 m on each side of the meander belt) by planting native species.
- It is requested at detailed design that no armouring of the bed of the watercourses take place under all road crossing structures to enable the creek to self-maintain a dynamically stable thalweg and low flow channel underneath all road crossing structures.
- Open bottom culverts are requested for all road crossing structures:
  - To maintain effective fish passage over the long term in the event that downcutting of the watercourse occurs;
  - To maintain groundwater and surface water interactions (recharge and discharge) to continue to occur within the channels in the road crossing structures;
  - To allow the creek to self-maintain a dynamic low flow channel underneath the road crossing.

47. **Figures 6.4A to 6.4D, Alignment and Planform Drawings (Creek Crossings and Block Widths)**
    - The Block widths shown on these figures will have to be revisited once all of the other comments have been addressed. Staff noted that currently some of the block widths shown don't match exactly the recommended widths elsewhere in the document.
    - Channel alignments shown no longer account for proposed culverts. These figures should be updated accordingly as part of the final EIR/FSS though we recognize the final details can be worked out at the detailed design stage.
    - Please demonstrate that the road layout is such that the creeks cross under the roads where the creek plan form is straight; creek crossings under roads should be designed so the creek crosses under the road at a perpendicular angle to reduce the length of the watercourse that is located under the crossing. Previous comments regarding natural channel design remain outstanding and can be addressed at a forthcoming meeting with the proponent's fluvial geomorphologist and water resources engineer.

48. **Figures 6.4A to 6.4C, Alignment and Planform Drawings (and Section 6.4.3.2 14W-22 Diversion & Section 6.4.3.3 14W-21 Diversion)** –As noted above and in previous comments, Conservation Halton staff are concerned with the potential for aggradation where the average channel slope is less than 0.5%. The current design proposes an average channel slope of 0.32% for Channel 14W-22 and 0.40% for Channel 14W-23, however, no discussion on the potential impact that this would have on sediment transport within and downstream of the subject reach was provided. As a general rule of thumb, Conservation Halton supports a channel slope in the range of 0.5% to 1.5% for sediment transport, and a minimum channel slope of 0.5% to support fisheries. This information is required prior to staff supporting the proposed channel design concepts.

49. **Figure 6.4E, Diversion Channel 14W-23 Alignment and Planform** – The resubmission did not demonstrate that there would be no erosion concerns at the sharp bends under higher flow events. Staff suggest that as one possible means of addressing this concern, that it be demonstrated that under Regional Storm conditions, the flood plain velocities and shear forces at the sharp bends in the creek block will be lower than the velocities and shear forces that can be withstood by vegetation.

50. **Figure 6.5, Channel Corridor Sections Typical for 14W-22** –Previous comments remain outstanding. A meeting regarding the channel forms proposed for the channel realignments is requested to take place soon after these comments are received by the proponents. Discussion as to whether "E" Type channel cross sections would be appropriate in the proposed scenarios is requested. There are concerns about the channel depths, channel sides slopes and width to depth ratios. These concerns are with respect to: low flow channels that may be too wide to optimally facilitate fish passage, wide channel bottoms that promote sun infiltration that could cause thermal warming, algae growth and excessive water evaporation. Further, we note that the figure has been revised, relocating the 3:1 side slopes into the meander belt width. The 3:1 side slopes should be relocated outside of the meander belt width and the 100 year erosion allowance similar to the approach utilized in the April 2012 submission.

51. **Section 6.4.5, Hydraulic Analysis, Page 6-14 & Appendix 6.1**
    a. A digital copy of the modeling remains outstanding.
    b. Flood plain mapping based on future conditions topography/grading remains outstanding.
    c. Post-development flow rates need to be clearly documented and supported. See Section 7 comments below.
    d. See Comment #55 regarding Appendix 6.1 for additional comments.
    e. Text indicates that the road crossings were not included within the modeling, however, Section 6.4.4. indicates that the culverts were modeled and they do appear to be within the hard copy

model results provided in Appendix 6.1 so we assume that this statement is a typographical error.

52. **Section 6.4.6, Maintenance of Riparian Storage, Page 6-14 & Appendix 6.2**
    a. Conservation Halton policies and NOCSS requires that flood storage be maintained for a full range of storm events. No loss of flood storage is considered insignificant due to the potential for cumulative impacts. The creek block designs must be modified accordingly.
    b. The riparian storage associated with Reach 14W-14A must be included within the analysis. It would appear that this may not be the case in the current analysis.
    c. The riparian storage analysis for Reach 14W-11A must be separated from the riparian storage analysis for Reaches 14W-14, 14W-14A and 14W-16 as it has a different receiving watercourse.
    d. Further to the last sentence in this section, staff note that Conservation Halton staff do not require the existing riparian storage associated with Reach 14W-13 to be maintained though we also do not allow for any storage within the proposed Reach 14W-21 to be included within the calculations. It would appear from the HEC-RAS output files that these reaches have not been included within the analysis however we require confirmation that is the case. Also further to the last sentence, staff note that any challenges created by "eliminating Reach 14W-14" are a result of the alignment/design proposed by the proponent and could be addressed through a redesign of Reach 14W-22
    e. The analyses may need to be updated further once the proposed flow regime is clarified. The resubmission should discuss the implications of the proposed changes in flow rates within the subject reaches and undertake additional/modified analyses as necessary.

53. **Section 6.4.7, Stream Length Requirements** – Conservation Halton staff continue to require the existing length of Reach 14W-14A be included and maintained in the stream length calculations. We also continue to be of the opinion that Reach 14W-21 cannot be utilized within the proposed conditions credits. As such, stream length densities have not been maintained.

54. **Appendix 6.1, Regional Floodplain Analysis, 14 Mile Creek** – Submission of a digital copy of the models for all reaches remains outstanding.
    a. **Regulatory Floodplain**
        1. Hard copy model and mapping remains outstanding for Reach 14W-14A.
        2. Reach 14W-11 and 14W-11A floodlines are not shown on Figures 6-2.1A (existing) and 6-2.1B (proposed).
        3. Hard copy model remains outstanding for Reach 14W-11 & 14W-11A.
        4. The cross-section locations shown on the figure within the Appendices do not match those provided on Figures within the main body of the text or as referenced in Table 6.1.6. Staff request that consistency be ensured between these two sections to prevent future confusion.
    b. **Flood Discharges**
        1. Staff are generally satisfied with the pre-development flow rates provided in Table 6-1.1, however, these will need to be revisited in conjunction with finalizing the issue of the drainage boundary mapping (see Comment 56), which remains partially outstanding.
        2. Post-development flow rates need to better documented and supported within the document (see also Section 7 comments below). A summary table of flow rates at all key nodes should be provided along with supporting documentation justifying the flow rates. In developing this summary/documentation staff note the following:
            - Interim development conditions should be presented if there is potential for higher flow rates as a result of proposed diversions not taking place at the same time.
            - Flow rates provided in Table 6-1.6 for River Stations 20 to 28 do not seem to reflect the flow rates from Table 6.1.3 for River ID 3, Reach 1 downstream of Hwy 407 (i.e.

downstream of Cross-Section 16 as shown in appendix figure as opposed to main text figure).

- The flow rates within the hydraulic analysis do not appear to account for proposed pond outlet points and while this would likely result in a conservative result from a flood plain mapping perspective it does mean that the flow rates provided cannot be utilized to assess instream flow changes with respect to fisheries, fluvial geomorphology or terrestrial ecology perspectives. It may also result in inaccurate riparian flood storage analyses. Flow rates should be consistent between Sections 6.0 and 7.0 of the report to prevent future confusion.
- Flow rates based on updated hydrologic modeling must be supported by digital copies of all hydrologic models with supporting output file print outs where appropriate to facilitate the review.

c. Addressed.

d. **Manning's Roughness** – Conservation Halton staff continue to be of the opinion that a Manning's 'n' of 0.07 for the overbank areas is too low for future vegetative conditions within the creek corridor limits.

e. Addressed.

f. **Figure 6-2.1, HEC-RAS Cross-Sections**

1. Mapping was provided at 1:2000 and not 1:1000 or better as requested. Only 1 metre contour lines were provided which is typically not sufficient to finalize property limits, particularly, where the lands are flat.
2. From RS7 to RS10.5 there are several locations on Figure 7.1 where the flood line and watercourse line are shown in the same location. This would not be expected unless there is an entrenched channel. Since a digital copy of the model was not provided, staff could not review these areas in detail to gain a better understanding of the system. As such, we request that the mapping and modeling and location of the watercourse be revisited in this area to ensure the drawing accurately reflects the location of the watercourse and flood plain.
3. While cross-sections are shown for Reach 14W-11 and 14W-11A, the floodline is missing on Figures 6.2.1A & B.

g. **Results**

1. No grading plans have been submitted for the proposed Open Space Blocks that would support the post-development conditions model.
2. As noted above, there are several outstanding issues with the models submitted to-date that must be addressed.
3. We have assumed that the proponent may be responsible for constructing the Avenue One crossing of Reach 14W-16 as part of their development in order to ensure adequate access to their lands, even though this crossing is located on lands under separate ownership. Staff note that the model results indicate minor increases in the Regional Storm flood elevation on the adjacent lands. Conservation Halton staff have no objections to these increases, subject to the landowners agreement along with their permission for the road to be constructed within their lands. Staff will require written agreement from the adjacent landowner for any increases on lands remaining within their ownership.

h. Addressed.

V. **New Comment – Section 7, Stormwater Management**

a. Conservation Halton staff recommend that the report include greater discussion on how the larger Highway 407 West Area will be serviced that demonstrates that the proposed plan will not place undue constraints on other developments or the Natural Heritage System. Some of the discussion could be provided within existing sub-sections but a standalone subsection may also be warranted. Staff apologize for not identifying this gap in our previous comments.

b. Staff have not reviewed in any great detail the proposed stormwater management concepts presented for the east side of the Main Fourteen Mile Creek Natural Heritage System (Core 1) as there is no supporting documentation for the proposed concepts. Figure 8.5 and the text of the document should state very clearly that the stormwater management concepts presented for east of Core 1 have no standing and will have to be revisited in their entirety through the EIR/FSS process when development proceeds in that area.
c. Figure 8.5 indicates that a single SWM pond will service lands immediately west of the Main Fourteen Mile Creek Natural Heritage System (Core 1), however, Table 7.3 indicates that flows will be directed to both Culvert FM-D4a and FM-D5, which suggests that a portion of this area will not be directed to the SWM pond but rather to the existing culvert FM-D4a. We anticipate that the details of servicing this block of lands can be dealt with under a future EIR/FSS, however, sufficient explanation should be provided in the current document to outline what is being relied on for the current servicing plan and what stormwater management concepts can and/or will have to be determined as part of the future EIR/FSS required for the adjacent lands.
d. Staff are satisfied that the lands located between Reaches 11/11A and Core 1 (i.e. Block P3) are best serviced through their own SWM measures as indicated on Figure 8.5.

55. **Section 7.4, Proposed Stormwater Management Approach, Page 7-4** – This section should be revisited as necessary in conjunction with addressing the following comments. Please note the following section quoted from MNR's Draft *Guidance for Development Activities in Redside Dace Protected Habitat*: *To maximize the absorption of nutrients and other contaminants and prevent them from entering streams, stormwater management facilities adjacent to Redside Dace habitat should be designed as hybrid extended detention wetlands/wet ponds. These facilities are more effective than traditional ponds at removing pollutants harmful to Redside Dace including nitrates, phosphorous and copper.* As such, it is recommended that end of pipe SWM facilities be designed to meet this criteria. Notwithstanding this recommendation, staff have provided the comments below on the stormwater management pond as currently designed.

56. **Section 7.4.1, Existing Drainage Boundaries, Page 7-4 & Figure 7.1** –
a. As previously noted, the Highway 407 ROW should be included in the drainage area delineations (currently it is shown excluded) as well as any portions of the Dundas Street ROW that drain to the upstream side of the road culverts (the current figure is not clear in this regard).
b. The drainage areas shown west of Neyagawa Boulevard do not match those provided in the Tremaine and Dundas Secondary Plan Subwatershed Study (Figure 4.1.1) and there is insufficient information provided on Figure 7.1 to verify the proposed revisions in this area. Sufficient contour information should be provided for this area to support the proposed drainage boundaries.

57. **Section 7.4.3, Preliminary Grading Plans and Post-Development Drainage Boundaries, Page 7-5 & & Appendix 8.5** -
a. Insufficient grading information has been provided on Drawing G1 (Appendix 8.5). Grading information for all altered Open Space/Natural Heritage System Blocks must be provided. Any grading required beyond the road ROWS within the NHS should be identified. SWM pond inlet and outlet grades for all ponds west of Core #1 should be provided to ensure that the ponds can function as proposed. Use of cross-sections should be considered in key areas adjacent to the Natural Heritage System.
b. Grading of as much as 6 metres is proposed immediately adjacent to the Natural Heritage system within future development lots. 3:1 slopes are proposed. Staff anticipate that landowners may not be willing to lose up to 20 metres of developable lands and as such, the potential requirement/use of retaining walls in these locations should be noted. If not, how these grade

changes will affect drainage areas to the various SWM ponds should be taken into consideration as the 3:1 slopes typically slope away from the proposed receiving SWM pond.

c. While approximately 15 ha of FM1102 located west of Tremaine Road **may** be redirected to culvert FM-D1 instead of to FM-D2 according to the Tremaine and Dundas Secondary Plan Subwatershed Study (TDSPSWS) it may not if a number of criteria with respect to downstream impacts and Riparian rights cannot be addressed satisfactorily through the Draft Plan approval process. Section 5.3.6.3 (Stormwater Management Pond Locations) of the TDSPSWS should be referred to for details. This possibility should be identified within Table 7.3 and recognized within the text portion of the section. We note that if the diversion west of Tremaine Road does not occur the drainage area to Culvert FM-D2 will be increased by 21 to 22 ha instead of the 6 ha suggested by Table 7.3.
d. Where will flows from Subcatchment 3050 (west of Tremaine Road) outlet?
e. The report does not verify that the proposed external and internal subcatchment diversions will have no negative impacts on the receiving watercourses, wetlands and natural heritage areas. As such, Conservation Halton cannot endorse the proposed diversions at this time.
f. The EIR/FSS does not discuss the potential that the upstream landowner may wish to realign the medium constraint Reach 14W-16 within their lands. While it is recognized that the adjacent landowner will be responsible for demonstrating fully that any proposed realignment on their lands is appropriate, sufficient discussion should be provided within the current EIR/FSS to demonstrate that the proposed alignment of 14W-22 along the west property line as opposed to along the current alignment as shown in the North Oakville West Master Plan will not negatively impact options for future creek realignments of appropriate lengths and gradients on the adjacent lands while ensuring feasible development layouts and SWM servicing options.
g. There are concerns that the configuration of stormwater management controls may reduce surface water flows from the pre-construction surface water flow condition. Please note the following section of the Endangered Species Act:

> Development and infrastructure — redside dace
> 23.1 (1) This section applies to a person who carries out any of the following activities if the activity is likely to kill, harm or harass redside dace or to damage or destroy the habitat of redside dace: If the mitigation report is approved by a district manager for the Ministry, the person responsible for carrying out the activity referred to in the report shall comply with all of the following conditions to minimize the effects of the activity on redside dace:1. **The flow of a stream or other watercourse through the habitat of redside dace shall be maintained without interruption.**

As such, it is recommended that a section be added to the EIR-FSS outlining how the post construction flow of the watercourses will match the preconstruction surface water flow in the watercourses on the property.

W. **New Comment - Section 7.4.5, Conveyance of Major Storm Flows, Page 7-6** – The second paragraph makes reference to a Block C3 which staff could not locate on Figure 8.5.

58. **Section 7.5, Post-Development Hydrologic Analysis, Page 7-7** –
a. The Main Channel and Off-Channel travel times (TMC & TOC) utilized in the post-development GAWSER model have been modified significantly from the previous submission. Staff request that calculations be provided to support the proposed TMC and TOC parameters.
b. Flow rates at all points of interest should be provided in order to assess potential hydraulic, fluvial geomorphological, fisheries, terrestrial ecology, etc. impacts. Flow rates should be provided for any interim conditions that may exist (for example, just the Subject Lands developed) as well as ultimate conditions.

c. Flow rates provided in Table 7.5 for Culvert FM-D2 assume that all potential diversions west of Tremaine Road have been completed. As the feasibility and timing of these potential diversions are unknown, Table 7.5 should be expanded to indicate potential interim flow rates if lands within Subcatchment 3000 proceed to development prior to the lands west of Tremaine Road and/or in the event that the external diversion of flows are not demonstrated to be appropriate.
d. Further to 'c' above, flow rates at Culvert FM-D1 and within the watercourse downstream of the confluence of the FM-D1 and FM-D2 culvert tributaries should be provided to ensure that instream targets are being met fairly between the developments west and east of Tremaine Road.
e. Digital copy of the hydrologic model is required.

59. **Section 7.6, Stormwater Management Facilities -**
a. Page 7-8 states that no allowance has been made for runoff from Dundas Street. Staff recommend that runoff from Dundas Street and its anticipated widening be provided within the SWM facilities unless it can be demonstrated that it is technically not feasible to do so.
b. Staff intend to discuss the future development and servicing of the Future Employment lands located between Reaches 14W-16 and 14W-22 with Town staff at an upcoming NOARM. Additional comments may be provided upon completion of these discussions.
c. Table 7.6 indicates a drainage area of 46.1 ha to Pond 3 whereas Figure 7.3 indicates a drainage area of 43.2 ha for Subcatchment 3100, which is the area utilized in the GAWSWER modelling. This discrepancy should be explained or rectified.
d. Staff could not reproduce the Target Peak Flow Rates provided within Tables 7.9 and 7.10. An explanation of how these flow rates were determined should be provided.
e. Staff appreciate the thought behind the proposed infiltration trench and gravel wetland at the proposed outlet from SWM Pond #3. Staff request that additional conceptual details be provided on a plan view drawing to better illustrate the scope and scale of the infrastructure. Some preliminary analysis should be provided to demonstrate how effective the size of system currently being proposed will have on polishing and cooling the stormwater management in order to assist in the overall evaluation of the mitigation measures being proposed.
f. Staff request that consideration be given to implementing a similar infiltration trench/gravel wetland at the proposed outlet from SWM Pond #2, with the infrastructure all located outside of the Natural Heritage System.
g. Inlet and outlet elevation details should be provided as well as existing elevations within the receiving watercourses/NHS areas. Figures 7.4, 7.5 and 8.5 should be updated accordingly.
h. Sediment dewatering areas should be shown on Figures 7.4 and 7.5 and their sizing justified in the report.

X. Section 7.6.3, Water Quality Control: This section needs to include information about how thermal pollution on downstream watercourses will be provided by all proposed SWM facilities. A multifaceted approach included 3.0 meter deep permanent pools, bottom draw outlets, adequately sized cooling trenches and cooling towers are recommended to sufficiently mitigate thermal warming of the downstream watercourses. We note that this recommendation may contradict the MOE Guidelines and Town of Oakville Guidelines, therefore further discussion between Conservation Halton, the MNR, MOE and Town staff is required on this item. Pre-construction monitoring of the thermal regimes of the receiving water bodies downstream of the proposed SWM outlets is advised to be initiated as soon as possible in 2013.

60. **Section 7.7 & Appendix 7, Erosion Control Analysis & Appendix 7 –**
a. As identified in Conservation Halton's September 6, 2011 comments, multiple analytical methods should be applied to determine the erosion threshold. As Appendix 7 has not been updated from the previous submission, staff continue to require provision of the results from at least three analytical methods as well as discussion that justifies the final method selected.

b. As identified in Conservation Halton's September 6, 2011 comments, the erosion threshold needs to be established for the most sensitive reach downstream of a proposed SWM facility. As such, an erosion threshold should also be established for upstream of Dundas Street and compared with the value determined for downstream of Dundas Street. The more conservative value should then be utilized to determine the necessary erosion controls.
c. Greater explanation should be provided on how the Erosion Indices incorporating critical shear were determined. Staff were unclear why the erosion indices were being quoted in hours.
d. Table 7.15 on Page 7-20 indicates a 14% increase in the total duration of flows exceeding the erosion threshold value. The same table indicates a 17% increase in the hourly exceedance counts based on an Erosion Indices incorporating critical shear. NOCSS requires that post-development conditions match pre-development conditions with a recognition that results within approximately 5% may be considered acceptable as long as a full and thorough discussion is provided in order to understand the likely effects and implications as well as to determine whether further mitigation, modeling refinement or monitoring is required. As such, it is our opinion that the current stormwater management concept does not meet NOCSS requirements.
e. A more comprehensive analysis for downstream of culvert FM-D2 is required prior to any development proceeding on the lands west of the subject property. Staff note that this analysis may be required as part of the current EIR/FSS depending on the final stormwater management concept proposed. In the event that once the final SWM plan is determined, it is reasonable to defer this matter to the development of the adjacent lands, the current EIR/FSS should identify this outstanding issue and the requirement that it be addressed in the future EIR/FSS update supporting the development of the adjacent lands.
f. It would appear that the proposed stormwater management scheme would result in extremely significant reductions in flows to Reach 14W-12A, moderate reductions in flows to Reach 14W-11/11A/23, and unknown changes to Reach 14W-12 upstream/downstream of the proposed pond outlets. The impacts of all of these changes have not been analysed in the report. Staff note that an erosion analysis could be performed for these reaches to demonstrate whether or not any proposed changes are appropriate.

61. **Section 7.8 & Appendix 6.4, Topographic Depression Volumes** – As noted in our August 16, 2012 comments, the Topographic Depression Volume Analysis provided in Appendix 6.4 indicates that depression storage analysis was not undertaken on the Hydrologic Feature 'A' located on Reach 14W-16 (ID 6) as it will be kept in its original condition. The bankfull channel in this location however is proposed for alterations. As such, the EIR/FSS should confirm that either no changes to the depressional storage will be a result of the proposed channel reconstruction or provide clear direction on any mitigation measures that would be required at the detailed design stage to ensure that the topographic depression storage volume will be maintained. The updated EIR/FSS should also demonstrate on its grading plan and/or through other drawings that Hydrologic Features 'B' ID7 and ID8 will be left undisturbed or the topographical depressional storage analysis should be updated accordingly.

62. **Section 7.9 & Appendix 7.2, Downstream Impacts for Regional Storm** – It is our understanding that Appendix 7.2 is unchanged from its original submission. As such, our September 6, 2011 comments remain outstanding as follows (minor modifications have been made to provide additional clarity):
a. Appendix 7.2 indicates increases in Regional Storm water surface elevations downstream of the QEW. There are known flood damage centres downstream of the QEW where the Regional Storm extends onto private property and overtop of municipal roadways. No increases will be supported in these specific areas. As such, it is the opinion of Conservation Halton staff that based on the information provided the analysis does not demonstrate that there will be no adverse impact on downstream landowners (including private property) or land uses.

b. In the event that the proponent wishes to continue to pursue the option of demonstrating that Regional Storm controls are not required, staff note that we will require the following information to be included in any such assessment:
   - A digital copy of the hydrologic and hydraulic models.
   - A hard copy of the hydrologic input and output files for post development conditions.
   - A hard copy of flood plain mapping at a scale that allows for a review of impacts. The mapping must clearly illustrate property limits and existing structures. The mapping should clearly identify all areas of increased flooding as well as the amount of the predicted change.
   - Unless the assessment demonstrates a zero increase in peak flows and flood elevations, the assessment must be extended to assume that Regional Storm controls will not be provided within any development upstream of Dundas Street within the Fourteen Mile Creek Watershed to ensure fairness to all developers.
   - Staff concur that the conversion of HEC-2 models into HEC-RAS can result in substantial changes to WSELs. The predicted increase as predicted at Cross-Section 63 (River 1, Reach 2), upstream of the Upper Middle Road crossing, however is very substantial (4.12 metre increase). Further discussion of this difference is warranted.
   - The original HEC-2 model for Fourteen Mile Creek has been updated in specific sections as development has proceeded within the watershed. As such, additional model modifications may be required to account for these works. The need for additional revisions will be determined once all of the other above noted concerns have been addressed and more detailed mapping and digital modeling has been provided in order to undertake an initial assessment of whether or not these model upgrades are necessary.

Y. **New Comment, Section 8, Municipal Servicing** –
   a. The stormwater management infrastructure drawings and tables provided in Appendix 8.3 and 8.4, including storm sewers and culverts, should be updated accordingly in conjunction with any changes to the stormwater management plan resulting from the comments of all agencies.
   b. The EIR/FSS should clearly indicate that the proposed culverts, sanitary sewer, watermain and road crossings of the Main Fourteen Mile Creek reaches (Reaches 14W-1A, 14W-2 & 14W-11) as shown on the drawings in Appendix 8.4 have not been reviewed or approved and that they will be subject to modifications through the EIR/FSS approval process for the adjacent lands.
   c. Staff understands that portions of the watermain and the Sanitary sewer along Dundas Street will be constructed by the proponent. Drawing P11 in Appendix 8.4 indicates an assumption of a minimum 0.4 metre clearance between the invert of the sanitary sewer and the top of the existing FM-D4 culvert. The drawing also indicates a minimum 0.5 metre clearance at Culvert FM-D5 though a clearance of over 2 metres is assumed for the profile. Staff anticipate that the existing culverts will likely have to be replaced with larger culverts or bridges at the time that Dundas Street is widened in the future. As such, staff request that the sanitary sewer servicing for the subject lands should allow for the maximum clearance possible between the tops of the existing culverts relative to the invert of the sanitary sewers in order to allow for maximum flexibility with the future culvert replacements. Staff will require confirmation from both the design proponent and Regional staff that the proposed design provides for maximum future flexibility. Staff apologize for not raising this in our previous comments.
   d. As noted under Comment # 57, additional grading information is required on Drawing GR1 in Appendix 8.5.

63. **Appendix 4.6, Groundwater and Surface Water Quality** - Comment not addressed. A map of groundwater and surface water quality monitoring locations is still requested. Surface water quality results indicate that uranium, cobalt and zinc levels exceed PWQO at six out of ten

sampling locations. These results also show that surface water levels of boron exceed the PWQO at 8 of 10 sampling locations. Please indicate if this situation has been addressed by the Ontario Ministry of Environment. It is noted that nitrates were not one of the parameters tested for with the surface water samples. Given that the previous land use of the property was pig farming, it would be helpful to include nitrates as a surface water parameter of interest.

64. **Appendix 5.6 Water Temperature Monitoring Data** - Comment not addressed to the satisfaction of CH Staff because the STATE analysis was not applied to the temperature data graph.

65. **Appendix 8.3 Figure A: Comment not addressed** - Figure A-8.3 should be updated to illustrate the proposed pond outlet locations.

66. **Appendix 8.4**
    - Drawing P1: There are concerns over the fill placement proposed in the valley surrounding 14W-16 (0 +375 to 0 + 500) located west of the Lazy Pat Property line and just east of the intersection of Avenue One and Avenue 2. There is concern that the watercourse will be disconnected from the floodplain if this fill is placed in this area. This disconnection could lead to in-stream erosion and higher shear stresses in the channel, which would have a negative impact on fish communities and fish habitat in this channel. A bridge structure that spans the meanderbelt width of the watercourse is the preferred crossing structure in this location. A creek crossing structure that meets these criteria would be in accordance with *Endangered Species Act* Guidelines.
    - Drawing P2: It is requested that the road crossings at 1 + 450 and at 1 + 525 in this drawing be designed as bridges that will span the meanderbelt width of the watercourse in accordance with *Endangered Species Act* Guidelines.
    - Drawing P2: There are concerns about fill placement in the valley areas where Avenue One crosses two tributaries of the Main Branch of Fourteen Mile Creek, one at 1 + 400 to 1 + 450 and the other at 1 + 500 to 1 + 550. There is concern that the watercourse will be disconnected from the floodplain if fill is placed in this area. Similar to the above, these crossings would need to meet MNR criteria for creek crossings in Redside Dace habitat. To meet this criteria, a bridge structure that spans the meanderbelt width of the respective watercourse would be recommended.
    - Drawing P4: Staff appreciate the inclusion of an open bottom creek crossing structure at this location. Please confirm that the span of the proposed culvert will encompass the meanderbelt width of the watercourse as specified in MNR's Draft Guidance for Development Activities in Redside Dace Protected Habitat document.
    - Drawing P5: There is concern regarding the Burnhamthorpe Road crossing of the main stem of Fourteen Mile Creek (Reach 14W-1A). It is preferred that a bridge structure that spans the meanderbelt width of the watercourse be placed at this road crossing, which is consistent with the MNR Draft Guidance for Development Activities in Redside Dace Protected Habitat document. It is also preferred that the future watermain crossing be attached to the bridge structure. As no storm or sanitary sewer crossings of this valley are required, staff are satisfied that these details can be worked out in conjunction with the adjacent development; however, the EIR/FSS should clearly indicate that the current design has not been approved.

67. Discussed in other sections.

Technical Memorandum NH # 1 – Reach 14W – 14A Aquatic Habitat Prepared by MMM Group, March 28, 2012:

68. **Section 3.1 Fish Community Survey**: Details on the design and methodology used to collect fish were not provided in the EIR-FSS; comments remain outstanding.

69. **Section 3.3 Supplemental Fish Habitat Documentation:** Water Quality Monitoring, Dissolved Oxygen comments were not addressed, raw data remains outstanding.

70. **Section 3.4 Water Temperature**: Raw surface water temperature data was not provided, previous CH comments remain outstanding.

71. **Section 3.5 Thermal Impacts of Proposed Conversion of Farm Pond to a Storm Water Management Pond**: It is again noted that cooling towers, vegetated islands and a north-south pond and outlet orientation were suggested by the MMM Group in their March 28, 2012 Technical Memorandum # 1 as methods to mitigate the warming effects of proposed SWM pond # 3. It is suggested that these thermal mitigation measures also be considered for other proposed swm ponds on the property.

72. No further comment required.

73. **Section 3.7 Sediment Source**: Comment remains outstanding. This comment should be addressed through stream length compensation requested.

74. **Section 3.8 Organic Material Source**: Comment remains outstanding. Organic material can be compensated for by implementation of Conservation Halton's *Landscaping and Tree Preservation Guidelines*. These guidelines will be applicable to all realigned watercourses on the property.

75. No further comment required.

76. **Section 4.0 Conclusions**: Comment is no longer relevant.

77. **Figure 1 Bathymetric Survey/Approximate Fish Community Sampling Locations**: A fish relocation will be required for fish in the pond. Discussions with CH staff and Aurora District OMNR staff at the detailed design stage will be required to determine an appropriate location for fish present in the existing farm pond.

78. **Figure 3, Pond Cross Section**: Comment no longer relevant.

79. **Figures 4 – 7 Water Temperature Comparisons at a Variety of Water Depths**: Comment no longer relevant.

Draft Plan of Subdivision 14T-11001

In light of the number of outstanding issues associated with the EIR/FSS, Conservation Halton staff have not undertaken a detailed review of the submitted Draft Plan. Once the limits of the corridors and SWM servicing requirements are finalized within an updated EIR/FSS, the Draft Plan should be revisited and updated accordingly.

We trust the above is of assistance. If you require additional information please contact the undersigned at extension 283.

Yours truly,

Leah Smith
Environmental Planner, MCIP, RPP
LS/

cc. (by email) Kristina Parker, Town of Oakville
Doug Corbett, Region of Halton
Melinda Thompson, Ministry of Natural Resources

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Sonia Rankin

From: Mark Cece
Sent: Friday, May 31, 2013 4:29 PM
To: Samantha.Jefferis@ontario.ca
Cc: Tom Farrell (tom.farrell@ontario.ca)
Subject: RE: North Oakville - Lazy Pat Lands

Samantha

Thank you for your response. We can certainly fill out these forms however, I wanted to provide some context to our previous discussions with John Pisapio to determine if this is the "right track" you want us to follow. Generally the premise of consulting with MNR was based on the recognition that ESA regulated species were present on site including Redside Dace (RSD) and the MNRs eventual permitting responsibility. It was felt that although the proponent is not seeking approvals from MNR under the ESA at this time, MNR consultation was warranted given the implications to development limits associated with ESA regulated species and the risk associated with proceeding without MNR input and having to revisit limits, linear infrastructure and transportation routes etc. Given our experience throughout the province as it relates to the ESA the one consistent message has been, consult early. The benefits of this early consultation was echoed by John as he indicated that although he could not at this stage of the planning process issue a permit he welcomed the opportunity to provide comment on the project as it related to ESA regulated species.

Again although we recognize that MNR and CH will consult with each other as required, we feel MNRs direct input is warranted on the project to understand the MNR's interest on the subject lands given the implications to the development fabric. As you may be aware the main policy document being relied upon by CH for the assessment of the onsite natural features is the North Oakville Creeks Subwatershed Study (NOCSS), a document developed in consultation with the MNR. Even with MNR involvement in the development of this document, ongoing consultation between your agencies and our continued interactions with CH (since 2010), it was not until John was on site in Oct 2011 (almost 2 years into this phase of the project) that we were made aware that Reach 14W-16 was classified by the MNR as RSD habitat, information absent from NOCSS and from previous discussions with CH. More recently CH indicated in their March 2013 comments that Reach 14W-11A previously considered a Medium Constraint stream was now considered RSD habitat, likely due to the habitat regulation released for this species in early 2012. In both instances there are significant implications to the development fabric including lot layout, infrastructure layouts, etc. and it becomes obvious why ongoing discussions are required with MNR. In the second instance related to reach 14W-11A, the information came approximately 1 year following the release of the RSD habitat regulation and it is uncertain whether the classification of Reach 14W-11A is from the regulating agency (MNR) or whether CH has made this determination independently and will not be reviewed under the ESA.

We are really looking for an opportunity to discuss the history of the project and the rationale for its current form. If you feel the starting point is the submission of these forms, we can initiate their preparation however, I think a more efficient approach would be to meet face to face and discuss in person. Please let me know your thoughts on this and if you have any specific dates in mind, we will make ourselves available.

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist
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From: Jefferis, Samantha (MNR) [mailto:Samantha.Jefferis@ontario.ca]
Sent: Thursday, May 23, 2013 4:37 PM
To: Mark Cece
Cc: Farrell, Tom (MNR)
Subject: RE: North Oakville - Lazy Pat Lands

Hi Mark,

Thank you for your interest in meeting to go over the Lazy Pat project history.

At this point in time, it is MNR's preference that the Information Gathering Form (IGF) and Avoidance Alternative Form (AAF), which I have attached, along with their guides, be submitted to our office prior to scheduling a meeting. This will allow us to review and become up to date on the project in regards to Species at Risk potential impacts, prior to a meeting. The IGF and AAF should be completed for Redside Dace, Bobolink, Barn Swallow (the May 2011 Environmental Implementation Report identified that Barn Swallows were observed on site during breeding bird surveys) and Eastern Meadowlark as well as any other Species at Risk that may have been found during site investigations.

I have also attached the C Permit Process Flowchart to give you a better understand of the permitting process.

Additionally, when the IGF and AAF are submitted, please clarify the following:
When was the Secondary Plan approved?
When was the final approval for the Draft Plan of Subdivision granted? Note that Draft Plans of Subdivision that are currently sitting with the Ontario Municipal Board would not be considered to have final approval.

Regards,

Sam Jefferis
Assistant Species at Risk Biologist
Ministry of Natural Resources
50 Bloomington Road, Aurora, ON L4G 0L8
Phone: (905) 713-7369
Email: samantha.jefferis@ontario.ca

From: Mark Cece [mailto:CeceM@mmm.ca]
Sent: May 21, 2013 1:55 PM
To: Jefferis, Samantha (MNR)
Cc: Farrell, Tom (MNR)
Subject: RE: North Oakville - Lazy Pat Lands

Samantha:

Further to my voicemail from May 16, 2013, I wanted to follow up with an email including my contact info. As mentioned I think the most effective way to bring you up speed on the project would be to get together and provide a summary of the works undertaken to date. Perhaps including Tom Farrell would be helpful as well.

Please let me know when you are available and we will do our best to make that work.

Thanks,

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist
Associate Partner
Ecology Department

MMM Group
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MMM GROUP

WORKING DRAFT

INTER-OFFICE MEMO

To:	Paul Bond, Halton Region Conservation Authority	Date:	July 4, 2013
From:	Chris Tyrrell, MMM Group Limited	Job No.:	14.09222.001.P01
Subject:	Bentall Kennedy LP (Lazy Pat Farm Property, 3269 and 3271 Dundas St. W.) Issues List - EIR/FSS 2nd Submission, December 2012	CC:	Mike Reel, Bentall-Kennedy

The following tables outline the comments on the EIR/FSS 2nd Submission, December 2012 (including HRCA comment letters dated June 3, 2013, and March 21, 2013), and draft MMM responses for review and discussion.

The issues have been categorized as follows:

1. Issues we agree with and will address in the 3rd Submission;
2. Issues we have questions and require clarification; and
3. Key Issues outstanding which require discussion.

Following HRCA's review of the issues and draft responses, MMM proposes to revise this memo in an effort to further scope the issues. This memo will then provide the basis for our Workshop Meeting Agenda to discuss the issues where further clarification is required (#2), and discuss the key issues (#3). The key issues (#3) which we suggest require further discussion at the forthcoming Workshop Meeting, anticipated in late August or early September, are summarized below:

Summary of Key Issues

HRCA Comment No. Reference	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)
1 (June 3, 2013) A (March 21, 2013)	**Existing Pond (14W-14A) and Use as a SWM Facility / Drainage Densities** • Relocation/replication of form and function of existing pond/stream • Replicating pond as equivalent length of stream • Total stream length (drainage densities) • Function of pond and detriment to Redside Dace population • Existing pond functions to be replicated/enhanced • Existing functions to be replicated/enhanced in a stream corridor	3	MMM: Steve van Haren (SVH); Mark Cece (MC)
B (March 21, 2013)	**Consolidation/Relocation of Stream Corridors** • Related to Central SWM pond issue • Concerns with channel slope, proposed flow regime, loss of stream length, maintenance of riparian	3	MMM: SVH

	storage • Drainage density		
K (March 21, 2013, Section 4 – Hydrogeology)	**Existing Pond (14W-14A)** • Groundwater inputs • Location of deep monitoring wells	3	MMM: Andrew Kulin (AK)
G (March 21, 2013)	**10, Location and Size of Stormwater Management Facilities** • Need to demonstrate that the proposed stormwater management plan will have no detrimental impacts on the Natural Heritage System or adjacent landowners.	3	MMM: SVH
59 (March 21, 2013, EIR/FSS)	**Dundas Street Stormwater Runoff and SWM Facility Allowances** • Request to accommodate Dundas Street runoff (Section 7.6 a))	3	MMM: SVH; Alex Williams (AW)
P (March 21, 2013, Section 4 – Hydrogeology)	**Water Balance** • Clarification of assumptions	3	MMM: AK
7 (March 21, 2013, EIR/FSS) Figure 3.1	**407 West Concept Plan** • Potential impacts on Main Fourteen Mile Creek and location of Avenue 1 relative to valley system	3	MMM: Chris Tyrrell (CAT); MC

The following tables outline HRCA comments, and draft responses for review.

HRCA Comments – June 3, 2013 (EIR/FSS 2nd Submission, June 2013)

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
1		**Existing Pond (14W-14A)/Drainage Densities** The existing stream corridor and pond, 14W-14 & 14W-14A, are designated as a Medium Constraint (blue) stream corridor. As you are aware, NOCSS provides for the relocation of these medium constraint features provided the form and function of these reaches are maintained. It is noted that both the stream (14W14) and the pond (14W14A) are	3	SVH	The location of pond 14W-14A is the only viable SWM pond location on the east side of Reach 14W-12 that can service the development blocks in accordance with good planning principles (SWM facilities adjacent to open space blocks, sized to minimize the total number of SWM facilities,

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		designated Blue. NOCSS also identifies the existing pond as a Hydrological Feature "A". Given the Medium Constraint designation, the pond cannot be converted/eliminated as a storm water management facility. As such, the existing pond (and stream) are to either remain in place or can be relocated subject to the form and function being maintained in accordance with NOCSS. In an effort to demonstrate flexibility with this issue, CH staff, in consultation with the MNR, offered the option of relocating the pond (14W14A) *as an equivalent length of stream,* constructed to the medium constraint (blue) standard as a defined channel system. This was viewed as a fair and equitable solution to move things forward while providing some potential benefits to the overall system. It was not our intention to have the specific pond "*function*" replicated as a stream, save for the general hydrology, environmental objectives and geomorphologic objectives of the overall stream system. It was always understood that the length of the pond was to be maintained in an equivalent length of Natural Heritage System. CH staff remain open to this option. As noted herein, the choice of leaving the 14W-14 and 14W14A features in place in accordance with NOCSS remains. With respect to *total* stream corridor length, when the 300+ metre length of Reach 14W-14A is added to the existing length of medium constraint Reaches 14W-14 and 14W-16 and the 200 metre length of Reach 14W-21 is deducted from the proposed stream length total, there is a shortfall of over 600 metres in stream length (based on the lengths provided in Table 6.14 of the EIR/FSS). We continue to be of the opinion that it is not appropriate to include Reach 14W-21 in the calculations as this reach is simply a diversion of Reach 14W-13's upstream drainage area. Reach 14W-13 is a low constraint watercourse. It is for this reason that Corridor 14W-21 has not been required to meet all of the same design/setback criteria applicable to medium constraint Reaches 14W-22 and 14W-11A. It is noted that enhancements to medium constraint streams as part of			maximized quality treatment with lowest potentials for sediment wash-out, etc.) This is a critical issue for which we are seeking clear positions on as numerous comments hinge on this particular item. We are referring to this issue as the "Central SWM pond issue". We appreciate the clarification on the replication of reach 14W-14A as an equivalent length of stream and are exploring methods to accommodate this direction. As for the functions of the pond as a Hydrologic Feature 'A', we request acknowledgement that this function can be replicated as an identical volume of active storage inside the realigned watercourse system, provided the floodplain behaviour achieves all required criteria (flood elevations, velocities, etc.) and post-development flow patterns in the various red watercourse reaches is acceptable. With respect to enhancement, we note that conversion of blue streams to red streams goes far above and beyond the intent of the enhancements envisioned by the NOCSS. We are of the opinion that the additional channel corridor widths, management direction and advanced natural channel designs were a significant improvement to the existing habitat on the site, extending the available reaches that Redside Dace could access significantly. We request some consideration of these benefits when addressing some of the less contentious issues.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		their relocation/realignment are required by NOCSS and therefore any improvements as part of the relocation should not be considered as an "extra" as appeared to be the suggestion at the April 15th NOARM, when it was stated that the proponent is increasing the length of red streams within the area by their proposed enhancements to the blue reaches.			
		With respect to function, the existing pond feature 14W-14A is not considered to be a detriment to the Redside Dace population. The removal of this pond is seen as being a loss from an ecological perspective due to the good water quality in the pond, the groundwater inputs, healthy submergent, floating, emergent and riparian vegetation communities, the good quality amphibian community and the self-sustaining sport fish and non-sport fish community existing within the pond. It is likely there is a self-sustaining zooplankton and phytoplankton community upon which these aquatic animals depend as well. As such, the loss or transition of this pond to a SWM facility would be considered a loss from an ecological perspective.	3	MC	The ecological function of the pond requires further clarification from CH as the proponent has not had the benefit of the data CH has used to make their determinations. Specifically the manner in which CH has made their determinations of "groundwater upwelling" and "good water quality" remain unclear. Furthermore, it is our position that the discussion surrounding this feature requires greater contextualization as it is a demonstrated constructed feature, the sportfish community is largely represented by a (presumably) stocked fish species (largemouth bass) given the apparent absence of a parent community and the self-sustaining zooplankton/phytoplankton community is reflective of impounded water with connection to a natural watercourse that can be mimicked within a SWMP facility.
		CH staff note that Reach 14W21 connects a green stream to a blue stream (Fig. 2.1 of EIR/FSS Second Submission and Figure 7.3.1 of NOCSS) rather than a blue stream to a red stream as stated in the issues list. Low constraint (green) stream length is not required to be replicated in form or function and is therefore not counted as "credit".	2	SVH	We acknowledge that Reach 14W-21 connects a green stream to a blue stream, which after redirection will be managed as a red stream. It is therefore our opinion that the reach connects a green stream to a red stream. As for the counting of Reach 14W-21 as a credit toward the drainage density calculations, if Reach 14W-21 is modified with an appropriate blue stream corridor and managed as such, we feel it is an extension of the downstream

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
					reach and should be eligible for the credit.
		The following existing pond functions should be replicated/enhanced if the **pond itself** (*in both form and function*) is to be relocated: a. Groundwater inputs b. Healthy, self-sustaining fish community c. Healthy self-sustaining floating, submerged, emergent and riparian vegetation community. d. Cold, cool and warm water pond environment with water depths up to and including 2.5 meters. e. Self-sustaining amphibian community including 5 species of frogs (American Toad, Northern Leopard Frog, Gray Tree Frog, Green Frog, Northern Bullfrog). f. Channel/pond length should be maintained in order to maintain regional stream density for the reasons outlined in our March 21, 2013 letter. g. Maintenance of any topographical depression storage to assist in the maintenance of the existing hydrogeologic and hydrologic systems. Staff note in revisiting Section 6.3.6 of the December 2013 EIR/FSS that this potential function of the existing pond was not quantified/addressed in the document. Staff apologize for not highlighting this gap in our previous comments. h. Maintenance of flood discharge-storage conditions for the full range of storm events up to and including the Regional Storm (to protect headwater hydrologic function as outlined in Appendix GG). Page 6-56 of NOCSS should be referred to for greater details on the steps required as part of addressing storage characteristics. This has not been provided to-date.	3	MC	Similar to above the ecological function of the pond requires further clarification from CH with presentation of the data used to make their determinations. Furthermore, this feature requires greater contextualization as it is a demonstrated constructed feature, the sportfish community is largely represented by a (presumably) stocked fish species (largemouth bass) given the apparent absence of a parent community and the self-sustaining zooplankton/phytoplankton community is reflective of impounded water with connection to a natural watercourse that can be mimicked within a SWMP facility. We disagree that reach 14W-21 cannot be included in the calculation of total stream corridor length if it is modified to provide the same design/setback criteria of the downstream reach it is connecting to. We require further discussion. As discussed above, the ecological function of the pond requires further clarification from CH specifically as it relates to their position regarding “groundwater upwelling” and “good water quality”. Furthermore, it is our position that the discussion surrounding this feature requires greater contextualization given that this is a constructed feature and has been influence to a great extent by human activity.
		The functions of Reach 14W-14A that should be reproduced and			Noted. This is related to the central SWM pond

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		enhanced in a **stream corridor** option include: a. Channel length equivalent to existing channel and pond length should be maintained in order to maintain regional stream density for the reasons outlined in our March 21, 2013 letter. b. Maintenance of flood discharge-storage conditions for the full range of storm events up to and including the Regional Storm (to protect headwater hydrologic function as outlined in Appendix GG). Page 6-56 of NOCSS should be referred to for greater details on the steps required as part of addressing storage characteristics. This has not been provided to-date. c. Maintenance of any topographical depression storage to assist in the maintenance of the existing hydrogeologic and hydrologic systems. Staff note in revisiting Section 6.3.6 of the December 2013 EIR/FSS that this potential function of the existing pond was not quantified/addressed in the document. Staff apologize for not highlighting this gap in our previous comments. d. Channel enhancements such as the re-establishment of a meandering planform with functioning floodplain and development of a riffle-pool morphology should be implemented (i.e. natural channel design principles should be applied).			issue. Documentation on the replication of total depression storage will be provided in the revised text. This is related to the central SWM pond issue. Noted, the replication of the ecological function of the pond will be further discussed in the revised text.
2		**<u>Flow Rates</u>** During the April 15th NOARM meeting, concerns were raised that the Town's correspondence appeared to be making contradictory comments about flows. We understand that the Town of Oakville will address the concerns respecting their comments. Notwithstanding, CH staff has also identified concerns about increased flows downstream of Dundas Street and the potential for decreased flows within specific reaches of the watercourses upstream of Dundas Street. It is our opinion as outlined in our March 21st, 2013 comments that the EIR/FSS does not adequately document the proposed changes to the flow regime within Fourteen Mile	2	SVH	Noted. Documentation on the pre and post-development flow patterns at each reach will be provided in the revised text, once the central SWM pond issue has been resolved.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		Creek; does not fully assess the potential impacts of proposed flow regime changes; and does not verify that there will be no unacceptable effects to the stream as a result of these changes.			
3		**Redside Dace** Through discussion with you at our May 2nd meeting at CH offices, it was agreed that our Senior Aquatic Ecologist, Samantha Mason, would coordinate an on-site meeting with the MNR (Mark Heaton), Mark Cece and Chris Tyrell to assess the 14W-11A tributary with respect to its designation as Redside Dace habitat under the Endangered Species Act legislation. The intent was to expedite the resolution of this issue through an on-site assessment. I understand that the arrangement of a suitable on site meeting time with the appropriate parties is still being pursued with Mr. Cece.	2	MC	As mentioned in an email to S. Mason on June 4, 2013, we have had direct interactions with the MNR related to the most appropriate staff to review the project on a more permanent basis rather than in "acting" position and are currently in discussions with the MNR to arrange a meeting and provide project history and context in order that they can be up to speed in the process to date and the rationale for the development plan. Once these discussions have taken place, we will arrange a meeting with MNR, CH and MMM to walk the site and understand the potential implications associated with SAR to the project from the ESA/MNR perspective. CH will continue to be informed of the outcome of these discussions as they occur in order to assist in their review of the project under the PPS.
4		Although not included on the proponent's "Issues List", I note that the road alignment issue raised at the last NOARM meeting has not yet been addressed.	2	ALL	As presented at the NOAR, there is sufficient flexibility in the road alignments (Avenue 1) as it leaves the Bentall property and crosses 14 Mile Creek. Further discussion is required as to why another site visit is needed. It is recognized that the potential impacts, will need to be addressed in the EIR/FSS prepared in support of development on the adjacent lands. Refer to Item I (Figure 3.1) comment below.

HRCA Comments – March 21, 2013 (EIR/FSS (2nd) Submission, December 2012)

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
A	Section 2.0 a) (Cover Letter)	**1 – Pond (Reach 14W-14A) and Use as a Stormwater Management Facility** – Staff did not indicate that the on-line pond could be used for a stormwater management facility but rather that we would not object to the stormwater management facility being located at the same location as the existing pond as long as the medium constraint corridor was relocated and replicated elsewhere as a fully protected stream corridor. This important distinction is also relevant to statements made in Sections 2.0 b) 10 & 11. We further note that a function of the existing pond is to assist in the maintenance of regional drainage densities.	3	SVH	See response to Comment #1 above. This is related to the Central SWM pond issue. We request the basis for this statement be fully explained.
B	Section 2.0 a) (Cover Letter)	**2 – Consolidation/Relocation of Stream Corridors** - While staff are prepared to consider some consolidation and relocation of stream corridors, it is our opinion that the current EIR/FSS does not provide sufficient justification for the current proposal. Conservation Halton staff continue to have concerns with respect to channel slope, proposed flow regime, loss of stream channel length, maintenance of riparian storage, etc. With respect to stream density, Section 6.3.4.1 of NOCSS indicates that regional stream density targets could be achieved for all of North Oakville based on protection of the red and blue streams. This along with other factors then led to the implementation strategy requiring the protection of all red and blue streams as outlined in Section 7.4.3.1 while allowing for the potential elimination of green streams. As per personal communication with the SWS team, it was not the intent of the SWS authors to suggest that SWM facilities could be used to substitute for blue streams but rather their inclusion on Page 6-53 of NOCSS was to provide additional justification why it should be considered acceptable to allow for the loss of green streams as well as the reduction in drainage	3	SVH	These issues are related to the central SWM pond issue. We are not proposing any alteration to stream corridor designations But are pointing out inconsistencies in the interpretation and application of the NOCSS policies based on more detailed study (i.e. detailed investigations and monitoring in reach 14W-14A) which appear to contradict some of the NOCSS findings. The intent of this exercise is to inform decisions from the regulatory agencies with the latest scientific information, providing the development plan with additional flexibility where these policies are concerned.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		density within some individual subcatchments (as long as all red and blue streams are protected). All figures within NOCSS identified Reach 14W-14A as a blue/medium constraint corridor. As such, we continue to be of the opinion that Section 6.3.4.1 supports the position that the length of all blue/medium constraint stream corridor systems must be protected/replicated. Given the above, we note that it is not appropriate to consider the loss of a single blue stream independent of the rest of the North Oakville Natural Heritage System, rather it must be considered in the context that this is a significant change to the NOCSS and Secondary Plan process. A piecemeal approach to altering the stream designations identified in NOCSS could result in a potentially significant reduction in the regional stream density targets.			
C	Section 2.0 a) (Cover Letter)	**5, Additional Geomorphic Field Surveys** - It is not sufficient to assess only the ditch downstream of Culvert FM-D2. The western tributary of Fourteen Mile Creek must also be investigated in order to establish the appropriate erosion controls for Subcatchment 1102. As the erosion control requirements for these lands could potentially be determined independently of the Subject Property and as they may be best assessed in conjunction with the development west of Tremaine Road, no additional assessment may be required at this time, as long as the proposed diversions are demonstrated to be appropriate (see Section 5, 6 and 7 comments). In the event that it is determined that additional analysis is not required at this time, we recommend that the need for additional erosion threshold analysis for this area be clearly identified within the current EIR/FSS	2	SVH	Due to additional modelling investigations, we believe the post-development drainage boundaries will be much more closely matched than previous submissions and the proposed diversions will be demonstrated to be appropriate. Therefore, the additional geomorphic surveys of the western tributary of 14 Mile Creek may be deferred. We will add text to the EIR/FSS to identify this study requirement for development west of Tremaine Road.
D	Section 2. b) (Cover Letter)	**7, Infiltration and Water Balance** – MNR's Redside Dace Guidelines were released after NOCSS. As such, it is not appropriate to consider that the MNR guidelines defer to NOCSS (subwatershed plan) (i.e. this statement within the guidelines only applies to subwatershed plans written after the guidelines were released). That being said, staff concur that the MNR guidelines do recognize that there can be limitations to infiltrating the 5 to 15 mm rainfall event based on soil permeability. As such, staff are generally satisfied with the proposed LID measures	1	AK/SVH	Acknowledged.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		subject to modifications as per the comments provided below and with the understanding that additional measures will be implemented wherever it is identified as being feasible through the detailed design of the SWM Blocks and the individual Site Plans.			
E	Section 2.0 b) (Cover Letter)	**8, Erosion Threshold Analysis** – It is our opinion that the current stormwater management concept does not meet NOCSS requirements with respect to erosion controls and is therefore not supported.	2	SVH	The Erosion Threshold Analysis is being modified based on additional field investigations.
F	Section 2.0 b) (Cover Letter)	**9, Flood Plain Model** – It is our opinion that the flood plain modeling remains insufficient to support Draft Plan approval.	2	SVH	The flood plain modelling is being modified based on additional data from the NOCSS consultant team.
G	Section 2.0 b) (Cover Letter)	**10, Location and Size of Stormwater Management Facilities** – It is our opinion that the current EIR/FSS has not demonstrated that the proposed stormwater management plan will have no detrimental impacts on the Natural Heritage System or adjacent landowners.	3	SVH	What specific detrimental impacts to adjacent landowners or the Natural Heritage Systems remain unaddressed? The location and sizing of the Stormwater Management facilities is in compliance with all relevant MOE, Town of Oakville and HRCA policies.
H	Section 2.0 b) (Cover Letter)	**12, Channel Forms** – It is our opinion that an accepted channel gradient for the watercourse realignments must be agreed to by all parties at the current level of planning as channel gradients cannot be substantially altered in the future without affecting channel length and potentially other channel parameters.	1	SVH	Agreed.
I	Section 2.0 b) (Cover Letter)	**13, Downstream Impacts** – Conservation Halton staff agree that a zero increase in peak flow rates and water elevations is not the only way to waive the requirements for Regional Storm controls. Conservation Halton staff however do not agree that the analysis provided shows a negligible increase in risk to downstream landowners/public. We also do not agree that the predicted increases are within levels considered to be of "no noticeable increase". There are several downstream areas that consist of privately owned lands, including homes and businesses that	2	SVH	See response F above.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		are flood susceptible. There are also several road crossings that are overtopped during the Regional Storm condition. As such, any increases in these specific locations have the potential to adversely affect the landowners and the land uses as a result of increased flood damage, reduced access/egress, reduced development potential, etc. In accordance with the EIR/FSS Terms of Reference, the submission must clearly demonstrate that there would be no adverse effect on the landowners and the land uses. We also continue to be of the opinion that the analysis must assume that all landowners within the Fourteen Mile Creek catchment area downstream of Highway 407 will not provide Regional Storm controls.			
		As noted above, the numbering below is consistent with our August 16, 2012 correspondence. 1. Addressed.	-	-	-
		2. **Executive Summary** – Should be updated as necessary to address the above and following comments.	1	ALL	The Executive Summary will be updated accordingly.
		3. Addressed.	-	-	-
	Section 2.1	**4. Natural Heritage System Components, Page 2-2 – Medium Constraint Corridors** – Staff continue to be of the opinion that the discussion on the proposed watercourse alterations is out of place in this section. Please see Section 5 and 6 comments below for our more detailed comments on the proposed watercourse alterations. Please however note that Conservation Halton staff do not agree with the statement that the proposed stream relocations are in keeping with the NOWSP policies for Medium Constraint Stream Corridor Areas.	2	MC	Noted, text will be revised to relocate discussion into subsequent sections of EIR
	Section 2.2	**5. Permitted Uses in the Natural Heritage System, Page 2-3 –** While Conservation Halton staff have no objection to the placement of the	1	MC	Further to the May 2, 2013 NOARM meeting and the subsequent June 3, 2013 comments issued by CH,

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		stormwater management facility in the same location as the existing pond (Reach 14W-14A), we do not support the elimination of this reach without full replication of its functions outside of the stormwater management block. This stream reach must be maintained and placed within a publicly owned Natural Heritage System Block.			the suggested function of the farm pond (Reach 14W-14A) will be further discussed in the subsequent submission as well as the incorporation of the relevant functions into the development plan.
	Section 3.2	6. **Trail Planning** – We note that an updated Trails Plan, Trails standards and revised EIR/FSS Terms of Reference for trails are currently being prepared by the Town of Oakville. Please contact Town staff to ensure the EIR/FSS has included the most up-to-date information regarding trails.	1	MC	Noted. The Town has approved a new North Oakville Trails Plan, May 2013, for both the East and West Secondary Plans (which previously did not exist for the West). We note that a trail is no longer planned along the 14W-12 / 14W-16 stream corridors, as was initially identified in the NOWSP. The North Oakville Trail Plan identifies Major Trails along the major arterials, and a "Signed Bike Route" is identified around the Zenon Woodlot/Core Area and 14W-11A on the Lazy Pat property (for which we are proposing to realign). Is this the correct designation (seems out of place). To confirm with Town.
	Figure 3.1	7. **407 West Employment Concept Plan** – Due to the potential impacts on Main Fourteen Mile Creek Valley, the Provincially Significant Wetlands and Woodlands on the adjacent GE owned lands, Conservation Halton staff still require the opportunity to review in the field the proposed location of Avenue 1 relative to this valley system prior to endorsing the 407 West Employment Area Concept Plan. Staff request that the proponent contact Conservation Halton staff at their earliest convenience in this regard to arrange for a site visit.	3	CAT/MC	This also relates to June 3, 2013 Comments (Item 4). As presented at the NOAR, there is sufficient flexibility in the road alignments (Avenue 1) as it leaves the Bentall property and crosses 14 Mile Creek. Further discussion is required as to why another site visit is needed. It is recognized that the potential impacts, will need to be addressed in the EIR/FSS prepared in support of development on the adjacent lands.
	Section 4 – Hydrogeology	The following new comments are provided by Conservation Halton's Hydrogeologist. Responses to our previous comments related to Section 4 are found below under points 8-14.			
J	Section	Section 4.3.2.1 discusses soil sample grain size analyses and hydraulic	1	AK	Table 4.2 was not used in the site specific analyses.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
	4.3.2.1	conductivity estimates using the Hazen method. In general, this is a rather crude approximation of soil hydraulic conductivities. This method is suitable for sandy types of soils characterized by grain size distribution d_{10} > 0.1 mm. The clayey type of soils, which are found throughout the site, are outside of the practical range of using this method. The results as reported in Table 4.2 should not be used for any site specific analysis.			Data from table 4.3 was used, as stated in the 2nd submission – soil classifications were used (in conjunction with soil mapping from NOCCS) to specify infiltration factor for soils used in water balance.
K		The report states that the human-made pond is conclusively shown to be maintained by surface water inflow rather than from groundwater contributions. Although, the pond was investigated as required based on the Terms of Reference and requests made by Conservation Halton staff; the locations of some of the instrumentation is not ideal. It would be more informative to install shallow and deep monitoring wells on the upstream side of the pond. A cross section along the longer axis of the pond would be useful.	3	AK	We disagree with this comment. The data logger placed in the pond consistently showed pond levels were higher than groundwater levels at the nearby monitoring wells and as water flows from high potential to low potential the pond discharges (loses) water into the ground. Installation of additional monitoring wells is not warranted. A longitudinal section will be provided.
L		For future work, water level hydrographs should be shown with larger vertical exaggeration. It is difficult to depict 0.1 metre events on a 20 metre vertical scale.	1	AK	All plots were originally provided at the same scale to facilitate direct comparison of water level fluctuations between monitors. Additional plots at a greater vertical exaggeration will be provided.
M		Percolation testing identified soils with higher than anticipated infiltration. This information does not seem to be used in the water balance estimates.	1	AK	Correct. The water balance estimates are based on the soil classifications presented in Table 4.3. Further note that these percolation test results were noted in the report text to be quite high and representative of highly weathered soil at surface. We would not base any design of infiltration measures on these two data points, as it is not in our opinion reasonable to assume these soils are 135 – 300 mm/hour type soils.
N		A discussion about potential discharge areas along the watercourses is useful, however a figure identifying the discharge zones should be provided.	1	AK	This will be added to one of the figures.
O		What computer model has Environment Canada used to calculate the actual evapotranspiration and water surplus for soils with different water	1	AK	Environment Canada is based upon Thornthwaite method as modified by Johnstone and Louie (1983).

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		holding capacities (page 4-25, first paragraph)?			The technical paper can be provided at the request of CH.
P		Water balance: The reported actual evapotranspiration (71 to 74 % of the annual average precipitation) seems high. The MOE Stormwater Planning and Design Manual (2003) referenced in the report multiple times reports evapotranspiration in the range of 55 to 59 percent of the total precipitation. Some of it could be attributed to the lower precipitation which was used for this assessment vs. what the MOE used. Also, the Oakville Gerard meteorogical climate station was located close to Lake Ontario. The reported temperature for this station could be influenced by the lake. It should be noted that the Thornthwaite-type monthly water balance models are very sensitive to **monthly** average input temperatures. Water Survey of Canada reports an average flow of 0.337 m^3/sec for the Fourteen Mile Creek at Oakville HYDAT station No. 02HB027 (based on 8 years of continuous flow monitoring). This amounts to 0.43 m/year per the station's catchment unit area and equals to 53 % of the total annual precipitation as reported in the EIR/FSS. That only leaves a maximum of 47% of precipitation for the actual evapotranspiration. Some of the increased run-off is associated with the urbanized portion of the watershed. I think these differences merit revisiting in the Water Balance Section to make sure that it represents the available measured data. Please note that the water balance should be updated accordingly based on any changes made to the plan as a result of these comments.	3	AK	The data provided in the example table from The MOE Stormwater Planning and design manual is provided by the MOE as an example, and the data is from an unidentified site, and therefore the numbers quoted in the table is irrelevant to this site. The Oakville Gerard station is the closest station to the site for which Environment Canada data is available for use in the water balance analyses. While it is closer to the Lake than the Bentall-Kennedy site, it is not located directly next to the shoreline and therefore lake effects on temperature will be not be as great as would be the case for a station located at the shoreline. We also note that ETR increases with higher temperature, and therefore if the case being made is that the data from the Oakville Gerard station is affected by lake effects, then its growing season temperatures will be cooler than at inland stations. This in turn would suggest that ETR (71-74%) is underestimated at the Bentall-Kennedy Site and should be higher. We have compared the calculated baseflows at the Bentall-Kennedy Site with baseflows (infiltration) predicted by the water balance and there is good agreement with the observed and predicted rates as we reported in our submission. Regarding the Water Survey of Canada data, the increased runoff at the station is indeed attributable to increased runoff from urbanization, and the

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					calculated ETR of 47% using this data is not relevant to our client's site in its pre-development state. Specific to the Bentall-Kennedy site, the existing subwatersheds are predominantly rural/agricultural, and north of the 407 will remain so in the future as these are designated as protected countryside. Looking closely at Table 4.9 in our 2nd submission report, the effect of urbanization, similar to what is seen in the Water Survey of Canada data, can be seen in the post development scenarios. Pre-Development ETR declines from 71% to 24% (Bentall-Kennedy lands only) and from 74% to 56% (entire subwatershed area north of Dundas Street) The water balance will be revised for the 3rd submission as warranted by any significant revision to the proposed site configuration.
Q		As recommended on page 4-42, last bullet: Additional mitigation measures to improve post development water balance at the lot scale should be incorporated.	1	AK	Noted.
R		Construction impacts: Groundwater dewatering discharge water quality is not addressed anywhere; however, this could be addressed at detailed design.	1	AK	Correct – dewatering discharge water quality is addressed in detailed design and the Permit to Take Water application.
S		Staff supports the recommendation that baseline groundwater level monitoring should be continued.	1	AK	Noted.
T		As shown in Monitoring Well MMM-09-10, and shown on Figure FWL-10 in Appendix 4-5 there is groundwater discharge to 14W-14. As such, staff would recommend realigning the watercourse in the same general location.	1	AK/SVH/MC	We noted in our report that groundwater discharge to this watercourse through the shale bedrock is occurring and the water level data supports this. However we also noted in our report that the rate of groundwater discharge through the shale is not great enough to support base flow during summer season, as no base flows have been observed, and at best the ground in channel is kept in a moist state.

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					The proposed realignment of this watercourse to the western property limit will place the channel bottom below the interpreted groundwater levels in the bedrock thereby maintaining groundwater discharge to the system along the new alignment which should eliminate the need to realign the watercourse in a same general location.
8	Section 4.4	**(Hydrogeology and Geology) Impacts of the Proposed Development, Page 4-23** – This section of the report does not discuss the potential impacts (and potential mitigation measures) related to the realignment of the various watercourse reaches as requested.	2	AK/MC	The text associated with the realignments and associated mitigation measures will be addressed in future submissions to the extent required.
9		Addressed.	-	-	-
10		Addressed.	-	-	-
11		Addressed.	-	-	-
12	Section 4.4.4.2	**Post-Development Water Balances, Page 4-30** – Staff appreciate the additional efforts taken by the proponent in an effort to improve the post-development water balance for the site while respecting Conservation Halton setback requirements. See comments under Section 7.0 (Stormwater Management) for specific technical details but in general we are supportive of the concepts presented provided further efforts are made to match post-development infiltration to pre development infiltration at detailed design. Conservation Halton had previously recommended that the infiltration swales be relocated outside of our regulated area and the additional required lands dedicated to the Town of Oakville for stormwater management purposes. The current proposal does propose the relocation of swales outside of the regulated area but does not propose additional land dedication to the Town where the swales cannot be located within the ESA buffer. Staff continue to recommend that these additional lands be dedicated to the Town of Oakville in order to ensure the ongoing protection and maintenance of these SWM facilities,	2	AK/Others	The dedication of additional lands around the ESA to the Town requires further discussion. A discussion and conceptual figure showing infiltration swales around trails and plantings will be added.

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		however, we defer a final decision in this regard to Town of Oakville staff. Further, MNR staff must confirm whether or not infiltration swales can be located within the 30m ESA buffer which includes undisturbed natural areas. As requested in Conservation Halton's August 16, 2012 correspondence, please provide a discussion and conceptual figure to determine/demonstrate how the proposed infiltration swales would fit into the buffer given the location of the trails and plantings. Staff did note that in Table WB-4-1001 in Appendix 4-7 that the table indicates that there will be more runoff generated from the property then what the "available volume of roof water" minus monthly infiltration capacity would suggest. We have assumed that this is because the monthly infiltration capacity includes the subsurface gravel wetland (which does not receive roof top runoff) as well as the infiltration swales. Staff do not anticipate that this will affect the outcome of the report's recommendations/findings however we request confirmation that our assumption is correct or clarification on this matter.			The understanding regarding Table WB-4-1001 is correct. The available capacity includes the swales that are to receive clean roof runoff (840 m^3/month) plus the capacity of the Subsurface Gravel Wetland and connected infiltration swales which are to receive treated stormwater. Excess clean roof water received by the infiltration swales is conservatively assumed not to infiltrate and therefore is treated as runoff.
13	Section 4.4.4.6	**Discussion of Potential for Base Flow Reductions to Watercourses –** See above comments.	1	AK	Noted
14	Section 4.4.4.7	**Dewatering Potential, Page 4-43** – In addition to utilizing a clay liner where the SWM ponds intercept the Shale Bedrock, it is suggested that a clay liner should also be applied where groundwater enters into the pond through localized sand seams. If this suggestion is carried forward this should also be noted in the Conclusions section (Section 4.5).	1	AK	This will be noted in the conclusions.
15		Addressed.	-	-	-
16	Section 5	**Natural Heritage –** It is the opinion of staff that the potential implications of the proposed stormwater management plan as outlined in Section 7.0 has not been fully discussed within Section 5.0. For example, while Section 7.0 does not provide a summary of the proposed flow regime at key node locations throughout the development area, it would appear that Reach 14-12A will experience a significant reduction in flows while	1	SVH	Due to additional modelling investigations, we believe the post-development drainage patterns will be much more closely matched than previous submissions and will be demonstrated to be

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		Reach 14W-11/11A/23 will experience some reduction in flows. The changes within Reach 14W-12 upstream and downstream of the proposed SWM pond outlets is unknown. Once Section 7.0 has been updated to clarify the proposed flow regimes within each of the watercourse reaches relative to existing conditions these changes should be addressed within Section 5 with respect to natural heritage features and functions (fisheries, fluvial geomorphology, terrestrial ecology, etc.).			appropriate.
17		Addressed	-	-	-
18	Section 5.2.1.5	**Hydrologic Features 'A' and 'B', Page 5-9 & Figure 5.1 -** The text does not identify the Hydrologic 'B' feature located on the Subject Property immediately west of 3367 Dundas Street West. Figure 5.1 indicates some features such as Provincially Significant Wetlands and Cores beyond the Subject Property limit but not the Hydrologic Features A and B. We recommend that Figure 5.1 include all Hydrologic Features shown in NOCSS whether they are located within the Subject Property or not to ensure consistency.	1	SVH	Figure 5.1 will be revised to include all Hydrologic features.
19		Addressed.	-	-	-
20	Section 5.3.3.1	**(Species at Risk)** - While staff appreciate that discussions with MNR with respect to ESA requirements for Bobolink, Barn Swallow, Eastern Meadowlark, Redside Dace are ongoing, it should be noted that a decision from MNR on the identification of habitat of endangered and threatened species as per the PPS also remains outstanding. In the absence of such information, staff are unable to advise the Town as to whether the proposal is consistent with provincial policy.	1	MC	Noted. As indicated in an email to CH dated June 4, 2013, the proponent has been in direct contact with the MNR following the departure of John Pisapio to determine the appropriate MNR staff representative that will be assigned to the project in a consistent manner. In an effort to avoid large scale revisions to the development plan we are continuing to engage the MNR to ensure that they are aware of the proposed approach and that their input is incorporated into the design. This approach is favourable to gaining CH/Town approval and then reviewing with the MNR. Furthermore, the data provided in the EIR identifies previous observations of Bobolink with subsequent discussions with MNR to determine the need for

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					species specific surveys. The observation of Barn Swallow during breeding bird surveys are also noted in the EIR, impacts to this species are still being reviewed. Furthermore, the NOCSS is clear on its delineation of the Redside Dace habitat however, given the differences in the delineation of habitat for this species and the NOCSS delineation additional discussions with the MNR are warranted.
21	Section 5.3.3.3	**Regionally Rare/Uncommon Species** – Addressed.	-	-	-
22	Section 5.3.4.4	**Aquatic Habitat Reach 14W-11A, 14W-11, 14W-13, 14W-14** – Addressed	-	-	-
23	Section 5.3.4.4	**Aquatic Habitat Reach 14W-14** – No further comment required.	-	-	-
24	Section 5.3.4.4	**Aquatic Habitat Reach 14W-14A** – Concerns over the proposal to compensate for feature 14W-14A with on line wetlands remains outstanding. Constructed on line wetlands at a local channel realignment project were inspected recently; these wetlands were observed to grow thick vegetation (e.g. cattails) through the thalweg of the creek channel during dry years leading to barriers to fish passage and potentially the loss of fish habitat. As such, online wetlands as a component of a natural channel design (where consistent water flow could be a limiting factor) are discouraged. A meeting with the proponents to discuss various aspects of the natural channel design elements and issues related to this property is requested.	3	SVH	On-line wetlands have been proposed due to their successful implementation on other MMM projects under the direction of MMM's senior watercourse rehabilitation specialist, who is also directing the natural channel designs and watercourse enhancements for this project. On Carleton Creek in Markham, the natural channel and on-line wetlands were completed 4 years ago in 2009 and the wetlands, except for a fringe of cattails around their perimeter, have remained free of vegetation. The project required a DFO permit and monitoring reports were submitted to DFO in 2010 and 2012. DFO reviewed the monitoring reports and found the performance and functioning of the wetlands to be acceptable. These on-line wetlands are similar to those being proposed for the Bentall lands. We are unclear as to the design features that may be contributing to the deterioration of the on-line

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					wetlands in the other project, but feel it is premature to discount their provision as compensation as this point. We note that Conservation Halton in comment #1 above has offered the option of relocating the pond as an equivalent length of stream, constructed to the medium constraint (blue) standard as a defined channel system, along with functions (a-d) that should be reproduced and enhanced in a stream corridor.
25	Section 5.3.4.4	**Aquatic Habitat Reach 14W-16** – Discussion of location for deposit of fish from pond is necessary; the site for relocation of fish should be approved by CH and MNR staff. This can be determined at the detailed design stage.	1	MC	Noted
26		Addressed.	-	-	-
27	Section 5.3.4.4	**Aquatic Habitat Reach 14W-12A** - Staff do not agree that this channel would only support generalist species due to the repeated occurrences of Redside Dace in the downstream sections of this watercourse and the lack of barriers to fish passage between the upstream and downstream sections of this watercourse.	2	MC	Noted. Although there may be a hydraulic connection during short periods in the year, the function as fish habitat of Reach 14W-12A is limited as stated in the EIR this reach appears "…*to provide negligible, seasonally direct fish habitat during periods of flooding and spring freshet affording fish passage to upstream reaches*" *due to "intermittent/ephemeral flows, marginal habitat present and the artificial nature of this channel (constructed to convey flow from Reach 14W-14A).*" Given the conditions observed on site with dense cattails at the downstream section of 14W-12A at the confluence with 12W-12 it is likely that passage would be inhibited for the majority of the year with likely low potential for passage during high flow periods, echoing the point made in CH Comment 24 related to "thick vegetation (e.g. cattails) through the

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					thalweg of the creek channel during dry years leading to barriers to fish passage and potentially the loss of fish habitat". Furthermore, there are obvious differences in habitat between the two reaches with 14W-12 consisting of a more diverse naturalized channel and 14W-12A an excavated ditched section (as indicated by historic aerial photography). As a result the function of reach 14W-12A varies substantially from the downstream reach of 14W-12 if fish were able to access the site and does not appear to contain habitat preferred by Redside Dace. It is acknowledged that the reach 14W-12A has the potential to provide a degree of fish habitat, the poor connectivity to downstream fish communities, ephemeral/intermittent flow regime and the absence of habitat preferred by Redside Dace, we maintain that this reach likely provides negligible, seasonally direct fish habitat during periods of flooding and spring freshet. Regardless of its actual function as fish habitat and specifically Redside Dace habitat (contributing or occupied), the corridor associated with a High (red) constraint watercourse has been assigned to this reach. As a result it is to be protected as intended in NOCSS and should no longer be an issue.
28		Addressed.	-	-	-
29	Section 5.3.7	**Hydrogeology** – Addressed.	-	-	-
30	Section 5.9.2	**Fish Habitat Compensation Concepts, Removal of Reach 14W-14A** – This section appears to be missing from the updated document. Staff maintain concerns regarding the construction of a stormwater management pond primarily due to the feasibility of mitigating thermal	1	MC	Noted.

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		impacts on downstream Redside Dace communities – see further comments below.			
31	Section 5.9.2	**Fish Habitat Compensation Concepts** – See above.			
32	Table 5.10	**Summary of Potential Impacts to Aquatic Resources** – Table 5.10 in previous EIR-FSS is now numbered as 5.11 Summary of Potential Impacts to Aquatic Resources: • Bullet # 1 addressed. • Bullet # 2 addressed and will need to be revisited at the detailed design stage. • Bullet # 3 It is requested that for the distance that the road encompasses or crosses a watercourse that is not to be realigned, that the same distance upstream and downstream of the watercourse be planted with appropriate native vegetation. For example, if a 20 meter wide road is proposed to cross a watercourse that is not to be realigned, then appropriate vegetation could be planted both upstream and downstream of the proposed road crossing structure. This would need to be coordinated with the MNR regarding Redside Dace requirements. • The following comments need to be added to this table regarding surface water drainage diversions: o lack of flow to Reach 14W-12A is of significant concern; o potential reductions of surface water flow to Reach 14W-23/11 are of concern; o there is not enough information to assess the changes to Reach 14W-12; o Please address the impacts that these proposed water diversions will have on the fish communities and fish habitat in the above noted watercourses. • RE: Column Entitled Residual Effects: It is maintained that open bottom road crossings over watercourses are preferred. Given	1	MC	Noted. Text to be revised in future submission.

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		the extent to which groundwater is entering the watercourses on the property through clay till soils that are cracked and fissured, open bottom culverts will help maintain groundwater inputs to these watercourses as well as recharge functions. With respect to road crossings over Redside Dace streams, MNR's Draft Guidance for Development Activities in Redside Dace Protected Habitat document provides the following recommendations: o New/replacement crossings in unconfined valleys (i.e., undefined valleys), stream crossings should be open bottom culverts designed to span the meander belt of the stream. The length of the culvert should be minimized by using retaining walls vs. longer culverts to minimize disruption to riparian habitat.			
33		Addressed.	-	-	-
34	Figure 5.2	**(EIR Vegetation Communities)** - At this time, it is staff's understanding that no works are proposed within the S3S4 Dry Oak – Hickory Deciduous Forest Type (FOD2-2), located within the portion of the red stream identified for rehabilitation (14W-11) . Should this change, we recommend that a meeting be convened with the Town of Oakville, Region of Halton, Conservation Halton and the proponent in order to determine a compatible treatment for this area.	1	MC	Noted
35	Section 5.8.6	**(formerly Section 5.9.5, Monitoring)-** MMM's March 30, 2012 response document indicated the following with respect to monitoring: • "A comprehensive natural heritage monitoring plan will be developed for the subject property in accordance with the NOCSS and will include pre, during and post-development monitoring of vegetation, amphibians, birds and benthic invertebrates at select locations. A monitoring study Terms of Reference including a figure identifying proposed monitoring locations will be developed and submitted to CH and the Town of Oakville, and the agreed upon monitoring plan will be appended to the revised EIR."	1	MC	Noted. Terms of Reference for the Monitoring Plan under development and will be submitted upon completion.

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		As such, staff request that the Terms of Reference be provided for our review as indicated. Further, the last paragraph indicates that additional monitoring for SWM facilities will be presented in Section 6. Staff could not locate this information within the report. Consistent with MNR's document entitled Draft Guidance for Development Activities in Redside Dace Protected Habitat, it is requested that a target of 24^{0}C for surface water temperatures, 7 mg/L for dissolved oxygen levels and total suspended sediment levels that are less than 25 mg/L above background levels be set as a target for stormwater effluent and water quality across the property. The recommendation for total suspended sediment levels is consistent with the level recommended by the Canadian Aquatic Water Quality Guidelines for the Protection of Aquatic Life for Total Particulate Matter.			
36	Section 5.10 (s/b 5.9)	**Conclusions and Recommendations -** Staff are appreciative of the demonstrated efforts to infiltrate stormwater on the subject property. It is noted that the bulk hydraulic conductivity of the soils near the surface on the property were measured to be 10^{-3} to 10^{-5} based on percolation tests (Section 4.3.2.2.1), which is significantly higher than what the monitoring well testing indicated (Section 4.3.2.2) and is more similar to the hydraulic conductivities expected for sand. As such, the potential exists for greater infiltration on the subject site then what the water balance predicts. We are satisfied however that this can be best addressed at the detailed design stage as noted in Sections 7.3.2.1 and 7.3.2.2 of the report. **Staff request that Town Subdivision review staff convey to their Site Plan technical review staff the importance of re-assessing the feasibility of additional LIDs on every site within the subject area.**	1 2	AK	Noted. In response, the two percolation tests were completed at a very shallow depth, and as originally stated in the report the results were higher than would be expected for the type of soils encountered at the site. The results were considered useful however for illustrating the effect of weathering and fracturing on increasing the bulk hydraulic conductivity in the shallow zone. The bulk hydraulic conductivity of the clay-rich Till will decrease with depth as the soils become less exposed to the effects of surface weathering. We also wish to reiterate that site grading activities will remove essentially all of this upper weathered zone of the Till soils in the developable land parcels, either through removal at cut areas, or from compaction of engineered fill in the low areas. The resulting exposed surficial soils will low conductivity clay-rich

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					soils which will not be conducive to mitigating infiltration. We do not agree that the potential exists for greater infiltration on the site that the water balance predicts. The water balance is based on clay-rich soils (predominantly Soil Type D (~80%), with some Soil Type D (~20%)). The water balance predictions of monthly base flows in the watercourses were identified in the report to be in close agreement with flows measured at the watercourses within the site. Additional investigative techniques such as percolation testing would be carried out during detailed design in the areas where infiltration measures, such as infiltration swales, are specifically proposed along the periphery of the natural environment areas. As noted in the report and in the response above, site grading activities (cut and fill) over much of the developable land area will leave large areas of the site with exposed soils that are not conducive to effective mitigative measures using infiltration.
37	Section 6.3.1.1	**Meander Belt Width, Page 6-2 & Appendix 6.7** • Reach 14W-12A is not included within Table 1 within Appendix 6.7. Staff anticipate that the values provided for this reach in Table 6.1 on Page 6-3 will be acceptable for pre-development conditions based on information available elsewhere in the report but request an update to Table 1 in Appendix 6.7 to verify the recommended value. • This section or another section of the report should provide recommended post-development meander belt widths	2	SVH	• Table 1 in Appendix 6.7 will be modified to include Reach 14W-12A. • Comment noted. • Under the existing condition the reach 14W-12A receives controlled discharge from the existing pond. It should be noted that existing pond (identified as 14W-14A) does not have any outlet locations at the south end. Hence, as the existing pond becomes

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		considering the post-development hydrologic regime for the various watercourses (See Section 7 comments below). • Staff agree that Reach 14W-12A is hydraulically distinct from the remainder of 14W-12, however, we disagree with the statement that Reach 14W-12A will continue to receive controlled discharge from SWM Pond 3 which is proposed to outlet directly to Reach 14W-12.			full, the water in the existing pond backs up and exits the pond via 14W-12A stream corridor.
38	Section 6.3.2	**Regulatory Floodplain, Page 6-3 –** • A digital copy of the hydraulic models for **all** reaches are required to complete our review. Conservation Halton staff will not be providing any further comments on flooding hazards unless digital copies of the models are submitted. • Hard copy model and mapping remains outstanding for Reach 14W-14A. • Reach 14W-11 and 14W-11A floodlines are not shown on Figures 6-2.1A (existing) and 6-2.1B (proposed). • Hard copy model remains outstanding for Reach 14W-11 & 14W-11A. • The hydraulic section locations shown on Figure 6-2.1A do not match those utilized in Appendix 6.1 for Reaches 14-12A, 14W-13, and 14W-14. These should be made consistent to facilitate future reviews and prevent confusion. • See also Comment #55 below regarding Appendix 6.1.	1 & 2	SVH	• To be provided. • Comment noted. • Comment noted. • To be provided. • The hydraulic section location shown in Figure 6-2.1A were found to match the hydraulic sections or river stations shown in Table 6-1.7 for the Pre-Development Condition. Additional clarification on this matter is required. • Will be addressed as #55.
39	Section 6.3.3	**Top of Bank, Page 6-4 –** Conservation Halton staff look forward to receiving the outstanding slope stability assessment for Reach 14W-11. Staff note that there is a typographical error at the end of this section that directs the reader to the incorrect Appendix.	1	SVH	The slope stability analysis has been completed by Exp. Inc. for Reach 14W-11. It report will be submitted in the next submission. However, if the CH wishes to review it now, it can be sent beforehand.
40	Section 6.3.5	**Setback and Buffer Requirements, Page 6-5** – This section has not been updated to clarify what the proposed setback and buffers are applied to nor does it reflect the correct setbacks. Further, we would like to note that watercourse 14W-11 A meets the definition of Redside Dace habitat in the ESA's Ontario Regulation 293/11. As such, this	2	SVH/MC	Comment noted. Further discussion is required.

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		watercourse should receive an appropriate setback (meander belt width + 30 m).			
41	Section 6.3.6	**Hydrologic Feature 'A', Page 6-5** • The text incorrectly references Reach 14W-12 instead of Reach 14W-16 with respect to one of the Hydrologic Feature 'A's. The potential impacts to this Hydrologic Feature 'A' as a result of the proposed reconstruction of the bankfull channel should be discussed. • See Comment #53 below regarding the riparian flood storage analysis. Staff are not satisfied that the analysis demonstrates to-date that the storage associated with the Hydrologic Feature 'A' associated with Reach 14W-14A has been replicated.	1 & 2	SVH	• Correction will be made to the text and comments noted. • The reach 14W-14A is an existing pond. It should be noted that in the NOCSS (2006) flood plain analysis was conducted for the 14W-14A corridor. We have requested the up-to-date HEC-RAS model from CH to update our analysis.
42	Section 6.3.7	**Corridor Widths, Page 6-6 & Appendix 6.5** – • Reach 14W-11 details should be included within Table 6.3 on Page 6-6. • Table 6.3 should clarify the 7.5 and 15 metre setback/buffer with respect to what they are based on (fisheries or hazards) and if they are applied to the meander belt, erosion hazard or other. • Staff note that the values in Table 6.3 do not always match those provided in Appendix 6.5 or on Figure 6.3. All three sources should be consistent. • Table 6.3 and Appendix 6.5 should be clarified where corridor widths are being recommended for existing conditions, proposed or both conditions. Table 6.3 appears to be covering existing conditions whereas Appendix 6.5 appears to be covering proposed conditions (though without taking in account the proposed flow regime changes). • Footnote 'b' in the Appendix 6.5 table is incorrect and should reference 3 m instead of 6 metres as Column 7 notes that the Factor of Safety is to be multiplied by 2. • For clarity, it would be helpful if this section noted those areas	1	SVH	Comments noted.

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		where the corridor width must be extended in order to encompass the floodplain/top of bank plus 7.5 metre allowance. • Appendix 6.5 states that a stable top of bank analysis is not required for Reach 14W-11 while the cover response letter and Section 6.3.3 indicates that a stable top of bank assessment will be submitted. Once all of the outstanding issues have been resolved, it should be ensured that the Draft Plan of Subdivision is updated accordingly.			
43	Figure 6.3	**Corridor Delineation –** • 'Top of Bank 7.5 m Buffer' would be more accurately named '7.5 m Hazard Allowance' as it can apply to the flood plain, meander belt or top of bank. Staff noted one location on Reach 14W-11A where the 7.5 metre allowance has not been applied to the Regional Storm floodline. • 'Environmental Setback' would be more accurately named '30m Redside Dace Setback'. • The solid black line should be included within the Legend. We have assumed that this line represents the future limits of the Open Space and SWM Block lines. • A 'Regulated Area Buffer' is not required on Reach 14W-21. This will not be a feature regulated by Conservation Halton in the future. Any buffers required on this reach will be determined by Town of Oakville staff and should be referenced accordingly. • All pond grading within the regulated habitat of Redside Dace must be discussed with the Ministry of Natural Resources.	1 & 2	SVH	While reach 14W-21 was previously proposed as a drainage connection only to redirect flow from reach 14W-13 to reach 14W-22, we are proposing to widen the corridor and have it maintained as a medium constraint corridor and effective extension of reach 14W-22 (which is being managed as a red stream) to offset the drainage density issue. A recommendation on Conservation Authority regulation of this reach should therefore be revisited.
44	Section 6.4.1	**Conceptual Natural Channel Design** - Concerns regarding the inclusion of a step/pool system to enable the passage of fish up the steeper channel reaches as part of the design criteria have not been addressed. It is understood that step/pool systems are not being proposed therefore reference to them should be removed from the report.	1	SVH	Comment noted.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
U	New Comment, Section 6.4.2	**Hydrology, Page 6-7** – The drainage areas listed for Reaches 14W-11A, 14W-16 and 14W-22 are slightly higher than what would be suggested by Figures 7.1 and 7.3. Is this because Hwy 407 drainage areas are included within Table 6.4 but not shown on the figures? Please revisit/correct/clarify.	1	SVH	Comment noted.
45	Section 6.4.3	**Proposed Channel Morphology, Page 6-8 -** It is noted that the average channel slope for 14W-22 is 0.32%. There is concern that this slope is too flat to maintain enough energy in the channel to allow the water flow to continue to scour a clear channel and to prevent the overgrowth of vegetation in the watercourse. If the channel becomes overgrown with vegetation, this will result in a loss of fish passage and fish habitat. It is preferred that the average slope of the channel be a minimum of 0.5%. When the channel slope is too flat, water is observed to remain in the channel in a stagnant form; this situation leads to the overgrowth of algae. It is noted that the average channel slope for 14W-23 is 0.40 %. It is preferred that the channel slopes be steepened to a slope of at least 0.50 %. Please add "meanderbelt width" to the list of parameters in Table 6.5 – Morphological Parameters for Channel Diversion and Rehabilitation. Further, once post-development drainage areas, stormwater management concepts and hydrologic conditions have been finalized and clearly documented, this section of the report will need to be revisited. The specific equations, etc. utilized should be included within the detailed design brief that will be required in conjunction with the detailed design of the channel.	1 & 2	SVH	• The proposed diversion channels 14W-22 and 14W-23 are to be constructed between two fixed channel bottom inverts. Hence there is limited opportunity and flexibility in adjusting the channel gradient. • "Meanderbelt width" will be included in the list of parameters of Table 6.5. • Comment noted.
46	Section 6.4.4	**Road Crossings, Page 6-9** • Conservation Halton staff continue to require the opportunity to review	1 & 2	SVH	• Comment noted. • Digital copy of the hydraulic model to be

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		the proposed location of Avenue 1 and Burnhamthorpe Road relative to the Main Fourteen Mile Creek valley within the field. • A hydraulic analysis has now been submitted for the proposed crossings. **Staff require a digital copy of the hydraulic models in order to complete our review**, however, we provide the following preliminary comments on the information that was provided: 1. **Section 6.4.4.1, Design Criteria** – In addition to meeting MTO design standards, Conservation Halton staff require that all new roads be designed to provide full access and egress under Regional Storm conditions, and preferably flood free access. Staff note that the current design would meet these criteria as no road overtopping is proposed under Regional Storm conditions. Fluvial geomorphological requirements must also be addressed. 2. **Section 6.4.4.2, Modelling & Analysis** – Flow rates utilized in the analysis need to be supported. See Section 7 comments below. 3. **Section 6.4.4.3, Summary** – This section states that the flood lines plotted are based on existing contour lines. Flood lines should be based on proposed grades in those areas where the flood plain is proposed for alterations (i.e. Reaches 14W-22, 14W-23 and potentially Reach 14W-16). • MNR's *Draft Guidance for Development Activities in Redside Dace Protected Habitat* provides the following advice regarding stream crossings in Redside Dace watercourses in unconfined watercourses: The location of new stream crossings should be chosen to: • Minimize the width of the crossings • Cross over straight sections of the stream where there is less likelihood for bank erosion			provided. The preliminary comments are noted. • Comments noted. • Comments noted. • Comments noted.

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		• Cross at areas that have already been disturbed and avoid initiating disturbances in new areas of the stream • For new/replacement crossings in unconfined valleys (i.e., undefined valleys), stream crossings should be open bottom culverts designed to span the meander belt of the stream. The length of the culvert should be minimized by using retaining walls vs. longer culverts to minimize disruption to riparian habitat. • In addition to the BMPs listed above, any construction activity that must occur in the stream should also incorporate the BMPs outlined for indirect habitats (i.e., upstream areas) below. This includes restoring any temporary disturbances within the riparian habitat (i.e., 30 m on each side of the meander belt) by planting native species. • It is requested at detailed design that no armouring of the bed of the watercourses take place under all road crossing structures to enable the creek to self-maintain a dynamically stable thalweg and low flow channel underneath all road crossing structures. Open bottom culverts are requested for all road crossing structures: • To maintain effective fish passage over the long term in the event that downcutting of the watercourse occurs; • To maintain groundwater and surface water interactions (recharge and discharge) to continue to occur within the channels in the road crossing structures; • To allow the creek to self-maintain a dynamic low flow channel underneath the road crossing.			
47	Figures 6.4A to 6.4D	**Alignment and Planform Drawings (Creek Crossings and Block Widths)** • The Block widths shown on these figures will have to be revisited once all of the other comments have been addressed. Staff noted that currently some of the block widths shown don't match exactly the recommended widths elsewhere in the document.	1	SVH	• Comments noted. • Comments noted. • Comments noted.

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		• Channel alignments shown no longer account for proposed culverts. These figures should be updated accordingly as part of the final EIR/FSS though we recognize the final details can be worked out at the detailed design stage. • Please demonstrate that the road layout is such that the creeks cross under the roads where the creek plan form is straight; creek crossings under roads should be designed so the creek crosses under the road at a perpendicular angle to reduce the length of the watercourse that is located under the crossing. Previous comments regarding natural channel design remain outstanding and can be addressed at a forthcoming meeting with the proponent's fluvial geomorphologist and water resources engineer.			
48	Figures 6.4A to 6.4C	**Alignment and Planform Drawings (and Section 6.4.3.2 14W-22 Diversion & Section 6.4.3.3 14W-21 Diversion) –**As noted above and in previous comments, Conservation Halton staff are concerned with the potential for aggradation where the average channel slope is less than 0.5%. The current design proposes an average channel slope of 0.32% for Channel 14W-22 and 0.40% for Channel 14W-23, however, no discussion on the potential impact that this would have on sediment transport within and downstream of the subject reach was provided. As a general rule of thumb, Conservation Halton supports a channel slope in the range of 0.5% to 1.5% for sediment transport, and a minimum channel slope of 0.5% to support fisheries. This information is required prior to staff supporting the proposed channel design concepts.	2	SVH	The average channel slope for section 14W-22 has been determined based on natural channel design procedures based on fluvial geomorphologic principles and is appropriate for the channel form given the available channel elevations between the connection points to Reach 14W-14 and 14W-16. We will investigate methods to maximize the channel grades (such as reducing the amplitude of the designed meanders), but we ask that the Regulatory Authorities acknowledge the limits to this approach. We note several municipal drain watercourses in Ontario, typically located in other jurisdictions, that possess longitudinal grades lower than the indicated 0.5%. While these channel may possess issues in some cases with aggradation, the 0.5% stated minimum slope requirement is typically assigned to storm sewer systems to avoid deposition of suspended sediment in nearly impossible to clean locations. The existing open channels (red streams) cannot have their channel grades altered and the

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					proposed channels incorporate natural channel principles that provide a balance between erosion/aggradation and promotes a watercourse system that preserves the meandering nature of a healthy system. We do not intend to create a system prone to aggradation for the sake of development, however "rule of thumb" guidance on minimum channel grades should be reconsidered as direction on channel design.
49	Figure 6.4E	**Diversion Channel 14W-23 Alignment and Planform** – The resubmission did not demonstrate that there would be no erosion concerns at the sharp bends under higher flow events. Staff suggest that as one possible means of addressing this concern, that it be demonstrated that under Regional Storm conditions, the flood plain velocities and shear forces at the sharp bends in the creek block will be lower than the velocities and shear forces that can be withstood by vegetation.	1 & 2	SVH	Comments noted.
50	Figure 6.5	**Channel Corridor Sections Typical for 14W-22 –**Previous comments remain outstanding. A meeting regarding the channel forms proposed for the channel realignments is requested to take place soon after these comments are received by the proponents. Discussion as to whether "E" Type channel cross sections would be appropriate in the proposed scenarios is requested. There are concerns about the channel depths, channel sides slopes and width to depth ratios. These concerns are with respect to: low flow channels that may be too wide to optimally facilitate fish passage, wide channel bottoms that promote sun infiltration that could cause thermal warming, algae growth and excessive water evaporation. Further, we note that the figure has been revised, relocating the 3:1 side slopes into the meander belt width. The 3:1 side slopes should be relocated outside of the meander belt width and the 100 year erosion allowance similar to the approach utilized in the April 2012 submission.	1 & 2	SVH	Comments noted.

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51	Section 6.4.5	**Hydraulic Analysis, Page 6-14 & Appendix 6.1** a. A digital copy of the modeling remains outstanding. b. Flood plain mapping based on future conditions topography/grading remains outstanding. c. Post-development flow rates need to be clearly documented and supported. See Section 7 comments below. d. See Comment #55 regarding Appendix 6.1 for additional comments. e. Text indicates that the road crossings were not included within the modeling, however, Section 6.4.4. indicates that the culverts were modeled and they do appear to be within the hard copy model results provided in Appendix 6.1 so we assume that this statement is a typographical error.	1	SVH	Comments noted.
52	Section 6.4.6	**Maintenance of Riparian Storage, Page 6-14 & Appendix 6.2** a. Conservation Halton policies and NOCSS requires that flood storage be maintained for a full range of storm events. No loss of flood storage is considered insignificant due to the potential for cumulative impacts. The creek block designs must be modified accordingly. b. The riparian storage associated with Reach 14W-14A must be included within the analysis. It would appear that this may not be the case in the current analysis. c. The riparian storage analysis for Reach 14W-11A must be separated from the riparian storage analysis for Reaches 14W-14, 14W-14A and 14W-16 as it has a different receiving watercourse. d. Further to the last sentence in this section, staff note that Conservation Halton staff do not require the existing riparian storage associated with Reach 14W-13 to be maintained though we also do not allow for any storage within the proposed Reach 14W-21 to be included within the calculations. It would appear from the HEC-RAS output files that these reaches have not been included within the analysis	1 & 2	SVH	Comments noted.

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		however we require confirmation that is the case. Also further to the last sentence, staff note that any challenges created by "eliminating Reach 14W-14" are a result of the alignment/design proposed by the proponent and could be addressed through a redesign of Reach 14W-22 e. The analyses may need to be updated further once the proposed flow regime is clarified. The resubmission should discuss the implications of the proposed changes in flow rates within the subject reaches and undertake additional/modified analyses as necessary.			
53	Section 6.4.7	**Stream Length Requirements** – Conservation Halton staff continue to require the existing length of Reach 14W-14A be included and maintained in the stream length calculations. We also continue to be of the opinion that Reach 14W-21 cannot be utilized within the proposed conditions credits. As such, stream length densities have not been maintained.	1 & 2	SVH	Comments noted.
54	Appendix 6.1	**Regional Floodplain Analysis, 14 Mile Creek** – Submission of a digital copy of the models for all reaches remains outstanding. a. **Regulatory Floodplain** 1. Hard copy model and mapping remains outstanding for Reach 14W-14A. 2. Reach 14W-11 and 14W-11A floodlines are not shown on Figures 6-2.1A (existing) and 6-2.1B (proposed). 3. Hard copy model remains outstanding for Reach 14W-11 & 14W-11A. 4. The cross-section locations shown on the figure within the Appendices do not match those provided on Figures within the main body of the text or as referenced in Table 6.1.6. Staff request that consistency be ensured between these two sections to prevent future confusion. b. **Flood Discharges**	1 & 2	SVH	Comments noted.

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		5. Staff are generally satisfied with the pre-development flow rates provided in Table 6-1.1, however, these will need to be revisited in conjunction with finalizing the issue of the drainage boundary mapping (see Comment 56), which remains partially outstanding. 6. Post-development flow rates need to better documented and supported within the document (see also Section 7 comments below). A summary table of flow rates at all key nodes should be provided along with supporting documentation justifying the flow rates. In developing this summary/documentation staff note the following: • Interim development conditions should be presented if there is potential for higher flow rates as a result of proposed diversions not taking place at the same time. • Flow rates provided in Table 6-1.6 for River Stations 20 to 28 do not seem to reflect the flow rates from Table 6.1.3 for River ID 3, Reach 1 downstream of Hwy 407 (i.e. downstream of Cross-Section 16 as shown in appendix figure as opposed to main text figure). • The flow rates within the hydraulic analysis do not appear to account for proposed pond outlet points and while this would likely result in a conservative result from a flood plain mapping perspective it does mean that the flow rates provided cannot be utilized to assess instream flow changes with respect to fisheries, fluvial geomorphology or terrestrial ecology perspectives. It may also result in inaccurate riparian flood storage analyses. Flow rates should be consistent between Sections 6.0 and 7.0 of the report to prevent future confusion. • Flow rates based on updated hydrologic modeling must be supported by digital copies of all hydrologic models with supporting output file print outs where appropriate to facilitate the review. c. Addressed. d. **Manning's Roughness –** Conservation Halton staff continue to be of			

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		the opinion that a Manning's 'n' of 0.07 for the overbank areas is too low for future vegetative conditions within the creek corridor limits. e. Addressed. f. **Figure 6-2.1, HEC-RAS Cross-Sections** 7. Mapping was provided at 1:2000 and not 1:1000 or better as requested. Only 1 metre contour lines were provided which is typically not sufficient to finalize property limits, particularly, where the lands are flat. 8. From RS7 to RS10.5 there are several locations on Figure 7.1 where the flood line and watercourse line are shown in the same location. This would not be expected unless there is an entrenched channel. Since a digital copy of the model was not provided, staff could not review these areas in detail to gain a better understanding of the system. As such, we request that the mapping and modeling and location of the watercourse be revisited in this area to ensure the drawing accurately reflects the location of the watercourse and flood plain. 9. While cross-sections are shown for Reach 14W-11 and 14W-11A, the floodline is missing on Figures 6.2.1A & B. g. **Results** 10. No grading plans have been submitted for the proposed Open Space Blocks that would support the post-development conditions model. 11. As noted above, there are several outstanding issues with the models submitted to-date that must be addressed. 12. We have assumed that the proponent may be responsible for constructing the Avenue One crossing of Reach 14W-16 as part of their development in order to ensure adequate access to their lands, even though this crossing is located on lands under separate ownership. Staff note that the model results indicate minor increases in the Regional Storm flood elevation on the adjacent lands.			

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		Conservation Halton staff have no objections to these increases, subject to the landowners agreement along with their permission for the road to be constructed within their lands. Staff will require written agreement from the adjacent landowner for any increases on lands remaining within their ownership. h. Addressed.			
V	New Comment – Section 7	**Stormwater Management** a. Conservation Halton staff recommend that the report include greater discussion on how the larger Highway 407 West Area will be serviced that demonstrates that the proposed plan will not place undue constraints on other developments or the Natural Heritage System. Some of the discussion could be provided within existing sub-sections but a standalone subsection may also be warranted. Staff apologize for not identifying this gap in our previous comments. b. Staff have not reviewed in any great detail the proposed stormwater management concepts presented for the east side of the Main Fourteen Mile Creek Natural Heritage System (Core 1) as there is no supporting documentation for the proposed concepts. Figure 8.5 and the text of the document should state very clearly that the stormwater management concepts presented for east of Core 1 have no standing and will have to be revisited in their entirety through the EIR/FSS process when development proceeds in that area. c. Figure 8.5 indicates that a single SWM pond will service lands immediately west of the Main Fourteen Mile Creek Natural Heritage System (Core 1), however, Table 7.3 indicates that flows will be directed to both Culvert FM-D4a and FM-D5, which suggests that a portion of this area will not be directed to the SWM pond but rather to the existing culvert FM-D4a. We anticipate that the details of servicing this block of lands can be dealt with under a future EIR/FSS, however, sufficient	1 & 2	SVH	Comments noted.

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		explanation should be provided in the current document to outline what is being relied on for the current servicing plan and what stormwater management concepts can and/or will have to be determined as part of the future EIR/FSS required for the adjacent lands. d. Staff are satisfied that the lands located between Reaches 11/11A and Core 1 (i.e. Block P3) are best serviced through their own SWM measures as indicated on Figure 8.5.			
55	Section 7.4	**Proposed Stormwater Management Approach, Page 7-4 –** This section should be revisited as necessary in conjunction with addressing the following comments. Please note the following section quoted from MNR's Draft *Guidance for Development Activities in Redside Dace Protected Habitat*: *To maximize the absorption of nutrients and other contaminants and prevent them from entering streams, stormwater management facilities adjacent to Redside Dace habitat should be designed as hybrid extended detention wetlands/wet ponds. These facilities are more effective than traditional ponds at removing pollutants harmful to Redside Dace including nitrates, phosphorous and copper.* As such, it is recommended that end of pipe SWM facilities be designed to meet this criteria. Notwithstanding this recommendation, staff have provided the comments below on the stormwater management pond as currently designed.	1 & 2	SVH	Comments noted.
56	Section 7.4.1	**Existing Drainage Boundaries, Page 7-4 & Figure 7.1 –** a. As previously noted, the Highway 407 ROW should be included in the drainage area delineations (currently it is shown excluded) as well as any portions of the Dundas Street ROW that drain to the upstream side of the road culverts (the current figure is not clear in this regard). b. The drainage areas shown west of Neyagawa Boulevard do not match those provided in the Tremaine and Dundas Secondary Plan Subwatershed Study (Figure 4.1.1) and there is insufficient information provided on Figure 7.1 to verify the proposed revisions in this area. Sufficient contour information	1	SVH	Comments noted.

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		should be provided for this area to support the proposed drainage boundaries.			
57	Section 7.4.3	**Preliminary Grading Plans and Post-Development Drainage Boundaries, Page 7-5 & & Appendix 8.5 -** a. Insufficient grading information has been provided on Drawing G1 (Appendix 8.5). Grading information for all altered Open Space/Natural Heritage System Blocks must be provided. Any grading required beyond the road ROWS within the NHS should be identified. SWM pond inlet and outlet grades for all ponds west of Core #1 should be provided to ensure that the ponds can function as proposed. Use of cross-sections should be considered in key areas adjacent to the Natural Heritage System. b. Grading of as much as 6 metres is proposed immediately adjacent to the Natural Heritage system within future development lots. 3:1 slopes are proposed. Staff anticipate that landowners may not be willing to lose up to 20 metres of developable lands and as such, the potential requirement/use of retaining walls in these locations should be noted. If not, how these grade changes will affect drainage areas to the various SWM ponds should be taken into consideration as the 3:1 slopes typically slope away from the proposed receiving SWM pond. c. While approximately 15 ha of FM1102 located west of Tremaine Road **may** be redirected to culvert FM-D1 instead of to FM-D2 according to the Tremaine and Dundas Secondary Plan Subwatershed Study (TDSPSWS) it may not if a number of criteria with respect to downstream impacts and Riparian rights cannot be addressed satisfactorily through the Draft Plan approval process. Section 5.3.6.3 (Stormwater Management Pond Locations) of the TDSPSWS should be referred to for details. This possibility should be identified within Table 7.3 and recognized within the text portion of the section. We note that if	2 1 1	SVH AW AW	a. Comments noted. b. Comments noted. c. Comments noted. d. The flows from Subcatchment 3050 outlets to the 14W-17 and 14W-16 stream corridor. In the Tremaine and Dundas Secondary Plan Subwatershed Study (2009) a similar drainage pattern was indicated. e. Comments noted. f. Comments noted. g. Comments noted. This is essentially requesting that we provide detailed design for the entire subdivision at this time. We are agreeable to providing inlet and outlet grades on our drawings to confirm that they function as necessary but providing cross-sections for lands which we do not have building and site layouts is an unnecessary exercise. We do not propose to grade into the NHS other than the sloping associated with the road crossings and for the pond outlets. The use of retaining walls v.s. sloping is a business decision for our client. We will note the potential use of retaining walls at appropriate locations on the grading plan. We have considered the entire development block in our pond sizing calculations, should sloping be utilized, the drainage area and therefore the storage requirements for each of the ponds will decrease.

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		the diversion west of Tremaine Road does not occur the drainage area to Culvert FM-D2 will be increased by 21 to 22 ha instead of the 6 ha suggested by Table 7.3. d. Where will flows from Subcatchment 3050 (west of Tremaine Road) outlet? e. The report does not verify that the proposed external and internal subcatchment diversions will have no negative impacts on the receiving watercourses, wetlands and natural heritage areas. As such, Conservation Halton cannot endorse the proposed diversions at this time. f. The EIR/FSS does not discuss the potential that the upstream landowner may wish to realign the medium constraint Reach 14W-16 within their lands. While it is recognized that the adjacent landowner will be responsible for demonstrating fully that any proposed realignment on their lands is appropriate, sufficient discussion should be provided within the current EIR/FSS to demonstrate that the proposed alignment of 14W-22 along the west property line as opposed to along the current alignment as shown in the North Oakville West Master Plan will not negatively impact options for future creek realignments of appropriate lengths and gradients on the adjacent lands while ensuring feasible development layouts and SWM servicing options. g. There are concerns that the configuration of stormwater management controls may reduce surface water flows from the pre-construction surface water flow condition. Please note the following section of the Endangered Species Act: Development and infrastructure — Redside Dace 23.1 (1) This section applies to a person who carries out any of the following activities if the activity is likely to kill, harm or harass redside dace or to damage or destroy the habitat of redside dace: If the mitigation report is approved by a district			

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		manager for the Ministry, the person responsible for carrying out the activity referred to in the report shall comply with all of the following conditions to minimize the effects of the activity on redside dace:1. **The flow of a stream or other watercourse through the habitat of redside dace shall be maintained without interruption.** As such, it is recommended that a section be added to the EIR-FSS outlining how the post construction flow of the watercourses will match the preconstruction surface water flow in the watercourses on the property.			
W	New Comment - Section 7.4.5	**Conveyance of Major Storm Flows, Page 7-6** – The second paragraph makes reference to a Block C3 which staff could not locate on Figure 8.5	1	SVH	The reference will be clarified in the revised text.
58	Section 7.5	**Post-Development Hydrologic Analysis, Page 7-7** – a. The Main Channel and Off-Channel travel times (TMC & TOC) utilized in the post-development GAWSER model have been modified significantly from the previous submission. Staff request that calculations be provided to support the proposed TMC and TOC parameters. b. Flow rates at all points of interest should be provided in order to assess potential hydraulic, fluvial geomorphological, fisheries, terrestrial ecology, etc. impacts. Flow rates should be provided for any interim conditions that may exist (for example, just the Subject Lands developed) as well as ultimate conditions. c. Flow rates provided in Table 7.5 for Culvert FM-D2 assume that all potential diversions west of Tremaine Road have been completed. As the feasibility and timing of these potential diversions are unknown, Table 7.5 should be expanded to indicate potential interim flow rates if lands within Subcatchment 3000 proceed to development prior to the lands west of Tremaine Road and/or in the event that the external diversion of	1 & 2	SVH	a. In the first submission (2011) the TMC and TOC values used for the catchment contributing to Pond 3 were 0.15 hr and 0.05 hr, respectively. In the latest submission (2012) the TMC and TOC values used for the catchment contributing to Pond 3 were updated to 0.5 hr and 0.2 hr, respectively. In the first submission the TMC and TOC values that were used were quite low considering the size of the contributing catchment area of approximately 46 ha. Therefore, in the second submission, a more reasonable value which was representative of the size of the catchment was used. Furthermore, a sensitivity analysis of the TMC and TOC values used between the two submissions showed that although the peak values were higher in the first submission, the proposed SWM Pond 3 over controls the peak inflows and generates similar outflows in both conditions.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		flows are not demonstrated to be appropriate. d. Further to 'c' above, flow rates at Culvert FM-D1 and within the watercourse downstream of the confluence of the FM-D1 and FM-D2 culvert tributaries should be provided to ensure that instream targets are being met fairly between the developments west and east of Tremaine Road. e. Digital copy of the hydrologic model is required.			b. In NOCSS the reference points that were used for flow comparison were the culvert crossings on Highway 407 and Dundas Street. Similar reference points were used in this study for reporting flow rates. c. Comments noted. d. Comments noted. e. Digital copy of hydrologic model has already been provided. However, the copies will be resent.
59	Section 7.6	**Stormwater Management Facilities -** a. Page 7-8 states that no allowance has been made for runoff from Dundas Street. Staff recommend that runoff from Dundas Street and its anticipated widening be provided within the SWM facilities unless it can be demonstrated that it is technically not feasible to do so. b. Staff intend to discuss the future development and servicing of the Future Employment lands located between Reaches 14W-16 and 14W-22 with Town staff at an upcoming NOARM. Additional comments may be provided upon completion of these discussions. c. Table 7.6 indicates a drainage area of 46.1 ha to Pond 3 whereas Figure 7.3 indicates a drainage area of 43.2 ha for Subcatchment 3100, which is the area utilized in the GAWSWER modelling. This discrepancy should be explained or rectified. d. Staff could not reproduce the Target Peak Flow Rates provided within Tables 7.9 and 7.10. An explanation of how these flow rates were determined should be provided. e. Staff appreciate the thought behind the proposed infiltration trench and gravel wetland at the proposed outlet from SWM Pond #3. Staff request that additional conceptual details be provided on a plan view drawing to better illustrate the scope	1 & 2	SVH	a. The approximate road low point elevation of Dundas Street within the study limits is approximately 150 m. At the road low point, the elevation of the edge of travelled lane is approximately 149.79 m (assuming there are 2 east/westbound lanes at 2% slope and 1.5 m shoulder width at 6% slope). The proposed storm sewer at the edge of travelled lane will require approximately 1.8 m cover, resulting in a storm sewer invert of approximately 148 m. An approximately 250 m storm sewer at 1% slope is required to convey the runoff to the proposed SWM Pond 2, resulting in a sewer inlet invert of approximately 145.5 m, which is lower than the SWM Pond 2 permanent pool (PP) elevation of 145.75 m. The PP elevation of SWM Pond 3 is also considerably higher than the proposed storm sewer inlet invert elevation. Therefore, the runoff from proposed Dundas Street cannot be treated by the proposed SWM Pond 2 or SWM Pond 3. Furthermore the Regional water surface elevations in SWM Pond 2 and SWM Pond 3 are also higher than the proposed road elevation at Dundas Street.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		and scale of the infrastructure. Some preliminary analysis should be provided to demonstrate how effective the size of system currently being proposed will have on polishing and cooling the stormwater management in order to assist in the overall evaluation of the mitigation measures being proposed. f. Staff request that consideration be given to implementing a similar infiltration trench/gravel wetland at the proposed outlet from SWM Pond #2, with the infrastructure all located outside of the Natural Heritage System. g. Inlet and outlet elevation details should be provided as well as existing elevations within the receiving watercourses/NHS areas. Figures 7.4, 7.5 and 8.5 should be updated accordingly. h. Sediment dewatering areas should be shown on Figures 7.4 and 7.5 and their sizing justified in the report.			b. Comments noted. c. Table 7.6 indicates a drainage area of 46.1 ha to Pond 3 whereas Figure 7.3 indicates a drainage area of 43.2 ha for Subcatchment 3100. It should be noted that SWM Pond 3 accommodates runoff from both Subcatchments 3080 (2.9 ha) and 3100 (43.2 ha). Hence the total contributing area to SWM Pond 3 is 46.1 ha. Both Table 7.6 and Figure 7.3 are correct. d. The target peak flow rates in Tables 7.9 and 7.10 were determined by multiplying the unit flow rates reported in Table 7.2 by the appropriate contributing drainage areas. e. Comments noted. f. Comments noted. g. Comments noted. h. Comments noted.
			3	AW	Due to the location of SWM Facilities, existing topography and proposed grading, it is not feasible to convey runoff from Dundas Street to the proposed SWM facilities.
			1	AW	Additional details will be added to the figures as requested.
X	Section 7.6.3	Water Quality Control: This section needs to include information about how thermal pollution on downstream watercourses will be provided by all proposed SWM facilities. A multifaceted approach included 3.0 meter deep permanent pools, bottom draw outlets, adequately sized cooling trenches and cooling towers are recommended to sufficiently mitigate thermal warming of the downstream watercourses. We note that this recommendation may contradict the MOE Guidelines and Town of Oakville Guidelines, therefore further discussion between Conservation Halton, the MNR,	1	SVH	Comments noted.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		MOE and Town staff is required on this item. Pre-construction monitoring of the thermal regimes of the receiving water bodies downstream of the proposed SWM outlets is advised to be initiated as soon as possible in 2013.			
60	Section 7.7 & Appendix 7	**Erosion Control Analysis & Appendix 7** – a. As identified in Conservation Halton's September 6, 2011 comments, multiple analytical methods should be applied to determine the erosion threshold. As Appendix 7 has not been updated from the previous submission, staff continue to require provision of the results from at least three analytical methods as well as discussion that justifies the final method selected. b. As identified in Conservation Halton's September 6, 2011 comments, the erosion threshold needs to be established for the most sensitive reach downstream of a proposed SWM facility. As such, an erosion threshold should also be established for upstream of Dundas Street and compared with the value determined for downstream of Dundas Street. The more conservative value should then be utilized to determine the necessary erosion controls. c. Greater explanation should be provided on how the Erosion Indices incorporating critical shear were determined. Staff were unclear why the erosion indices were being quoted in hours. d. Table 7.15 on Page 7-20 indicates a 14% increase in the total duration of flows exceeding the erosion threshold value. The same table indicates a 17% increase in the hourly exceedance counts based on an Erosion Indices incorporating critical shear. NOCSS requires that post-development conditions match pre-development conditions with a recognition that results within approximately 5% may be considered acceptable as long as a full and thorough discussion is provided in order to understand the likely effects and implications as well as to determine whether further mitigation, modeling refinement or monitoring is	1 & 2	SVH	Erosion control analysis will be modified followed by additional field investigations.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		required. As such, it is our opinion that the current stormwater management concept does not meet NOCSS requirements. e. A more comprehensive analysis for downstream of culvert FM-D2 is required prior to any development proceeding on the lands west of the subject property. Staff note that this analysis may be required as part of the current EIR/FSS depending on the final stormwater management concept proposed. In the event that once the final SWM plan is determined, it is reasonable to defer this matter to the development of the adjacent lands, the current EIR/FSS should identify this outstanding issue and the requirement that it be addressed in the future EIR/FSS update supporting the development of the adjacent lands. f. It would appear that the proposed stormwater management scheme would result in extremely significant reductions in flows to Reach 14W-12A, moderate reductions in flows to Reach 14W-11/11A/23, and unknown changes to Reach 14W-12 upstream/downstream of the proposed pond outlets. The impacts of all of these changes have not been analysed in the report. Staff note that an erosion analysis could be performed for these reaches to demonstrate whether or not any proposed changes are appropriate.			
61	Section 7.8 & Appendix 6.4	**Topographic Depression Volumes** – As noted in our August 16, 2012 comments, the Topographic Depression Volume Analysis provided in Appendix 6.4 indicates that depression storage analysis was not undertaken on the Hydrologic Feature 'A' located on Reach 14W-16 (ID 6) as it will be kept in its original condition. The bankfull channel in this location however is proposed for alterations. As such, the EIR/FSS should confirm that either no changes to the depressional storage will be a result of the proposed channel reconstruction or provide clear direction on any mitigation measures that would be required at the detailed design stage to ensure that the topographic depression storage volume will be maintained. The updated EIR/FSS should also demonstrate on its grading plan and/or through other drawings that Hydrologic Features 'B'	1	SVH	Comments noted.

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		ID7 and ID8 will be left undisturbed or the topographical depressional storage analysis should be updated accordingly.			
62	Section 7.9 & Appendix 7.2	**Downstream Impacts for Regional Storm –** It is our understanding that Appendix 7.2 is unchanged from its original submission. As such, our September 6, 2011 comments remain outstanding as follows (minor modifications have been made to provide additional clarity): a. Appendix 7.2 indicates increases in Regional Storm water surface elevations downstream of the QEW. There are known flood damage centres downstream of the QEW where the Regional Storm extends onto private property and overtop of municipal roadways. No increases will be supported in these specific areas. As such, it is the opinion of Conservation Halton staff that based on the information provided the analysis does not demonstrate that there will be no adverse impact on downstream landowners (including private property) or land uses. b. In the event that the proponent wishes to continue to pursue the option of demonstrating that Regional Storm controls are not required, staff note that we will require the following information to be included in any such assessment: • A digital copy of the hydrologic and hydraulic models. • A hard copy of the hydrologic input and output files for post development conditions. • A hard copy of flood plain mapping at a scale that allows for a review of impacts. The mapping must clearly illustrate property limits and existing structures. The mapping should clearly identify all areas of increased flooding as well as the amount of the predicted change. • Unless the assessment demonstrates a zero increase in peak flows and flood elevations, the assessment must be extended to assume that Regional Storm controls will not be provided within any development	1 & 2	SVH	a. To be addressed. b. At cross-section 63 (River 1 and Reach 2), upstream of the Upper Middle Road Bridge Crossing the substantial difference (4.12 m) can be attributed to the convergence error in HEC-2 hydraulic analysis, in which case the HEC-2 software only shows the critical water surface elevation (122.59 m) upstream of the bridge. Whereas, the HEC-RAS hydraulic model does not have that limitation and provides an accurate water surface elevation of 126.71 m. It should be noted that the water surface elevations upstream of the bridge crossing are close to ±126.5 m, which is consistent with the HEC-RAS water surface elevations found upstream of the bridge.

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		upstream of Dundas Street within the Fourteen Mile Creek Watershed to ensure fairness to all developers. • Staff concur that the conversion of HEC-2 models into HEC-RAS can result in substantial changes to WSELs. The predicted increase as predicted at Cross-Section 63 (River 1, Reach 2), upstream of the Upper Middle Road crossing, however is very substantial (4.12 metre increase). Further discussion of this difference is warranted. • The original HEC-2 model for Fourteen Mile Creek has been updated in specific sections as development has proceeded within the watershed. As such, additional model modifications may be required to account for these works. The need for additional revisions will be determined once all of the other above noted concerns have been addressed and more detailed mapping and digital modeling has been provided in order to undertake an initial assessment of whether or not these model upgrades are necessary.			
Y	New Comment, Section 8	**Municipal Servicing** – a. The stormwater management infrastructure drawings and tables provided in Appendix 8.3 and 8.4, including storm sewers and culverts, should be updated accordingly in conjunction with any changes to the stormwater management plan resulting from the comments of all agencies. b. The EIR/FSS should clearly indicate that the proposed culverts, sanitary sewer, watermain and road crossings of the Main Fourteen Mile Creek reaches (Reaches 14W-1A, 14W-2 & 14W-11) as shown on the drawings in Appendix 8.4 have not been reviewed or approved and that they will be subject to modifications through the EIR/FSS approval process for the adjacent lands. c. Staff understands that portions of the watermain and the	1 1 1	AW AW AW	The design of the storm drainage system will be revised to reflect any changes to the overall stormwater management plan. A note will be added to this effect. The sanitary sewer above the existing FM-D4 culvert

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		Sanitary sewer along Dundas Street will be constructed by the proponent. Drawing P11 in Appendix 8.4 indicates an assumption of a minimum 0.4 metre clearance between the invert of the sanitary sewer and the top of the existing FM-D4 culvert. The drawing also indicates a minimum 0.5 metre clearance at Culvert FM-D5 though a clearance of over 2 metres is assumed for the profile. Staff anticipate that the existing culverts will likely have to be replaced with larger culverts or bridges at the time that Dundas Street is widened in the future. As such, staff request that the sanitary sewer servicing for the subject lands should allow for the maximum clearance possible between the tops of the existing culverts relative to the invert of the sanitary sewers in order to allow for maximum flexibility with the future culvert replacements. Staff will require confirmation from both the design proponent and Regional staff that the proposed design provides for maximum future flexibility. Staff apologize for not raising this in our previous comments. d. As noted under Comment # 57, additional grading information is required on Drawing GR1 in Appendix 8.5.			can be raised approximately 0.8m while maintaining minimum cover. This could be achieved by reducing the slope of the sewer on Dundas from Avenue Two to east of the culvert to 0.35% (from 0.5%). The sanitary sewer above Culvert FM-D5 is already at minimum cover and cannot be raised any higher. As noted in the comment, there is already a clearance of approximately 2m provided between the invert of the sewer and the top of the culvert. See response above.
63	Appendix 4.6	**Groundwater and Surface Water Quality** - Comment not addressed. A map of groundwater and surface water quality monitoring locations is still requested. Surface water quality results indicate that uranium, cobalt and zinc levels exceed PWQO at six out of ten sampling locations. These results also show that surface water levels of boron exceed the PWQO at 8 of 10 sampling locations. Please indicate if this situation has been addressed by the Ontario Ministry of Environment. It is noted that nitrates were not one of the parameters tested for with the surface water samples. Given that the previous land use of the property was pig farming, it would be helpful to include nitrates as a surface water parameter of interest.	1	AK	**Comment was addressed, and this wording is highly misleading.** Figure 4.4 shows the location of the surface water monitoring station SG-01 as was requested in the CA's letter dated September 6, 2011 ("*Staff were unable to locate a map depicting locations of surface water chemistry monitoring locations. Please provide these locations on a map*"). This was provided in the 2nd Submission. In response to the new comment stating that a map of groundwater sampling locations is still outstanding, the groundwater samples are identified in the tables by their well Identifications (e.g., MMM-

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
					09-19S), and the well locations are shown on Figures 4.3 and 4.4 (and other figures). This information is therefore already available in the 2nd submission. In response to the new comment regarding exceedences of uranium, cobalt, zinc and boron exceeding PWQOs at 6 to 8 out of 10 water sampling locations, we point out that a total of 9 locations were sampled (one twice). Eight of these locations are monitoring wells from which groundwater samples were collected (there are 9 samples shown from these 8 locations as the sample identified as MMM-09-17 (FD-1) is a field duplicate sample collected as part of the QA/QC protocols). There was one surface water sampling location. We note that there is no requirement to notify MOE of these results. Based on our review of the analytical results for both surface water and groundwater, the measured concentrations of metals and inorganic parameters do not pose a significant risk to human health and the environment. Nitrate was analyzed at all 9 sampling locations and the results were provided in Table WQ-2 and in the original laboratory analytical reports in Appendix 4.6.
64	Appendix 5.6	**Water Temperature Monitoring Data -** Comment not addressed to the satisfaction of CH Staff because the STATE analysis was not applied to the temperature data graph.	2	MC	Following numerous attempts to unsuccessfully use the STATE analysis software that was requested by CH we contacted the developer of the software for direction. The developer stated that error/crashing experienced by MMM staff was due to the sample size being shorter than 6 months and they have yet to resolve this issue.

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					As you are aware CH requested in their August 5, 2011 email that water temperature data collection in the farm pond with specific reference to water temperature data collection be initiated as soon as possible to include the month of August and extend to September 15th. This information was relayed by CH in advance of the email in a voicemail message from L. Smith in June and as a result the loggers were in place by June 30, 2011. Although the recording period collected data through the summer months and beyond, it was not sufficient to capture the required timeframe to allow the STATE analysis to work. Furthermore, an analysis of the water temperature was undertaken using 3 other acceptable methods. Water temperature data was initially assessed using the methods in the *Ontario Stream Assessment Protocol (OSAP) (Stanfield, 2005)* and *A Thermal Habitat Classification for Lower Michigan Rivers (Wehrly et al, 1999).* The general results were presented to CH during a site meeting and CH requested the assessment of the data using the *Evaluation of a Simple Method to Classify the Thermal Characteristics of Streams Using a Nomogram of Daily maximum Air and Water Temperature (Cindy Chu, et. al., 2009).* This third tool was also used to assess the water temperature data. All three methods yielded relatively consistent results and were presented in the EIR. Given the limitations of the STATE analysis tool, the

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					analysis of the data using other acceptable analysis methods and the relatively consistent results we trust that the temperature data as presented meets the requirements of CH's inquiries and continued analysis of the data is not required given the time/resources spent to date on this specific matter.
65	Appendix 8.3 Figure A	**Comment not addressed** - Figure A-8.3 should be updated to illustrate the proposed pond outlet locations.	1	AW	The figure will be revised as noted.
66	Appendix 8.4	• Drawing P1: There are concerns over the fill placement proposed in the valley surrounding 14W-16 (0 +375 to 0 + 500) located west of the Lazy Pat Property line and just east of the intersection of Avenue One and Avenue 2. There is concern that the watercourse will be disconnected from the floodplain if this fill is placed in this area. This disconnection could lead to in-stream erosion and higher shear stresses in the channel, which would have a negative impact on fish communities and fish habitat in this channel. A bridge structure that spans the meanderbelt width of the watercourse is the preferred crossing structure in this location. A creek crossing structure that meets these criteria would be in accordance with *Endangered Species Act* Guidelines. • Drawing P2: It is requested that the road crossings at 1 + 450 and at 1 + 525 in this drawing be designed as bridges that will span the meanderbelt width of the watercourse in accordance with *Endangered Species Act* Guidelines. • Drawing P2: There are concerns about fill placement in the valley areas where Avenue One crosses two tributaries of the Main Branch of Fourteen Mile Creek, one at 1 + 400 to 1 + 450 and the other at 1 + 500 to 1 + 550. There is concern that the watercourse will be disconnected from the floodplain if fill is placed in this area. Similar to the above, these crossings would need to meet MNR criteria for creek crossings in Redside Dace habitat. To meet this	2	AW	A bridge structure that spans the meander belt is not practical in this situation. We have completed the preliminary calculations to determine the opening requirements to properly convey the channel flows without creating the erosion issues noted here. These calculations will be further refined during the detailed design stage. We will deal directly with the MNR during the detailed design stage to address the requirements for all the crossings with respect to the Endangered Species Act. Wherever practical, watermains and sewer crossings will be made by either over the top of or attached to the structure.

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		criteria, a bridge structure that spans the meanderbelt width of the respective watercourse would be recommended. • Drawing P4: Staff appreciate the inclusion of an open bottom creek crossing structure at this location. Please confirm that the span of the proposed culvert will encompass the meanderbelt width of the watercourse as specified in MNR's Draft Guidance for Development Activities in Redside Dace Protected Habitat document. • Drawing P5: There is concern regarding the Burnhamthorpe Road crossing of the main stem of Fourteen Mile Creek (Reach 14W-1A). It is preferred that a bridge structure that spans the meanderbelt width of the watercourse be placed at this road crossing, which is consistent with the MNR Draft Guidance for Development Activities in Redside Dace Protected Habitat document. It is also preferred that the future watermain crossing be attached to the bridge structure. As no storm or sanitary sewer crossings of this valley are required, staff are satisfied that these details can be worked out in conjunction with the adjacent development; however, the EIR/FSS should clearly indicate that the current design has not been approved.			
67		Discussed in other sections. Technical Memorandum NH # 1 – Reach 14W – 14A Aquatic Habitat Prepared by MMM Group, March 28, 2012:	-	-	-
68	Section 3.1	**Fish Community Survey**: Details on the design and methodology used to collect fish were not provided in the EIR-FSS; comments remain outstanding.	1	MC	Data sent on January 9, 2013 via email. Will resend.
69	Section 3.3	**Supplemental Fish Habitat Documentation:** Water Quality Monitoring, Dissolved Oxygen comments were not addressed, raw data remains outstanding.	1	MC	Data sent on January 9, 2013 via email. Will resend.
70	Section 3.4	**Water Temperature**: Raw surface water temperature data was not provided, previous CH comments remain outstanding.	1	MC	Data sent on January 9, 2013 via email. Will resend.
71	Section 3.5	**Thermal Impacts of Proposed Conversion of Farm Pond to a Storm Water Management Pond**: It is again noted that cooling towers,	1	SVH	Appropriate thermal mitigation measures will be considered for all proposed SWM facilities.

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		vegetated islands and a north-south pond and outlet orientation were suggested by the MMM Group in their March 28, 2012 Technical Memorandum # 1 as methods to mitigate the warming effects of proposed SWM pond # 3. It is suggested that these thermal mitigation measures also be considered for other proposed swm ponds on the property.			
72		No further comment required.	-	-	-
73	Section 3.7	**Sediment Source**: Comment remains outstanding. This comment should be addressed through stream length compensation requested.	2	SVH	This comment is related to the Central SWM pond issue.
74	Section 3.8	**Organic Material Source**: Comment remains outstanding. Organic material can be compensated for by implementation of Conservation Halton's *Landscaping and Tree Preservation Guidelines*. These guidelines will be applicable to all realigned watercourses on the property.	1	MC	Noted. The principles identified in Conservation Halton's *Landscaping and Tree Preservation Guidelines* will be incorporated into the realigned channel reaches thereby contributing to theorganix material source. Once again we maintain that the transport of coarse organic material such as leaves and twigs from the pond, to downstream fish habitat is greatly inhibited by the intermittent connection to downstream fish habitat as well as the dense cattail growth at the inlet/outlet that would physically block the movement of this material.
75		No further comment required.	-	-	-
76	Section 4.0	**Conclusions**: Comment is no longer relevant.	-	-	-
77	Figure 1	**Bathymetric Survey/Approximate Fish Community Sampling Locations**: A fish relocation will be required for fish in the pond. Discussions with CH staff and Aurora District OMNR staff at the detailed design stage will be required to determine an appropriate location for fish present in the existing farm pond.	1	MC	Noted. This element of the project will occur during the detail design phase of the project.
78	Figure 3	**Pond Cross Section**: Comment no longer relevant.	-		
79	Figures 4 – 7	**Water Temperature Comparisons at a Variety of Water Depths**: Comment no longer relevant.	-	-	-
		Draft Plan of Subdivision 14T-11001	-	All	Draft Plan will be revised as part of the 3rd

No.	EIR/FSS Section(s)	HRCA Issue/Comment	Category	Responsibility (HRCA/MMM)	Response
		In light of the number of outstanding issues associated with the EIR/FSS, Conservation Halton staff have not undertaken a detailed review of the submitted Draft Plan. Once the limits of the corridors and SWM servicing requirements are finalized within an updated EIR/FSS, the Draft Plan should be revisited and updated accordingly.			Submission.

Mark Cece

From: Jefferis, Samantha (MNR) <Samantha.Jefferis@ontario.ca>
Sent: Thursday, July 25, 2013 2:47 PM
To: Mark Cece
Subject: RE: North Oakville - Lazy Pat Lands
Attachments: LazyPat_RSD_25Jul13.pdf

Hi Mark,

[redacted]

I have attached a map (NOT FOR DISTRIBUTION) that provides a rough outline of which reaches on the Lazy Pat lands are considered occupied Redside Dace reaches (meanderbelt +30m buffer applies) and which may be considered contributing Redside Dace reaches. The map is just a quick representation so do not take the coloured lines as actual watercourse mapping (lines are rough). Additionally, the extent of both the contributing and occupied reach colouring is also drawn on roughly so where the colours extend to and/or converge is not accurate. Please note that this map does not delineate regulated Redside Dace habitat in the sense that it does not map the meanderbelt +30m. As you can see this map confirms what you have illustrated in your below figure.

To confirm:
Occupied reaches: 14W-12 and 14W-16
Potential contributing features: 14W-11, 14W-13 and 14W-14 (14W-14 confirmed as contributing by John Pisapio, as per October 20, 2011 site meeting minutes)

I hope this helps. If you have any questions please don't hesitate to contact me.

Regards,

Sam Jefferis
Assistant Species at Risk Biologist
Ministry of Natural Resources
50 Bloomington Road, Aurora, ON L4G 0L8
Phone: (905) 713-7369
Email: samantha.jefferis@ontario.ca

Ministry of
Natural Resources
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50 Bloomington Road
Aurora, Ontario L4G 0L8

Ministère des
Richesses naturelles

Telephone: (905) 713-7400
Facsimile: (905) 713-7361

Ontario

September 6, 2013

Sonia Rankin
MMM Group
100 Commerce Valley Drive West
Thornhill, Ontario
L3T 0A1

Dear Ms. Rankin:

Please find enclosed a Licence to Collect Fish for Scientific Purposes #1075281. Please print off 2 copies of the licence and conditions, sign both copies and return one signed copy to me via email. Your signature is acknowledgement that you understand and agree to the terms and conditions of the licence. You and your assistants are required to carry a copy of this licence with you at all times while collecting specimens.

As noted in the conditions, you must complete a two-part Mandatory Report for fish collected under this licence. MNR has developed a new electronic report form to facilitate efficient reporting. The Mandatory Report, user guide and field definitions will be sent to you by email. The completed mandatory report for licence #1075281 must be submitted by November 30, 2013 to scp.aurora@ontario.ca.

Please note that all collections and sampling must be in compliance with the best management practices identified in the enclosed technical bulletin. A fish disease known as Viral Hemorrhagic Septicemia (VHS) has been confirmed in the lower Great Lakes and some inland tributaries as well as in Lake Simcoe. A VHS Management Zone for the lower Great Lakes and some inland tributaries as well as a Lake Simcoe Management Zone have been created to slow the spread of VHS and invasive species. A map is attached to assist you in determining the location of your work site(s) in relation to the two VHS management zones where waters are considered to be VHS positive. Please feel free to contact us should you have any questions regarding the definition of VHS positive waters.

Please contact me if you have any questions.

Yours truly,

K. Golby

Karen Golby
Business Services Clerk
Aurora District Office
Tel: (905) 713-7403
Fax: (905) 713-7361



2012 Map of New VHS Zones.pdf

BMP_Sci Coll Permits 2012_Final_December 22 2011.pdf

2012 VHS Risk Assessment - SciCollPerm - final December 22 2011.pdf

Ontario

Ministry of Natural Resources

Ministère des Richesses naturelles

Licence to Collect Fish for Scientific Purposes

Permis pour faire la collecte de poissons à des fins scientifiques

Licence No. / N° de permis	1075281
Local Reference No. / N° de référence local	
Issuer Account No. / N° de compte du délivreur de permis.	7491147

This licence is issued under Part I of the Fish Licensing Regulation made under the Fish and Wildlife Conservation Act, 1997 to:

Ce permis est délivré en vertu de la Partie I du règlement sur la délivrance de permis de pêche formulé conformément à la Loi sur la protection du poisson et de la faune de 1997 à:

Name of Licencee / Nom du titulaire du permis

Last Name / Nom de famille	First Name / Prénom	Middle Name / Second Prénom
Ms. Rankin	Sonia	

Name of Business/Organization/Affiliation (if applicable) / Nom de l'entreprise/de l'organisme/de l'affiliation (le cas échéant)

MMM Group

Mailing address of Licencee / *Adresse postale du titulaire du permis*

Street Name & No./PO Box/RR#/Gen. Del./ N° rue/C.P./R.R./poste restante

100 Commerce Valley Drive West

City/Town/Municipality / Ville/village/municipalité	Province/State / Province/État	Postal Code/Zip Code / Code Postal/Zip
Thornhill	ON	L3T 0A1

to collect the species, size and quantites of fish from the waters as set out below.
Pour faire la collecte des espèces suivantes (stade et nombre indiqués ci-dessous):

Species / Espèces	Eggs / Oeuf	Juvenile / Fretin	Adults / Adulte	Numbers / Nombre	Name of Waterbody / Nom de l'étendue d'eau
	X	X	X		
fish		X	X		Stormwater Management Ponds (as per attached Schedule A)

Yes/Oui ☐ Additional species/Waterbody list attached / Liste d'espèces/d'étendue d'eau additionnelles ci-jointe

Purpose of collection / *But de la collecte*: Fish Rescue

Licence Dates / *Dates du permis*

Effective Date / Date d'entrée en vigueur (YYYY-MM-DD)	Expiry Date / Date d'expiration (YYYY-MM-DD)
2013-09-06	2013-10-31

Licence conditions / *Conditions du permis*: This licence is subject to the conditions contained in Schedule A if included. / Ce permis doit respecter les conditions de l'annexe A si celle-ci est jointe.

Yes/Oui ☒ No/Non ☐ Schedule A included. / Annexe A ci-jointe

Issued by (please print) / Délivré par (veuillez écrire en caractères d'imprimerie): Elizabeth Stanley

Signature of Issuer / Signature du délivreur

Date of Issue/Date de délivrance: (YYYY-MM-DD) 2013-09-06

Signature of Licencee / Signature du titulaire du permis

Date: (YYYY-MM-DD) 2013-09-06

Personal information contained on this form is collected under the authority of the Fish and Wildlife Conservation Act, 1997 and will be used for the purpose of licencing, identification, enforcement, resource management and customer service surveys. Please direct further inquiries to the District Manager of the MNR issuing district.

Les renseignements personnels dans ce formulaire sont recueillis conformément à la Loi sur la protection du poisson de la faune, 1997 , et ils seront utilisés aux fins de délivrance de permis, d'identification, d'application des règlements, de gestion des ressources et de sondage sur les services a la clientèle. Veuillez communiquer avec le chef du district du MRN qui délivré le permis si vous avez des questions.

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1075281
No de permis

This licence is subject to the conditions listed below.

1. Licencee may collect fish in Summerhill North stormwater management pond located between Rushbrook Drive and Bartholomew Drive; Summerhill South stormwater management pond located south of Mulock Drive between McBride Crescent and Columbus Way; Summerhill Woods stormwater management pond located south of William Dunn Crescent in the Town of Newmarket, Regional Municipality of York.

2. All fish captured will be euthanized and will not be returned to the waterbody.

3. This Licence is valid only for the persons, species, numbers, areas and calendar year indicated. A Mandatory Report documenting the sampling conducted under this licence must be submitted to the licence issuer within 30 days of the termination date, but in no case later than January 31 next following the year of issue. The Mandatory Report form (Part 1) must be completed for each sampling program and the Site.Collection Reports (Part 2) must be completed for each collection site. A map clearly indicating the location of each collection site must be attached to the Site Collection Reports. Submit the Mandatory Report (Part 1) and the Site Collection Reports (Part 2 & maps) electronically by email to scp.aurora@ontario.ca. The submission of a satisfactory report is a prerequisite to any subsequent renewals.

4. Before carrying out any operation under the licence in any area the licenced person shall inform the Area Supervisor or Lake Manager of his or her intentions at least a week before commencing work and include information as to the type of operation, location, duration, and the name or names of personnel involved.

5. A copy of the original licence must be carried by the licenced person when working at the designated sites. An assistant of the licenced person who is carrying out activities under this licence during the absence of the licenced person shall carry a copy of the licence on his or her person.

6. All collection gear shall be clearly marked with the licenced person's and the organization's name.

7. This licence is not valid in Provincial Parks, park reserves, or National Parks without the written permission from the authorized person in charge of the area concerned.

8. Capture gear shall be inspected regularly and live holding traps must be inspected at least once daily.

9. **The licencee shall follow the best management practices for the collection, handling, transportation and holding of fish identified in FPS Bulletin 2011 – 01 July 29, 2011 included with the licence in order to minimize the risk of spreading aquatic invasive species and diseases.**

10. Licencee must photograph and release live any redside dace captured. The photographs must be forwarded to MNR's Aurora District office for identification confirmation.

11. Any person, while acting under the authority of this authorization, shall immediately report the capture of any invasive species (eg. Ruffe, tubenose goby,**round goby**, rusty crayfish, Asian carp, etc.) found outside its previously known range (as determined by the distribution information available at http://www.invadingspecies.com/indexen.cfm to the licence issuing office. Any such specimens captured outside of their established range (not already naturalized) **shall be euthanized**, not returned to the water.

12. Licencee may fish with a backpack electrofisher, seine nets, dip nets and minnow traps.

Signature of Licencee / Signature du titulaire du permis **Date**

License to Collect Fish for Scientific Purposes
Permis pour faire la collecte de poissons à des fins scientifiques
Schedule A - Licence Conditions
Annexe A - Conditions du permis

Licence No 1075281
No de permis

13. Licencee may be assisted by: Joel Smith, Alex Stettler, Mark Cece, Patricia Mohr.

Signature of Licencee / Signature du titulaire du permis **Date**

WORKSHOP MEETING

Lazy Pat Farm Property

Discussion of Key Issues

EIR/FSS 2nd Submission, Dec. 2012

September 10, 2013

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

Bentall Kennedy

MMM GROUP

MMM GROUP

AGENDA

1. Introduction (Mike Reel)
2. Overview of Development Concept and Philosophy (Chris Tyrrell)
3. Approach to Workshop (Chris Tyrrell)
4. Update on Discussions/Site Visit with MNR (Mark Cece)
5. Discussion of Key Issues (#3) (All)
6. Discussion/Clarification of Other Issues (#2 and #1) (All)
7. Next Steps/Schedule (Chris Tyrrell)

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1. INTRODUCTION

COMMUNITIES

TRANSPORTATION

BUILDINGS

INFRASTRUCTURE

MMM GROUP

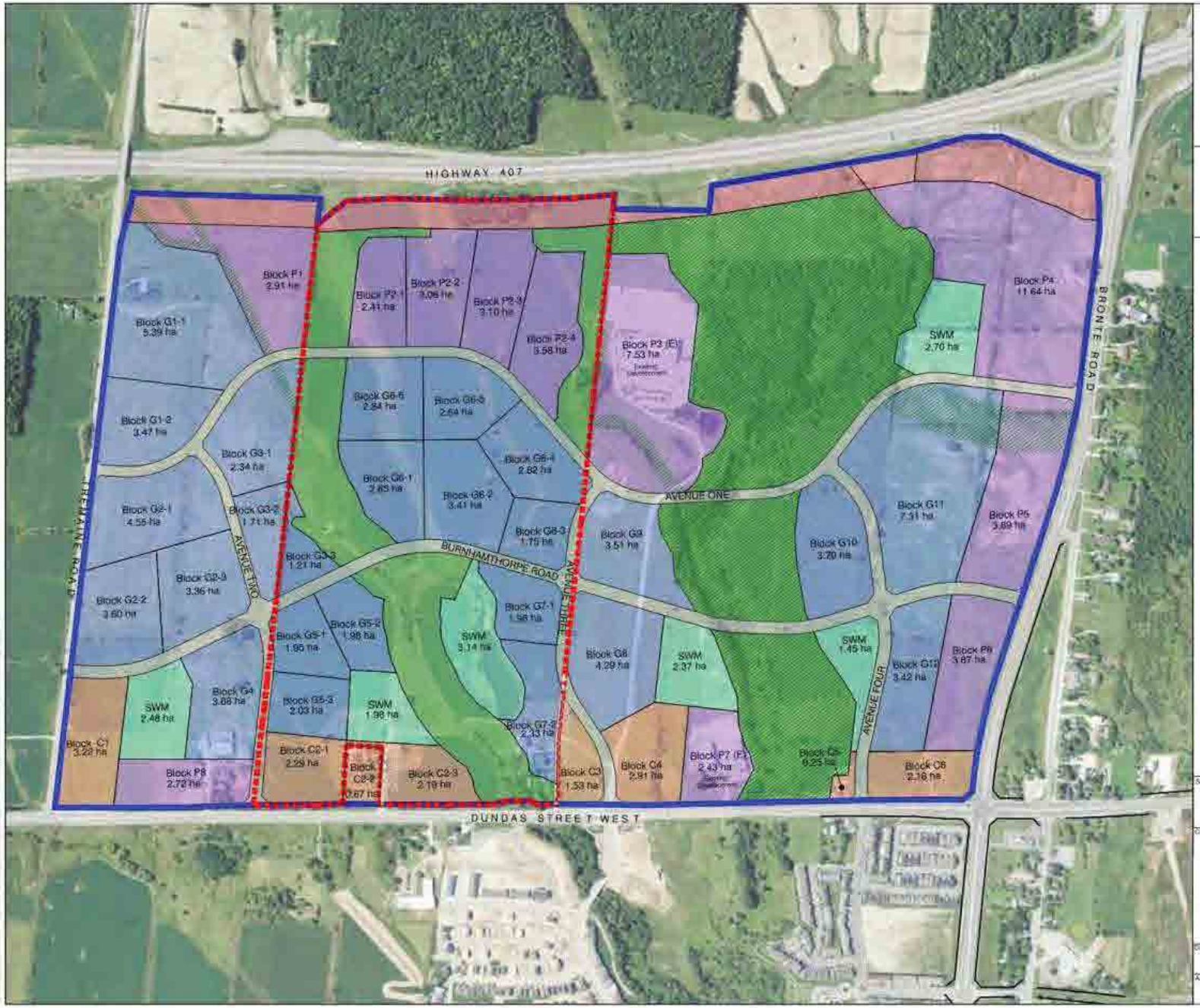
MMM GROUP LIMITED

2. OVERVIEW OF DEVELOPMENT CONCEPT AND PHILOSOPHY

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

MMM GROUP

407 West Development Concept (EIR/FSS 2nd Submission)



407 West Employment Area
Lazy Pat Property

Area Concept Plan (INTERNAL USE ONLY)

LEGEND	Area Hectares	Acres
Service Area (Service/Retail/Office)	15.4	37
Light Employment	47.1	117
General Employment	78.1	193
Open Space	68.3	169
Stormwater Management	14.1	35
407 Transitway	12.3	30
Roads	15.7	39
	251.0 ha	620 ac

407 West Employment Area

Subject Lands

Notes:

- For the purposes of our analysis we have made land use assumptions for the entire 407 West Employment Area
- Right-of-way requirements for future 407 Transitway to be determined
- The Natural Heritage System on lands owned by others is conceptual, as shown in the North Oakville West Secondary Plan, and is subject to further study.

Scale: 1 : 7500

Client: Bentall Kennedy

Prepared by: MMM GROUP

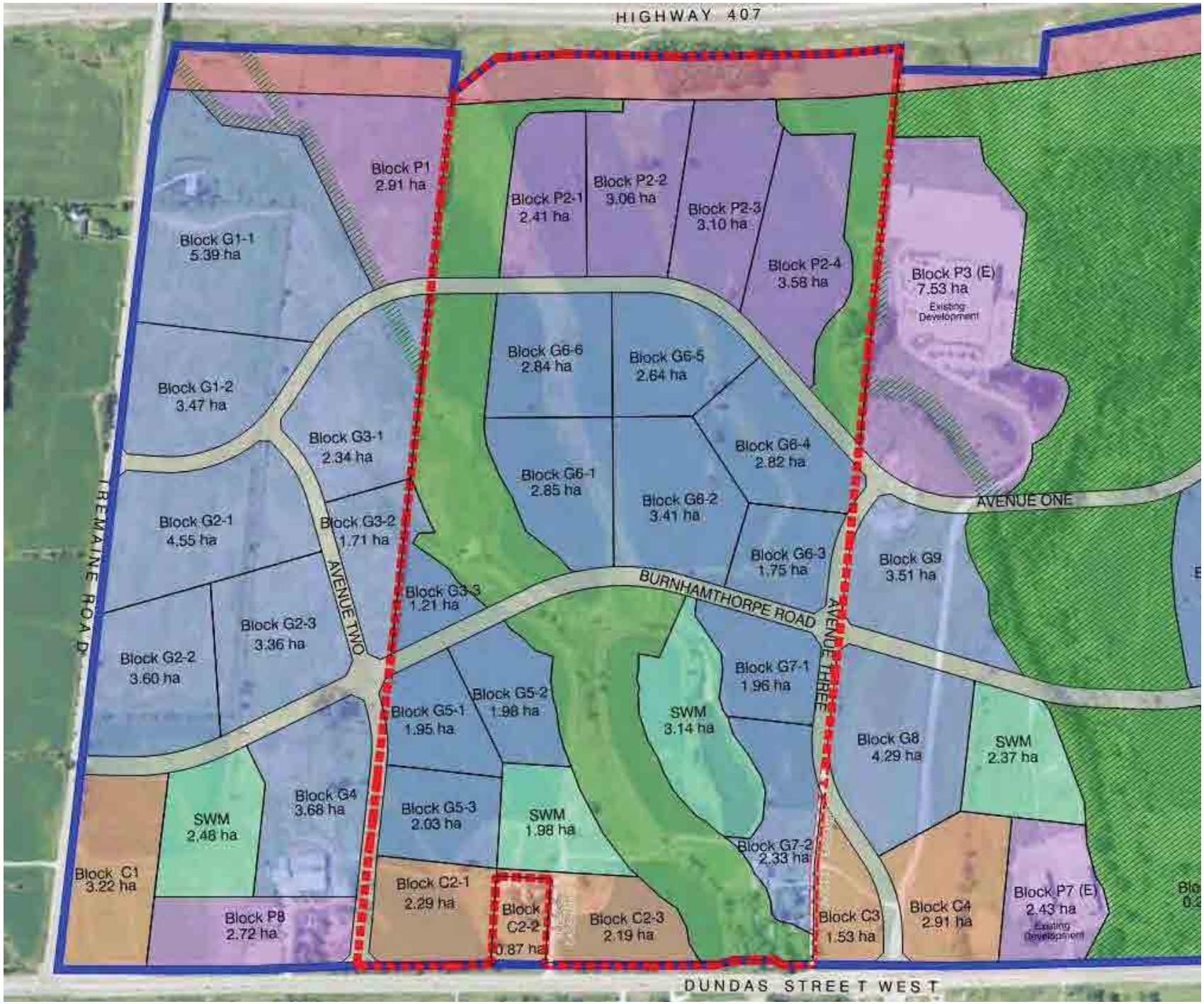
Date: January 25, 2013

Project No.: 1409222.001

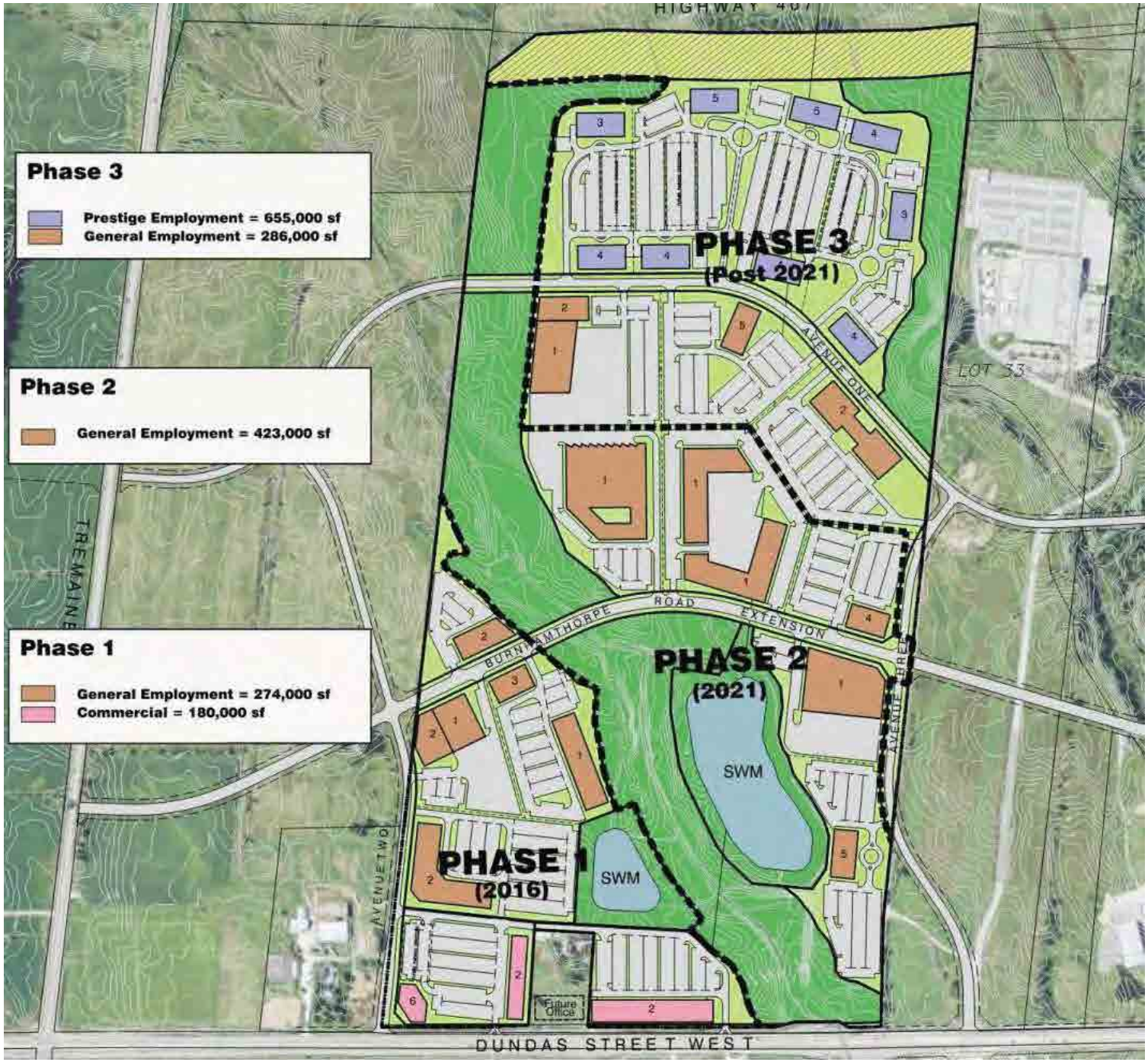
Aerial Photo: © DigitalGlobe 2010, Google 2009

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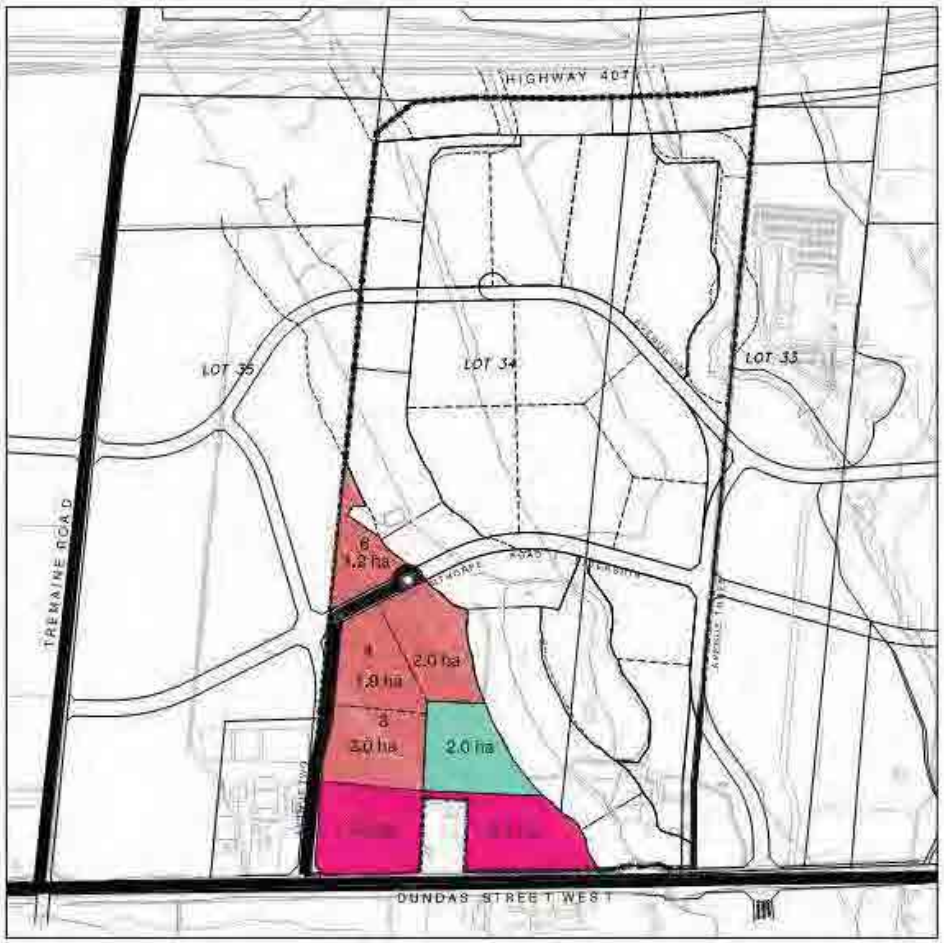
Lazy Pat Concept Plan



Lazy Pat Preliminary Master Plan



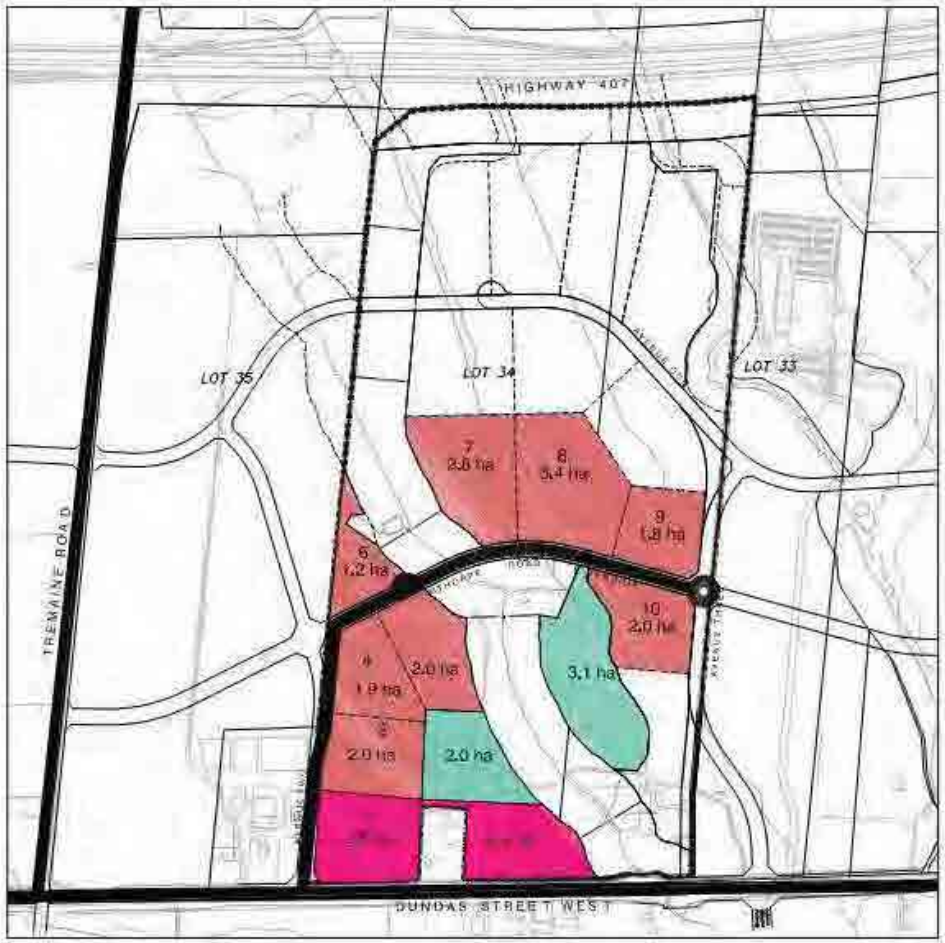
Lazy Pat Preliminary Phasing Plan (Phase 1a and 1b)



Phase 1a

(Before Creek Crossing)

Service Area (Commercial)	4.5 ha
General Employment (Industrial)	7.1 ha
Storm Water Management	2.0 ha



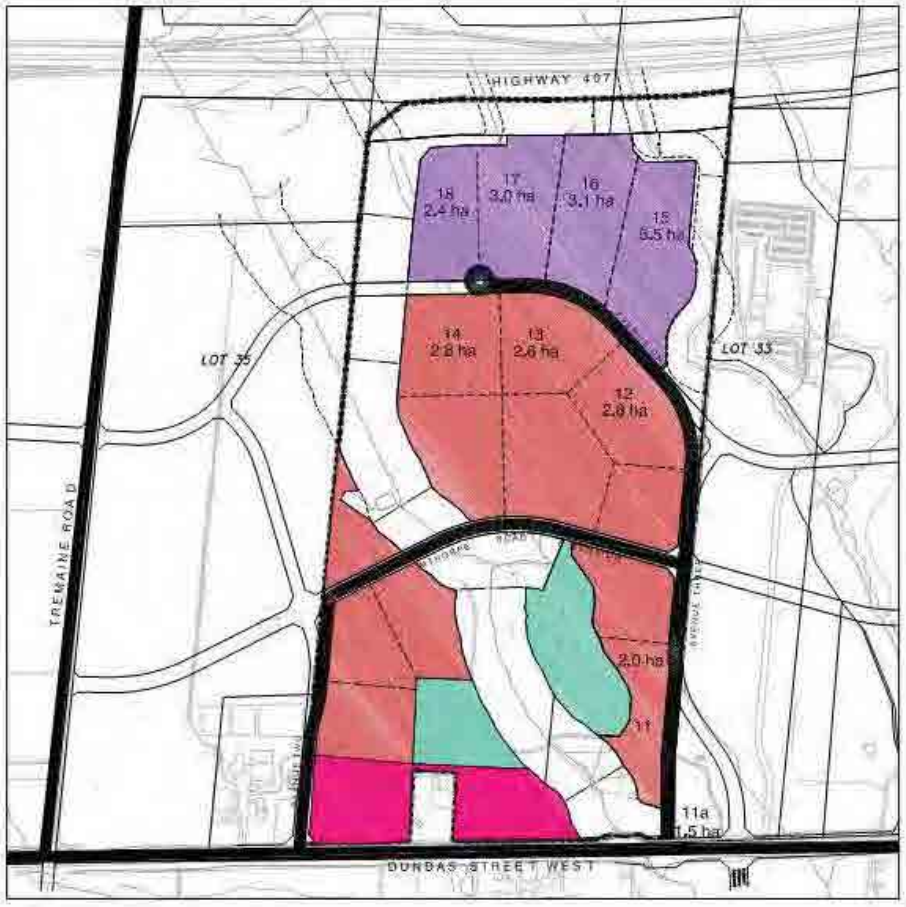
Phase 1b

(Before Second Connection)

Service Area (Commercial)	4.5 ha
General Employment (Industrial)	17.1 ha
Storm Water Management	5.1 ha

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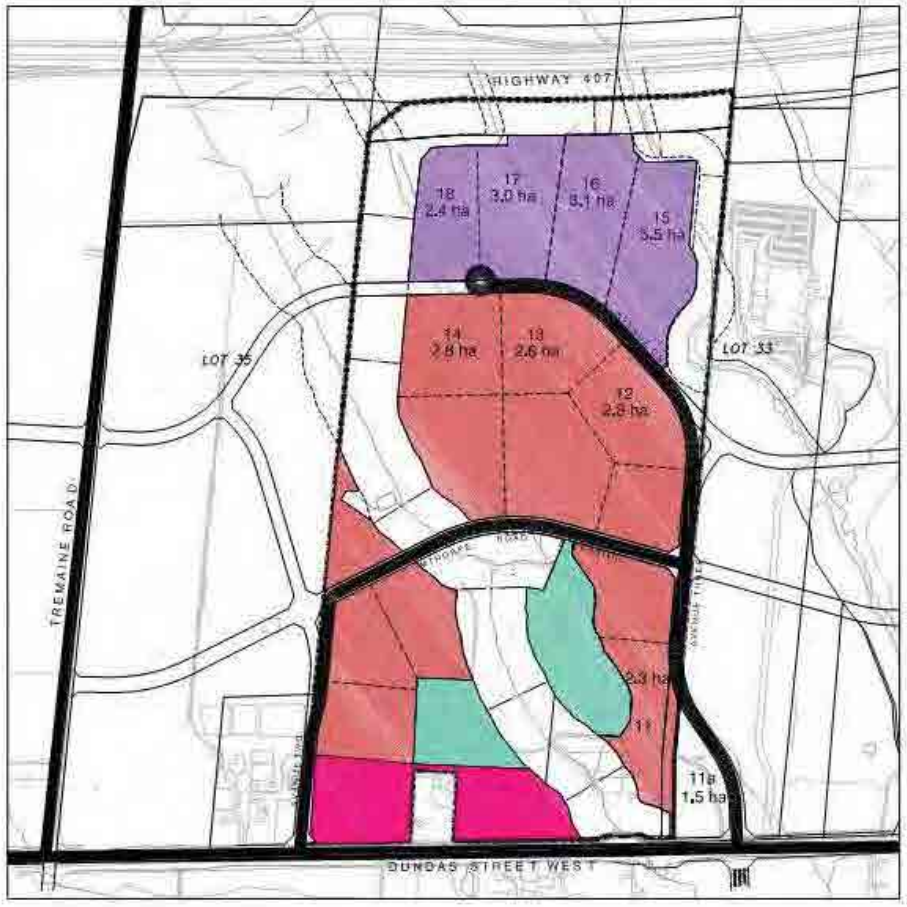
Lazy Pat Preliminary Phasing Plan (Phase 2a and 2b)



Phase 2a

(After Second Connection)

Service Area (Commercial)	4.5 ha
General Employment (Industrial)	27.3 ha
Prestige Employment (Light Industrial)	14 ha
Storm Water Management	5.1 ha



Phase 2b

(After Second Connection)

Service Area (Commercial)	4.5ha
General Employment (Industrial)	27.6 ha
Prestige Employment (Light Industrial)	14 ha
Storm Water Management	5.1 ha

Employment District Built Forms
(North Oakville Urban Design and Open Space Guidelines)





Light and General Employment uses







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Bentall Kennedy LP
Precedent Business Park Developments


Financial Drive, Mississauga


Royal Bank, Mississauga


Microsoft Canada, Mississauga


Maple Leaf Foods, Meadowvale, Mississauga


Steeles Technology Campus, Toronto

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3. APPROACH TO WORKSHOP

COMMUNITIES

TRANSPORTATION

BUILDINGS

INFRASTRUCTURE

MMM GROUP

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Approach to Workshop

- Implementing policy “on the ground”
- Constructive solutions to address key issues
- Heading to 3rd Submission of EIR/FSS, want to be acceptable to Town and Agencies

MMM GROUP LIMITED

4. UPDATE ON DISCUSSIONS/SITE VISIT WITH MNR

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

MMM GROUP

MMM GROUP LIMITED

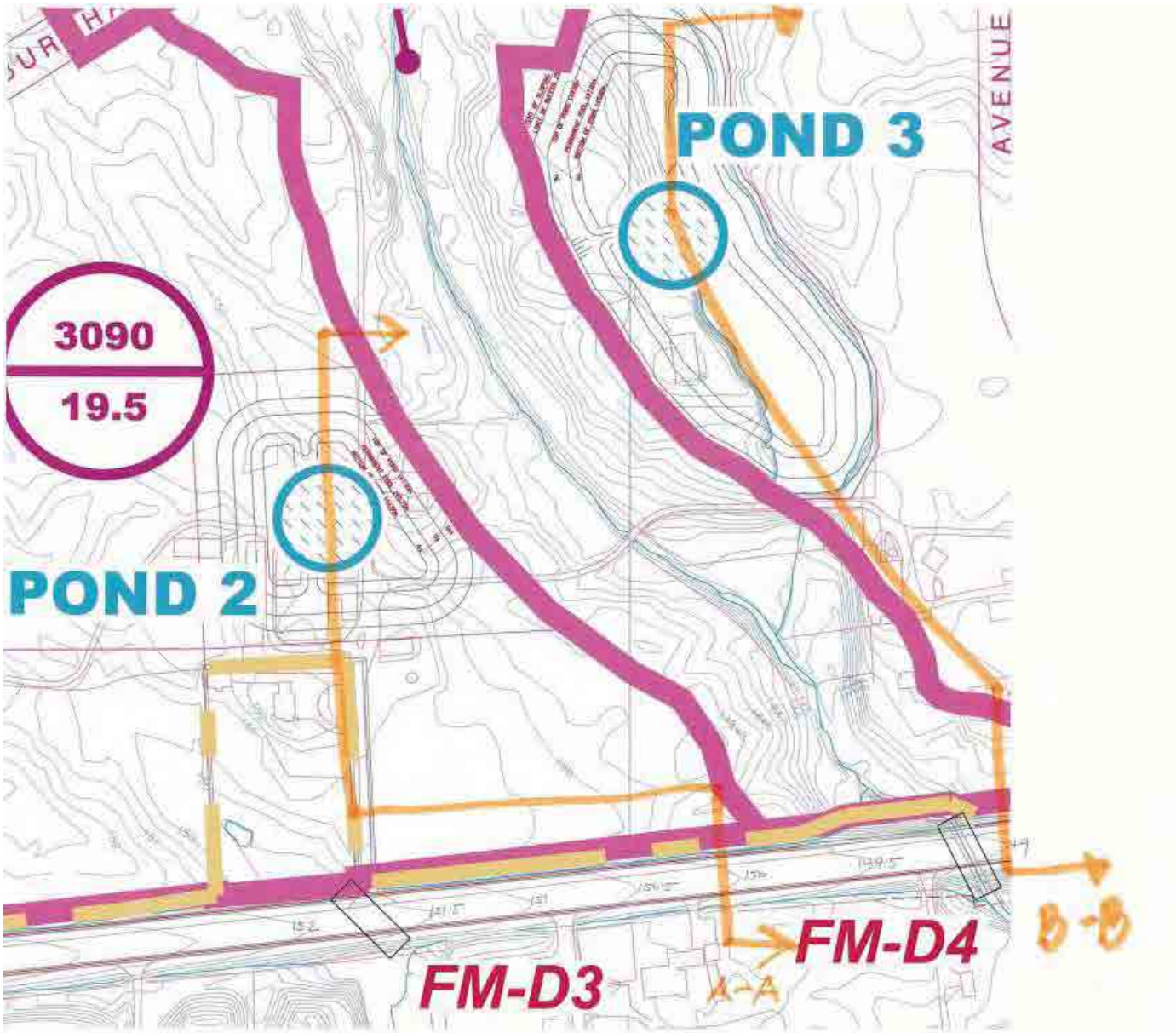
5. DISCUSSION OF KEY ISSUES

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

MMM GROUP

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a. Dundas Street Stormwater Runoff and SWM Facility Allowances



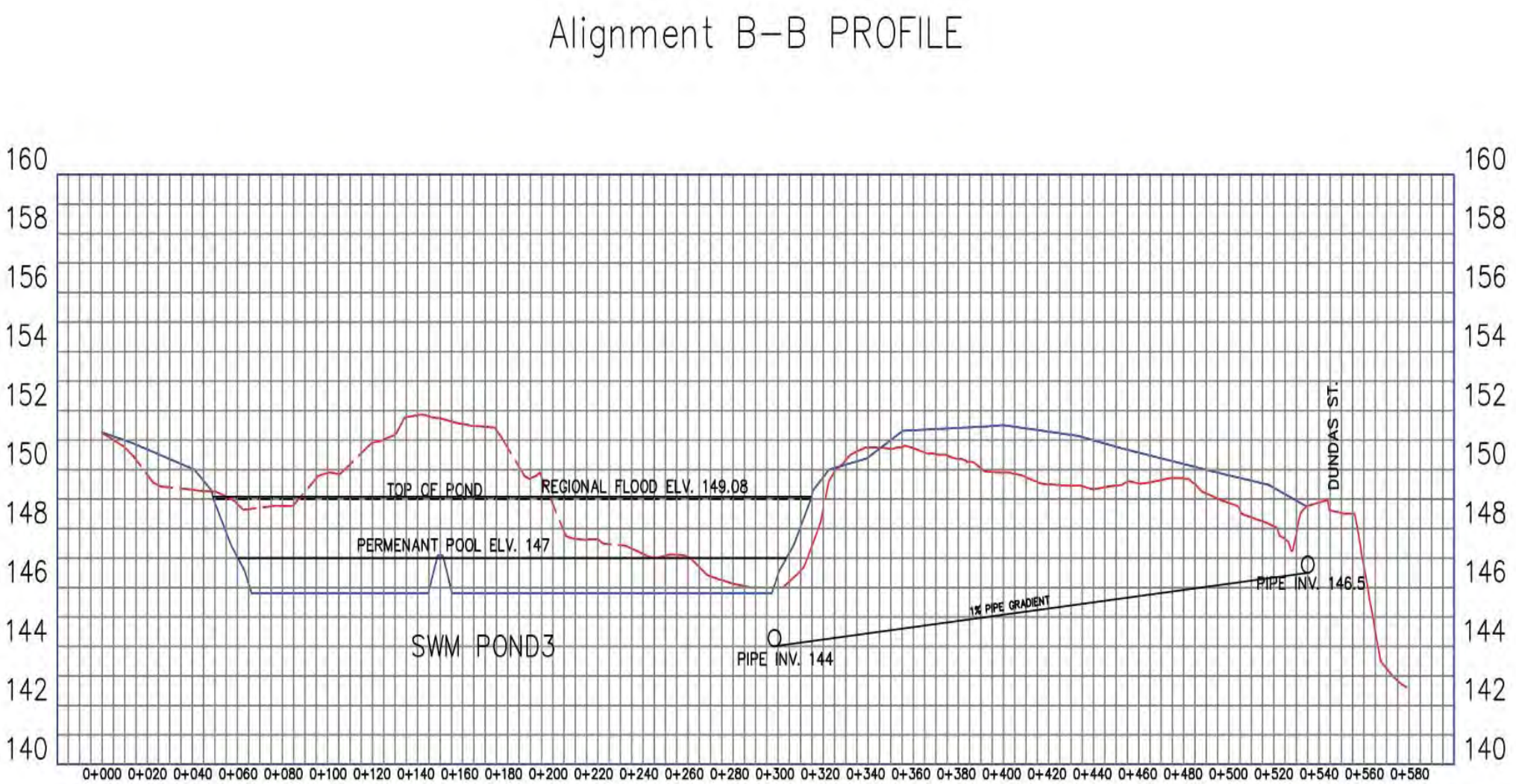
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Section A-A across Dundas Street and SWM Pond 2



MMM GROUP

Section B-B across Dundas Street and SWM Pond 3

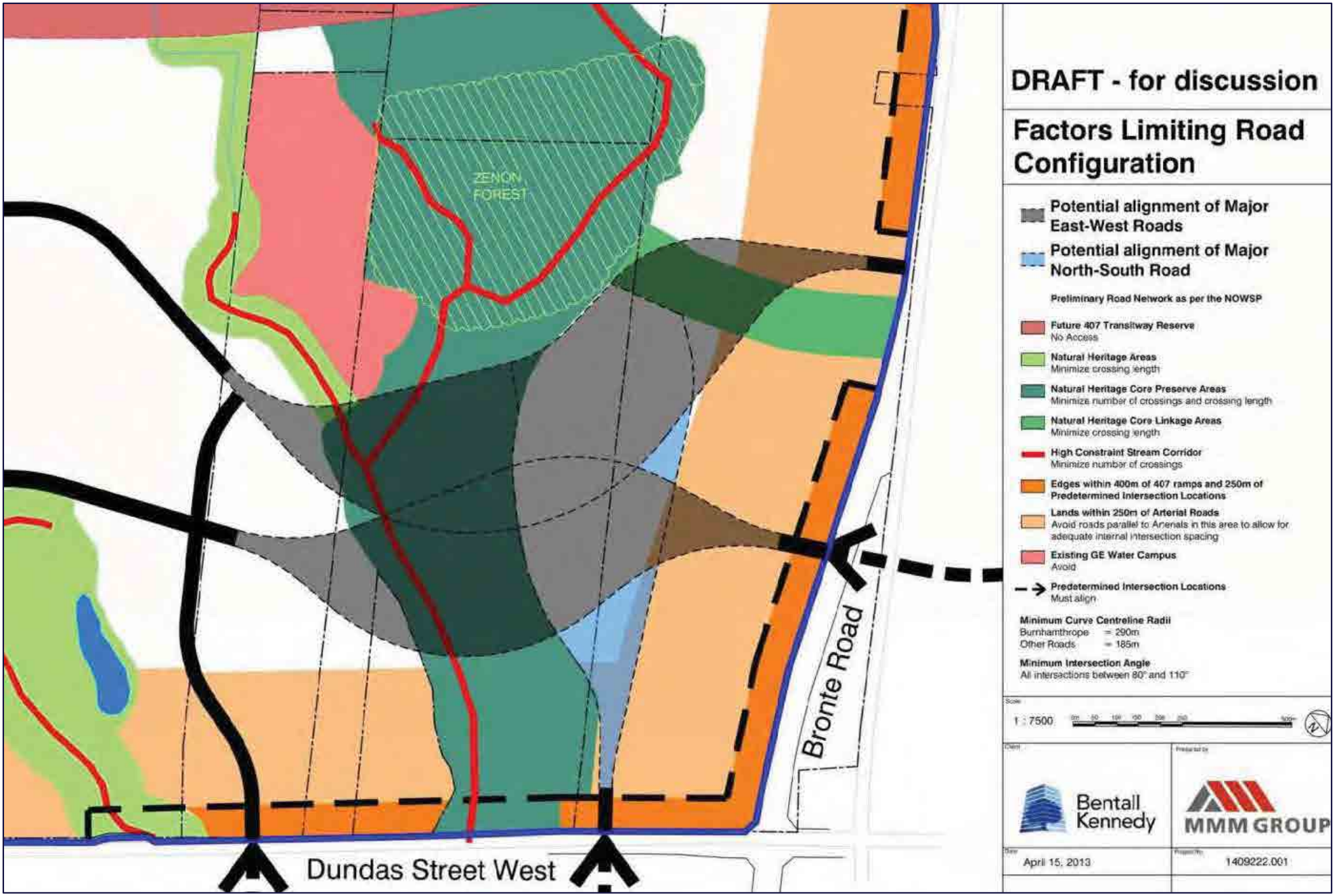


MMM GROUP

b. 407 West Concept Plan (Avenue 1 Alignment, Sanitary Servicing)

- Sufficient flexibility in road alignment options as they leave the Lazy Pat Farm property.

Avenue One / Burnhamthorpe Road Alignment Options

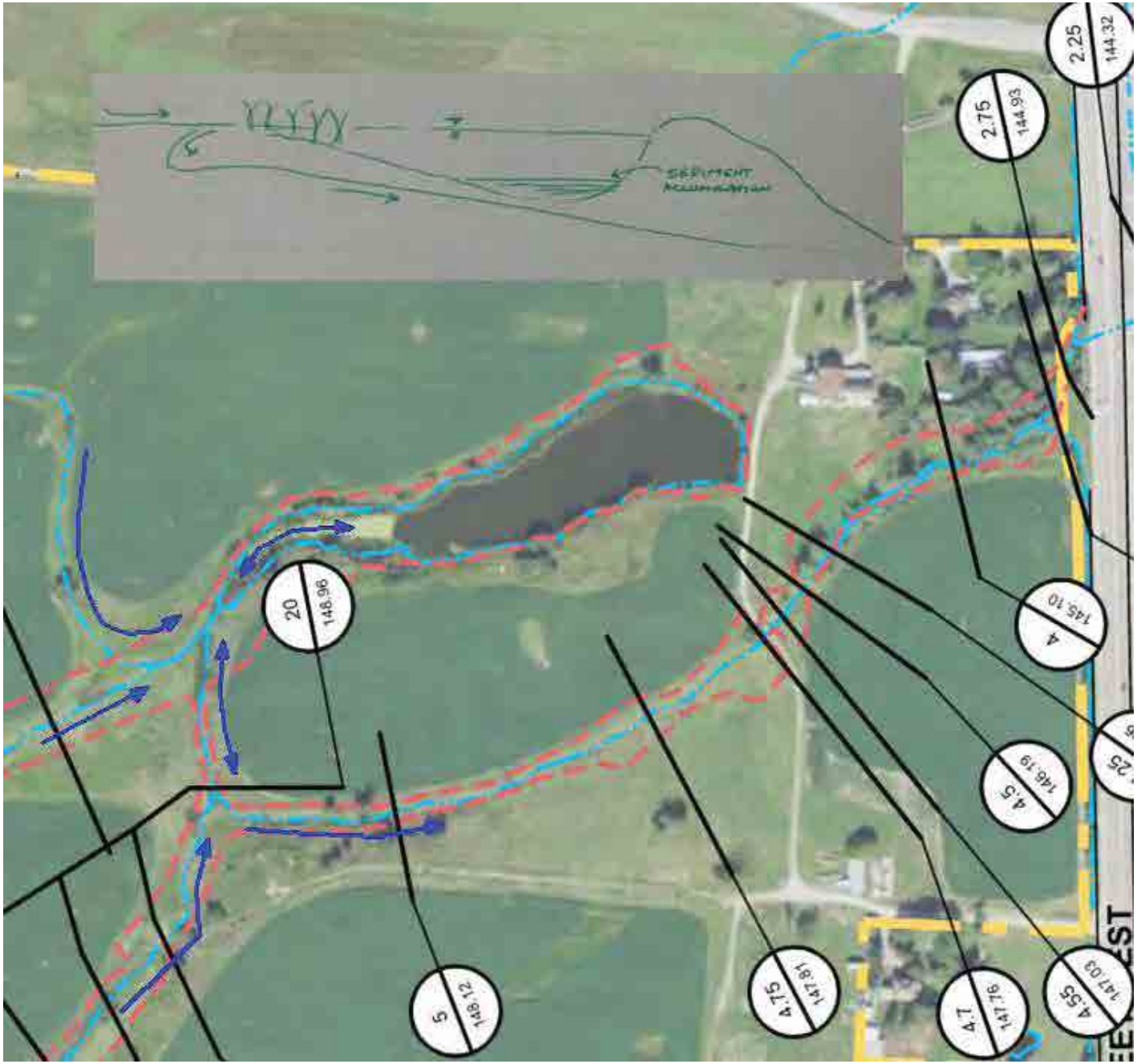


MMM GROUP

c. Characterization of Existing Pond (14W-14A) and Use as a SWM Facility

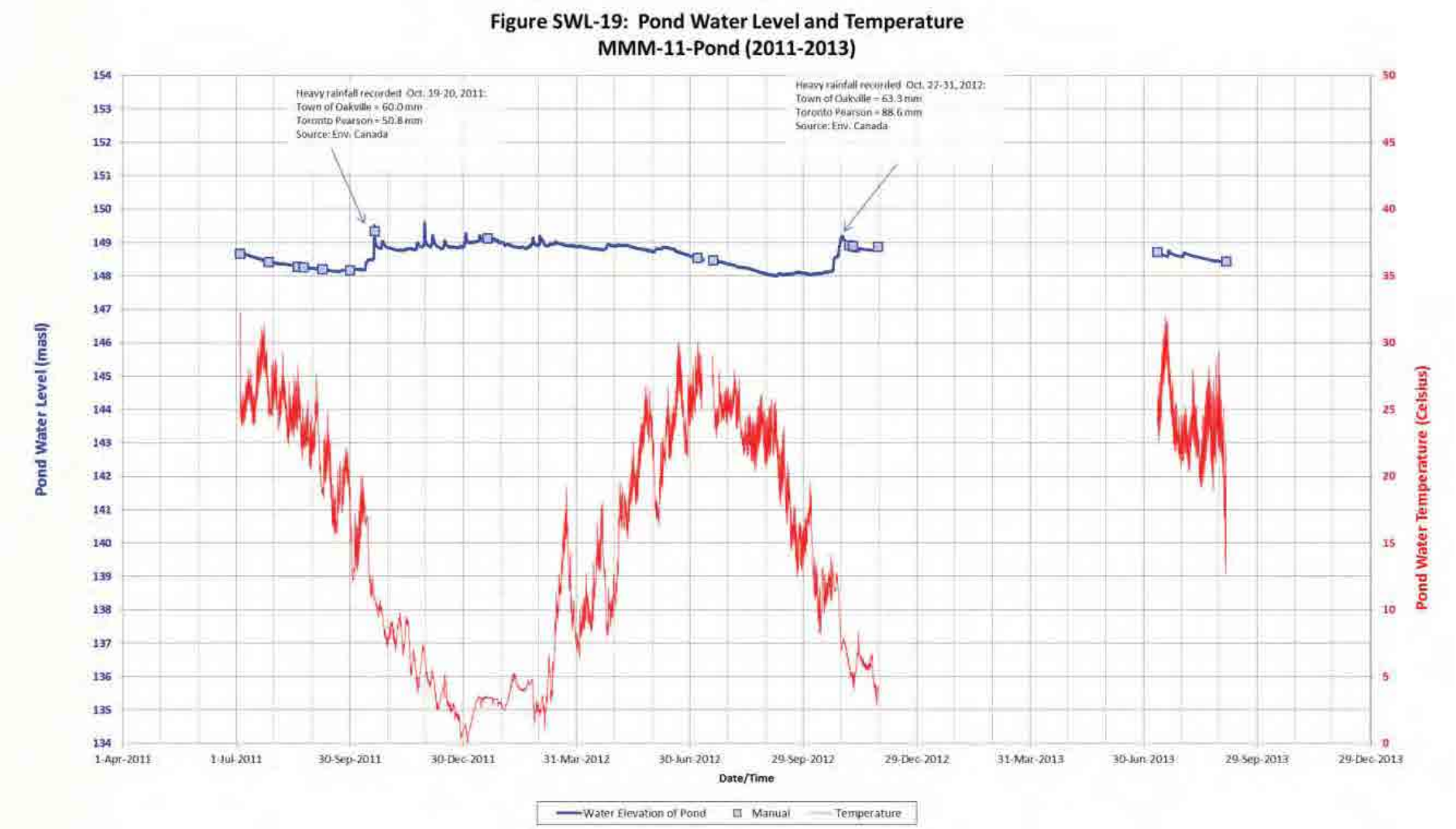
- Pond constructed between 1934 & 1960 for agricultural purposes
- Reach 14W-12A appears at same time (for flow connection back to main creek)
- Possesses thick cattail patch at northern point
  - Diffuse flow enters pond – no inherent circulation path in pond
  - Gross particulates filtered by cattails, fine sediment reaches pond body
  - Thick muck pond bottom due to accumulation of fine sediment
  - No inherent flow path due to obstruction at mouth of pond

c. Characterization of Existing Pond (14W-14A) and Use as a SWM Facility



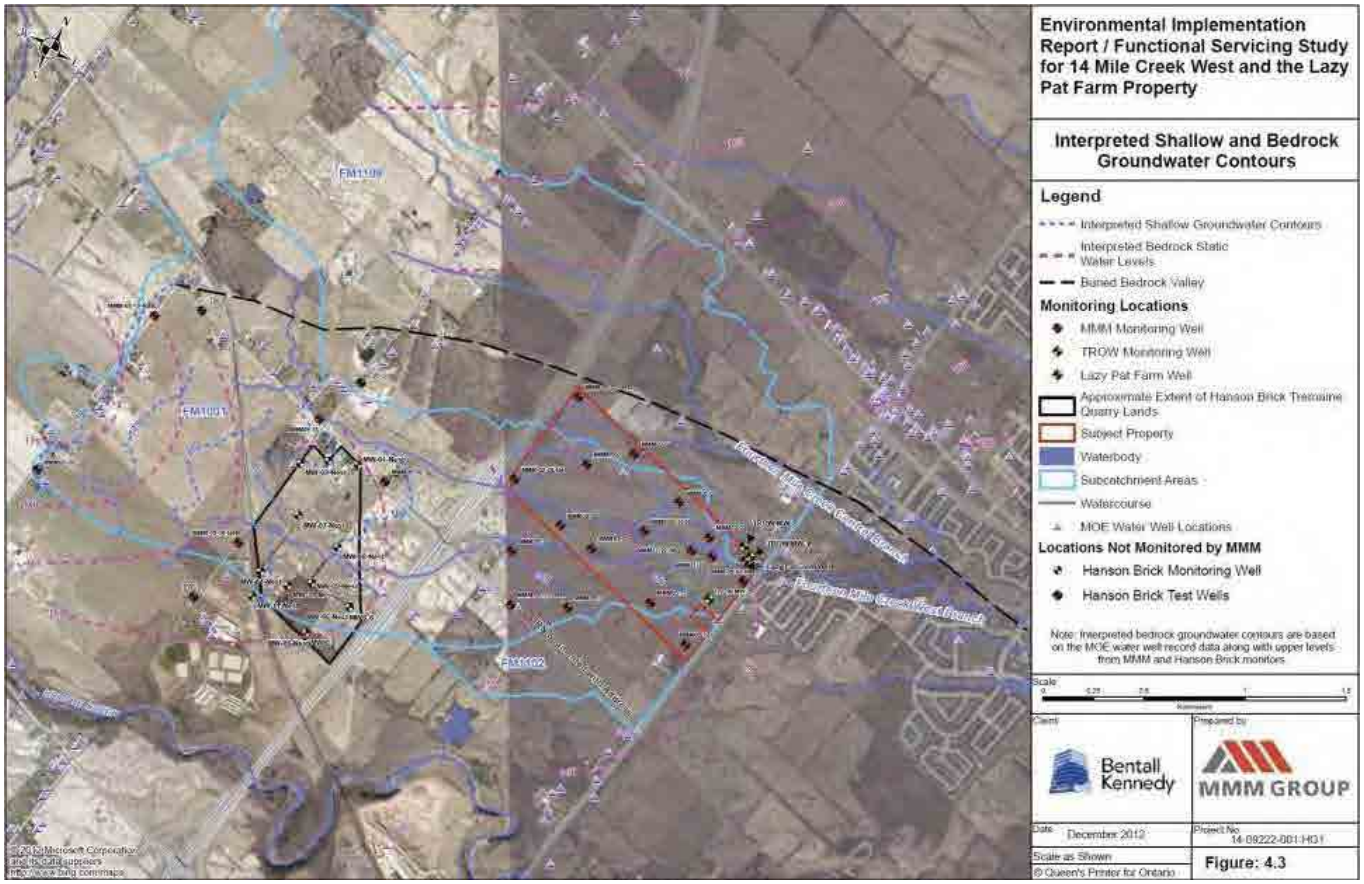
MMM GROUP

Pond Data – Water Levels and Water Temperature



Hydrogeological Conditions

- Halton Till (Silt/Clay) overlying Queenston Shale Bedrock
- Buried Sand and Gravel bedrock valley northeast of site (below GE property)
  - Draws down shallow till/bedrock groundwater to East-Northeast

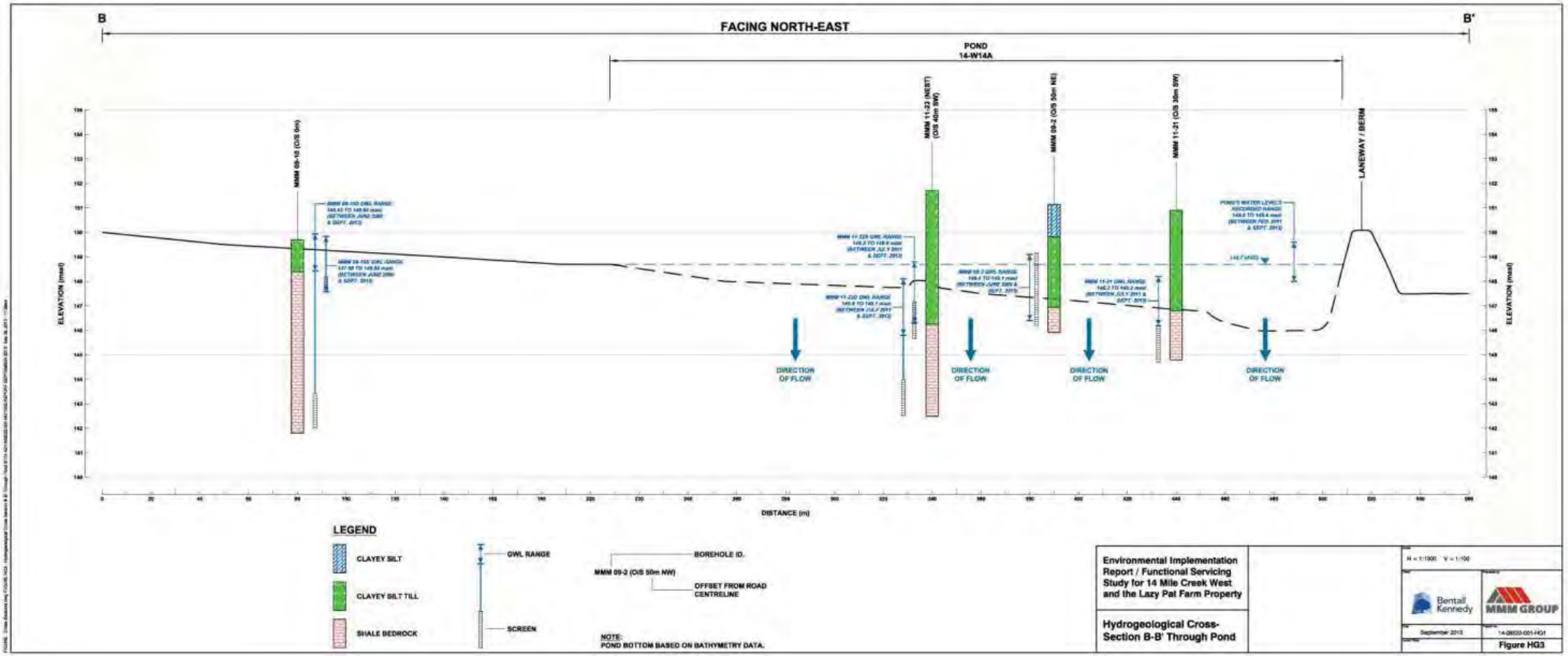


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Pond-Groundwater Interaction

- Pond identified as maintained by Surface Water Inflows in 1st Submission
- Additional Studies were requested to confirm the function of the pond (Ecology, Hydrogeology)
  - Groundwater study included installation of new monitoring wells and use of data loggers at surrounding wells and the pond
- Logger data collected between June 2011 and November 2012 (2nd Submission) conclusively showed water levels in pond always higher than the shallow groundwater at adjacent monitoring wells to east and west of pond
  - Pond water temperatures also ranged between 0C to 32C during the 17 month time frame
- Conclusion – Pond is losing water into the ground and is maintained by surface water inflows

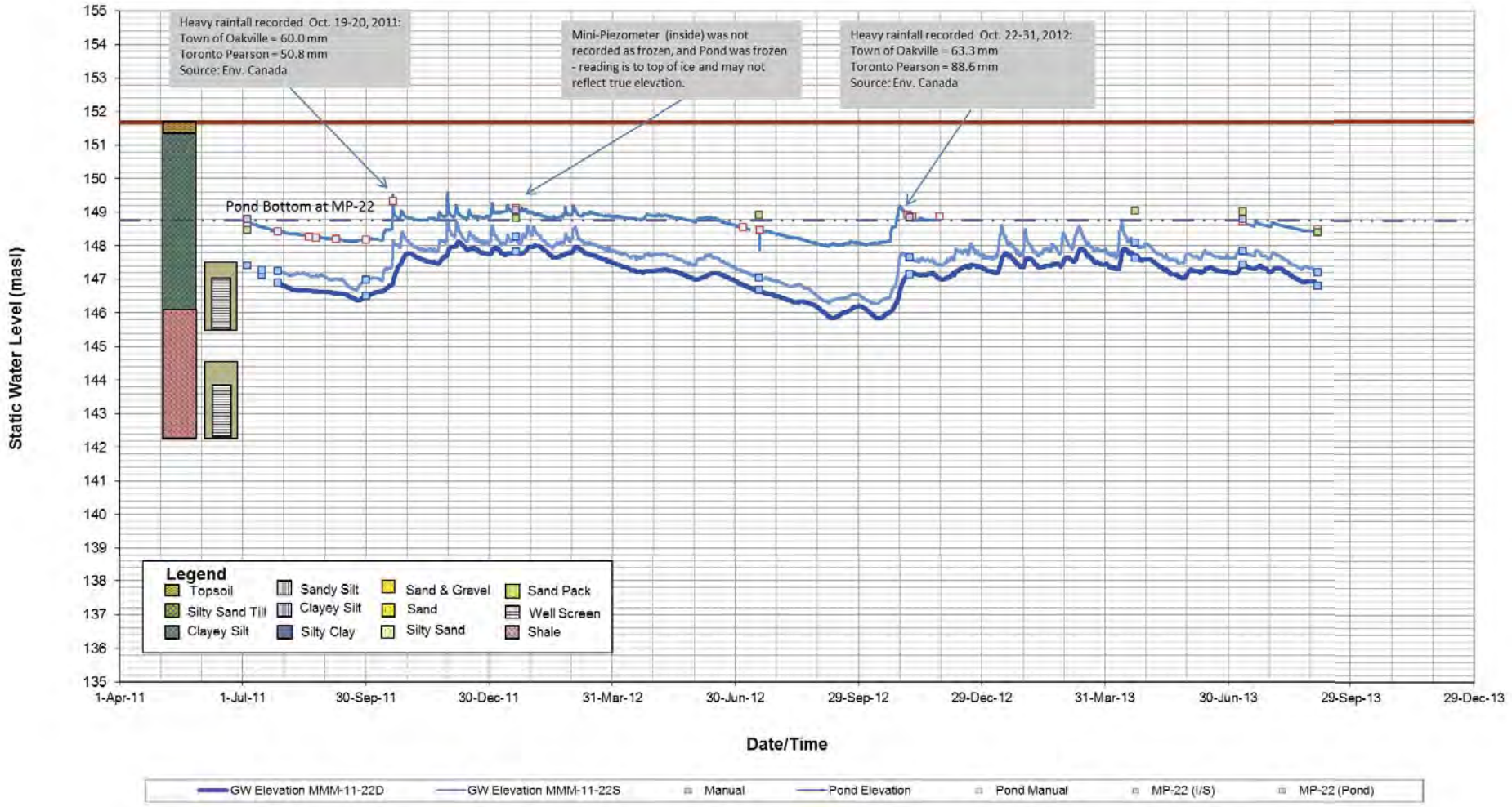
Longitudinal Cross Section



MMM GROUP

Example: Pond Levels vs. Groundwater Levels at Monitoring Well Nest MMM11-22

Figure SWL-18: Static Water Levels and Groundwater Temperature
MMM-11-22 Nest (2011-2013)



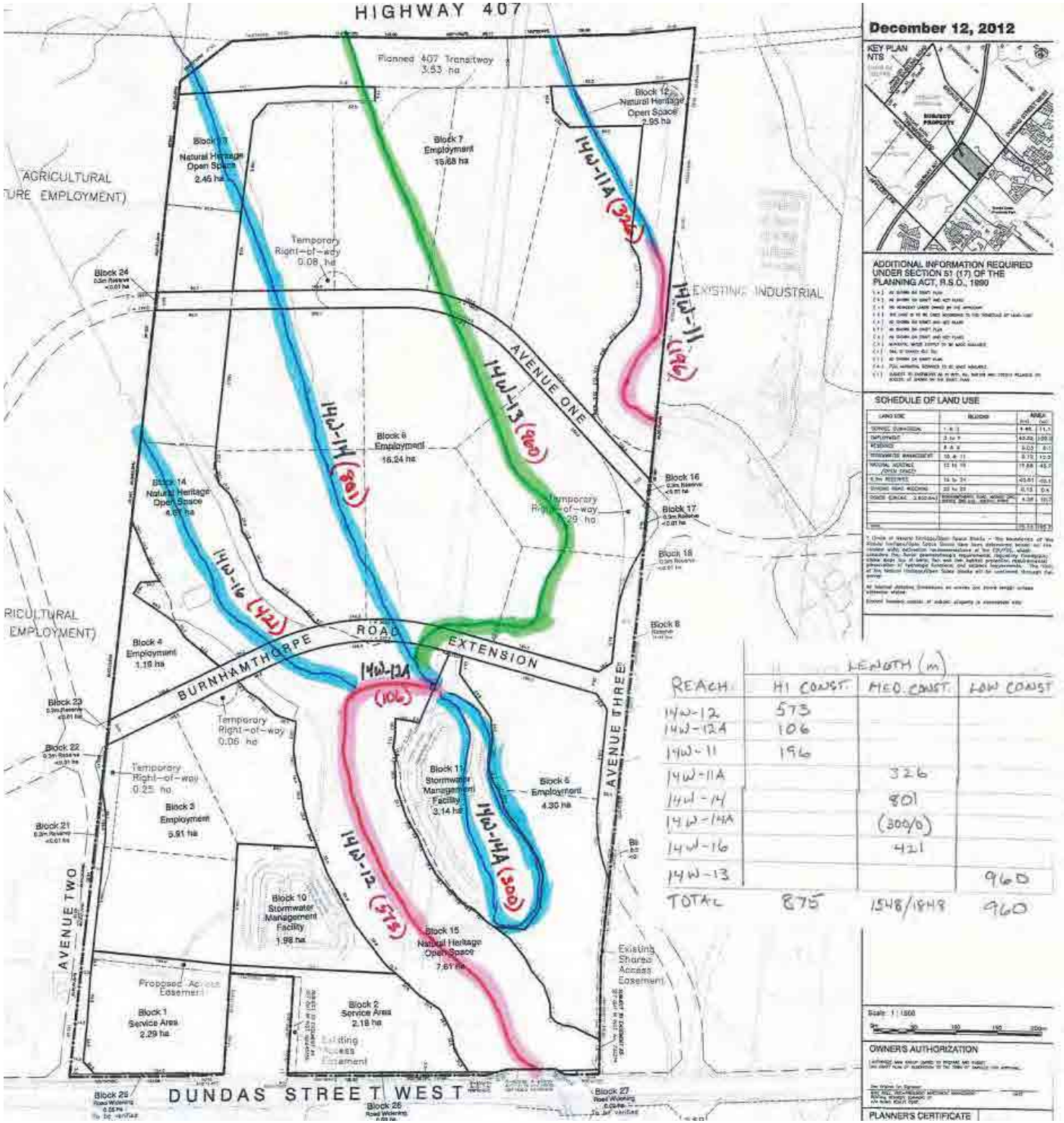
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d. Drainage Densities

- Goal: Overall Protection of Total Length of Red/Blue Streams
- Contentions:
- Reach 14W-14A designated in NOCSS as a Level 2 (Blue) Feature
  - Implication: Possession of a stream length due to perception of what "Blue" designation imparts.
  - No discussion of stream length on this feature in NOCSS.
- Reach 14W-21 (200m length) cannot be counted toward stream length contribution.

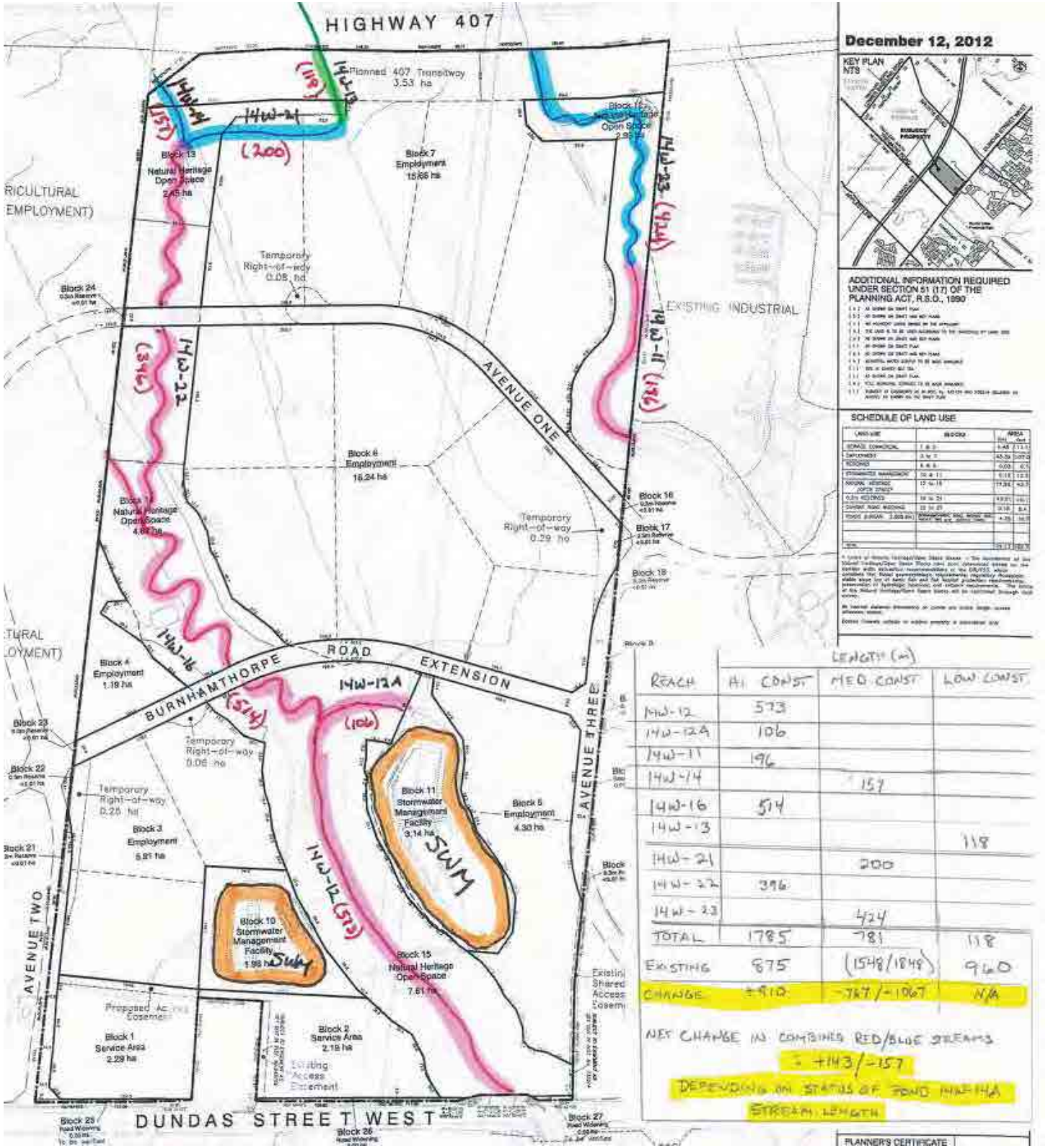
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Existing Conditions



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Proposed Conditions



REACH	LENGTH (m) HI CONST	MED CONST	LOW CONST
14W-12	573		
14W-12A	106		
14W-11	196		
14W-14		157	
14W-16	514		
14W-13			118
14W-21		200	
14W-22	396		
14W-23		424	
TOTAL	1785	781	118
EXISTING	875	(1548/1848)	960
CHANGE	+910	-767/-1067	N/A

NET CHANGE IN COMBINED RED/BLUE STREAMS
= +143/-157
DEPENDING ON STATUS OF POND 14W-14A
STREAM LENGTH

MMM GROUP

d. Drainage Densities

Post Development Drainage Density:

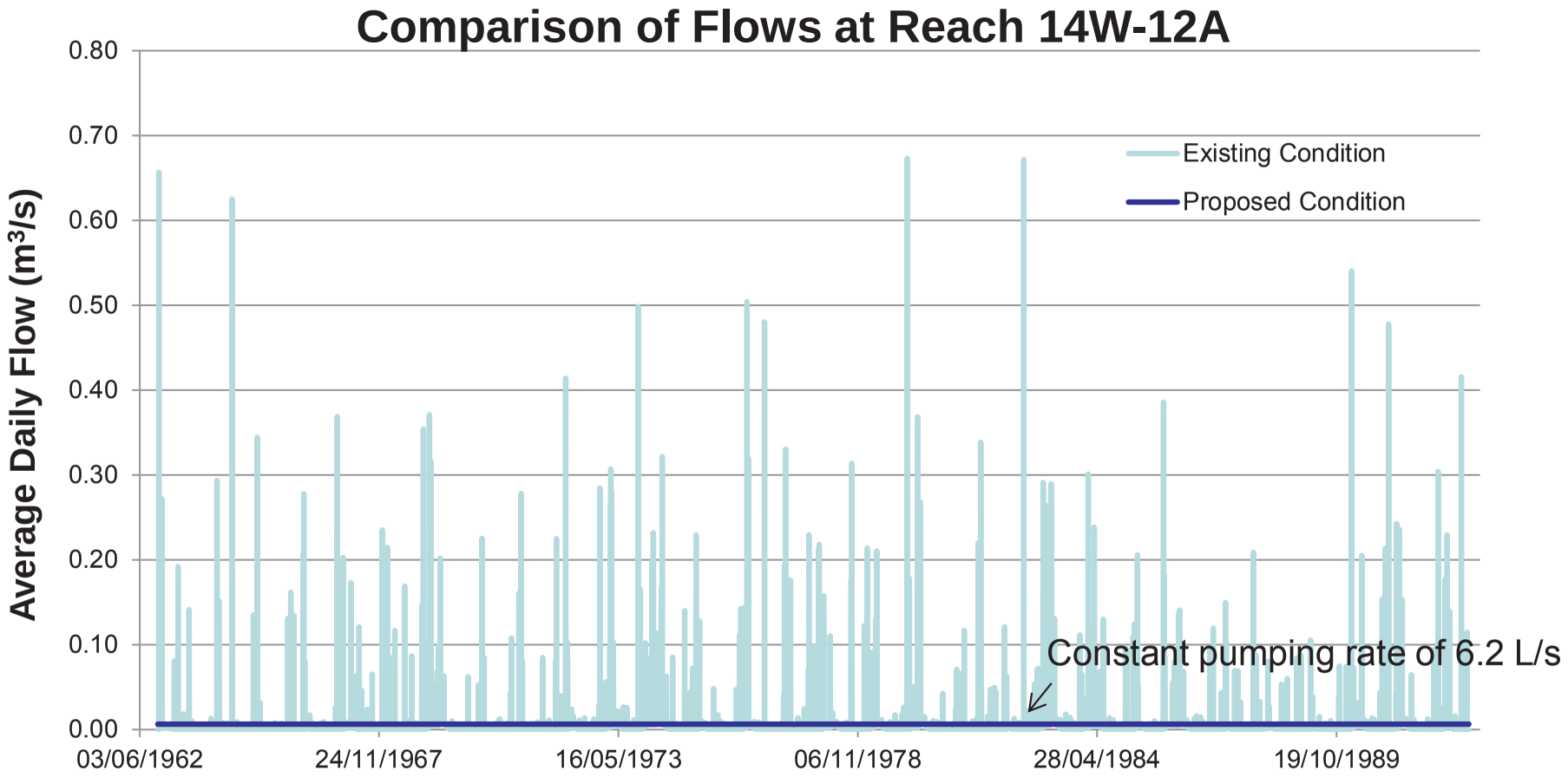
- Total Length, Red Streams (Post-Development):1,785m (+910m)
  Total Length, Blue Streams (Post-Development): 781m (-767 / -1067m)

- Net Change: +143m/-157m depending on status of Pond 14W-14A Stream Length.

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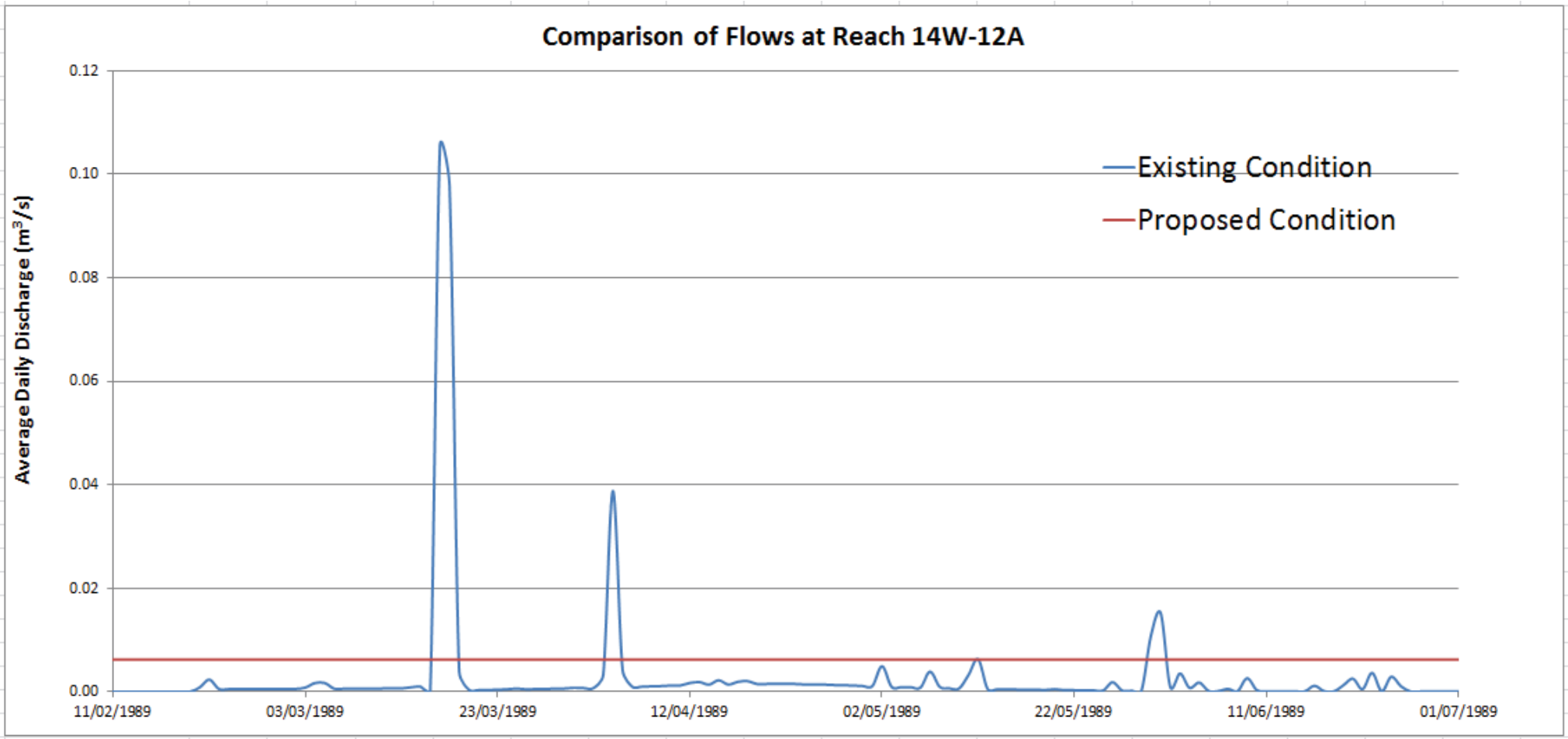
e. Consolidation/Relocation of Stream Corridors (channel form, flow regime comparison)

Parameters	Flows (m3/s)	
	Existing	Proposed
Mean	0.00615	0.00620
Standard Deviation	0.03058	0.00000
Maximum	0.67306	0.00620
Minimum	0.00000	0.00620



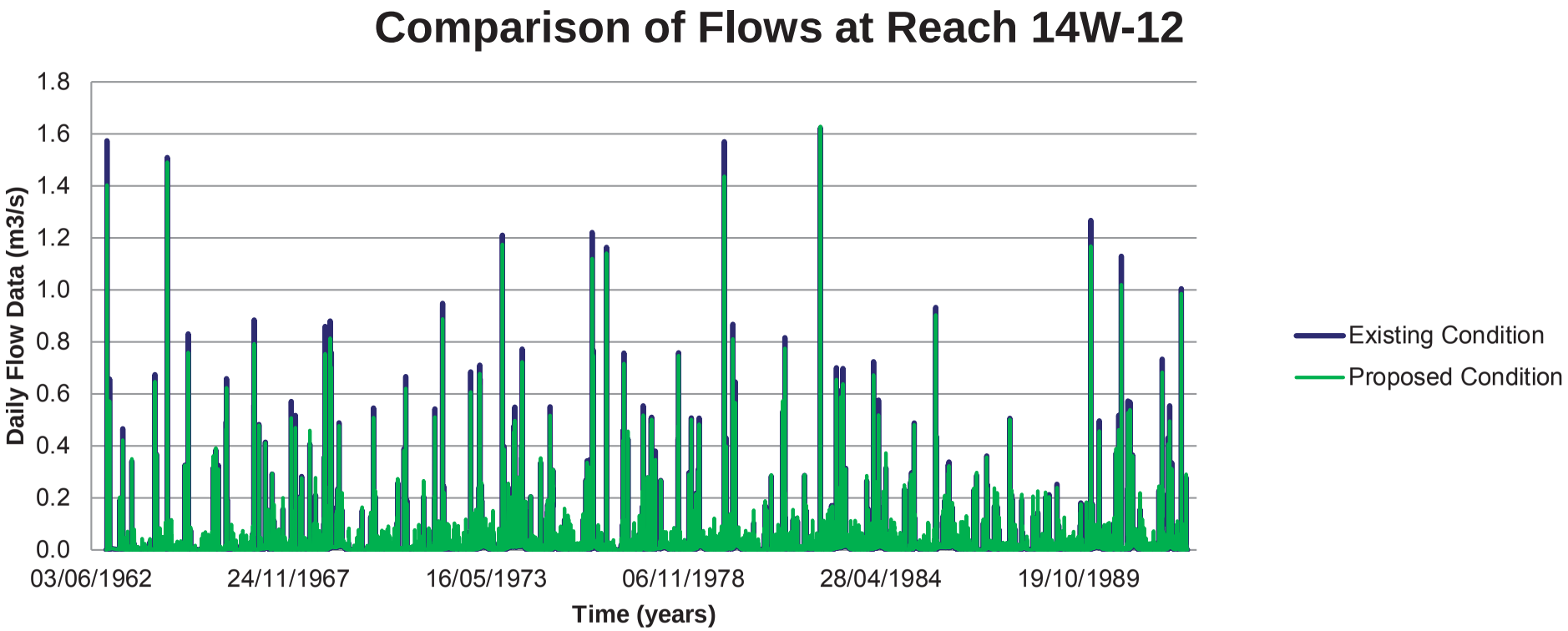
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Flow regime comparison (1989)



Flow regime comparison (continued)

Parameters	Flows (m3/s)	
	Existing	Proposed
Mean	0.01438	0.02100
Standard Deviation	0.07318	0.07220
Maximum	1.62333	1.62900
Minimum	0.00000	0.00000



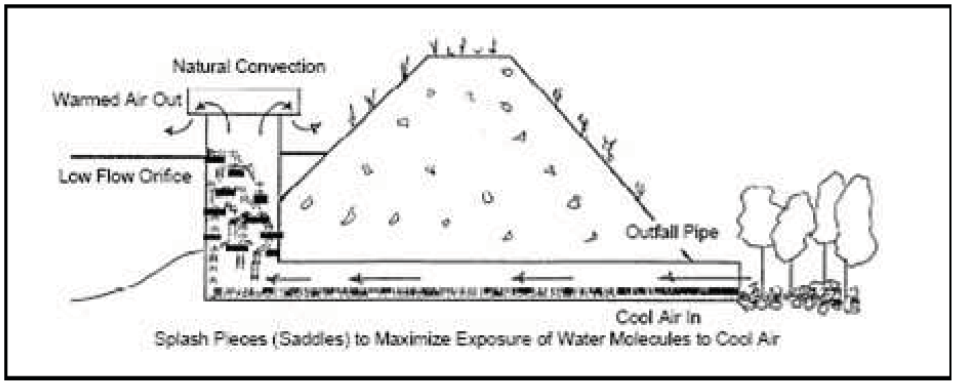
- Marginal increase in daily stream flow data.
- Reduction in standard deviation ensures a healthy baseflow regime.
- Peak flow of the proposed condition is the same as the existing.

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f. Location and Size of SWM Facilities

- Larger ponds more effective than multiple, smaller ponds to treat stormwater
- NOCSS did not account for potential watercourse realignments when locating SWMP locations – the NOWSP anticipates realignments
- Reduced future maintenance burden
- Positioned to preserve Dundas St. corridor (Urban Design Guidelines)
- Need to maintain flow in RSD designated reaches
- Requires pumping to 14W-12A
- Ability to enhance thermal mitigation (cooling towers, floating wetlands, etc.) as a Pilot Project if desired



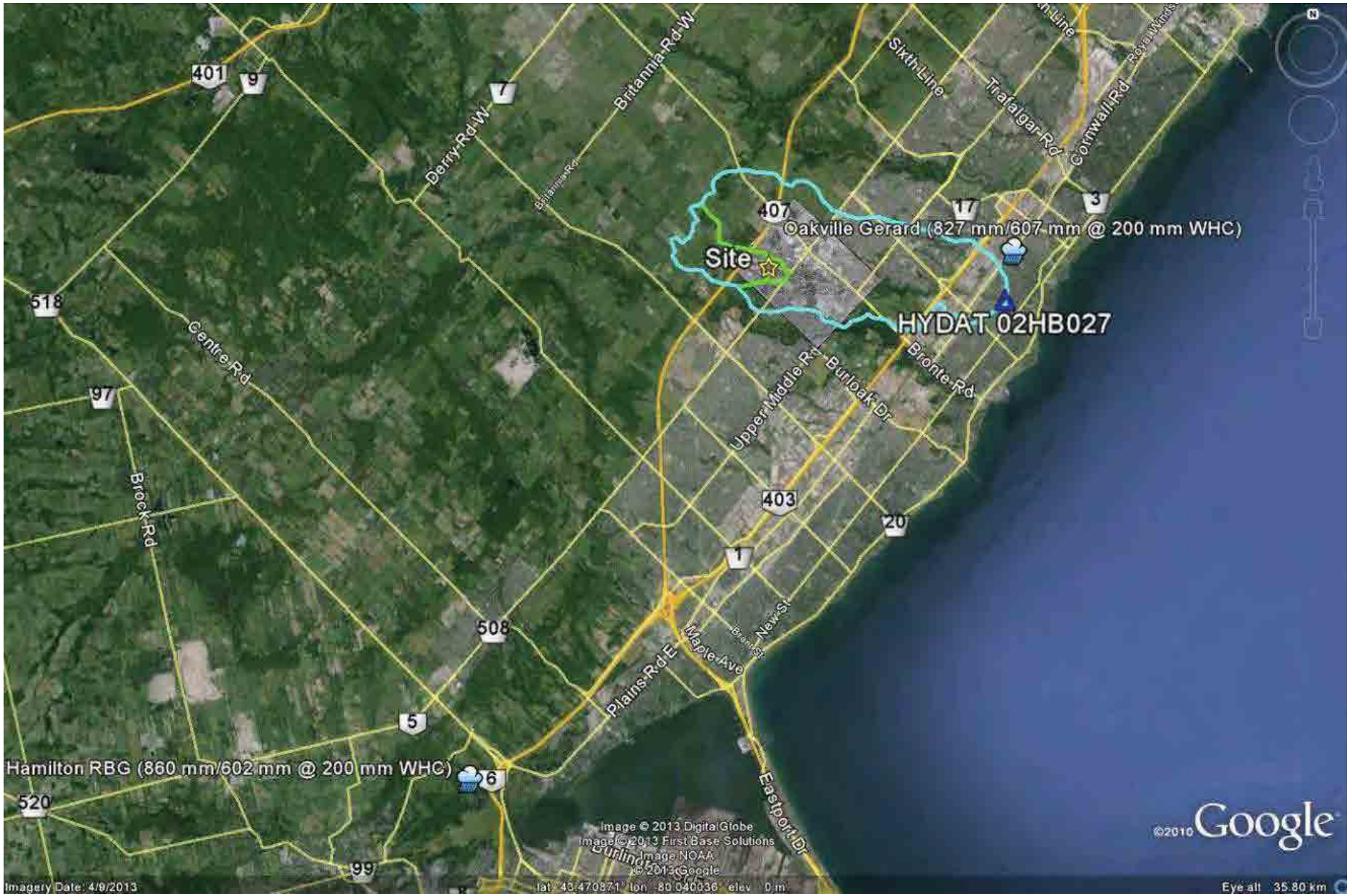


(adapted from Claytor 1993)

Figure 3-2: Schematic of Potential Cooling Tower Design

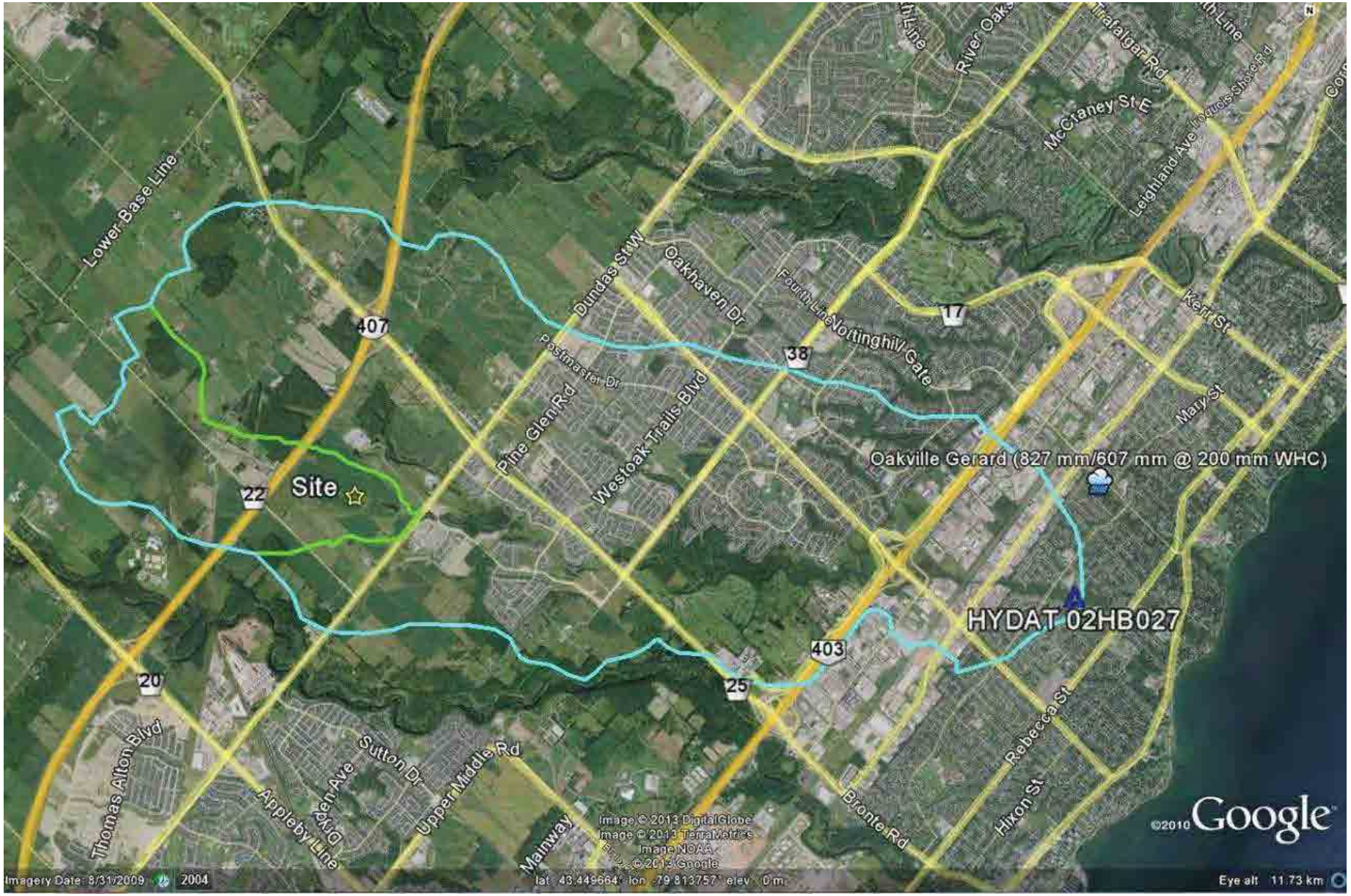
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g. Water Balance (Clarification)

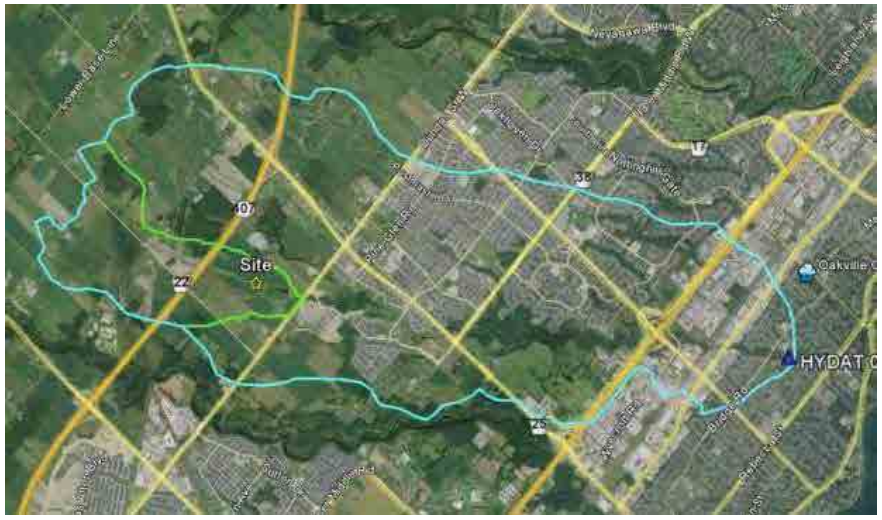


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g. Water Balance (Focused in On Site Area)



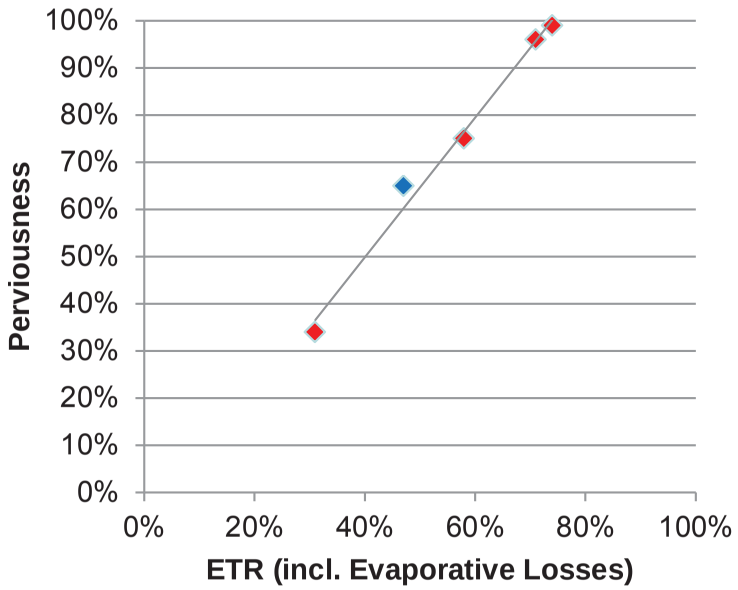
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Appropriateness of Water Balance/ Calculated ETRs

- Question whether Water budget data used in Water Balance is appropriate (Oakville Gerard)

Sub-Watershed	Approx. Perviousness	Calculated ETR	Notes
MMM Water Balance (Table 4-8)			
FM-1001 (bcIMC)	99%	74%	Pre-Dev
FM-1001 (All)	96%	71%	Pre-Dev
FM-1001 (bcIMC)	34%	31%	Post-Dev
FM-1001 (All)	75%	58%	Post-Dev
CH Comments			
HYDAT 02HB027	65%	47%	Based on measured stream flow data
MOE SWMP Man'l Table 3.1	N/A	55-59%	Generic Site – somewhere in Ontario



- Site and upgradient watershed ~undeveloped and ETR % is in line with expected values
- As land gets urbanized ETR declines due to reduction in green space
- 47% available ETR based on HYDAT station records is in line with values calculated by MMM (see chart) – therefore no need to revisit water balance

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6. DISCUSSION/CLARIFICATION OF OTHER ISSUES (#2 and #1)

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

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7. NEXT STEPS / SCHEDULE

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

MMM GROUP

WORKSHOP MEETING

Lazy Pat Farm Property

Discussion of Key Issues

EIR/FSS 2nd Submission, Dec. 2012

September 10, 2013

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

Bentall Kennedy

MMM GROUP

Sonia Rankin

From: Randall Roth
Sent: Friday, September 13, 2013 2:22 PM
To: pbond@hrca.on.ca; Janette Brenner (jbrenner@hrca.on.ca); 'Samantha Mason'; Richard.Clark@halton.ca; 'jane.Devlin@ontario.ca'; 'Thun, Robert'; KParker@oakville.ca; Philip Kelly (PKelly@oakville.ca); Reel, Mike (MReel@Bentallkennedy.com); Mark Cece; Steve VanHaren; 'aquader@mmm.ca'; Andrew Kulin; Alex Williams; Chris Tyrrell
Cc: Charles McConnell (CMcConnell@oakville.ca); 'Najak, Zahir (Zahir.Najak@halton.ca)'; 'samantha.jefferis@ontario.ca'
Subject: Lazy Pat - September 10, 2013 Workshop - Action Items List
Attachments: BK Workshop September 10, 2013 Final.pdf; Meeting Report - Action Items Draft.pdf

Importance: High

Hi,

We would like to thank everyone for their participation at the workshop meeting on September 10, 2013, in relation to the Lazy Pat Farms EIR/FSS 2nd Submission (Dec. 2012) and discussion of key issues. As discussed at the workshop, please find attached a draft of the Action Items, including individual responsibilities and proposed timeframes.

Also attached is a copy of the workshop presentation slides for your information.

We appreciate everyone's efforts in moving forward with the 3rd submission of the EIR/FSS, targeted for this Fall.

Please contact myself or Chris if you have any questions.

Thanks,

Randall Roth, MCIP, RPP
Senior Planner/Project Manager, Associate
Planning & Environmental Design
MMM Group Limited
100 Commerce Valley Drive West,
Thornhill, ON, L3T 0A1
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MMM GROUP

MEETING REPORT
WITHOUT PREJUDICE

Date:	September 13, 2013	**Project:**	Lazy Pat Farms (EIR/FSS): Bentall Kennedy
Date of meeting:	September 10, 2013	**Project Number:**	14.09222.001
Location:	Town of Oakville	**Author:**	Chris Tyrrell Randall Roth
Purpose:	**Discussion of Key Issues: Action Items**		

Attendees:	**E-Mail**
Paul Bond, HRCA	PBond@hrca.on.ca
Janette Brenner, HRCA	JBrenner@hrca.on.ca
Samantha Mason, HRCA	SMason@hrca.on.ca
Ronald MacKenzie, Region	Ronald.Mackenzie@halton.ca
Richard Clark, Region	Richard.Clark@halton.ca
Jane Devlin, MNR	Jane.Devlin@ontario.ca
Robert Thun, Town	RThun@oakville.ca
Kristina Parker, Town	KParker@oakville.ca
Philip Kelly, Town	PKelly@oakville.ca
Mike Reel, Bentall Kennedy	MReel@Bentallkennedy.com
Mark Cece, MMM	CeceM@mmm.ca
Steve VanHaren, MMM	VanHarenS@mmm.ca
Asif Quader, MMM	AQuader@mmm.ca
Andrew Kulin, MMM	KulinA@mmm.ca
Alex Williams, MMM	WilliamsA@mmm.ca
Chris Tyrrell, MMM	TyrrellC@mmm.ca
Randall Roth, MMM	RothR@mmm.ca

DISTRIBUTION: All Attendees and the following:

Charlie McConnell, Town	CMcConnell@oakville.ca
Zahir Najak, Region	Zahir.Najak@halton.ca
Samantha Jefferis, MNR	Samantha.Jefferis@ontario.ca

ATTACHMENTS: September 10, 2013, Workshop Presentation Slides

Item	Details	Action By	Action Date
4.	**Update on Discussions/Site Visit with MNR**		
	i. MNR to confirm they have the most recent version of the EIR/FSS (2nd Submission dated December, 2012). MNR to review the most recent detailed information on EIR/FSS, and will provide formal comments in response. Timeframe TBD. MC to follow-up with Samantha Jefferis and Jane Devlin on the timeframe and comments. Correspondence on the Species at Risk topic should be cc'd to CH (Paul Bond), Town (Rob Thun) and Region (Richard Clark).	Mark Cece, MNR	MNR to advise

Item	Details	Action By	Action Date
5.	**Discussion of Key Issues and Action Items**		
a.	**Dundas Street Stormwater Runoff and SWM Facility Allowances**		
	i. MMM to investigate issue of Dundas St. Stormwater Runoff and SWM facility allocations in revised EIR/FSS further, acknowledging that accommodation of Dundas St. drainage in Pond 3 is not feasible, Pond 2 may not be feasible, and that Ponds 1 and 4 (off-site) may be feasible. Follow-up with Matt Krusto is required (Steve VanHaren and Alex Williams) with options to determine if the Region wishes to pursue the matter further. Authorizations from MNR will be required for SWM facilities adjacent to RSD streams subsequent to the approval of the EIR/FSS.	Steve VanHaren, Alex Williams, Region (Matt Krusto)	Oct.
b.	**407 West Concept Plan (Avenue 1 Alignment, Sanitary Servicing)**		
	i. CH agrees that we do not need a site visit on the main branch of 14 Mile Creek to address the road alignment issue. The alignment provides for sufficient flexibility, and would be confirmed through a subsequent EIR/FSS for the affected lands.	NA	NA
	ii. ASP and FSS to address the question of directional drilling for sanitary sewers. MMM to justify 2.2 m of cover or provide for 3.0 m of cover in preliminary design. Impact of sanitary sewer on Dundas Street culverts to be addressed in the ASP and EIR/FSS.	Alex Williams, Region	Sept.
c.	**Characterization of Existing Pond (14W-14A) and Use as a SWM Facility**		
	i. Andrew Kulin to meet with CH hydrogeologist re: data collection, characterization of pond, and water balance. Andrew to report back to Town (Rob), CH (Paul), BK Team (Chris).	Andrew Kulin, CH Hydrogeologist	Sept. / Early Oct.
d.	**Drainage Densities**		
	i. Steve VanHaren to discuss stream design form and function with Lamoire Alexander (MMM) and provide further justification. MMM to discuss with CH (Samantha and Janette) and MNR prior to submission of the 3rd submission of the EIR/FSS.	Steve VanHaren	Sept. / Early Oct.
	ii. Town to coordinate a meeting with Parrish Geomorphic (John Parrish) to discuss the original intent of the drainage density provisions of the NOCSS, and specifically discuss MMM's characterization of the Pond (14W-14A) vs. the NOCSS characterization as a blue feature relative to the drainage density provisions. Steve VanHaren has requested to attend the Town's meeting. Pending outcome	Philip Kelly, Kristina Parker, Steve VanHaren	Early Oct.

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Item	Details	Action By	Action Date
	without Steve VanHaren present, Steve would like a discussion with Parrish Geomorphic.		
	CH (Janette) to provide additional information to MMM (Steve VanHaren) on this topic, if available.	Janette Brenner	
iii.	CH's position is that 14W-21 cannot be counted towards stream length and drainage density (due to small drainage area, and small flows). Steve VanHaren to discuss with Lamoire Alexander and place a reasoned opinion in front of CH (Janette) and Town, tabled for subsequent discussions with Parrish.	Steve VanHaren, Janette Brenner	End of Sept.
e.	**Consolidation/Relocation of Stream Corridors (channel form, flow regime comparison)**		
i.	Need a stronger justification in the 3rd Submission of EIR/FSS on the forms and functions of the pond being replicated, responding to CH's June 3, 2013 letter. CH and Town staff to review draft response on Page 5 of Issues Table Responses (July 4th) prior to 3rd Submission of EIR/FSS and provide comment.	Steve VanHaren, Mark Cece, CH/Town	Mid Oct.
ii.	How does the pre- vs. post-development Natural Heritage Area compare? MMM to evaluate using identified conceptual NHS in Schedule NOW 2 of the Secondary Plan (subject to the addition of appropriate stream corridor widths and setbacks) as the "pre-" condition and the identified NHS in the development concept as "post-".	Mark Cece	Mid Oct.
iii.	Samantha Mason to provide MMM with recommendations on temperature targets for the SWM outputs to reach 14W-12A. Meeting with CH (Samantha Mason) and MMM (Steve VanHaren) to discuss prior to 3rd Submission of EIR/FSS.	Steve VanHaren, Samantha Mason	End of Sept. for recommendations, meeting end of Oct.
f.	**Location and Size of Stormwater Management Facilities**		
i.	Maintenance of the SWM pumps is key to maintain flow to Redside Dace habitat (14W-12A). The Town does not typically support pumping of stormwater. Further consideration is requested in this unique circumstance. Kristina to take this away to Town management for consideration.	Kristina Parker	
ii.	Justification for pond location to be enunciated clearly in the 3rd submission of the EIR/FSS.	Steve VanHaren, Alex Williams	Address in 3rd Submission of EIR/FSS.
iii.	Town (Kristina) to investigate allowances for roof top storage and respond to MMM (Steve VanHaren).	Kristina Parker	Late Sept.
iv.	Samantha to provide a suitable example of thermal regime calculations to Steve VanHaren for consideration in 3rd submission of EIR/FSS.	Samantha Mason, Steve VanHaren	Late Sept.

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Item	Details	Action By	Action Date
g.	**Water Balance (Clarification of Assumptions)**		
	i. As per item c) Andrew Kulin to meet with CH hydrogeologist re: data collection and characterization of pond, and water balance assumptions. Andrew to report back to Town (Rob), CH (Paul), BK Team (Chris).	Andrew Kulin. CH Hydrogeologist	Sept. / Early Oct.
6.	**Discussion/Clarification of Other Issues**		
	i. It was discussed that there remains outstanding items outlined in CH/Town comments, and included in MMM's preliminary Issues List responses dated July 4, 2013. It was discussed that MMM is generally in agreement with these issues/comments and they will be addressed in the 3rd submission of the EIR/FSS.	MMM – Initiate follow-up discussions where required.	Address in 3rd Submission of EIR/FSS.
	ii. CH/Town to provide informal comments on MMM's preliminary Issues List responses dated July 4, 2013, and/or follow-up where necessary.	CH, Town, Region, MMM – Initiate follow-up discussions where required.	End of Sept.
7.	**Next Steps/Schedule**		
	The intent is to prepare next submissions of the EIR/FSS and ASP, that are acceptable to the Town/CH and Region. The critical path items for resubmission are:		
a.	**EIR/FSS and Draft Plan of Subdivision:** 1st Submission, May 2011 2nd Submission, December 2012 3rd Submission, Targeted for December, 2013	MMM	Dec. 2013
b.	**ASP:** 1st Submission, May 2011 2nd Submission, December 2012 3rd Submission, June 2013 4th Submission, Targeted for Early Oct. 2013	MMM	Early Oct.

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Sonia Rankin

From: Mark Cece
Sent: Thursday, October 24, 2013 11:06 AM
To: Sonia Rankin
Subject: FW: Bentall - North Oakville

Fyi

[redacted]

From: Devlin, Jane (MNR) [mailto:Jane.Devlin@ontario.ca]
Sent: Thursday, October 24, 2013 9:39 AM
To: Mark Cece
Cc: Jefferis, Samantha (MNR)
Subject: RE: Bentall - North Oakville

Hello Mark,
Thank you for the delivery – yes I received it this morning. I will proceed with review of the most recent submission and compiling comments from MNR.
Also - MNR will not require any further sampling for fish in the farm pond. I will be in touch if I need any further information beyond what was already provided to us.

Thanks,
Jane

From: Mark Cece [mailto:CeceM@mmm.ca]
Sent: October-24-13 8:48 AM
To: Devlin, Jane (MNR)
Cc: Jefferis, Samantha (MNR)
Subject: RE: Bentall - North Oakville

Jane

Further to the email below, a member of our staff delivered 1 hard copy of the most recent EIR (3 binders) to your office yesterday afternoon, it was left with Karen Golby. Can you please confirm you received the delivery and your anticipated time frame to complete your review of the information?

Thanks and let us know whether we can help further in your review of the project.

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist
Associate Partner
Ecology Department

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From: Mark Cece
Sent: Friday, October 18, 2013 11:32 AM
To: 'Devlin, Jane (MNR)'
Cc: Jefferis, Samantha (MNR)
Subject: RE: Bentall - North Oakville

Jane

We will get you the most up to date version of the reports as possible in order that you can continue your review of the project.

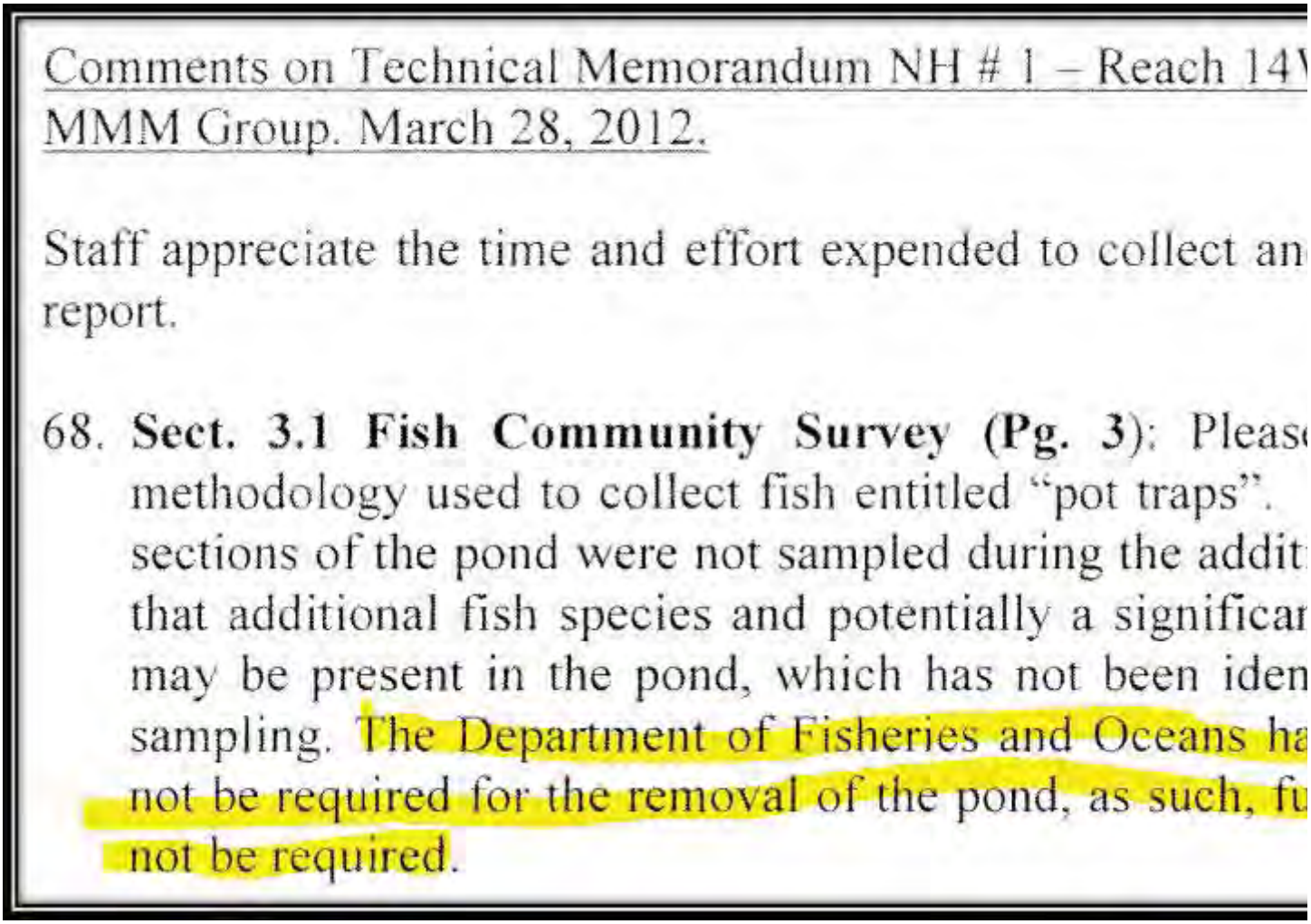
In regards to your statement that you did not say there was no further requirements for fish sampling, I can only state that my recollection and those of my colleagues differ. I recall indicating that I did not see the value of understanding how the presence of more/other fish species (if present) in the deeper area (only 2-2.5 m deep) of the pond at the southeast end would benefit the review of the project in terms of Redside Dace habitat function or review under the ESA. Given that there exists a physical separation of the species by the poor connection at the pond inlet/outlet (seasonal connectivity, dense cattail/emergent growth, diffuse flow (when present) through vegetation) to downstream habitat, the absence of suitable Redside Dace occupied habitat within the pond itself and that at best the pond may function as contributing habitat (although not identified as such on MNR mapping), we felt further sampling was not warranted. Furthermore, I recall requesting that if the MNR did require additional fish community sampling that there be a clear rationale stated as to why additional fish species (if present) in the deeper water would be of value to the evaluation/assessment of the project under the ESA and then asking for confirmation whether the MNR would require further sampling.

Notwithstanding our difference in the recollection of the discussion, if there is a desire from MNR for additional sampling of the fish community within the farm pond for review of the project under ESA I would request the following:

- could you please provide clear and specific rationale as to the need for this additional sampling as it relates to the MNRs review of the project under the ESA, and
- please provide MNR accepted sampling methodology for the farm pond in order that we can develop a suitable sampling program that meets the regulatory review and avoids the need to revisit this topic.

This information will assist us in better understanding the requirements under the ESA as well as provide a clear explanation to the client related to why additional effort/resources are required to once again document the fish community of this farm pond.

Furthermore, for your information the table below identifies the previous fish community sampling that has been undertaken as well as those parties that have undertaken the sampling. I have also included below for your review a screen capture from the Conservation Halton August 16, 2012 Correspondence where CH states that although they would like to have seen sampling of the deeper habitat, they do not require additional fish community sampling and as a result we have met their fish community sampling requirements. A copy of the entire correspondence is attached for your files if you do not have a copy.



Comments on Technical Memorandum NH # 1 – Reach 14
MMM Group. March 28, 2012.

Staff appreciate the time and effort expended to collect an
report.

68. **Sect. 3.1 Fish Community Survey (Pg. 3)**: Pleas
methodology used to collect fish entitled "pot traps".
sections of the pond were not sampled during the addit
that additional fish species and potentially a significar
may be present in the pond, which has not been iden
sampling. The Department of Fisheries and Oceans ha
not be required for the removal of the pond, as such, fu
not be required.

Once again, thank you for your ongoing dialogue on the project review and for verifying the need for the most recent version of the documents for your review. Please let me know if I can be of further assistance in any way to continue to move this forward.

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist
Associate Partner
Ecology Department

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From: Devlin, Jane (MNR) [mailto:Jane.Devlin@ontario.ca]
Sent: Wednesday, October 16, 2013 6:12 PM
To: Mark Cece
Cc: Jefferis, Samantha (MNR)
Subject: RE: Bentall - North Oakville

Hi Mark,
Unfortunately the version we have here is May 2011. Was the second submission of Dec 2012 submitted to MNR? I have been looking at an outdated plan, so we will need the Dec 2012 sent in hard copy. However I suspect this will not take much additional time for me to review.

I did not say that there are no further requirements for fish sampling. I only indicated that the sampling conducted so far, using multiple capture techniques, was conducted in the same habitat within the pond and therefore is likely to capture the same fish species across capture gear used. Additional sampling may be required – I can confirm whether or not once reviewing the information provided in the most recent submission.

My apologies for not catching this outdated version sooner!

Jane

From: Mark Cece [mailto:CeceM@mmm.ca]
Sent: October 16, 2013 12:39 PM
To: Devlin, Jane (MNR)
Cc: Jefferis, Samantha (MNR)
Subject: RE: Bentall - North Oakville

Jane

Thanks for the response, I realize there is a lot of information to go through as there was extensive field investigations undertaken by many disciplines. Again, please let us know if you would like us to come in and meet with you to provide some context or clarification related to the data, we will make ourselves available and ensure whatever staff are required (i.e. hydrogeologist) are in attendance.

Perhaps as a first step you can confirm whether you have the most up to date information.

I also wanted to clarify the results of the discussion had at the September 10, 2013 meeting related to the farm pond and fish sampling. It was clear to me that the MNR did not require additional fish community sampling of the pond in order to determine its contribution (if any) to the downstream Redside Dace habitat given that the pond did not function as “Occupied Habitat”. I wanted to ensure that my notes and those of my colleagues here were correct.

Thanks again and please do not hesitate to contact me should you have any questions or comments. We look forward to your response related to the information you currently have in your possession and are reviewing to ensure you are not reading outdated material.

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist
Associate Partner
Ecology Department

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From: Devlin, Jane (MNR) [mailto:Jane.Devlin@ontario.ca]
Sent: Monday, September 30, 2013 5:12 PM
To: Mark Cece
Cc: Jefferis, Samantha (MNR)
Subject: RE: Bentall - North Oakville

Hi Mark,
I will touch base with you later this week. There is a great deal of information to go though, and I will be coordinating a response with Sam as well. I don't know that I can give you a solid timeline for our full detailed response, but I do appreciate that the goal is for the third submission to be completed this fall. I will do my best to provide my detailed comments to you soon.

Regards,

Jane

From: Mark Cece [mailto:CeceM@mmm.ca]
Sent: September 27, 2013 12:10 PM
To: Devlin, Jane (MNR)
Cc: Jefferis, Samantha (MNR)
Subject: Bentall - North Oakville

Jane:

Just touching base with you to see if you had a chance to determine whether you had the most recent/up to date information related to Redside Dace and what your timelines were for reviewing this information and providing comment. Once again I would like to extend the offer of meeting in person to address any of you questions or provide clarification as there is a great deal of data associated with this project. Thanks again for you contribution to the project and look forward to your response.

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist
Associate Partner
Ecology Department

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Subject: **EIR / FSS (2nd Submission - December 2012) Lazy Pat Farm Property, Town of Oakville**

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1.0 Ministry of Natural Resources (MNR) Comment: We confirm that the following features are designated Redside Dace habitat under section 29.1 of Ontario Regulation 242/08:

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i. Reach 14W-12 (29.1 subsections i, ii, iii and iv apply)

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Comment requested from MNR related to the SWMP encroachment of the berm and outlet structures as well as discharged storm water to Redside Dace habitat.

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ii. Reach 14W-16 (29.1 subsections i, ii, iii and iv apply)

*MNR Classification:*vAc(ˇ 7 ˇedged0vvi rigi llyvindicatedvinv ctˇ %erv '0,v &"v sitevmeetingv 7thv MNR,v)8v ˇ vv#*ˇ 0vv hev ++ˇicatiˇ vofvsectiˇ v&>'0vsu%sectiˇ nsv,vii,vii,v ˇ v$vofwthevActvcˇassifyv thisvreachvasvˇ~ccu+iedvn %tat" ˇ rvn %t twthatvisvˆrvnasv%env7thinvthevˇastv&vyears_vnh %tedv/%v " edsidev#ace0vvvv

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Comment requested from MNR related to the proposed road crossing and Reach 14W-16 modifications.

iii. Reach 14W-11A (29.1 subsection v applies)

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Comment requested from MNR on the proposed realignment of 14W-11A.

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iv. Reach 14W-12A (29.1 subsection v applies)

*MNR Classification:*wAc(˘ 7˘ edged0wwrigi llywindicatedwnw˙ ct˘ %erw'0,w&"w sitewmeetingw7thw MNR,w)8w˘ w#*˙ 0wthew++˘ ication˘ wofwsecti˘ w&>0wsu%secti˘ w$wofwthewActwc˘ assifieswthiswreachwaswv ~c˘ ntri%uti gwh %t t" ˘ rwh %tatwthatwsu++˘ rtsw edsidewv#acew˘ ccu+iedwh %tat".wwwwww

Proposed Interaction with Development Plan:)hangeswt˘ wdrainagewareaswt˘ wdirectwst˘ rmw7aterwt˘ w S¸˝ :w ˘ wv+˘ +˘ sedwremo$ ˘ wofwthewfarmw+˘ ˘ w'^ eachw'!¸ ;' ! ¸ _wss˘ ciatedw7thwthewde$e˘˘ +mentw c˘ nce+tw7˘ wresultwinwchangeswt˘ wthewsurfacew7aterwc˘ ntri%uti˘ nswt˘ wthiswshortwre chw+˘ $idingw " edsidewv#acewc˘ ntri%uti gwh %t t0wwhewfl˘ 7swrigi llywc˘ $eyedw˘ wthiswreachwfromw' eacheswv'!¸ ; ' ! w ˘ w'!¸ ;'.w 7i˘ w%ewredirectedwthroughw' eachw'!¸ ;&&wre ˘ ignedw' eachw'!¸ ;' ! _w˘ w' eachw ' !¸ ;'xw ˘ w7˘ wc˘ ntinuew˘ w%ewc˘ $eyedw˘ wthew' edsidewv#acew ccu+iedwh %tatwofw' eacheswv'!¸ ;

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Comment requested from MNR related to the specific function(s) of interest in the reach and the proposed redirection of flow as it relates to the mitigation measures discussed.

v. Reach 14W-13 (29.1 subsection v applies)

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- hew++ˇicatiˇ wofwsectiˇ w&>0wsu%sectiˇ w$iofwthewActwcˇassifieswthiswre chwaswcˇ ntri%uti gwh %tat" ˇrwh %t twthatwsu++ˇrtsw edsidew#acew~ccu+iedwh %tat".wwwwww

Proposed Interaction with Development Plan: The development will result in the elimination of each reach's classification as a Constraint Stream (i.e. Constraint Stream indicates that these reaches streams can be re-aligned through infrastructure or filled in from each reach's contributing drainage area). The re-aligned reaches will be directed into each reach's proposed re-aligned channel. The re-aligned channel will increase the length of the directed drainage area and will

Comment requested from MNR related to the elimination of Reach 14W-13 and redirection of flow to Reach 14W-22 (realigned Reach 14W-14).

vi. Reach 14W-14 (29.1 subsection v applies)

MNR Classification: According to the site meeting with MNR, the site is not regulated by the MNR, however the Authority has classified this reach as a Constraint Stream due to the presence of fish habitat.

Proposed Interaction with Development Plan: The development will result in the realignment of each reach's channel. The re-aligned channel will increase the length of each reach's contributing drainage area. The re-aligned channel will be directed into each reach's proposed re-aligned channel. Previous discussions with the Authority indicate that each reach's contributing drainage area will be directly reduced. Refer to the Screenwood Tributary Assessment of Reach 14W-13 meeting minutes for more information. The re-aligned channel will be directed into each reach's currently proposed re-aligned channel.

Further it is stated that the re-alignment of the channel using natural design principles as the additional flow contributing drainage area from each reach's proposed re-aligned channel that could directly result in the re-aligned channel. The re-alignment of this reach is considered a Constraint Stream that is permitted by the Authority as the re-alignment could be considered an enhancement to the existing habitat that has been degraded through agricultural practices.

Comment requested from MNR related to the realignment of Reach 14W-14 (post-development Reach 14W-22).

Item	Details	Action By	Action Date
	Stream Realignment of Reach 14W-11A JP was unavailable to visit this area of the property to view the existing conditions in Reach 14W-11A. JP requested to view this feature at a later date when his schedule permits to be coordinated by MMM. SM indicated that the concept of the realigned section of Reach 14W-11A was very angular. MC indicated that the preliminary alignment is an early conceptual alignment and will be designed to create a stable channel. Furthermore, the block identifies the area in which the channel will be located but does not necessarily indicate that the channel will be subject to a 90 degree turn as it will be a meandering naturalized channel. RK provided a preliminary assessment of the potential for the proposed works to result in the Harmful Alteration Disruption, Destruction (HADD) of fish habitat. RK indicated that based upon the fish community, permanency/resilience and intensity of the proposed impacts to this feature, the proposed realignment is likely to pose a Low risk of resulting in a HADD and a *Fisheries Act* Authorization is unlikely to be required. SM supported this assessment. *Reach 14W-14* JP indicated that this feature lacks a channel capable of directly supporting Redside Dace, thereby providing contributing Redside Dace habitat. JP and SM were in agreement with the evaluation of this tributary. Similar to Reach 14W-11A, RK indicated that the proposed realignment is likely to pose a Low risk of resulting in a HADD and a Fisheries Act Authorization is unlikely to be required. SM supported this assessment. JP indicated that the proposed realignment including the consolidation with Reach 14W-13 would likely result in increased permanence in flow and may result in the channel directly supporting Redside Dace. As a result, the watercourse will be subject to the meanderbelt plus 30 m setback associated with Redside Dace. *Reach 14W-16* JP indicated that the proposed channel stabilization would provide the opportunity for improved habitat diversity suitable to improve habitat for Redside Dace including the increased flow anticipated from the realignment of Reach 14W-14. SM and RK were supportive of this approach. Similar to Reach 14W-11A, RK indicated that the proposed stabilization is likely to pose a Low risk of resulting in a HADD and a Fisheries Act Authorization is unlikely to be required. SM supported this assessment. JP also indicated that the entire Reach (14W-16) was considered by the MNR as Redside Dace habitat and as a result, the watercourse is subject to the meanderbelt plus 30 m setback associated with Redside Dace.		

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vii. Farm Pond/Reach 14W-14A (29.1 subsection v applies)

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> 29.1 For the purpose of clause (a) of the definition of "habitat" in subsection 2 (1) of the Act, the following areas are prescribed as the habitat of redside dace:
>
> 1. Within the cities of Hamilton and Toronto, the counties of Bruce, Grey, Huron, Simcoe and Wellington, the regional municipalities of Durham, Halton, Peel and York, the Townships of St. Joseph, Jocelyn and Hilton, and the Village of Hilton Beach,
>
> i. any part of a stream or other watercourse that is being used by a redside dace,
>
> ii. any part of a stream or other watercourse that was used by a redside dace at any time during the previous 20 years and that provides suitable conditions for a redside dace to carry out its life processes,
>
> iii. the area encompassing the meander belt width of an area described in subparagraph i or ii,
>
> iv. the vegetated area or agricultural lands that are within 30 metres of an area described in subparagraph iii, and
>
> v. a stream, permanent or intermittent headwater drainage feature, groundwater discharge area or wetland that augments or maintains the baseflow, coarse sediment supply or surface water quality of a part of a stream or other watercourse described in subparagraph i or ii, provided the part of the stream or watercourse has an average bankfull width of 7.5 metres or less.

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[1] Groundwater elevations at a monitoring well nest located approximately 100 m upstream of the pond inlet (alongside Reach 14W-14) indicate groundwater elevations at that location to range between about 0.5 and 1.0 m higher than the surface water levels in the pond located downstream, of this station (further note that during the summer season, groundwater elevations at these monitors would typically decline the base of the channel, so inputs to the channel are not year-round). The data from this monitoring well nest indicated that the area where the potential for groundwater inputs changed to surface water losses would be located near the upstream end of the pond. The data collected at MP-24D further supports this.

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Comment requested from MNR related to the justification of the inclusion of the farm pond (Reach 14W-14A) as Redside Dace habitat, its removal from the landscape and specific function to be replicated to support Redside Dace (if any).

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viii. Riparian Wetlands, as described on Figure 6.3.4

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Comment requested from MNR related to the re-creation of wetland habitat within the realigned reaches.

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2.0 In reviewing the document we noted that a number of key sections did not reference the Draft Guidance for Development Activities in Redside Dace Protected Habitat (http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@species/documents/document/stdprod_082290.pdf). Accordingly we have concerns with the following:

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i. Lack of pre-development and post-development water balance calculations

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MMM's detailed site-specific studies of the Subject Property did not identify any areas with soils suitable for enhanced infiltration techniques (e.g., sands). The upper weathered zone of the Halton Till (clay-silt soil with low permeability) with its fracturing therefore remains the most viable option for infiltration and following development these soil conditions will be limited to the natural environment areas associated with the watercourses with the principal means of mitigating infiltration losses from infiltration swales constructed along the edges of these watercourse valleys.

Under these less than ideal site conditions, the water balance analysis calculated a reduction in infiltration with mitigation measures following development on the Subject Property improved from a 62% calculated post-development loss with no mitigation measured employed, to a 29% calculated loss with the proposed mitigation measures. This is a significant improvement considering the low permeability of soils and the proposed maximum 90% lot coverage for the developable areas, based on the more urban and intensive employment uses envisaged by the Town, and provided for in the North Oakville Zoning By-law.

MNR's Redside Dace Guidelines state: "Post development water balance (i.e., the hydrogeological cycle of water including the flow and levels of surface and ground water) should match predevelopment water balance in order to protect the natural hydrological functions of Redside Dace streams. Therefore there should be no storm run-off from rainfall events in the range of 5 – 15mm (however, this may depend on the recommendations set forth in the subwatershed plan and on soil permeability)". The MNR guideline does not state that post-development infiltration must 100% match the pre-development infiltration in the vicinity of Redside Dace streams as it recognizes the role of soil permeability in allowing for effective mitigation. Furthermore, the MNR Guideline also defers to the recommendations set forth in local; subwatershed plans, and the North Oakville Creeks Subwatershed Study (NOCSS) does not indicate that 100% post-development infiltration is "required", rather, that using best efforts and best management practices to minimize infiltration reduction is required.

Therefore, in our opinion that the proposed mitigation concepts described in the EIR/FSS with 29% calculated reduction in infiltration meet the stated goals/requirements of the NOCSS and the MNR Redside Dace Guidelines given the soil properties on the lands.

ii. Proposed storm water management facilities and the design criteria used

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iii. The number of stream crossings proposed in the development site as well as adjacent lands

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As presented at the discussed at the Scoping meeting, the Draft Concept Plan was prepared to address the comments received on the NOWSP, and the sensitivities identified in the Draft EIR/FSS. The

In our opinion, the proposed road pattern is consistent with the NOWSP, and follows a modified grid pattern which responds to the existing environmental and site conditions while encouraging accessibility and a viable transit network throughout the 407 West Employment area. Furthermore, the Draft Plan of Subdivision also identifies potential temporary right-of-ways and existing easements (driveways), which are intended to accommodate an appropriate road network and access to the Subject Property until such time as the proposed roads and intersections have been constructed on adjacent lands, where required.

iv. Proposed relocation and alteration of Redside Dace habitat

Although there is much discussion regarding the relocation and alteration of Redside Dace habitat, the agency is not in a position to provide comments on this matter at this time. Please address the requirements of the Endangered Species Act, 2007 and associated regulations. Please contact Ministry staff to discuss the requirements of the Endangered Species Act, 2007 and associated regulations prior to undertaking any activities that may result in contravention of the Act.

Please address the requirements of the Endangered Species Act, 2007 and associated regulations. Please contact Ministry staff to discuss the requirements of the Endangered Species Act, 2007 and associated regulations prior to undertaking any activities that may result in contravention of the Act.

As indicated in your letter, we welcome the opportunity to meet with you at your office to review these comments in further detail, at your earliest convenience.

3.0 Based on records of Bobolink, MNR has determined the subject property provides habitat for Bobolink. An authorization under the ESA is required for the damage or destruction of Bobolink habitat.

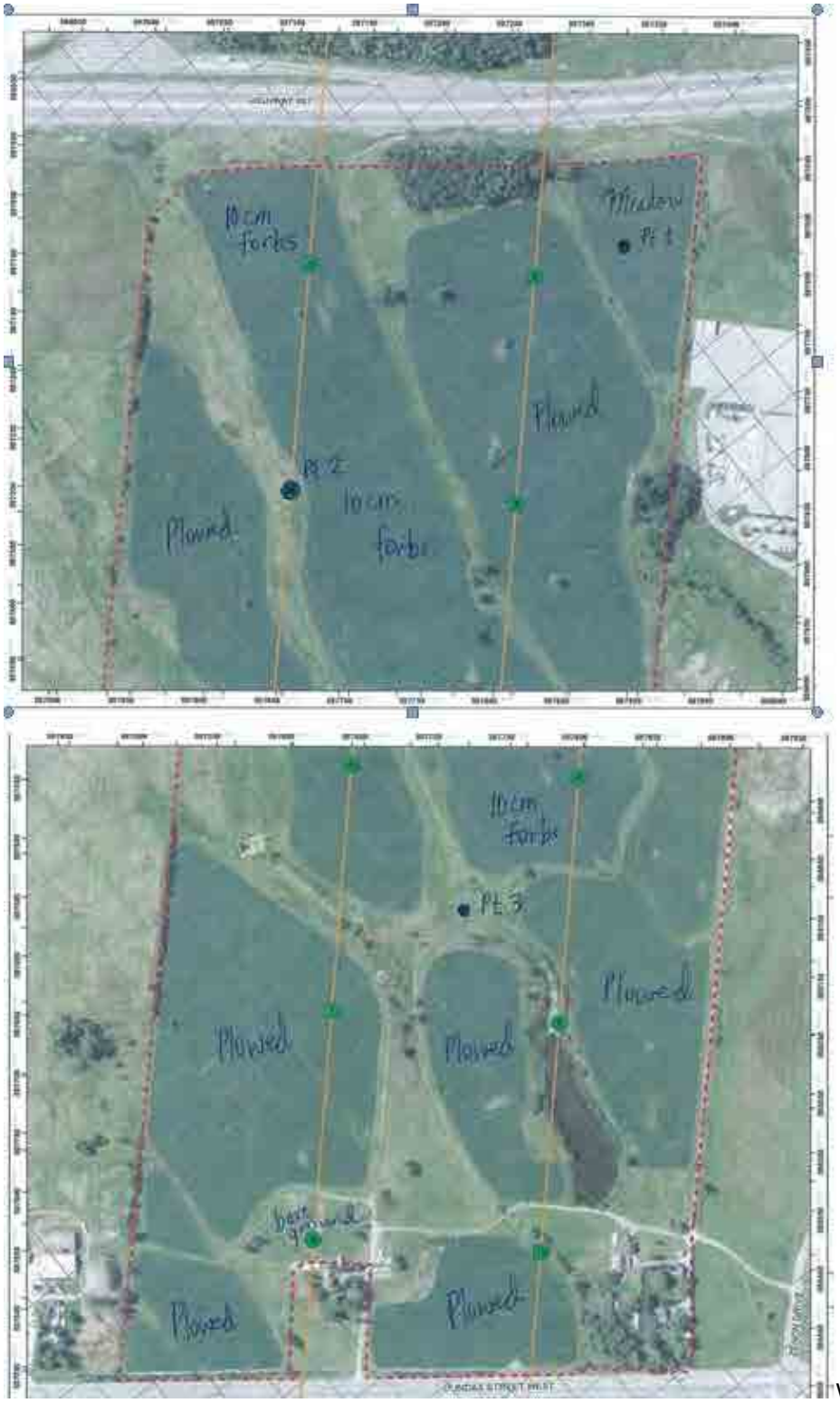
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4.0 Barn swallow has been found breeding on the subject property. An authorization under the ESA is required for the damage or destruction of Barn Swallow habitat. It is recommended that the proponent work with MNR to determine qualification under O.Reg 242/08, Section 23.5 for the removal of the structures on site that support Barn Swallow. Please note, O.Reg 242/08, Section 23.5 only speaks to the removal of buildings or structures that provide habitat for Barn Swallow and does not cover the damage or destruction of adjacent foraging habitat. If the adjacent foraging habitat is planned to be removed, damaged and/or destroyed in the future, an ESA 17(2)(c) Permit will be required.

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5.0 Please provide all available data on the historic bird survey records, which include Eastern Meadowlark.

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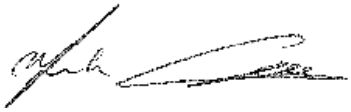
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6.0 Recently, the Little Brown Myotis and Northern Long-eared Myotis have been listed on the ESA, 2007, as endangered. These species are now afforded both species and habitat protection under the ESA, 2007. MNR recommends that the site be surveyed for potentially suitable bat habitat (including, but not limited to: forested areas, abandoned buildings, houses, sheds, etc.) and that if any potentially suitable habitat is found on site, bat surveys be conducted prior to the damage or destruction of any habitat which may support bats. This information on potentially suitable bat habitat should be provided to MNR for review.

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MMM GROUP

INTER-OFFICE MEMO

To:	Paul Bond	Date:	February 27, 2014
From:	Chris Tyrrell	Job No.:	14.09222.001.P01
Subject:	Bentall Kennedy (Lazy Pat Lands) Response to Conservation Halton comments, February 13, 2014 email	CC:	Mike Reel Rob Thun Rita Julio Janette Brenner Jacek Strakowski Samantha Mason Lesley Matich

We appreciate your comments in your email of February 13, 2014, and wish to provide the following responses as shown as (***MMM bold and in italics***).

June 3, 2013 CH Letter Regarding 2nd Submission of EIR/FSS

1. Comment addressed. It is noted that ecology staff are still waiting for Oxygen concentration data.

MMM: Information has been electronically sent to Paul Bond via email and will be saved on a flash drive and couriered directly to Mr. Bond.

2. To be addressed in future submission.

MMM: No Further Comment

4. Road Alignment – Conservation Halton staff agree that there is no further action to be taken with respect to the road alignment other than that the additional information provided to demonstrate the future road flexibility should be incorporated into the EIR/FSS document. At the September 10th meeting, however, we also discussed the sanitary sewer servicing under this heading and it was the further actions to be taken with respect to the sanitary sewer servicing that we were referring to.

MMM: The revised sanitary servicing option of the sanitary sewers under the watercourse crossings have been included as part of the recently provided Area Servicing Plan for the 407 West Employment Lands for Conservation Halton's review. This option demonstrates that the sanitary sewers can be installed with a minimum of 3m below the bottom of the existing watercourse as requested by CH.

March 21, 2013 CH Letter

A. There is outstanding concern regarding the proposed size of the proposed SWM pond proposed for the existing 14W-14A pond. The concern lies with the potential for thermal impacts on the downstream fish community and the feasibility of reaching stormwater thermal targets.

MMM: In order to mitigate the potential thermal impact on the downstream fish community, a thermal trench is being designed, which enables a definite portion of the controlled release rate from SWM Pond 3 to attain an optimum temperature for the benefit of the fish community before the runoff is released to the 14W-12 channel reach. The design of the thermal trench has

been undertaken in accordance to the spreadsheet [Thermodynamic model developed by Doug Nuttal (Water Resources Engineer, Mississippi Valley Conservation Authority)] sent by Samantha Mason. The details of the thermal trench and the supporting calculations will be provided in the upcoming EIR/FSS. It should be noted that the size of the thermal trench is limited by available space, the invert of the downstream channel reach, and the invert of the SWM Pond 3 outlet structure.

D. Infiltration and Water Balance – Staff look forward to reviewing further documentation regarding how best efforts to achieve infiltration and water balance on the property in order to help sustain and provide a net benefit to the endangered Redside Dace on the downstream portion of the property.

MMM: As reported many times in the past, the clay-rich soil conditions at the site make achieving a post development water balance very difficult. MMM will review the Elm Drive West bio-swale monitoring data (see below) and adjust our water balance calculations if this real world data is applicable to the Bentall site. Furthermore, MMM will be meeting with the MNR on February 26 to discuss the Redside Dace issue as we understand they now retain full jurisdiction over the ESA.

G. Location and Size of SWM Facilities – Clarification required from Town of Oakville Staff regarding their position on a pipe in a pipe cooling system in terms of acceptance of this approach. Preference would be not to rule out the use of a "pipe in a pipe" approach to thermal cooling until this cooling method has been discussed with Town of Oakville staff. The maximum allowable permanent pool depth for a wet pond as per table 4.6 in the 2003 MOE Stormwater Management Planning and Design Manual is 3.0 m. This table also states that the preferred length to width ratios for wet ponds will be constructed with a 4:1 to 5:1 length:width ratio. It is requested that these length to width ratios be considered for all proposed SWM facilities on the property. Please note the following SWM guidelines provided in the MNR document entitled: DRAFT Guidance for Development Activities in Redside Dace Protected Habitat:

- the discharge of water from urban development stormwater management facilities into Redside Dace habitat should not exceed 25 mg/l of total suspended solids (TSS) above the background stream level of total suspended solids
- Post development water balance (i.e., the hydrological cycle of the water including the flow and levels of surface and ground water) should match predevelopment water balance in order to protect the natural hydrological functions of Redside Dace streams
- To maximize the absorption of nutrients and other contaminants and prevent them from entering streams, stormwater management facilities adjacent to Redside Dace habitat should be designed as hybrid extended detention wetlands/wet ponds
- The above objectives can be achieved by utilizing a low impact development strategy for stormwater management that treats stormwater as close to the source as possible and focuses on runoff prevention. This includes such measures as:
- Site design strategies to minimize runoff which involves:
    - conserving natural features that absorb rainfall (e.g., wetlands, stream buffers, forested areas, permeable soil, etc.)
    - locating and designing buildings/infrastructure to reduce impact (e.g., clustering development in less sensitive areas, reducing footprints of buildings and roadways)
    - Evaporation and infiltration practices (e.g., using native vegetation/trees, green roofs, soak away pits, infiltration trenches, permeable pavement)
    - Rainwater harvesting (e.g., rain barrels, cisterns)

  - Runoff conveyance (e.g., perforated pipe systems or grass channels which treat and infiltrate runoff as it is being transported)
  - Runoff storage (e.g., woodland restoration, constructed wetlands which capture and then release water as evaporation into the air)
- Several of these low impact development measures may be required, which will vary depending on site specific factors including the soil, geology and groundwater level. These measures will reduce the amount of effort required to implement effective end-of-the-pipe solutions.

Please note that these sections of MNR's Guidance for Development in Protected Redside Dace Habitat are provided for the proponent's reference with respect to options that may be required for the cooling of stormwater originating from the Lazy Pat lands that will enter the habitat of Redside Dace.

MMM: MMM is not currently ruling out the "pipe in a pipe" approach, however the application of this approach is new to Ontario, and as design engineers, we have significant reservations about its use. While the concept is similar in principle to a heat exchanger, we have concerns about long-term operation and maintenance of this system, repair/replacement costs, ease of access, etc. We have significantly more experience with cooling trenches and are preparing a cooling trench design consistent with the design guidance provided to MMM by Samantha Mason, based on an analysis from her colleague at the Mississippi Valley Conservation Authority. The design will be presented in the revised EIR/FSS for CH review to show consistency with the OMB mediation item on thermal SWM effluent targets. At this time, we are not professionally supportive of the "pipe in a pipe" approach in a planning document for a project of this nature, unless the Town believes it will provide significant benefits over a cooling trench design and agrees to maintain it after assumption. We also request an example of where this approach has been used successfully in a cold climate location so that we can compare its performance to date to the climate of the current project.

With respect to the allowable permanent pool depth and length to width ratios, we are aware of the maximum allowable depth for wet ponds from the 2003 MOE Stormwater Management Planning and Design Manual (SWMPDM). We also note that MOE's preferred criteria is a maximum 2.5m deep permanent pool with a mean depth of 1.0-2.0m, specifically to avoid the tendency to promote anoxic conditions in the SWM pond and to avoid resuspension of settled pollutants. Providing maximum depth ponds throughout the pond cell will likely increase the probability of a thermocline in the pond, which will prevent mixing of the pond depth layers, promoting anoxic waters and impairing treatment function. We are proposing shallower ponds at the planning stage to ensure sufficient SWM block sizes are reserved to provide the MOE stipulated volumes for active storage and water quality treatment and to ensure a 'preferred' SWM pond treatment capacity. As the EIR/FSS is a planning level document, it is preferable to demonstrate 'preferred' configurations for SWM facilities to allow flexibility (such as deeper areas near the outlets) at the detailed design stage. Once the SWM pond block sizes are confirmed, deep outlet pools can be configured into the detailed design plans to ensure additional thermal treatment by draw off of deeper pond water through effective mixing of shallower pond water with the deep cells via the mixing action of the reversed slope pond outlet pipe. As for the 4:1 to 5:1 length to width ratios, these ratios can be provided by internal berming (i.e. a serpentine design, as shown in figure 4.19 of the SWMPDM) which allows for SWM block shapes that facilitate a favourable subdivision plan (so long as sufficient volume remains in the ponds after displacement by the internal berms. The shallower depths of the pond at the EIR/FSS stage allow for deepening of the ponds in select areas to account for loss of permanent pool by these berms.)

We note the MNR SWM guidelines provided. As the project requires an MNR permit, we will address MNR concerns on the SWM strategy and its effect on Red Side Dace habitat directly with them. MMM is fully supportive of LID measures to promote their respective environmental benefits. However, the Town of Oakville requires an independently effective SWM strategy to avoid the risk of private SWM measures that are not wholly or partially functional. An example of this was seen in the negotiation of diversion of rooftop runoff from buildings adjacent to reach 14W-12A where the Town would not permit a reduction in SWM pond effective storage and quality treatment capacity despite the full diversion of the catchment areas of these rooftops to the affected reach.

H – Staff look forward to seeing maximized channel gradients for the proposed realigned watercourses.

MMM: No further comment.

5. Section 2.2 Permitted Uses in the Natural Heritage System – Staff encourage the use of the bioswales to achieve water balance on the site. Due to the fact that they will require periodic maintenance, it is recommended they be located outside of the Natural Heritage system including Redside Dace habitat.

MMM: As noted above, we will be replacing bio-swales with equivalent infiltration trenches located on the private lots outside of, but adjacent to the Natural Heritage system. Siting these mitigation measures alongside the Natural Heritage system remains the most feasible and effective method to mitigate against site-wide infiltration losses because:

- ***The on-site soils are comprised completely of low conductivity Clay-Silt Halton Till;***
- ***In situ hydraulic conductivity of the Halton Till measured at depth (on-site), in the unweathered zone, results in hydraulic conductivities on the range of 10^{-9} to 10^{-10} m/sec (very low values). These values are in agreement with other published studies for this Till;***
- ***The upper depths of the Till are weathered and fractured. This results in enhanced "secondary" permeability of the upper zone, with this enhanced permeability being found through the fractures and promoting lateral shallow flows towards the watercourses;***
- ***Through the central, developable parts of the site, site grading activities will eliminate this upper secondary permeability because:***
    - ***in areas of Cut grading will remove the upper fractured zone, exposing unweathered Till at surface (10^{-9} to 10^{-10} m/sec hydraulic conductivities); and,***
    - ***In areas of Fill, the fractured zones will be buried, and covered by Clay-Silt rich soils that will be further compacted to engineered fill specifications with resultant low hydraulic conductivity;***
- ***The Natural Heritage areas will remain largely untouched by construction activities and construction traffic, thereby preserving the secondary permeability zone in the upper soils, and thereby providing pathways for water to infiltrate more readily into the ground that will no longer exist in the central areas of the site. Additionally, water infiltrating into the ground along the edges of the Natural Heritage system will be directed towards the watercourses, whereas, water infiltrating into the ground across the central portions of the site may be intercepted by site servicing trenches and redirected elsewhere.***

8. Section 4.4, (Hydrogeology and Geology), Impacts of the Proposed Development – This comment was provided by our Water Resources Engineer further to comments she provided on the original EIR/FSS. The December 2012 (2nd Submission) EIR/FSS discusses the effects of the proposed development on the overall water balance and specifically changes on infiltration to the groundwater system. It also discusses potential impacts of dewatering. While the last sentence in the introduction on Page 4-24 states that the subsequent sections will discuss the potential impacts related to the proposed stream realignments, no further discussion was provided in this portion of the December 2012 report. The July 4, 2013 MMM response table states that the "text associated with the realignments and associated mitigation measures will be addressed in future submissions to the extent required". Andrew Kulin is welcomed to contact Janette Brenner directly should he wish to clarify this comment further.

MMM: Jeannette Brenner will be contacted.

12. Section 4.4.4.2, Post-Development Water Balance – From an engineering perspective, CH staff have no objections in principle to the Conceptual Flat-Bottomed Infiltration Swales presented in Figures 4.9a and 4.9b. The feasibility of utilizing 2:1 slopes instead of standard 3:1 slopes will be dependent on swale height and volume/velocity of water being directed into the swale, and will need to be confirmed in the EIR/FSS. The final concept will also be dependent on the conceptual grading plan(s) required as part of the EIR/FSS that will demonstrate that the swales will be located outside of Conservation Halton's regulated area.

MMM: The flat-bottomed infiltration swales (bio-swales) will be replaced with equivalent infiltration trenches located along the lot property lines adjacent to the natural features. This will eliminate the conflict with placing these mitigative measures within the green areas.

12. (Aquatic comments) - Monitoring of bioswales in the City of Mississauga is showing favourable performance of this type of infrastructure in the following functions:

-capturing the first 20mm of runoff events
-improvements to water quality of stormwater
-aesthetically pleasing
-lower maintenance frequency and cost as compared to conventional stormwater infrastructure

As such, it is suggested that this approach be pursued for this land development scenario as a way of keeping runoff out of the conventional SWM facilities, thereby reducing the volume of runoff for which warm temperatures need to be mitigated. The use of bioswales is encouraged as a way to help maintain the existing hydrologic regime under which Redside Dace currently exist. Our original statement was not meant to suggest that the mediation item requires efforts to maximize water balance but rather that our inquiries into means of mitigating thermal impacts indicate that efforts to maximize the water balance (with respect to infiltration/evapotranspiration) as much as possible are going to be necessary in order to meet the mediation item's thermal SWM effluent target. As such, we appreciate MMM's efforts to-date to propose the use of infiltration swales.

MMM: MMM will consider the findings from the bio-swale study at Elm Drive West in Mississauga and if applicable, apply the results in our calculations and water balance reporting. However, while we note that additional monitoring information has been posted on Credit Valley Conservation's web-site, it omits important information and we would require more detailed information to complete our review. We trust that Conservation Halton could provide assistance in obtaining this information from CVC .

24. Staff continue to have an interest in visiting the on-line wetlands in Carlton Creek in 2014. It is suggested that this site visit be arranged to take place in April or May.

MMM: We can coordinate a site visit with CH (Cathedraltown, Markham).

41. Section 6.3.6, Hydrologic Feature 'A' – Staff appreciate the effort taken by the consultant team to update the NOCSS HEC-RAS model. We had made our previous comment because we were concerned that MMM's previous response only indicated that they had obtained the NOCSS HEC-RAS model from CH and did not state that it was going to be updated and we wanted to make sure that was the intent. We look forward to receiving the updated models/information.

MMM: No further comment.

43. Section 6.3, Corridor Delineation – No concerns with MMM response.

MMM: No further comment.

49. Information regarding the diversion channel 14W-23 alignment and plan form remains outstanding.

MMM: To be provided in next submission.

53. CH comments to be addressed in upcoming EIR/FSS submission.

MMM: No further comment.

59. Section 7.6, Stormwater Management Facilities – No concerns with MMM response.

MMM: No further comment.

X. Section 7.6.3, Water Quality Control - CH comments to be addressed in upcoming EIR/FSS submission.

MMM: No further comment.

Y. Section 8, Municipal Servicing – CH staff are satisfied that this item has been addressed subject to the clarifications outlined in our email dated November 13, 2013. Staff are currently reviewing the recently submitted final ASP document.

MMM: No further comment.

65. Appendix 8.3, Figure A – Staff look forward to receiving the updated figure in the pending EIR/FSS resubmission.

MMM: No further comment.

Sonia Rankin

From: Paul Bond <pbond@hrca.on.ca>
Sent: Wednesday, June 11, 2014 10:26 AM
To: Randall Roth
Cc: Janette Brenner; Jacek Strakowski; Lesley Matich; Samantha Mason; Rita Juliao; RThun@oakville.ca; Andrew Kulin; Steve VanHaren; Mark Cece; Chris Tyrrell; Reel, Mike (MReel@Bentallkennedy.com); Brenda Axon
Subject: RE: Bentall - North Oakville

Hi Randall,

Our apologies for the time which has lapsed here. CH staff have completed our review your response submission and note that we are satisfied with all of the responses to our previous comments. Further to our March 21, 2013 CH Letter Comment #8, Andrew Kulin has contacted Janette Brenner and will provide additional discussion in the final EIR/FSS document with respect to the potential hydrogeological impacts associated with the proposed stream realignments.

We look forward to receipt of the EIR/FSS follow up submission and moving the applications forward to completion.

Kind regards,

Paul Bond
Environmental Planner
Conservation Halton
t: 905-336-1158 ext. 2257 | f: 905-336-6684
2596 Britannia Road West
Burlington ON L7P 0G3
e-mail: pbond@hrca.on.ca
www.conservationhalton.ca

From: Randall Roth [mailto:RothR@mmm.ca]
Sent: February 27, 2014 1:09 PM
To: Paul Bond
Cc: Janette Brenner; Jacek Strakowski; Lesley Matich; Samantha Mason; Rita Juliao; RThun@oakville.ca; Andrew Kulin; Steve VanHaren; Mark Cece; Chris Tyrrell; Reel, Mike (MReel@Bentallkennedy.com)
Subject: RE: Bentall - North Oakville

Hi Paul,

We appreciate your comments below on our Dec. 5, 2013 response.
We wish to offer the additional attached responses to the outstanding issues you have raised.

Regards,

Randall Roth, MCIP, RPP
Senior Planner/Project Manager, Associate
Planning & Environmental Design
MMM Group Limited

From: Paul Bond [mailto:pbond@hrca.on.ca]
Sent: February-13-14 11:48 AM

MMM Group Limited
Planning & Environmental Design
100 Commerce Valley Drive West,
Thornhill, Ontario, L3T 0A1
t: 905.882.1100 | f: 905.882.0055
www.mmm.ca

Subject: **Lazy Pat Farm Property, Town of Oakville**
February 26, 2014 Meeting Minutes

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1. Provincially Significant Wetlands

MMM GROUP

2. Reference to Draft Guidance for Development Activities in Redside Dace Protected Habitat, MNR, 2011

As indicated in the March 20, 2014 meeting minutes, the Project Team has been advised that the Draft Guidance for Redside Dace Protected Habitat, MNR, 2011 is no longer applicable and will not be referenced in the Project's Environmental Assessment. As a result, the Project Team has been advised that the inclusion of the Draft Guidance in the March 20, 2014 meeting minutes should be removed. It is requested that the March 20, 2014 meeting minutes be updated to reflect this change.

Section 10.8 of the Guidance states that *BMPs is not intended to be an exhaustive list, but rather to cover the major construction activities that most commonly have an impact on Redside Dace and their habitat…The BMPs listed for each activity are intended to act as suggested methods or techniques that can be implemented to protect habitat conditions for Redside Dace*" and "*This document is intended to provide guidance to proponents interested in developing lands in and adjacent to protected habitats of Redside Dace.*" The Guidance does not indicate that the MNR Project Team is responsible for the implementation of BMPs including stream crossings and instream grading. The Guidance is "*intended to act as suggested methods or techniques that can be implemented to protect habitat conditions for Redside Dace*". The Guidance is not a source for suggested techniques or guidance to minimize potential effects. The Guidance does not contain "absolute" nature of the comments made by MNR at the meeting. Therefore referencing this same document is not appropriate.

Although it is acknowledged that additional information specific to Redside Dace was discussed with the Project Team at the meeting, they were referenced in the Guidance and are not discussed in some detail within the Final Report. The meeting minutes should be updated to remove reference to the Guidance in the meeting minutes and instead include the information discussed with the Project Team as an attachment to the meeting minutes.

2.1 Stream Crossings

Meeting minutes state:

"MNR indicated they do not support in-stream activities that will result in the loss of habitat for endangered species, and the Project Team was advised that a regulated 30 metre buffer from the stream bank (or greater if warranted) is recommended for stream crossings. It was further discussed that although the Project Team is committed to the Secondary Plan, their commitment is limited to the Natural Heritage System and not to the identification of the secondary plan. As a result, the Project Team feels that the in-stream activities will not be sufficiently considered."

MMM GROUP

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*Executive Summary of the Guideline (p.1) states: "2) Stream Crossings – **development activities should attempt to minimize the number of stream crossings**, and where required, minimize widths, target straight sections of the stream and areas that have been previously disturbed, minimize activity/footprint within regulated habitat, including spanning the meanderbelt, adherence to timing windows, incorporation of effective erosion and sediment control measures, and design in a manner that promotes fish passage;"*

*The Guideline further states (p.26-27): "For all direct Redside Dace habitat, crossings should be designed to avoid/mitigate impacts by adhering to the following: The **proposed road networks for new crossings should be designed to minimize the number of stream crossings** (e.g., stream crossings should **generally be limited to 1 per kilometre of stream**)."*

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2.2 Stormwater Management - Runoff

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*The Guideline (p.34) states: "Post development water balance (i.e., the hydrological cycle of the water including the flow and levels of surface and ground water) should match predevelopment water balance in order to protect the natural hydrological functions of Redside Dace streams. Therefore, there should be no storm run-off from rainfall events in the range of 5 – 15mm (**however, this may depend on the recommendations set forth in the subwatershed plan and on soil permeability**)".*

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3. Outstanding SAR Information

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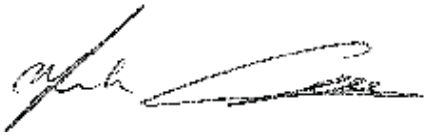
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MMM GROUP

MEETING REPORT
WITHOUT PREJUDICE

Date:		**Project:**	
Date of meeting:		**Project Number:**	
Location:		**Author:**	

Purpose: **MNR Meeting to Discuss Endangered Species Act**

Attendees: **E-Mail**

DISTRIBUTION:

Item	Details	Action By
1.	**MMM Group to provide background of aquatic habitat on-site**	
2.	**MMM Group to provide updates to the development plan from the December 2012 (2nd) Submission of the EIR/FSS**	
3.	**MNR to provide Redside Dace (RSD) Habitat Classification**	

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5. MMM Group to outline water balance and description of recommended Low Impact Development (LID) measures

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7. Species at Risk Discussion w

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Lorraine Adderley

From: Mark Cece
Sent: November-10-14 4:04 PM
To: Lorraine Adderley
Subject: FW: Bentall Kennedy (Lazy Pat) - North Oakville Meeting - Draft Meeting Minutes
Attachments: Lazy Pat wetlands 2006.jpg; Lazy Pat PSWs current.jpg

No PSW email from MNR with attachments.

From: Heaton, Mark (MNR) [mailto:mark.heaton@ontario.ca]
Sent: Wednesday, July 23, 2014 2:45 PM
To: Randall Roth
Cc: Funnell, Emily (MNR); Devlin, Jane (MNR); Jefferis, Samantha (MNR); 'Thun, Robert'; pbond@hrca.on.ca; Mark Cece
Subject: RE: Bentall Kennedy (Lazy Pat) - North Oakville Meeting - Draft Meeting Minutes

Hello Randall,

We have checked the wetland mapping for North Oakville. Two images attached:

- Lazy Pat wetlands 2006 – depicts the wetlands that were identified and evaluated including sub-units 2, 3, 4 and 5
- Lazy Pat PSWs current – depicts the wetlands that are part of the approved PSW

Previous units 2, 3, 4 and 5 are not included in the PSW. However, the identified wetlands are considered part of the regulated habitat for Redside Dace as per Ontario Regulation 242/08 29.1 1 (v)

Regards,

Mark Heaton
Fish and Wildlife Biologist
OMNRF Aurora District

-----Original Message-----
From: Randall Roth [mailto:RothR@mmm.ca]
Sent: July 4, 2014 8:14 AM
To: Heaton, Mark (MNR)
Cc: Chris Tyrrell; Steve VanHaren; Reel, Mike; Andrew Kulin; Asif Quader; Funnell, Emily (MNR); Devlin, Jane (MNR); Jefferis, Samantha (MNR); 'Thun, Robert'; pbond@hrca.on.ca; Mark Cece
Subject: RE: Bentall Kennedy (Lazy Pat) - North Oakville Meeting - Draft Meeting Minutes

Hi Mark,

Thanks for your comments, please find attached the finalized meeting minutes for your files.
As discussed at the meeting, and highlighted in the covering letter, we are still awaiting receipt of the outstanding SAR information to be provided by MNR. Please advise when we can expect to receive this information.

Thanks,

Randall Roth, MCIP, RPP
Senior Planner/Project Manager, Associate Planning & Environmental Design MMM Group Limited

-----Original Message-----
From: Heaton, Mark (MNR) [mailto:mark.heaton@ontario.ca]
Sent: June-18-14 8:17 AM
To: Mark Cece
Cc: Chris Tyrrell; Randall Roth; Steve VanHaren; Reel, Mike; Andrew Kulin; Asif Quader; Funnell, Emily (MNR); Devlin, Jane (MNR); Jefferis, Samantha (MNR)
Subject: RE: Bentall Kennedy (Lazy Pat) - North Oakville Meeting - Draft Meeting Minutes

Hello Mark,

The minutes need to be cleaned up a bit - last three pages are unnecessary. Where text has been stricken out - remove it entirely.

MNR met with the Town of Oakville this past Monday and discussed the proposed road network for North Oakville West. The Town will be organizing a meeting of interested parties to discuss road crossings for Endangered Species Act regulated stream corridors. The meeting will also cover stream relocations and stormwater management.

MNR "agreement in principle" in the number of stream crossings, stream relocations and stormwater management is required given that ESA approval will be required in the future.

Regards

Mark Heaton
Fish and Wildlife Biologist
OMNR Aurora District
(905) 713 7406 office
(416) 993 1295 mobile

_____
From: Mark Cece [CeceM@mmm.ca]
Sent: Tuesday, April 29, 2014 9:59 AM
To: Heaton, Mark (MNR)
Cc: Chris Tyrrell; Randall Roth; Steve VanHaren; Reel, Mike; Andrew Kulin; Asif Quader; Funnell, Emily (MNR); Devlin, Jane (MNR); Jefferis, Samantha (MNR)
Subject: Bentall Kennedy (Lazy Pat) - North Oakville Meeting - Draft Meeting Minutes

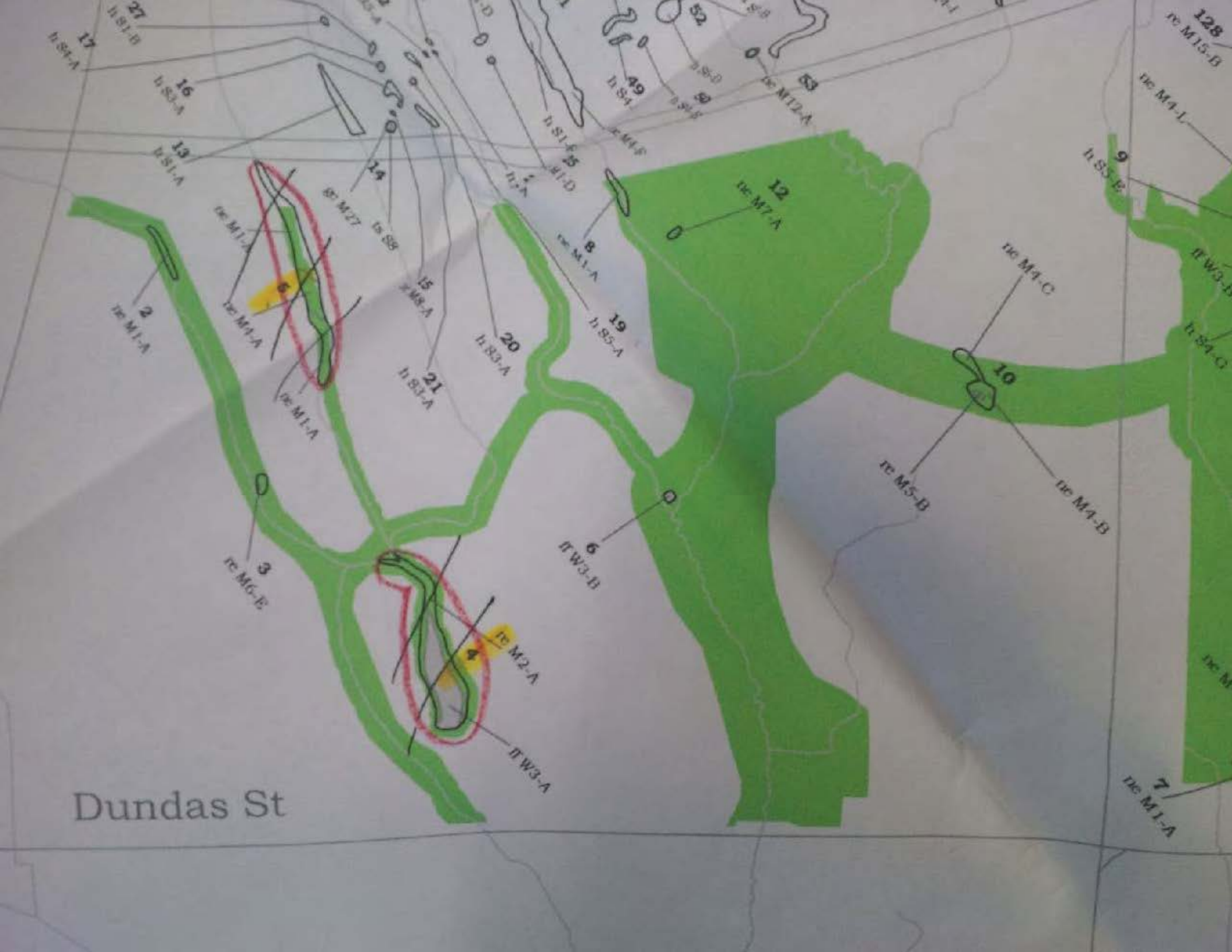
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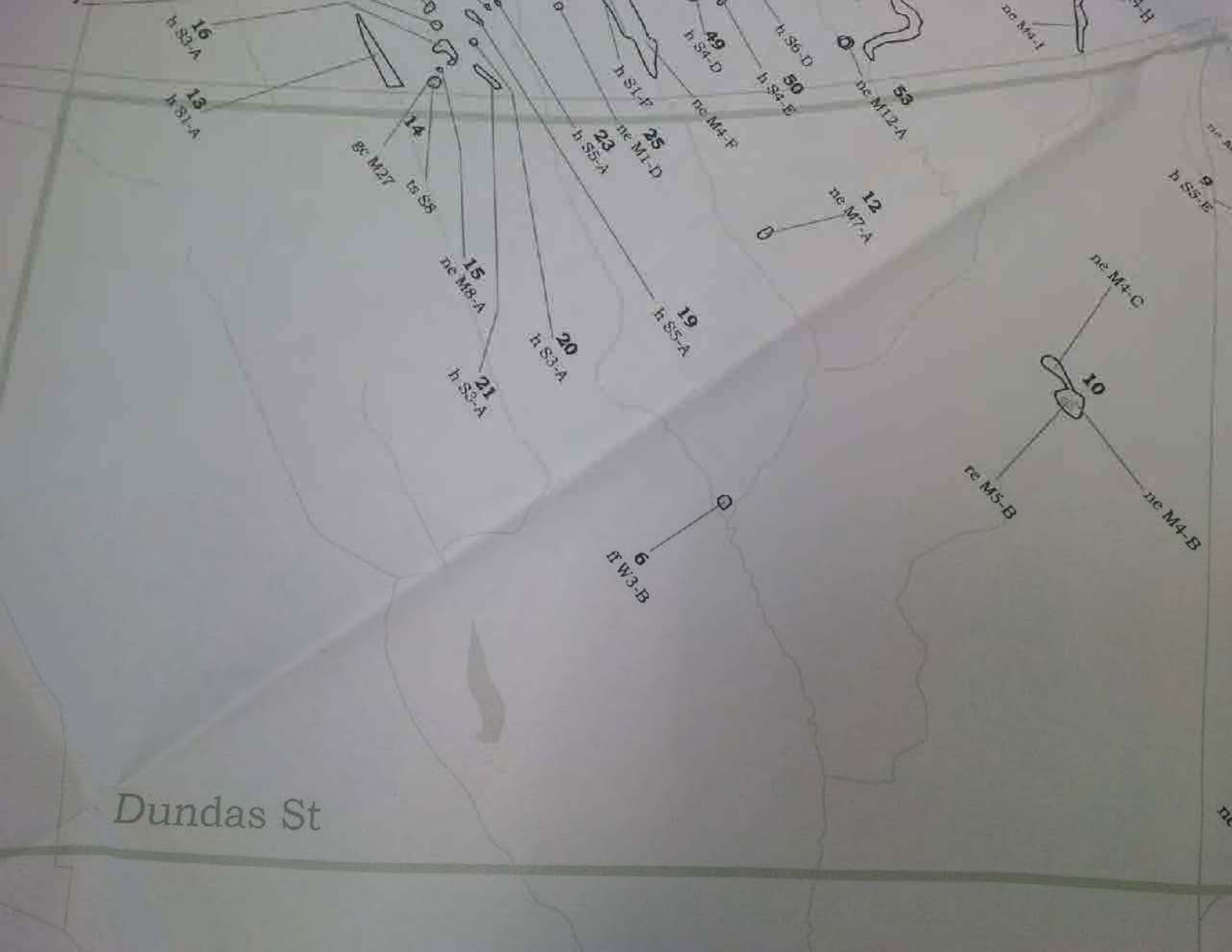
Please find attached the revised meeting minutes from our February 26, 2014 meeting related to the Lazy Pat Lands in North Oakville. You will note that many of your comments have been incorporated into the minutes. We ask that you please review this revised document that includes some additional revisions/comments made by our team in order that we can finalize. Thank you and as always please advise if you have any question or would like to discuss any of this information further.

_____

Mark Cece, B.Sc.
Ecology Manager/Senior Fisheries Biologist Associate Partner Ecology Department MMM Group
100 Commerce Valley Drive West
Thornhill, ON Canada L3T 0A1
t: 905.882.1100 ext: 6861 | f: 905.882.0055 | c: 647.222.1073 cecem@mmm.ca<mailto:cecem@mmm.com> | www.mmm.ca<http://www.mmm.ca> This communication is intended for the sole use of the person(s) to whom it is addressed, and may contain information that is privileged, confidential or subject to copyright. Any unauthorized use, disclosure or copying of this communication is strictly prohibited. If you have received this communication in error, please contact the sender immediately. Any communication received in error should be deleted and all copies destroyed.

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Appendix 5.9 – Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat

Appendix 5.9 – Technical Memorandum NH#1 – Reach 14W-14A Aquatic Habitat

MMM GROUP

TECHNICAL MEMORANDUM NH#1 - REACH 14W-14A AQUATIC HABITAT

Job No.: 14.09222.001

Date: March 28, 2012

Author: Mark Cece, B.Sc. – Ecology Department Manager/Senior Fisheries Biologist

1 Introduction

As you are aware MMM Group has been retained by Bentall Kennedy (Canada) LP - Lazy Pat Farms (hereinafter referred to as Lazy Pat lands) to undertake an assessment of the natural environmental features in support of the proposed commercial land development. The results of field investigations and monitoring were documented in the Environmental Impact Report/Functional Servicing Study (March 2011) and submitted to the Town of Oakville (Town) and Conservation Halton (CH) for review. The Town and CH provided comments in an August 5, 2011 e-mail and a subsequent September 6, 2011 correspondence. The majority of the comments are addressed in a response table that has been prepared and submitted under a separate cover. Due to the nature of data collected and the corresponding analysis, the response table format was not considered a suitable format to present detailed information and as a result (this) Memorandum NH#1 – Reach 14W-14A Aquatic Habitat has been prepared and referred to in the response table. This memorandum focuses principally upon information requests associated with Reach 14W-14A also referred to as the "farm pond" and should also be considered an addendum to the EIR/FSS submitted to CH and the Town.

This memorandum details the additional fieldwork undertaken to address undertaken between June and October 2011 and the analysis of the data. Specifically the following information is addressed:

1.1 Fish Community Survey

CH has recommended that at least 2 or 3 gear types be used to sample fish species in the pond based on the rationale that different fish species will utilize different habitats in the pond (i.e. shallow water vs. deep water, shaded water versus open water and the availability of cover).

1.2 Fish Community Classification

CH has indicated that they consider the pond to have a self-sustaining coolwater fish population.

1.3 Supplemental Fish Habitat Documentation

CH has requested supplemental fish habitat surveys to identify habitat features supporting critical life stages, bathymetric surveys and aquatic vegetation surveys.

1.4 Water Temperature Data

CH requested the installation three continuously recording temperature data loggers in the deepest area of the pond at depths of 33%, 66% and near the bottom. In addition to temperature monitoring, sampling for dissolved oxygen and water clarity measurements at these depths should be undertaken.

1.5 Thermal Impacts of Proposed Conversion of Farm Pond to a SWMP

CH has suggested that the conversion of the farm pond to a SWMP will result in an increase to the thermal warming impacts and will cause a less stable thermal regime.

1.6 Phytoplankton/Zooplankton Production

HC has indicated that the pond contributes self-sustaining phytoplankton and zooplankton to downstream watercourses during periods of high flow.

1.7 Sediment Source

HC has indicated that the pond provides a source of sediment to downstream watercourses as a provision for bedload, an important resource to maintain erosion in a state of dynamic equilibrium.

1.8 Organic Material Source

HC has indicated that the pond is a source of organic material in the form of leaves, twigs, etc. to downstream watercourse for downstream watercourses that helps provide a base of the food chain.

1.9 Headwater Wetland Function

HC indicated that the pond can be considered a headwater wetland that provides many functions which are beneficial from a fish community, water quality, water quantity, wildlife habitat and flood regulation standpoint.

1.10 Pond providing Pelagic and Littoral Habitat

CH has indicated that the pond provides pelagic and littoral zone habitat that is adjacent to open water areas; both of which are limited to in the North Oakville area.

2 Existing Conditions

As described in Section 5.3.4.4 (p. 5-26) of the EIR, the farm pond was constructed between 1954 and 1960 as a component of the agricultural operation (likely irrigation) and functions as a by-pass pond with a single inlet/outlet and has an intermittent connection to the receiving watercourse (Reach 14W-12). The source of water for the pond consists of surface water contributions, specifically flow from Reaches 14W-14, 14W-13 and perhaps backflow from 14W-12. Water is stored in the farm pond stores the water until such time as the water level reaches a certain elevation then the pond discharges into Reach 14W-12. Thus the farm pond's connection to Reach 14W-12 is related to the surface water level.

An examination of the groundwater conditions potentially influencing the farm pond were also examined and based on hydrogeological investigations undertaken in support of the development plan, the farm pond is losing water into the ground. As a result the farm pond does not appear to be receiving sufficient groundwater inputs that would moderate thermal impacts and provide a stable thermal regime or maintain a consistent water depth. This assessment is supported by the water temperature data presented in the following sections.

Due to the inlet/outlet feature as well as the minimal groundwater interactions, water discharging from the farm pond will consist of the surface water that during the summer is at its warmest. This water is then discharged into Reach 14W-12 supporting coolwater Redside Dace habitat.

3 Results and Assessment of Additional Data

The following sections respond to the HC comments related to the farm pond (Reach 14W-14A), specifically the request for additional information and their suspected functions of this feature that were outlined in the August 3, 2011 email as well as the September 6, 2011 correspondence. .

3.1 Fish Community Survey

As was identified in the EIR, fish community sampling had been undertaken in 2002 by MMM Group (formerly Marshal Macklin Monaghan Ltd) using minnow traps to obtain baseline fish community data. Fish community sampling was also undertaken in 2002 by Natural Resource Solutions Incorporated (NRSI), a member of the consulting team preparing the NOCSS, using a backpack electroshocking unit. MMM Group replicated these sampling methods in the pond in 2009 to document up to date data in support of the preparation of the EIR. Both of these sampling events used two sampling methods thus meeting the recommended 2-3 methods identified in the HC August 3, 2011 email.

The EIR summarized the fish community data collected in 2002 and 2009 that indicated a fish community made up largely of tolerant fish species. The one exception was the presence of Largemouth Bass that we presume is stocked considering the absence of naturally occurring suitable habitat in the area as well as the artificial nature of the pond that are often stocked by landowners. This data is summarized in Table 1.

Table 1: Summary of Fish Community Sampling (14W-14A, MESP 2003, MMM, 2003 & MMM, 2009)

Common Name	Scientific Name	Number of Individuals
Brook Stickleback	*Culaea inconstans*	2
Brown Bullhead	*Ictalurus nebulosus*	1
Creek Chub	*Semotilus atromaculatus*	*37*
Largemouth Bass	*Micropterus salmoides*	*3*
White Sucker	*Catostomus commersoni*	*7*

In response to the August 3, 2011 CH email, an additional round of sampling was undertaken in 2011. A Licence to Collect for Scientific Purposes (Licence no 1064904) was obtained from the MNR on (September 26, 2011) to undertake the 2011 fish community sampling. Fish community sampling efforts in 2011 involved the use of minnow traps and pot traps set throughout the pond at various locations and water depths to collect fish that are anticipated to use the different habitats within the pond. The nine (9) traps were set between 0915 and1206 hrs on October 6, 2011, for a period of 24 hours (Table 2). It has been our experience (throughout the province) that the use of pot traps in combination with minnow traps have resulted in the capture of a wide range of species including Centrarchidae, Cyprinidae, Gadidae, Percidae, Esocidae and Umbridae various age classes (young-of-the-year, juvenile and adult).

Table 2: Summary 2011 Sampling Methodology/Gear Types

Equipment Type	UTM Coordinate
Pot Trap	17 T 598200 4809169
Minnow Trap	17 T 598203 4809161
Pot Trap	17 T 598195 4809148
Minnow Trap	17 T 598148 4809160
Pot Trap	17 T 598155 4809155
Minnow Trap	17 T 598168 4809209
Minnow Trap	17 T 598076 4809221
Minnow Trap	17 T 598033 4809233
Minnow Trap	17 T 598031 4809218
Minnow Trap	17 T 598067 4809189

The fish community captured in 2011 is similar to the fish captured in previous sampling events and did not revise the previous understanding of the pond as supporting a warmwater community with coolwater tolerant species. Due to the habitat present in the pond, poor connectivity to downstream habitat as well as the thermal regime a more diverse community is unlikely to be supported by the pond. Table 3 summarizes the results of fish community sampling in 2011. These species are consistent with previous sampling efforts in the pond for species composition with the addition of another warmwater species, Pumpkinseed.

Table 3: Summary of Fish Community Sampling (14W-14A, 2011)

Common Name	Scientific Name	Number of Individuals
Brown Bullhead	*Ameiurus nebulosus*	7
Creek Chub	*Semotilus atromaculatus*	7
Largemouth Bass	*Micropterus salmoides*	1
Pumpkinseed (adult & YoY)	*Lepomis gibbosus*	81

As a result the fish community of the farm pond has been surveyed on the following occasions and the approximate locations identified on Figure 1:

- 2002 MMM Group – Minnow Trap (approx. 24 hr set) to obtain background data for site;
- 2002 NRSI – Backpack Electroshocking along the shoreline in support of NOCSS;
- 2009 MMM Group – Minnow Trap (approx. 24 hr set) in support of the EIR;
- 2009 MMM Group – Backpack Electroshocking along the shoreline in support of the EIR
- 2011 MMM Group – Minnow Trap to supplement existing data at request of HC
- 2011 MMM Group – Pot Trap to supplement existing data at request of HC

It is our opinion that the use of 3 sampling gear types as well as two sampling events in each year (2002, 2009 and 2011) at times by two separate parties should be sufficient to characterize the fish community present in this farm pond. Given the effort, cost and the type of habitat present the use of alternative sampling methods suggested by HC including a boat electroshocker are not warranted as it is unlikely that the fish community would differ from that observed during previous sampling of this farm pond.

As requested by CH we have also calculated the catch per unit effort (CPUE) for the sampling events, excluding NRSI data as it is unavailable.

Minnow/Pot Trap

Average fishing time (unit of effort) for the 10 minnow and pot traps set in 2011 is 26 hours for an approximate total fishing time of (10 traps x 26 hrs) 260 total trap hours. The total number of fish captured is 103. Resulting in a catch per unit of effort (CPUE):

CPUE = [# fish / # Total Trap Hours]

= [103 Fish / 260 Total Trap Hours]

= 0.396 Fish / Total Trap Hours

Electrofishing

For the electroshocking we captured 6 fish during 368 shocking seconds within an area sample of approximate 320 m^2.

CPUE = [# fish / Sampling Effort]

= [6 Fish / (320 m^2/ 368 second)]

= [6 Fish / 0.87 m^2/s]

= 6.89 Fish / (m^2/s)

3.2 Fish Community Classification

The species captured as well as their thermal classification (based on thermal preference) is identified in Table 4. The three coolwater species identified in the table have a preference within the coolwater thermal regime; however, they also have a tolerance for warmwater habitat and are commonly found within warmwater habitats. These three species including White Sucker, Creek Chub and Brook Stickleback have a thermal range of 0ºC to 31.2ºC, 1.7ºC to 32.5ºC and 0ºC – 30.6ºC respectively. When examining the warmwater species thermal preferences and ranges of tolerance it would appear that the habitat present is well suited to their thermal requirements.

As a result of the thermal tolerances of the coolwater species and the water temperature data presented in the following sections, it would appear that the classification of this community as a warmwater is more appropriate. This is supported by NOCSS Characterization Report (p.4W-118) that states *"There is a manmade online pond (14W-14A) located in the vicinity of Dundas Street. Shoreline habitat of this pond consists of cattails, stumps and woody debris. Underwater habitat throughout the pond is unknown. Substrate consists of silt and muck. This pond supports a* ***warmwater baitfish and sportfish community*** *(LGL 1999, NRSI 2005). The presence of sportfish indicates that the pond is productive as largemouth bass are the top level predator species requiring a substantive forage base."*

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Table 4: THERMAL AND VELOCITY TOLERANCES FOR FISH SPECIES KNOWN TO OCCUR WITHIN THE ZONE OF INFLUENCE*

FISH SPECIES		LIVE STAGE							
							MORTALITY (ADULT)		PREFERRED TEMPERATURE (TABLE 3, CHU ET. AL., 2009)
COMMON NAME	SCIENTIFIC NAME	SPAWNING	EGG/EMBRYO	LARVAE/FRY	JUVENILE	ADULT	Acclimation Temperature	Upper Incipient Lethal Temperature	
Brook Stickleback	*Culea inconstans*	May – June at 8ºC - 19ºC	Hatch: 8 – 10 days at 16ºC - 17ºC 9 – 11 days at 17ºC - 18ºC Optimum hatching temp.: 18.3ºC max for embryo survival: 21ºC			Thermal range: 0ºC – 30.6ºC	25ºC - 26ºC	30.6ºC	21.3 ºC
Creek Chub	*Semotilus atromaculatus*	April – July Spawning triggered at: 12.8ºC Range: 12.8ºC – 26.7ºC	Hatch in 10 days at 13ºC Temperature range for hatching: 15ºC - 20ºC Optimal temperature range for embryo: 14ºC - 20ºC in spring		Optimal growth range: 12ºC - 24ºC, preferred for growth: 21ºC	Thermal range: 1.7ºC – 32.5ºC	5ºC	24.7ºC	20.8 ºC
							10ºC	27.3ºC	
							15ºC	29.3ºC (lower 0.7ºC)	
							25ºC	30.3ºC (lower 4.5ºC)	
Largemouth Bass	*Micropterus salmoides*	May – June Spawning occurs at: 17ºC - 22ºC	Hatch: 13ºC - 26ºC, optimal: 20ºC - 21ºC low survival >30ºC and <10ºC Upper lethal limits: Acclimated to 20ºC is 36.7ºC Acclimated to 28ºC is 40.1ºC	Larvae: Thermal range: 20ºC - 30ºC Preferred: 27ºC Fry: Thermal range: 17.5ºC – 27.5ºC Preferred: 27ºC Critical limit: >36ºC	Thermal range: 23ºC - 31ºC Preferred: 30ºC Optimal growth: 24ºC - 30ºC Little growth <15ºC	Thermal range: 10ºC - 38ºC Preferred temp.: 30.3ºC	20ºC	32.5ºC (lower 5.5ºC)	30.2 ºC
							25ºC	34.5ºC (lower 7ºC)	
							30ºC	36.4ºC (lower 11.8ºC)	
Pumpkinseed	*Lepomis gibbosus*	May – August Spawning occurs at: 20ºC - 28ºC At 11ºC - 13ºC spawning ceases	Hatch: 19ºC - 28ºC, optimum temperature: 28ºC		Thermal range: 24.2ºC - 32ºC Preferred: 30ºC Lower lethal temp.: 2.1ºC when acclimated to 12ºC in summer.	Thermal range: 4.5ºC - 38ºC Preferred: 26ºC Signs of stress begin at 31ºC - 38ºC and < 4.5ºC	5ºC	(lower 1.1ºC)	26 ºC
							10ºC	(lower 1.2ºC)	
							12ºC	28.5ºC (lower 3.6ºC)	
							20ºC	31.6ºC (lower 6.4ºC)	
							28ºC	31.9ºC (11.3ºC)	
							30ºC	34.8ºC (lower 13.4ºC)	
							32ºC	33.5ºC	
							34ºC	37ºC (lower 16.1ºC)	
White Sucker	*Catostomus commersonii*	April – June Spawning migration triggered: 10ºC - 18ºC Spawning occurs: 7ºC - 10ºC	Hatch: 13.9ºC - 20ºC, prefer 11ºC - 16ºC upper lethal temp.: 24ºC lower lethal temp.: 6ºC	Thermal range: 13ºC - 25ºC, preferred 27ºC Upper lethal: 32ºC	Upper lethal temp. 26ºC - 31ºC, lower lethal temp. 21ºC - 6ºC	Thermal range: 0ºC – 31.2ºC Preferred temp.: 22.4ºC	5ºC	26.3ºC	22.4 ºC
							10ºC	27.7ºC	
							15ºC	29.3ºC	
							20ºC	29.3ºC (lower 2.5ºC)	
							25ºC	28.3ºC (lower 6.6ºC)	
Brown Bullhead	*Ameiurus nebulosus*	May – June Temperature reaches 21.1 ºC	Hatch: 20.6 ºC to 23.3 ºC			Upper Tolerance Temperature: 36.1 ºC	6 ºC	28.6 ºC	
							36 ºC	37.5 ºC	26 ºC

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Wismer, D.A. and A.E. Christie. 1987. *Temperature relationships of Great Lakes fishes: a data compilation* . Great Lakes Fishery Commission Special Publication 878-3. 165p.

3.3 Supplemental Fish Habitat Documentation

The pond to date has not been actively managed by the landowner as anything but a farm pond and in that time the absence of management for its intended function as agricultural function has allowed it to naturalize. HC has requested additional information including the preparation of a bathymetric survey, critical habitat assessment in addition to this request sediment sampling and an attempt to visually assess habitat in the deeper portions of the pond was undertaken. Aquatic habitat was visually assessed from the shoreline and wadeable depths to document near shore habitat as well as aquatic vegetation. Deeper water areas were assessed during field investigations in 2011 from a canoe including the attempted use of an underwater camera. This vantage point allowed staff to view submerged vegetation in the shallow, non-wadeable areas of the pond and to easily document the riparian community along the waterline.

Bathymetric Survey

The bathymetry of the pond is illustrated in Figure 1. The pond is generally shallowest at the northwest end of the pond, with depth increasing fairly uniformly toward the southeast end of the pond. The slope of the pond bottom varies, with some areas having a greater slope than other areas. The most prominent slope occurs along the southeastern end of the pond, parallel to the laneway.

Aquatic Vegetation

The aquatic vegetation associated with the farm pond consists of emergent vegetation, submerged and floating vegetation. Algal growth occurs throughout the pond primarily at the northwest end and along the perimeter of the pond, which consists of dense mats of algae. Similar algae mats were observed in Stream Reaches 14W-16 and 14W-12 over the course of 2009 and 2011 field investigations on the Lazy Pat lands. A detailed species list associated with the pond is presented in the EIR. In addition to the vegetation identified in the EIR, supplemental vegetation investigations were undertaken in 2011 and resulted in the identification of two additional species including:

- Stalk-grain Sedge (Carex stipata)
- Common Hornwort (Ceratophyllum demersum)

Fish Habitat Structure and Function

As previously mentioned the aquatic habitat in the shallower areas of the pond was assessed from the shore as well as wadeable water depths with deeper areas examined from a canoe examining the surface as well as attempting to examine the deeper water areas with an underwater camera. Generally the dense aquatic vegetation appears to provide the greatest amount of cover and habitat for the fish present. Woody debris is scattered along the shoreline in limited quantities owing to the absence of woody vegetation surrounding the pond. Observations of the deeper water area with the underwater camera were unclear owning to the limited clarity in the pond however, there were scattered areas of submerged vegetation stems observed during the examination. It is anticipated that the cover/structure habitat within the deeper water area is limited due to the constructed nature of this feature, its function as a farm pond (fish habitat structured unlikely to have been installed) and the absence of woody debris and/or coarse substrate that would improve habitat complexity. As a result it appears that the main cover habitat within the pond consists of the aquatic vegetation along the fringe of the pond.

The substrate of the pond was also observed using a combination of visual assessments during field investigations as well as using an Ekman Dredge from the canoe. Generally with the exception of the boulders and concrete debris along the laneway, the substrate throughout the pond is dominated by silt and muck which is consistent with observations made in NOCSS.

Fish Habitat Structure and Function

The pond presumably provides suitable specialized habitat for the species present (i.e. spawning habitat, nursery habitat, etc.) however, considering the generalized nature of the species present their requirements are often limited to spawning habitat.

Specialized spawning habitat associated with the Largemouth Bass and Pumpkinseed is likely located in the shallower habitat in the vicinity of the inlet/outlet as well as the gently sloping pond bed in this northern portion of the pond. As the depths increase towards the laneway, the habitat in this area is less likely to provide this type of suitable specialized habitat. The combination of dense aquatic vegetation surrounding the pond shores (for Largemouth Bass) as well as adjacent open water habitat (for Pumpkinseed) would be suitable to fulfill the majority of the habitat needs for these species as it provides cover and forage habitat. It is anticipated that the deeper area within the pond at the south end provides overwintering habitat for this and the other species present.

Extensive spawning habitat is available for Brown Bullhead that requires muddy substrates in close proximity to woody debris/aquatic vegetation and flooded vegetation. The pond provides suitable habitat for this species that is typically found near /on the bottom in shallow, warmwater habitats, in slow moving water (i.e. ponds, small lakes, etc) in association with dense aquatic vegetation, and sand to mud bottoms.

Brook Stickleback spawns on the stems of aquatic or flooded vegetation that are abundant in the area and the habitat in the pond provides suitable habitat for the species as they are often found in wetlands, beaver ponds and pond habitats with aquatic vegetation and are able to withstand periods of low dissolved oxygen. Given the habitat present they are well suited to the pond owing to the dense aquatic vegetation and seasonally flooded shoreline (flooded vegetation).

It would appear that the pond does not provide spawning habitat for Creek Chub as they typically will spawn in riffle habitat with gravel substrate. Creek chub are not typically found within pond habitat, they do occupy small lakes in nearshore areas. Although the farm pond is not its preferred habitat for creek chub they are a very common species and generalists in their habitat needs and as a result does not require additional specialized habitat.

Spawning habitat for White Sucker does not appear to be present in the farm pond as they tend to spawn in shallow flowing water over gravel substrate. In lake environments they will spawn over gravelly/sand shoals subject to wave action, this habitat is not present in the farm pond. White Sucker is also a tolerant species that does not demonstrate a preference for a specialized habitat type beyond spawning, and are tolerant of a wide range of water quality conditions including turbidity and low dissolved oxygen.

Riparian Habitat

Generally the vegetation community results in an open canopy with scattered trees and shrubs. Several mature trees, which include Basswood are growing at the top of the exposed bank, providing the only significant shading for the pond. The vegetation along perimeter of the southern end of the pond consists of purple loosestrife, water plantain, lance-leaved aster, queen anne's lace, cutgrass, and fox sedge. Several shrubs grow along the shoreline adjacent to the laneway amongst the cobble and concrete debris that forms the shoreline. A detailed species list associated with the pond is presented in the EIR.

Water Levels

As discussed the pond receives input from tributaries 14W-13 and 14W-14 at the north end and through surface flows from the relatively small catchment area from the adjacent table lands draining the pond. As a result, water levels can fluctuate by more than a meter during periods of heavy rains. The following pictures show the staff gauge installed at the south end of the pond at the deepest part of the pond. The photo on the left (Plate 1) was taken on (October 6, 2011 when Environment Canada recorded 0 mm of rainfall during the 24 hours prior, (26.5 mm of rain – 7 days prior). The photo on the right (Plate 2) shows the staff gauge on October 20, 2011 with when Environment Canada recorded approximately 60 mm of rainfall during the 24 hours prior (63.5 mm of rain – 7 days prior). The observation suggest that the pond is heavily influenced by the surface water contributions and that once the pond is no longer hydraulically connected to the downstream watercourse, there are no other inputs that assist in maintaining water levels. Instead the water level is decreased through evaporation.



Plate 1: Staff Gauge, October 6, 2011



Plate 2: Staff Gauge, October 20, 2011

Water Quality Monitoring

Water quality monitoring for dissolved oxygen and water clarity was recorded at the approximate location of the water temperature logger strings and at the approximate vertical position of the temperature loggers.

Dissolved Oxygen

Dissolved oxygen was sampled using (HANNA HI9146-04N Dissolved Oxygen Meter and was compared against the target of 6 mg/l identified in the OMB Mediation Item: Stormwater Management – Temperature and Dissolved Oxygen Targets. For Fourteen Mile Creek, the conservative DO target is 6 mg/l, which is the Provincial Water Quality Objective for coldwater fisheries associated with a water temperature of 20ºC. Dissolve oxygen measurements taken at the three temperature logger locations, representing the north, middle and south areas of the pond indicate that oxygen levels vary based on depth and the time of the year. As expected and likely due to surface agitation, the DO levels in the pond at the surface meet or exceeding the OMB target. As the depth increases, the DO levels continue to drop with DO levels at depths of 2.0 m or greater below the OMB target of 6 mg/l associated with recorded water temperatures between 20 and 24.3 ºC. This distribution of DO is not unexpected considering the shallow depth of the farm pond and the likelihood of mixing. The reduced DO in the deeper area is likely attributed to less mixing and bacteria activity in the sediment.

Water Clarity

Water clarity was also documented at each of the water temperature logger string locations using a Secchi Disk (Table 5). The Sechi Disk is a black and white circular plastic plate, 20 cm diameter. A measured line is attached to the center of the disk to allow the recorder to note the depth of the disk as it is lowered into the water. The depth at which the disk was no longer visible was recorded. The disk was then lowered slightly and slowly retrieved to a depth at which the disk became visible. This depth was also recorded. The Secchi Disk provides a quantitative way of identifying the level of clarity (transparency determinations) in natural waters. Water that is clear has a high transparency, resulting in a higher secchi depth reading, which indicates lower turbidity. Transparency in freshwater systems typically decreases in the summer when plankton, silt and organic matter are more likely to be prevalent. For reference, the most transparent lakes are usually seepage lakes as this characteristic greatly reduces the amount of silt bearing influents. Drainage lakes carry more silt and usually are less transparent. To minimize errors during the readings, the same observer was used, using the same method and all readings were taken between 10am and 2pm. The weather conditions on each reading were generally the same, with clear sunny skies.

Table 5: Summary of Secchi Depths for Stream Reach 14W-14A (2011)

Date	Sampling Location	Secchi Down (m)	Secchi Up (m)	Clarity Depth (m)
August 19	South Logger	0.75	0.60	0.675
	Middle Logger	0.60	0.50	0.55
	North Logger	0.60	0.60	0.60
August 24	South Logger	0.60	0.40	0.50
	Middle Logger	0.70	0.50	0.60
	North Logger	0.55	0.45	0.50
October 7	South Logger	0.55	0.45	0.50
	Middle Logger	0.54	0.52	0.53
	North Logger	0.52	0.51	0.515

Readings were taken at the approximately at the same time and were based on three separate readings. The water clarity in the pond showed little variation in water clarity throughout the pond and no marked improvement in water clarity during the sampling period. The highest reading was recorded in the deepest part of the pond at the south (0.675 m). However, the difference between the highest and lowest reading is 17.5 cm (0.175 m). This suggests that visibility within the water would range between 0.5 and 0.68 m during sunny, clear sky conditions, near the surface with light levels reaching plants at or below .68 m would be significantly reduced.

This is supported by the observation of submerged vegetation in greater density at the north end of the pond where the water was shallow. Using an underwater camera, visibility was extremely poor at the south end of the pond and although scattered stems of submerged vegetation were observed, the plants were sparse.

The lack of clarity would likely be attributed to a combination of wind action agitating the water thereby maintaining suspended sediments as well as phytoplankton.

3.4 Water Temperature

In recognition that additional water temperature data would likely be required, MMM Group initiated water temperature investigations in advance of receiving the August 5, 2011 e-mail, specifically the installation of water temperature loggers. Water temperature monitoring in the pond was initiated on July 4, 2011 and used water temperature loggers set to record data hourly. A total of nine loggers were installed, three at each string located along the length of the pond (Plate 3 and Figure 2). Each string was set up to record the water temperatures at the bottom, middle and top of the water column. The maximum depth of the bottom loggers (Logger String 1, south end) was approximately 3 m below the water surface at the time of installation (July 4, 2011). The minimum depth of the bottom loggers (Logger String 3, northern end) was 1.5 m below the water surface at the time of installation (July 4, 2011). Although maintaining the same distance from the bottom of the pond, the water depth relative to the surface for the middle and top loggers varied throughout the survey period due to fluctuating water levels. The middle loggers were generally positioned halfway between the surface and bottom loggers, approximately 1.5 m, 1 m, 0.75 m (Logger Strings 1, 2 & 3 respectively).

Although CH requested the installation of three loggers in the deepest part of the pond set at the bottom, 33% and 66% depth, the existing loggers were left in place due to the extent of the data collected and the distribution of a greater number of loggers than requested over varying depths was felt to provide sufficient coverage to cover the intent of the CH recommendation.

Through consultation with CH the water temperature data was analyzed using methods identified in *Evaluation of a Simple Method to Classify the Thermal Characteristics of Streams Using a Nomogram of Daily maximum Air and Water Temperature* (Cindy Chu, et. al., 2009). In the study, the maximum daily water temperature recorded between July 1 and August 31 was plotted against the maximum daily air temperature within the period. Following consultation with CH, the temperature recorded at 4pm was selected as the maximum water temperature for the comparison which is consistent with the study that indicated that water temperature recorded between 4pm and 6pm represent the time during which water temperatures are most likely to be at their maximum. The resulting graph of temperature comparisons provided a tool to determine if the water temperature could be characterized as coldwater, cool-coldwater, coolwater, cool-warmwater or warmwater. The preferred nomogram used by CH staff for this purpose is Figure 7 on pg 1615 of the published study. The approximate temperature ranges for the thermal classifications are summarized in Table 6:

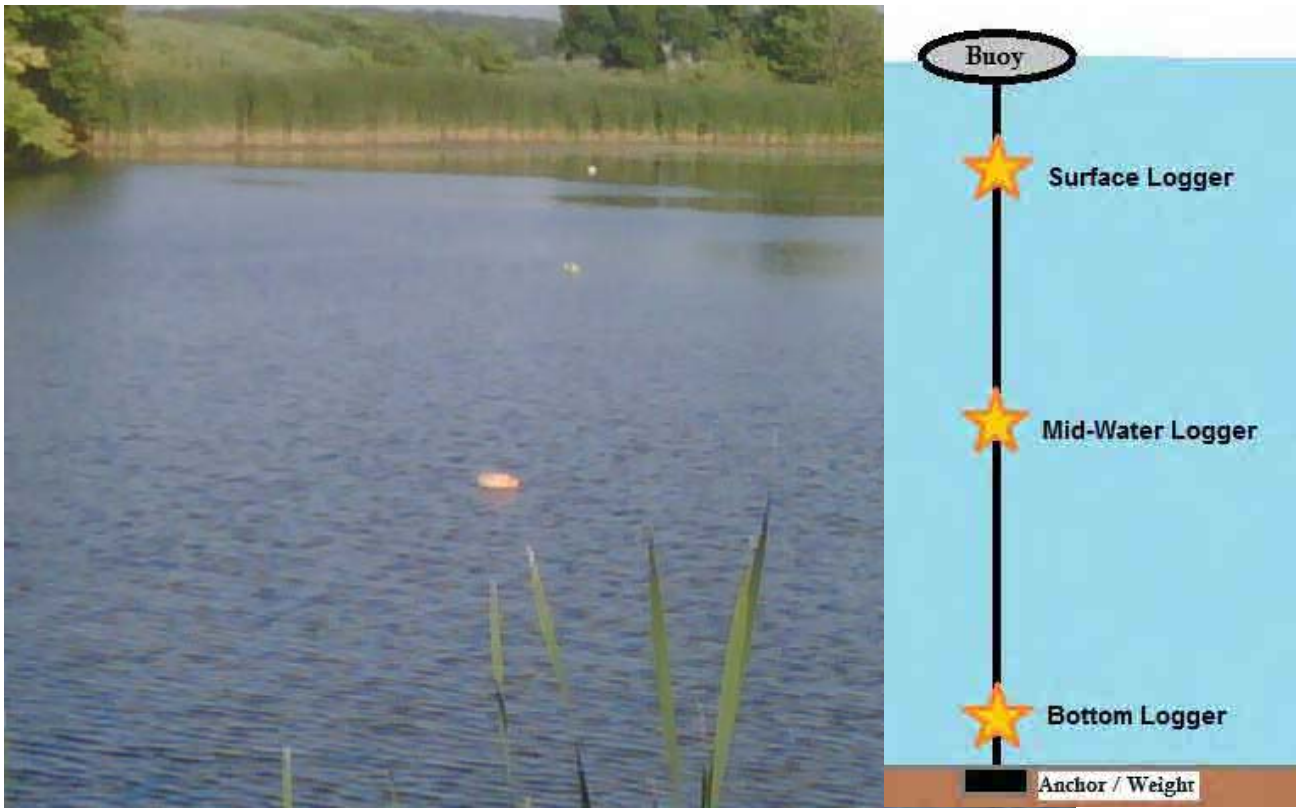


Plate 3: Facing north, showing the location of the temperature logger strings in the pond (left). Vertical position of loggers on each string (right)

Table 6: Approximate Thermal Classification Ranges for Watercourses, Based on Figure 7 Nomogram (Chu. et. al., 2009)

Thermal Classification	Maximum Water temperature Range at 24°C	Maximum Water temperature Range at 36°C	Est. Maximum Water temperature Range at 28 °C
Coldwater	10 °C to 15 °C	10 °C to 16 °C	10 °C to 16 °C
Cold-coolwater	15 °C to 17 °C	16 °C to 20 °C	16 °C to 18 °C
Coolwater	17 °C to 20 °C	20 °C to 24 °C	18 °C to 21 °C
Cool-warmwater	20 °C to 23 °C	24 °C to 28 °C	21 °C to 24 °C
Warmwater	23 °C to 32 °C +	28 °C to 32 °C +	24 °C to 32 °C +

Water temperature sampling was undertaken between July and October, 2011. For the purposes of analysis, only the water temperatures recorded at 4pm between July 4 and August 31, 2011 were used to determine the thermal classification of the pond. The maximum daily air temperatures recorded by Environment Canada for the weather station at Lester B. Pearson International Airport in Mississauga Ontario during the assessment period reported temperatures ranging from 22.3 °C (August 28, 2011) and 37.9 °C (July 21, 2011), with an average temperature of 28.69 °C. A weather station is also located in the Town of Oakville; however, the difference in temperature comparison when using the Town of Oakville air temperature is less than 0.5°C. As such, the use of the weather station at Lester B. Pearson was used as this is consistent with reference data for the EIS/FSS report (2009).

In order to identify the thermal stratification in the pond the temperature loggers were grouped according to the depth range where sampling occurred. These depths represent the surface (0-1 m), mid-water (1-2 m), bottom (2 m+) of the water column. As a result of the pond bathymetry profile, logger string locations, the nine loggers were assigned as follows: due to varying water levels during the season five loggers recorded temperatures at depths at 1 m or less (surface); two loggers occurred at depths between 1 and 2 m (mid-column) and 1 logger recorded at depths greater than 2 m (bottom). Figure 3 illustrates the thermal profile of the pond at 24 ºC, 36 ºC and at the average maximum air temperature recorded between July 4 and August 31. A linear trendline was established for each set of data points to determine the thermal classification that best approximates the temperatures recorded for the surface, mid-water and bottom of the water column in the pond, where y = water temperature and x = Air Temperature (ºC).

Surface

The linear trendline equation (Figure 4) for the average data at the surface of the column is:

y = 0.404x + 15.585

Based on this equation, the temperatures at 24 ºC and 36 ºC are calculated to be 25.28 ºC and 30.13 ºC, respectively. Based on the temperature ranges in Table 6, the surface of the pond falls within the warmwater range. Based on the average maximum air temperature the water temperature within the pond at the surface is estimated to be 27.18 ºC (warmwater). The lowest recorded temperature is 22.74 ºC, while the maximum temperature is 31.30 ºC (difference: 8.56 ºC).

The data for the individual surface loggers are shown in Figure 5.

Mid-Water

The linear trendline equation (Figure 4) for the average data within the mid-water column is:

y = 0.3226x + 16.136

Based on this equation, the temperatures at 24 ºC and 36 ºC are calculated to be 23.88 ºC and 27.75 ºC, respectively. Based on the temperature ranges in Table 6, the mid-water area of the pond falls within the warmwater to cool-warmwater range. Based on the average maximum air temperature the water temperature within the pond at the mid-water depth is estimated to be 25.39 ºC (warmwater). The lowest recorded temperature is 21.65 ºC, while the maximum temperature is 29.39 ºC (difference: 7.74 ºC).

The data for the individual mid-water loggers are shown in Figure 6.

Bottom

The linear trendline equation for the average data (Figure 4) at the bottom of the water column is:

y= –0.1173x + 24.607

Based on this equation, the temperatures at 24 ºC and 36 ºC are calculated to be 21.79 ºC and 20.38 ºC, respectively. Based on the temperature ranges in Table 6, the bottom of the pond falls within the coolwater to cool-warmwater range. Based on the average maximum air temperature the water temperature within the pond at the bottom of the pond is estimated to be 21.24 ºC (cool-warmwater). The lowest recorded temperature is 17.4 ºC, while the maximum temperature is 23.18 ºC (difference: 5.78 ºC).The data for the individual bottom logger is shown in Figure 7.

It is important to note that this cool-warmwater designation seems to conflict with the hydrogeological assessment that indicated that the pond is not receiving groundwater inputs that would assist with buffering of the thermal effects. Essentially the general assessment of the pond as a whole remains

the same as if this “cooler” water is present at the bottom of the pond it is not directly discharged into the receiving watercourse and detailed hydrogeological assessment confirms an absence of groundwater inputs into the pond during this period.

Table 7 summarizes the calculated temperatures based on the maximum water temperature comparison against maximum daily air temperature. Included in the table are the minimum, maximum and average recorded temperatures.

Table 7: Summary of Calculated Water Temperatures in the Pone (14W-14A) based on the Max Air Temp vs. Max Water Temp Trendline between July 4 and August 31, 2011.

Water Depth	Calc H_2O temp @ 24 °C (°C)	Calc H_2O temp @ 36 °C (°C)	Calc H_2O temp @ 28.69 °C (°C)	Lowest recorded Maximum Water Temp (°C)	Highest recorded Maximum Water Temp (°C)	Average recorded Maximum Water Temp (°C)
Surface (0-1m)	25.28	30.13	27.18	22.74	31.30	27.18
Mid-water (1-2m)	23.88	27.75	25.39	21.65	29.39	25.39
Bottom (2+m)	21.79	20.38	21.24	17.4	23.18	21.24

The water temperature data was also assessed using the protocol set forth in the *Ontario Stream Assessment Protocol* (OSAP) (Stanfield, 2005) and *A Thermal Habitat Classification for Lower Michigan Rivers* (Wehrly et al, 1999). The average weekly maximum and minimum water temperature was calculated for each of the first three weeks in July. This data was then used to calculate the average weekly temperature fluctuation for the watercourse. The watercourses were placed into one of three thermal regimes described by the MNR; coldwater (average maximum summer water temperature from 10°C to 18°C), coolwater (18°C to 25°C) or warmwater (25°C or warmer). Based upon water temperature fluctuations described in Wehrly et al (1999), the pond was then classified into one of three thermal range categories; stable (<5°C), moderately stable (5°C to 10°C) and extreme (> 10°C) (MNR, 2004; Stanfield, 2005; Wehrly et al, 1999). This assessment indicates that with the exception of the pond bottom at its deepest point (greater than 2 m) the thermal regime is moderately stable warmwater with a weekly average in July ranging from 25 to 27°C and maximums ranging from 26 to 30°C and in August from 24 to 25°C and maximums ranging from 25 to 29°C. In both months the higher weekly averages and maximums are attributed to the surface waters, the water that is discharged downstream when flows discharge from the pond.

3.5 Thermal Impacts of Proposed Conversion of Farm Pond to a SWMP

It acknowledged that a larger pond in this setting has the potential to be subject to increased thermal effects due to its size however, the reconfiguration of the pond into a managed Stormwater Management facility provides opportunities to mitigate these effects. The design of preventative thermal measures such as those proposed by the Credit Valley Conservation's study: Thermal Impacts of Urbanization including Preventative and Mitigation Techniques, January, 2011 including 'cooling towers' and floating vegetated islands along with a north-south pond and outlet channel orientation to maximize shading periods would assist in minimizing this effect. Given that the pond currently functions as moderately stable warmwater habitat, the mitigation measures included in the SWMP design have the potential to improve the temperature discharging from the future SWMP.

3.6 Phytoplankton/Zooplankton Production

It is acknowledged that this pond, like most open water habitats including SWM ponds, have self-sustaining phytoplankton and zooplankton populations however, the contributions to downstream habitats are limited due to the relatively small size of the pond as well as the intermittent discharge to downstream habitat during the low flow periods in its existing inlet/outlet configuration. It is anticipated that the production and contribution of zooplankton and phytoplankton in a SWM facility to the downstream fisheries will be similar to existing conditions.

3.7 Sediment Source

The configuration of the pond does not support the provision of sediment or bedload as a resource in the west branch of Fourteen Mile Creek. The intermittent flow in/flow out (through a single connection point) during high flow events only suggests the pond acts as a sediment trap and will act against the concept of dynamic equilibrium by removing sediment from downstream areas, resulting in a less stable bedload, and thereby facilitating downstream erosion when attempting to re-establish a stable bedload. In addition, the top-draw, uncontrolled discharge nature of the pond suggests that high flows may be sustained for longer periods as water flows out of the pond and into the watercourse system, creating extended periods of higher shear stress than naturally occurs.

3.8 Organic Material Source

The transport of coarse organic material such as leaves and twigs, to downstream fish habitat is limited by the intermittent connection to downstream fish habitat as well as the dense cattail growth at the inlet/outlet that would physically block the movement of this material. Furthermore, it is anticipated that if this pond was removed, its contribution can likely be addressed through riparian zone restoration/planting.

3.9 Headwater Wetland Function

Once again we would like to emphasize that this is an agricultural pond that has naturalized over time due to a lack of management as agricultural feature rather than a conscious decision to create/manage it as fish and wildlife habitat.

Generally headwater wetlands are wetlands associated with groundwater discharge zones that give rise to creeks and streams. Water level data from the pond as well as groundwater data indicate that the pond does not receive groundwater inputs in sufficient quantities that create discharge into the watercourses, the discharge from the pond is associated with surface water inputs. The lack of groundwater inputs is supported by the warmwater thermal regime of the pond. It seems more likely the pond is a 'sink' rather than 'source', receiving surface flows and losing water to evaporation rather than consistently contributing water from the pond to the downstream watercourse.

Furthermore the wetland vegetation communities present are common (cattail shallow marsh and duckweed shallow aquatic) and are typical of vegetation associated with stagnant ponds. The vegetation present is not obviously sustained by groundwater inputs to the pond, but rather appears to be sustained by the presence of surface water that occasionally flows into the pond from the watercourses. The wetland community present is typical of those found within SWM facilities in Halton Region, and could be replicated through standard SWM pond construction and re-vegetation practices.

3.10 Pond providing Pelagic and Littoral Habitat

Although the pond may have a secondary function providing pelagic and littoral habitat by its intrinsic function of storing water for agriculture, it is a farm pond that was created to facilitate agricultural activities. The limited availably of this type of habitat in the area is appears to be associated with the absence of naturally occurring open water habitat in North Oakville and the use of a farm pond to bolster a type of habitat that appears to be naturally limited in North Oakville seems unrealistic.

4 Conclusions

Generally the pond appears to function as warmwater habitat that supports a warmwater fish community. Given the current configuration of the pond with a single inlet/outlet feature that is principally influenced by surface water, it appears that this pond functioning as a basin storing water until such time that it overflows into the receiving watercourse. The resulting storage of water, intermittent connection to downstream watercourses and apparent lack of groundwater inputs results in water temperature increasing during the low flow period. This warmer water is then discharged into the receiving watercourse (Reach 14W-12) that supports Redside Dace. As a result of these influences the pond in its current form does not appear to match the intent of the management of the receiving watercourse (Reach 14W-12).

According to the DFO's *Working Around Water? Factsheet Series (Ontario Edition)* by-pass ponds *"… are also prone to dissolved oxygen and water quality problems, increases in water temperature, and sediment accumulation problems. Proposals* ***for bypass ponds on coldwater streams are generally not approved due to the potential that downstream water temperatures may increase beyond levels that coldwater fish need to survive****".* It has been our experience that the removal of pond habitat (i.e. by-pass, on-line), specifically those contributing to cool/coldwater habitats, is a measure often identified to improve water quality (i.e. water temperature) related to fish habitat and is frequently used as a compensation measure used to address a HADD. The *NOSCC Implementation Report* states that one of its broad level riparian corridor management recommendations to achieve certain targets on a system wide basis includes the removal of online ponds as they are considered detrimental from a temperature moderation perspective. Although the pond in question is not an online feature, its effects are similar and the removal of these adverse effects would be beneficial to the aquatic habitat of downstream reaches.

It is acknowledged that the proposal is not merely to remove the pond (Reach 14W-14A) to benefit the natural heritage system; instead it is a replacement of the existing pond with a SWM pond. SWM ponds are necessary to address the post-development flows and although the resulting SWM pond will be larger and likely subject to greater thermal impacts due to its size, there are mitigation measures that can be incorporated into the design that will assist in mitigating these effects. This proposed approach consisting of removing a farm pond that is detrimental to downstream habitat and using the area to construct a necessary SWM pond in its place represents a benefit over the the alternative of maintaining the farm pond (and its effects) and construction additional pond(s) on the landscape.

Notwithstanding the thermal influences of the pond, it is recognized that the pond does support a warmwater fish community and as a result the proposed works are subject to review under the Fisheries Act and Conservation Authorities Act. Due to its proximity and connection to Redside Dace habitat it is also subject to review under the ESA. As a result we request that CH and MNR review this information and provide comment.

We trust this information satisfies the additional information request presented in the August 3, 2011 email as well as the September 6, 2011 written correspondence and request that CH and MNR identify what specific functions of this feature (if any) considered worthy of retention in order that the feasibility of incorporating this type of feature in other locations can be examined.

5 References

- Chu, Cindy, N.E. Jones, A.R. Piggott and J.M. Buttle. Evaluation of a Simple Method to Classify the Thermal Characteristics of Streams Using a Nomogram of Daily Maximum Air and Water Temperatures, North American Journal of Fisheries Management 29: 1605-1619, 2009.
- Wehrly, Kevin; M.J. Wiley & P.W. Seelbach. A Thermal Habitat Classification for Lower Michigan Rivers. Michigan Department of Natural Resources. Fisheries Research Report No. 2038, 1998.

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Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

Bathymetric Survey / Approximate Fish Community Sampling Locations



LEGEND

- Contour Lines

Equipment Type / Sampling Method

- Minnow Trap (2011)
- Pot Trap (2011)
- Trap (MMM - 2002)

Electrofishing

- EF-A (2009)
- EF-B (2009)
- NRSI (2002)

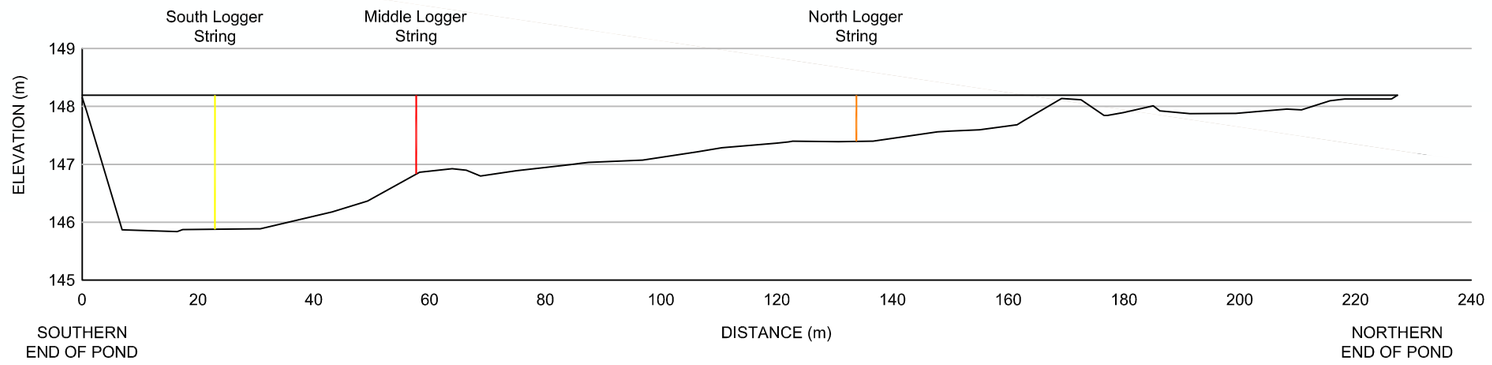
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Date: February 2012	Project No.: 1409222001
Aerial Photo: © 2012 Microsoft Corporation Imagery © Microsoft © 2010 NAVTEQ	**Figure: 1**

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LEGEND

Logger Sampling Locations

- North Logger String (1-2-3)
- Middle Logger String (4-5-6)
- South Logger String (7-8-9)

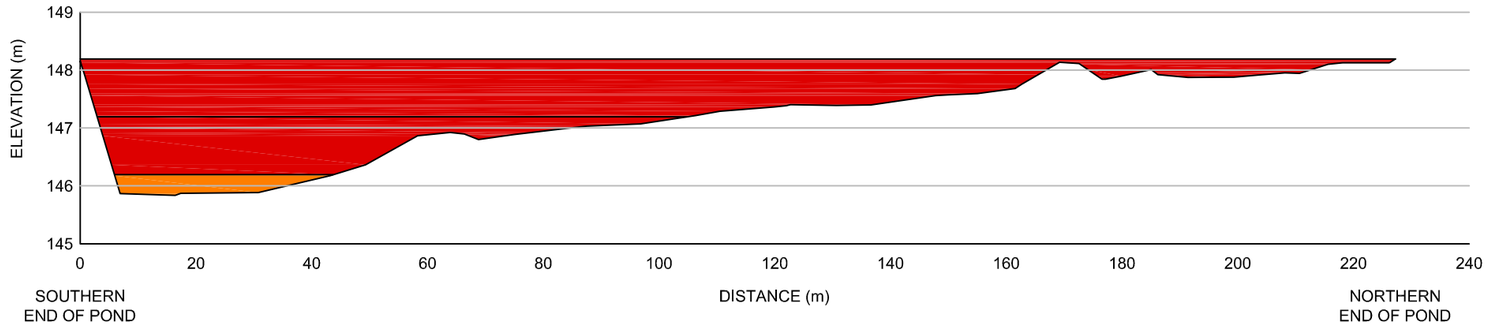
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Title: Water Temperature Monitoring (2011)
Bathymetric Survey and Profile

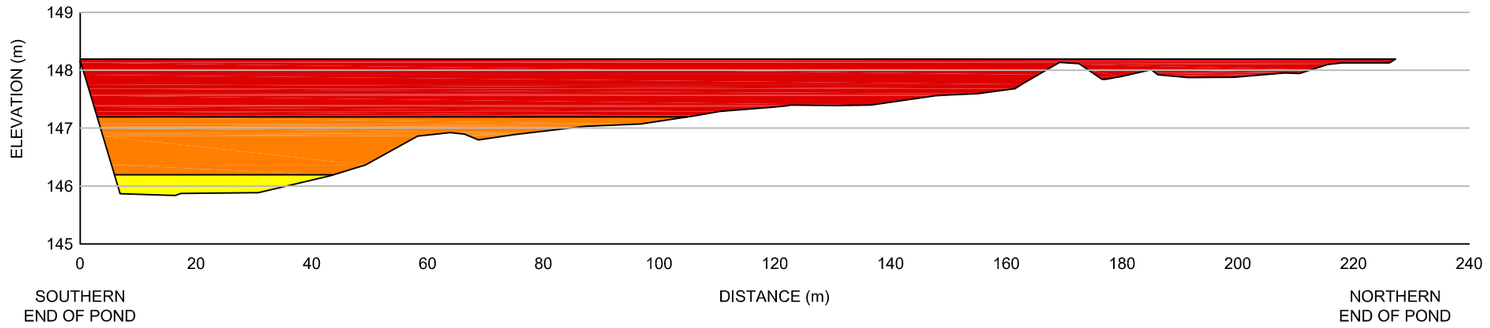
Prepared by: MMM GROUP

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Date: February 2012	Figure: 2	

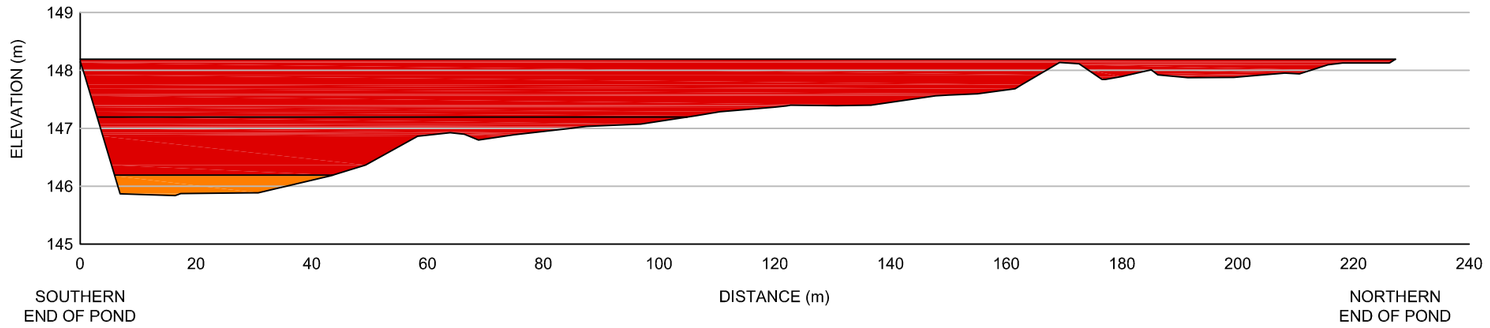
WATER TEMPERATURE AT MAXIMUM AIR TEMPERATURE OF 24°C



WATER TEMPERATURE AT MAXIMUM AIR TEMPERATURE OF 36°C



WATER TEMPERATURE AT MAXIMUM AIR TEMPERATURE OF 28.69°C



Thermal Classification (Colour Code)	Maximum Water Temperature Range at 24°C	Maximum Water Temperature Range at 36°C	Maximum Water Temperature Range at 28°C
Cold Water (BLUE)	0°C to 15°C	0°C to 16°C	0°C to 16°C
Cold - Cool Water (GREEN)	15°C to 17°C	16°C to 20°C	16°C to 18°C
Cool Water (YELLOW)	17°C to 20°C	20°C to 24°C	18°C to 21°C
Cool - Warm Water (ORANGE)	20°C to 23°C	24°C to 28°C	21°C to 24°C
Warm Water (RED)	23°C and higher	28°C and higher	24°C and higher

Client: BENTALL KENNEDY

Title: Pond Cross Section

Prepared by: MMM GROUP

14.09222.001.EN1 | Scale: NTS | Review: SR

Date: February 2012

Figure: **3**

Figure4: Vertical Comparison of Average Water Temperatures (14W-14A: Bottom, Mid-Water, Surface)

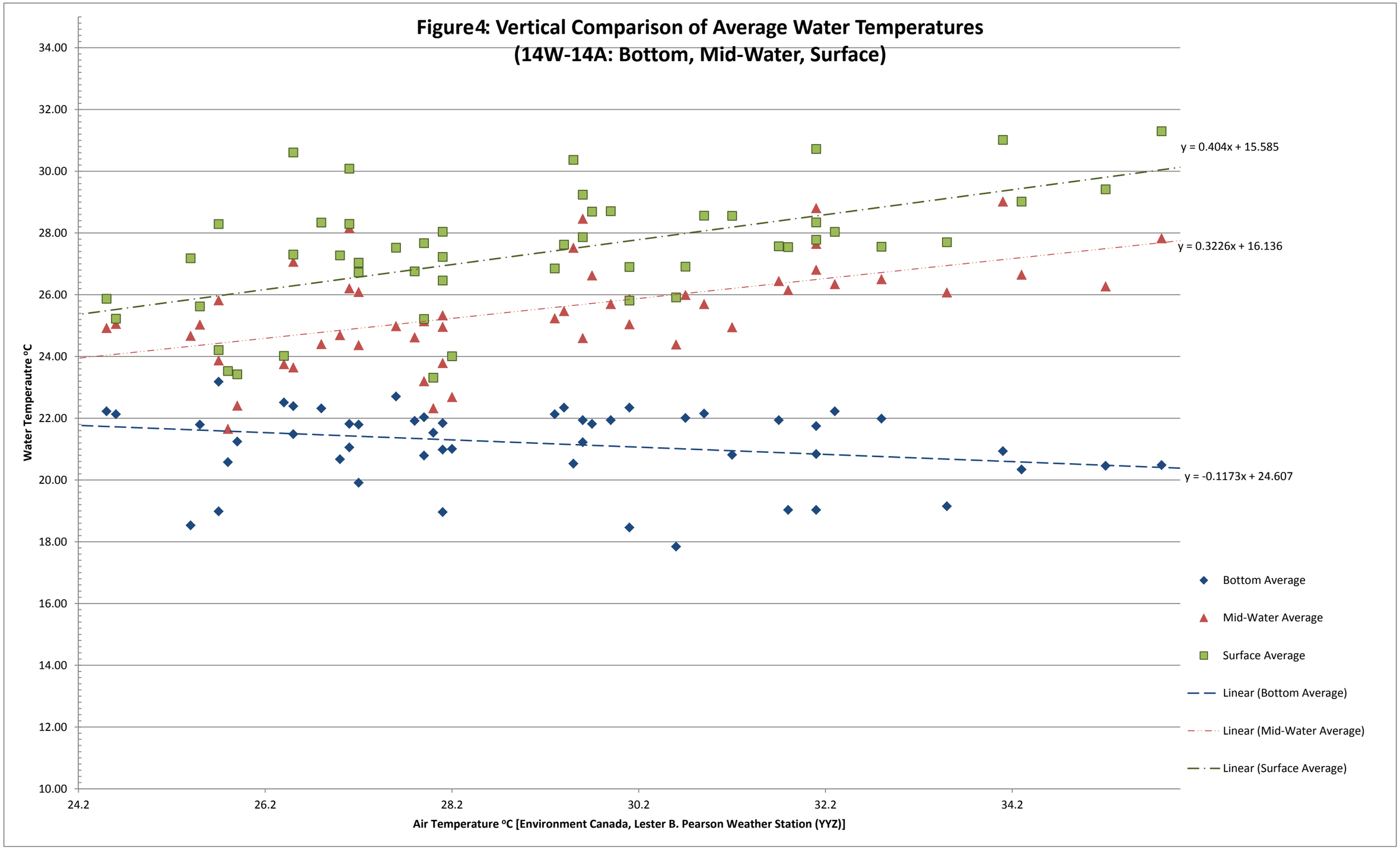


Figure 5: Water Temperature Comparison of Surface Water Loggers (0 - 1 m)
14W-14A (Loggers 2, 3, 5, 6 & 9)

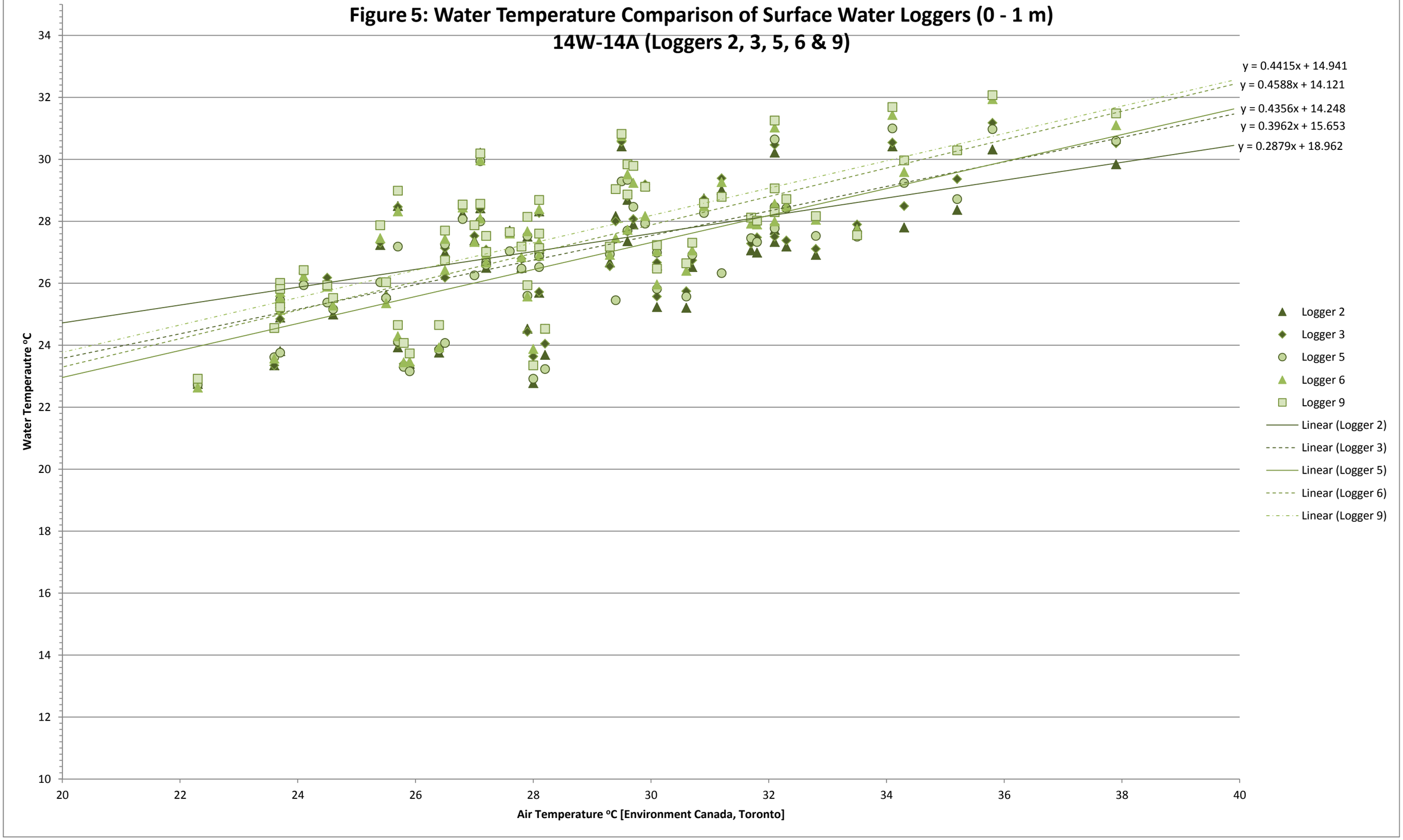


Figure 6: Water Temperature Comparison of Mid-Water (1-2 m) Loggers 14W-14A (Loggers 1& 8)

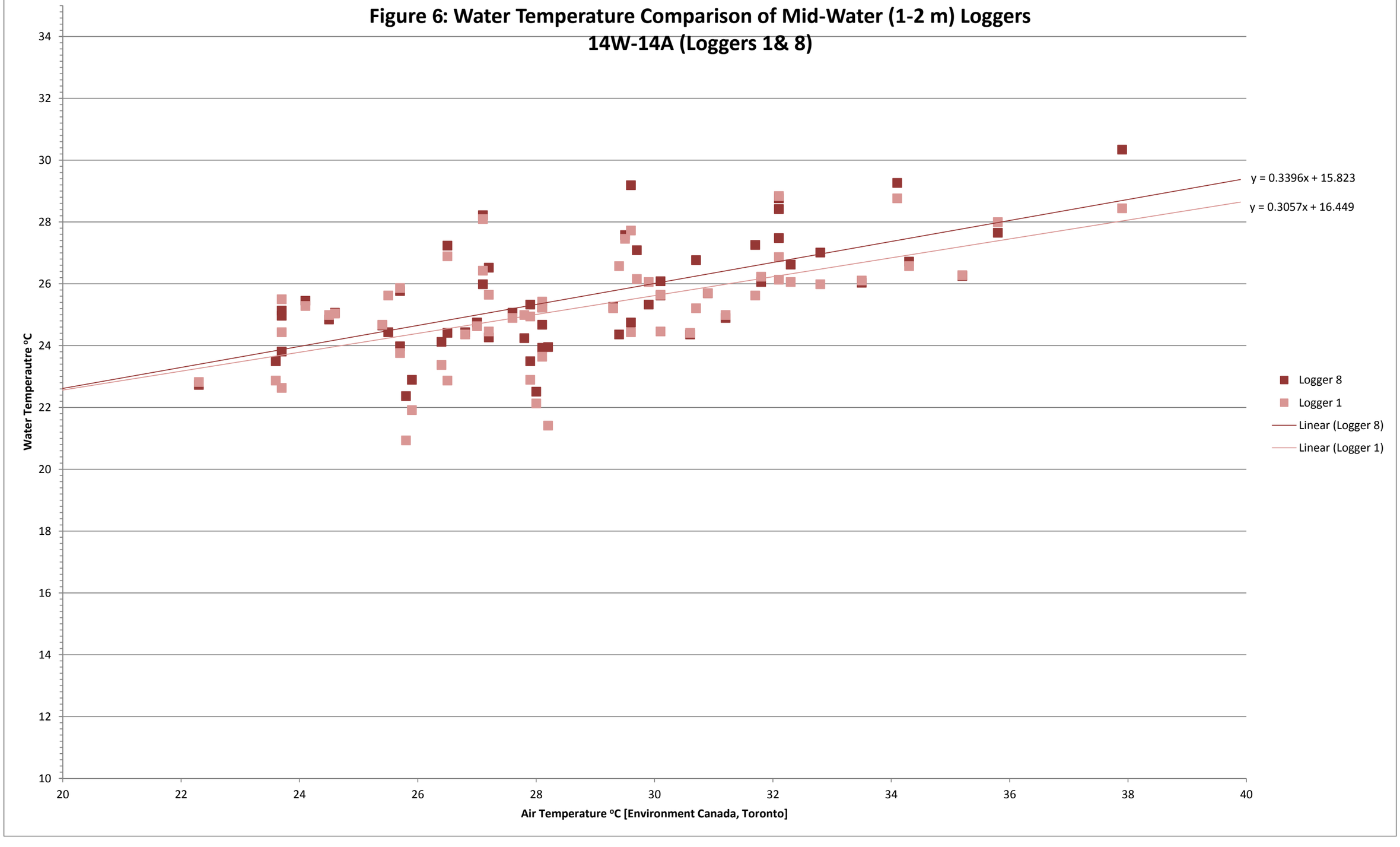
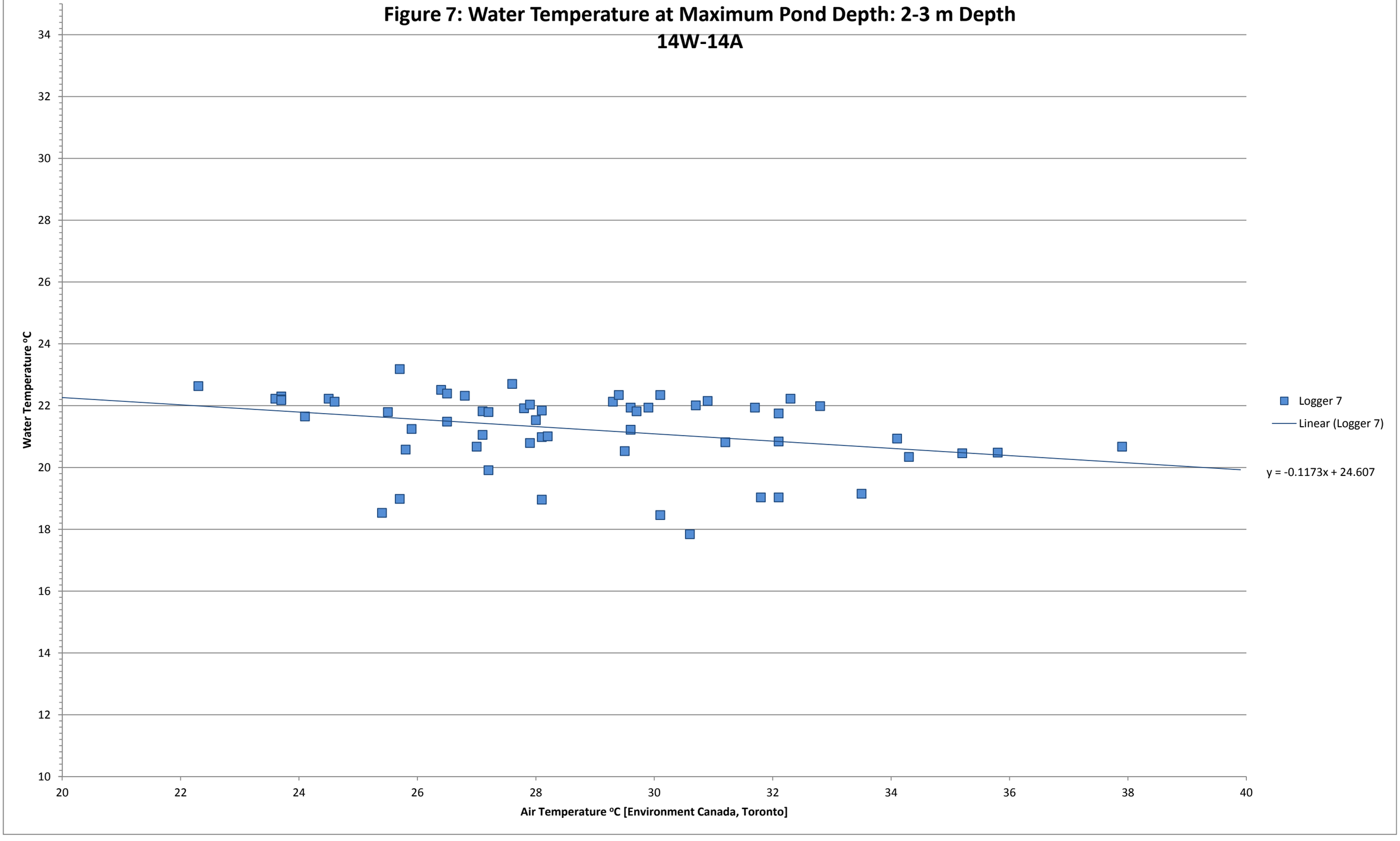


Figure 7: Water Temperature at Maximum Pond Depth: 2-3 m Depth
14W-14A



Appendix 6.0

6.1 HEC RAS Results
6.2 Proposed Cross Sections
6.3 Proposed Crossings
6.4 Corridor Width Delineation
6.5 EXP Report
6.6 Stream Length and Drainage Density
6.7 Water Surface Profiles at Tie in of 14W-22 and 14W-12A

Appendix 6.1 – HEC RAS Results

14 MILE CREEK WEST

HEC-RAS MODEL RESULTS FOR

EXISTING CONDITION

- **14W-16 (Reach 1A)**
- **14W-12 (Reach 1)**
- **14W-14 (Reach 2A)**
- **14W-12A (Reach 2B and 2C)**

HEC-RAS Plan: Existing Updated

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2B	240	Regional	8.23	149.50	149.85		149.87	0.001440	0.63	15.12	49.14	0.34
Reach-2B	240	100YR	3.20	149.50	149.70	149.59	149.71	0.001367	0.43	8.22	44.75	0.30
Reach-2B	240	50YR	2.83	149.50	149.69	149.59	149.70	0.001284	0.40	7.74	44.29	0.29
Reach-2B	240	25YR	2.48	149.50	149.68	149.58	149.69	0.001207	0.37	7.25	43.82	0.28
Reach-2B	240	10YR	1.94	149.50	149.66	149.57	149.67	0.001116	0.33	6.34	42.92	0.26
Reach-2B	240	5YR	1.59	149.50	149.65	149.56	149.65	0.000990	0.29	5.80	42.38	0.24
Reach-2B	240	2YR	1.00	149.50	149.62	149.54	149.62	0.000823	0.23	4.58	41.13	0.21
Reach-2B	239	Regional	8.23	149.50	149.83		149.84	0.000611	0.39	22.12	73.43	0.22
Reach-2B	239	100YR	3.20	149.50	149.56	149.56	149.60	0.022003	0.79	4.09	64.66	1.00
Reach-2B	239	50YR	2.83	149.50	149.56	149.56	149.59	0.023145	0.76	3.74	64.54	1.01
Reach-2B	239	25YR	2.48	149.50	149.55	149.55	149.58	0.023233	0.73	3.44	64.43	1.00
Reach-2B	239	10YR	1.94	149.50	149.55	149.55	149.57	0.024559	0.67	2.92	64.24	1.00
Reach-2B	239	5YR	1.59	149.50	149.54	149.54	149.56	0.026530	0.63	2.53	64.10	1.01
Reach-2B	239	2YR	1.00	149.50	149.53	149.53	149.54	0.021035	0.49	2.05	63.93	0.87
Reach-2B	238	Regional	8.23	149.00	149.83		149.83	0.000035	0.17	47.75	58.78	0.06
Reach-2B	238	100YR	3.20	149.00	149.43		149.43	0.000047	0.13	24.67	57.60	0.06
Reach-2B	238	50YR	2.83	149.00	149.41		149.41	0.000043	0.12	23.59	57.56	0.06
Reach-2B	238	25YR	2.48	149.00	149.39		149.40	0.000038	0.11	22.50	57.52	0.06
Reach-2B	238	10YR	1.94	149.00	149.36		149.36	0.000031	0.09	20.70	57.44	0.05
Reach-2B	238	5YR	1.59	149.00	149.34		149.34	0.000026	0.08	19.43	57.39	0.05
Reach-2B	238	2YR	1.00	149.00	149.30		149.30	0.000016	0.06	16.97	57.29	0.03
Reach-2B	237	Regional	8.23	149.00	149.83		149.83	0.000049	0.21	43.21	56.97	0.07
Reach-2B	237	100YR	3.20	149.00	149.43		149.43	0.000067	0.16	21.46	52.43	0.08
Reach-2B	237	50YR	2.83	149.00	149.41		149.41	0.000061	0.14	20.49	52.22	0.07
Reach-2B	237	25YR	2.48	149.00	149.39		149.39	0.000055	0.13	19.52	52.00	0.07
Reach-2B	237	10YR	1.94	149.00	149.36		149.36	0.000044	0.11	17.92	51.65	0.06
Reach-2B	237	5YR	1.59	149.00	149.34		149.34	0.000036	0.10	16.79	51.40	0.05
Reach-2B	237	2YR	1.00	149.00	149.30		149.30	0.000022	0.07	14.62	50.92	0.04
Reach-2B	236	Regional	8.23	149.00	149.82		149.83	0.000066	0.24	36.83	47.98	0.08
Reach-2B	236	100YR	3.20	149.00	149.43		149.43	0.000091	0.18	18.36	44.80	0.09
Reach-2B	236	50YR	2.83	149.00	149.41		149.41	0.000082	0.17	17.55	44.65	0.08
Reach-2B	236	25YR	2.48	149.00	149.39		149.39	0.000074	0.15	16.73	44.51	0.08
Reach-2B	236	10YR	1.94	149.00	149.36		149.36	0.000059	0.13	15.39	44.27	0.07
Reach-2B	236	5YR	1.59	149.00	149.34		149.34	0.000049	0.11	14.44	44.09	0.06
Reach-2B	236	2YR	1.00	149.00	149.30		149.30	0.000030	0.08	12.61	43.76	0.05
Reach-2B	235	Regional	8.23	149.00	149.82		149.82	0.000131	0.33	27.97	39.16	0.12
Reach-2B	235	100YR	3.20	149.00	149.42		149.42	0.000189	0.26	13.33	34.33	0.13
Reach-2B	235	50YR	2.83	149.00	149.40		149.40	0.000171	0.24	12.73	34.12	0.12
Reach-2B	235	25YR	2.48	149.00	149.38		149.39	0.000152	0.22	12.13	33.91	0.11
Reach-2B	235	10YR	1.94	149.00	149.35		149.36	0.000122	0.18	11.15	33.56	0.10
Reach-2B	235	5YR	1.59	149.00	149.33		149.34	0.000100	0.16	10.46	33.31	0.09
Reach-2B	235	2YR	1.00	149.00	149.29		149.29	0.000061	0.11	9.13	32.82	0.07
Reach-2B	234	Regional	8.23	149.00	149.81		149.82	0.000102	0.29	32.86	47.64	0.10
Reach-2B	234	100YR	3.20	149.00	149.41		149.42	0.000154	0.23	15.20	40.47	0.11
Reach-2B	234	50YR	2.83	149.00	149.40		149.40	0.000138	0.21	14.52	40.16	0.11
Reach-2B	234	25YR	2.48	149.00	149.38		149.38	0.000123	0.19	13.84	39.86	0.10
Reach-2B	234	10YR	1.94	149.00	149.35		149.35	0.000098	0.16	12.72	39.35	0.09
Reach-2B	234	5YR	1.59	149.00	149.33		149.33	0.000080	0.14	11.93	38.99	0.08
Reach-2B	234	2YR	1.00	149.00	149.29		149.29	0.000048	0.10	10.42	38.30	0.06
Reach-2B	233	Regional	8.23	149.00	149.81		149.82	0.000124	0.32	37.49	56.94	0.11
Reach-2B	233	100YR	3.20	149.00	149.41		149.41	0.000205	0.26	16.17	48.25	0.13
Reach-2B	233	50YR	2.83	149.00	149.39		149.39	0.000185	0.24	15.39	47.78	0.12
Reach-2B	233	25YR	2.48	149.00	149.38		149.38	0.000165	0.22	14.60	47.32	0.12
Reach-2B	233	10YR	1.94	149.00	149.35		149.35	0.000131	0.19	13.31	46.55	0.10
Reach-2B	233	5YR	1.59	149.00	149.33		149.33	0.000108	0.16	12.41	46.00	0.09
Reach-2B	233	2YR	1.00	149.00	149.29		149.29	0.000065	0.12	10.68	44.94	0.07
Reach-2B	232	Regional	8.23	149.12	149.79		149.81	0.000663	0.63	27.20	54.29	0.25
Reach-2B	232	100YR	3.20	149.12	149.32	149.32	149.39	0.015485	1.22	4.48	39.45	0.98
Reach-2B	232	50YR	2.83	149.12	149.31	149.31	149.37	0.015517	1.17	4.08	38.99	0.97
Reach-2B	232	25YR	2.48	149.12	149.30	149.30	149.36	0.015304	1.11	3.70	38.55	0.95
Reach-2B	232	10YR	1.94	149.12	149.29	149.29	149.33	0.015281	1.02	3.06	37.78	0.93
Reach-2B	232	5YR	1.59	149.12	149.27	149.27	149.31	0.015695	0.96	2.57	37.19	0.92
Reach-2B	232	2YR	1.00	149.12	149.25	149.25	149.28	0.016697	0.83	1.65	35.00	0.91
Reach-2B	231	Regional	8.23	148.25	149.79		149.79	0.000211	0.61	45.13	58.27	0.16
Reach-2B	231	100YR	3.20	148.25	149.29		149.29	0.000248	0.50	18.86	43.13	0.17
Reach-2B	231	50YR	2.83	148.25	149.24		149.25	0.000246	0.48	16.94	40.87	0.16
Reach-2B	231	25YR	2.48	148.25	149.20		149.20	0.000238	0.46	15.20	38.70	0.16

HEC-RAS Plan: Existing Updated (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2B	231	10YR	1.94	148.25	149.13		149.13	0.000220	0.42	12.54	35.13	0.15
Reach-2B	231	5YR	1.59	148.25	149.07		149.08	0.000202	0.38	10.81	32.60	0.14
Reach-2B	231	2YR	1.00	148.25	148.98		148.98	0.000154	0.30	7.82	27.62	0.12
Reach-2A	3081	Regional	8.23	154.25	154.63	154.59	154.73	0.007896	1.38	7.20	33.78	0.78
Reach-2A	3081	100YR	3.20	154.25	154.52	154.46	154.56	0.005252	0.85	3.97	24.21	0.59
Reach-2A	3081	50YR	2.83	154.25	154.51		154.54	0.005030	0.80	3.69	23.17	0.58
Reach-2A	3081	25YR	2.48	154.25	154.50		154.53	0.004751	0.74	3.42	22.17	0.55
Reach-2A	3081	10YR	1.94	154.25	154.47		154.49	0.005064	0.69	2.83	19.75	0.56
Reach-2A	3081	5YR	1.59	154.25	154.46		154.48	0.004548	0.62	2.58	18.63	0.52
Reach-2A	3081	2YR	1.00	154.25	154.42		154.44	0.003736	0.50	2.00	16.51	0.46
Reach-2A	228	Regional	8.23	153.98	154.24		154.27	0.005029	0.79	10.36	53.17	0.57
Reach-2A	228	100YR	3.20	153.98	154.13		154.15	0.006242	0.63	5.04	42.66	0.59
Reach-2A	228	50YR	2.83	153.98	154.12		154.14	0.006410	0.61	4.61	41.81	0.59
Reach-2A	228	25YR	2.48	153.98	154.11		154.13	0.006737	0.60	4.16	40.91	0.60
Reach-2A	228	10YR	1.94	153.98	154.10		154.11	0.005816	0.52	3.72	40.01	0.55
Reach-2A	228	5YR	1.59	153.98	154.08		154.10	0.006419	0.50	3.17	38.85	0.56
Reach-2A	228	2YR	1.00	153.98	154.06	154.04	154.07	0.007819	0.45	2.21	36.73	0.59
Reach-2A	227	Regional	8.23	153.04	153.32	153.32	153.42	0.015283	1.39	6.01	33.59	1.00
Reach-2A	227	100YR	3.20	153.04	153.24	153.22	153.29	0.011477	0.91	3.53	27.49	0.81
Reach-2A	227	50YR	2.83	153.04	153.23	153.21	153.27	0.011126	0.87	3.27	26.80	0.79
Reach-2A	227	25YR	2.48	153.04	153.23	153.20	153.26	0.010530	0.81	3.04	26.15	0.76
Reach-2A	227	10YR	1.94	153.04	153.20	153.19	153.23	0.013225	0.82	2.38	24.16	0.83
Reach-2A	227	5YR	1.59	153.04	153.19	153.17	153.22	0.011590	0.73	2.17	23.44	0.77
Reach-2A	227	2YR	1.00	153.04	153.17	153.15	153.19	0.009230	0.59	1.71	21.76	0.67
Reach-2A	226	Regional	8.23	152.44	152.76		152.79	0.003181	0.73	11.27	47.50	0.47
Reach-2A	226	100YR	3.20	152.44	152.63		152.64	0.003878	0.58	5.56	38.06	0.48
Reach-2A	226	50YR	2.83	152.44	152.61		152.63	0.003954	0.56	5.09	37.20	0.48
Reach-2A	226	25YR	2.48	152.44	152.60		152.62	0.004063	0.54	4.62	36.33	0.48
Reach-2A	226	10YR	1.94	152.44	152.59		152.60	0.003531	0.47	4.11	35.37	0.44
Reach-2A	226	5YR	1.59	152.44	152.57		152.58	0.003793	0.45	3.52	34.22	0.45
Reach-2A	226	2YR	1.00	152.44	152.54		152.55	0.004446	0.40	2.48	32.00	0.46
Reach-2A	225	Regional	8.23	151.75	152.27	152.22	152.35	0.005889	1.43	12.28	56.22	0.71
Reach-2A	225	100YR	3.20	151.75	152.12	152.07	152.17	0.005684	1.03	5.01	36.38	0.64
Reach-2A	225	50YR	2.83	151.75	152.10	152.06	152.15	0.005680	0.99	4.44	34.67	0.64
Reach-2A	225	25YR	2.48	151.75	152.09	152.04	152.13	0.005687	0.95	3.89	33.57	0.63
Reach-2A	225	10YR	1.94	151.75	152.04	152.01	152.09	0.007648	0.96	2.55	27.09	0.70
Reach-2A	225	5YR	1.59	151.75	152.03	151.98	152.06	0.007052	0.87	2.14	25.07	0.67
Reach-2A	225	2YR	1.00	151.75	151.99		152.01	0.006326	0.71	1.40	10.04	0.61
Reach-2A	224	Regional	8.23	151.25	151.74	151.65	151.82	0.004732	1.38	11.74	41.75	0.65
Reach-2A	224	100YR	3.20	151.25	151.55	151.50	151.60	0.005603	1.05	4.79	29.50	0.64
Reach-2A	224	50YR	2.83	151.25	151.53	151.48	151.58	0.005646	1.01	4.27	28.32	0.64
Reach-2A	224	25YR	2.48	151.25	151.51	151.46	151.56	0.005649	0.96	3.79	27.17	0.63
Reach-2A	224	10YR	1.94	151.25	151.50	151.43	151.53	0.004048	0.79	3.53	26.52	0.53
Reach-2A	224	5YR	1.59	151.25	151.48	151.41	151.50	0.004400	0.76	2.82	23.43	0.54
Reach-2A	224	2YR	1.00	151.25	151.42	151.38	151.45	0.004988	0.66	1.77	17.73	0.55
Reach-2A	223	Regional	8.23	150.26	151.00	151.00	151.14	0.010014	1.99	9.64	43.51	0.92
Reach-2A	223	100YR	3.20	150.26	150.83	150.83	150.93	0.007784	1.47	4.16	30.76	0.77
Reach-2A	223	50YR	2.83	150.26	150.81	150.81	150.90	0.007682	1.42	3.56	30.52	0.76
Reach-2A	223	25YR	2.48	150.26	150.79	150.79	150.88	0.007766	1.38	2.88	30.24	0.76
Reach-2A	223	10YR	1.94	150.26	150.67	150.67	150.81	0.014543	1.67	1.16	4.11	1.00
Reach-2A	223	5YR	1.59	150.26	150.64	150.63	150.76	0.013829	1.56	1.02	3.89	0.97
Reach-2A	223	2YR	1.00	150.26	150.57	150.55	150.66	0.013356	1.33	0.75	3.57	0.92
Reach-2A	222	Regional	8.23	149.74	150.40	150.30	150.46	0.003652	1.36	16.96	59.69	0.58
Reach-2A	222	100YR	3.20	149.74	150.22	150.15	150.26	0.003519	1.02	7.26	44.06	0.53
Reach-2A	222	50YR	2.83	149.74	150.20	150.13	150.24	0.003466	0.98	6.45	42.09	0.52
Reach-2A	222	25YR	2.48	149.74	150.18	150.10	150.21	0.003417	0.93	5.66	40.07	0.51
Reach-2A	222	10YR	1.94	149.74	150.15	150.05	150.18	0.003149	0.84	4.52	36.97	0.49
Reach-2A	222	5YR	1.59	149.74	150.12	150.01	150.15	0.003127	0.79	3.57	33.02	0.48
Reach-2A	222	2YR	1.00	149.74	150.05	149.94	150.08	0.002981	0.70	1.82	19.15	0.45
Reach-2A	221	Regional	8.23	149.23	149.71	149.71	149.86	0.009958	1.85	7.73	34.98	0.92
Reach-2A	221	100YR	3.20	149.23	149.53	149.53	149.63	0.012315	1.42	2.81	20.53	0.93
Reach-2A	221	50YR	2.83	149.23	149.51	149.51	149.60	0.012799	1.37	2.45	19.18	0.93
Reach-2A	221	25YR	2.48	149.23	149.49	149.49	149.58	0.013256	1.32	2.12	17.86	0.94
Reach-2A	221	10YR	1.94	149.23	149.45	149.45	149.54	0.016379	1.30	1.51	10.39	1.01
Reach-2A	221	5YR	1.59	149.23	149.43	149.43	149.51	0.016831	1.23	1.30	9.00	1.01
Reach-2A	221	2YR	1.00	149.23	149.38	149.38	149.44	0.018103	1.09	0.92	7.71	1.00

HEC-RAS Plan: Existing Updated (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2C	220.3	Regional	8.23	148.25	149.79		149.79	0.000033	0.20	54.92	68.94	0.06
Reach-2C	220.3	100YR	3.20	148.25	149.29		149.29	0.000045	0.16	22.84	53.16	0.07
Reach-2C	220.3	50YR	2.83	148.25	149.25		149.25	0.000047	0.15	20.47	50.24	0.07
Reach-2C	220.3	25YR	2.48	148.25	149.20		149.20	0.000049	0.14	18.32	47.46	0.07
Reach-2C	220.3	10YR	1.94	148.25	149.13		149.13	0.000051	0.13	15.04	42.85	0.07
Reach-2C	220.3	5YR	1.59	148.25	149.08		149.08	0.000054	0.12	12.91	39.59	0.07
Reach-2C	220.3	2YR	1.00	148.25	148.98		148.98	0.000058	0.11	9.27	33.28	0.07
Reach-2C	220.2	Regional	8.23	148.57	149.41	149.41	149.75	0.009452	2.64	3.91	6.97	0.98
Reach-2C	220.2	100YR	3.20	148.57	149.08	149.07	149.27	0.011143	1.93	1.85	5.43	0.96
Reach-2C	220.2	50YR	2.83	148.57	149.06	149.04	149.22	0.009917	1.77	1.77	5.36	0.90
Reach-2C	220.2	25YR	2.48	148.57	149.05	149.01	149.18	0.008913	1.63	1.67	5.27	0.85
Reach-2C	220.2	10YR	1.94	148.57	149.01		149.11	0.008048	1.43	1.46	5.09	0.79
Reach-2C	220.2	5YR	1.59	148.57	148.97		149.06	0.007715	1.31	1.30	4.93	0.76
Reach-2C	220.2	2YR	1.00	148.57	148.90		148.96	0.007667	1.09	0.95	4.60	0.73
Reach-2C	220.1	Regional	8.23	148.25	149.29		149.32	0.001554	0.88	23.78	72.45	0.37
Reach-2C	220.1	100YR	3.20	148.25	148.96		149.02	0.004247	1.08	3.97	18.98	0.58
Reach-2C	220.1	50YR	2.83	148.25	148.92		148.98	0.004626	1.09	3.30	17.26	0.60
Reach-2C	220.1	25YR	2.48	148.25	148.89		148.94	0.005029	1.08	2.69	15.53	0.62
Reach-2C	220.1	10YR	1.94	148.25	148.82		148.88	0.005593	1.06	1.90	9.06	0.64
Reach-2C	220.1	5YR	1.59	148.25	148.78		148.83	0.005899	1.03	1.55	6.41	0.64
Reach-2C	220.1	2YR	1.00	148.25	148.68		148.73	0.006595	0.97	1.03	4.72	0.66
Reach-2C	220	Regional	8.23	148.25	149.29		149.32	0.001577	0.88	23.63	72.42	0.38
Reach-2C	220	100YR	3.20	148.25	148.95		149.01	0.004498	1.11	3.84	18.68	0.59
Reach-2C	220	50YR	2.83	148.25	148.91		148.98	0.004946	1.11	3.17	16.92	0.62
Reach-2C	220	25YR	2.48	148.25	148.88	148.78	148.94	0.005418	1.11	2.57	15.16	0.64
Reach-2C	220	10YR	1.94	148.25	148.81		148.87	0.006155	1.10	1.81	8.49	0.67
Reach-2C	220	5YR	1.59	148.25	148.77		148.83	0.006571	1.07	1.49	5.88	0.68
Reach-2C	220	2YR	1.00	148.25	148.67		148.72	0.007667	1.03	0.97	4.58	0.71
Reach-1A	210.5	Regional	8.22	155.11	155.51	155.48	155.55	0.010424	0.81	10.17	88.07	0.76
Reach-1A	210.5	100YR	3.34	155.11	155.43	155.42	155.46	0.013632	0.74	4.52	54.49	0.82
Reach-1A	210.5	50YR	2.95	155.11	155.42	155.41	155.45	0.013862	0.72	4.10	52.14	0.82
Reach-1A	210.5	25YR	2.59	155.11	155.41	155.40	155.44	0.014055	0.70	3.71	49.85	0.82
Reach-1A	210.5	10YR	2.04	155.11	155.40	155.39	155.42	0.014915	0.67	3.05	45.72	0.83
Reach-1A	210.5	5YR	1.69	155.11	155.39	155.38	155.41	0.015262	0.64	2.64	42.87	0.83
Reach-1A	210.5	2YR	1.08	155.11	155.36	155.35	155.38	0.015106	0.67	1.61	24.31	0.83
Reach-1A	210	Regional	8.22	154.96	155.27		155.31	0.006641	0.89	9.20	48.77	0.66
Reach-1A	210	100YR	3.34	154.96	155.17		155.19	0.006502	0.69	4.87	37.82	0.61
Reach-1A	210	50YR	2.95	154.96	155.15		155.18	0.006586	0.66	4.44	36.50	0.61
Reach-1A	210	25YR	2.59	154.96	155.14		155.16	0.006493	0.64	4.07	35.33	0.60
Reach-1A	210	10YR	2.04	154.96	155.13		155.14	0.006603	0.60	3.42	33.18	0.59
Reach-1A	210	5YR	1.69	154.96	155.11		155.13	0.006577	0.56	3.01	31.72	0.58
Reach-1A	210	2YR	1.08	154.96	155.09	155.06	155.10	0.006692	0.49	2.20	28.66	0.57
Reach-1A	209	Regional	8.22	154.46	154.73		154.76	0.003709	0.82	15.41	75.02	0.52
Reach-1A	209	100YR	3.34	154.46	154.63		154.64	0.003730	0.58	8.10	64.22	0.48
Reach-1A	209	50YR	2.95	154.46	154.62		154.63	0.003709	0.55	7.44	62.71	0.47
Reach-1A	209	25YR	2.59	154.46	154.61		154.62	0.003695	0.53	6.81	61.80	0.46
Reach-1A	209	10YR	2.04	154.46	154.59		154.60	0.003636	0.48	5.80	60.34	0.45
Reach-1A	209	5YR	1.69	154.46	154.58		154.59	0.003655	0.45	5.09	59.26	0.44
Reach-1A	209	2YR	1.08	154.46	154.56		154.56	0.003495	0.37	3.78	57.26	0.41
Reach-1A	208.3	Regional	8.22	152.95	153.44	153.44	153.59	0.010530	1.84	7.34	31.91	0.93
Reach-1A	208.3	100YR	3.34	152.95	153.27	153.27	153.37	0.013438	1.43	2.95	19.94	0.96
Reach-1A	208.3	50YR	2.95	152.95	153.26	153.26	153.35	0.013939	1.38	2.61	18.66	0.97
Reach-1A	208.3	25YR	2.59	152.95	153.24	153.24	153.33	0.014501	1.33	2.31	17.41	0.97
Reach-1A	208.3	10YR	2.04	152.95	153.21	153.21	153.29	0.015710	1.24	1.84	15.34	0.98
Reach-1A	208.3	5YR	1.69	152.95	153.19	153.19	153.26	0.016173	1.16	1.58	14.16	0.98
Reach-1A	208.3	2YR	1.08	152.95	153.15	153.15	153.21	0.019147	1.03	1.08	11.65	1.01
Reach-1A	208.2	Regional	8.22	152.50	153.04		153.11	0.003294	1.20	10.51	34.46	0.54
Reach-1A	208.2	100YR	3.34	152.50	152.87		152.90	0.002612	0.80	5.37	24.40	0.45
Reach-1A	208.2	50YR	2.95	152.50	152.85		152.88	0.002425	0.75	5.00	23.60	0.43
Reach-1A	208.2	25YR	2.59	152.50	152.83		152.86	0.002315	0.70	4.58	22.67	0.42
Reach-1A	208.2	10YR	2.04	152.50	152.80		152.82	0.002051	0.62	3.97	21.24	0.39
Reach-1A	208.2	5YR	1.69	152.50	152.78		152.80	0.001909	0.56	3.52	20.11	0.37
Reach-1A	208.2	2YR	1.08	152.50	152.75		152.76	0.001348	0.42	2.84	18.30	0.30
Reach-1A	208.1	Regional	8.22	152.51	152.94		152.98	0.002835	1.00	15.47	46.30	0.49
Reach-1A	208.1	100YR	3.34	152.51	152.72	152.66	152.75	0.005807	0.88	6.45	35.83	0.62
Reach-1A	208.1	50YR	2.95	152.51	152.70		152.73	0.007207	0.89	5.53	34.63	0.68
Reach-1A	208.1	25YR	2.59	152.51	152.68		152.71	0.007529	0.86	5.00	33.92	0.68

HEC-RAS Plan: Existing Updated (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1A	208.1	10YR	2.04	152.51	152.66		152.68	0.008330	0.81	4.15	32.74	0.70
Reach-1A	208.1	5YR	1.69	152.51	152.64	152.61	152.66	0.008897	0.76	3.60	31.97	0.70
Reach-1A	208.1	2YR	1.08	152.51	152.58	152.58	152.62	0.028586	0.90	1.89	29.36	1.14
Reach-1A	208	Regional	8.22	151.00	152.23	152.23	152.49	0.008617	2.30	5.33	17.12	0.88
Reach-1A	208	100YR	3.34	151.00	152.00		152.11	0.006244	1.49	2.40	7.43	0.70
Reach-1A	208	50YR	2.95	151.00	151.99		152.08	0.005292	1.35	2.32	6.77	0.64
Reach-1A	208	25YR	2.59	151.00	151.95		152.04	0.005505	1.30	2.07	6.26	0.65
Reach-1A	208	10YR	2.04	151.00	151.90		151.97	0.005634	1.19	1.73	5.52	0.64
Reach-1A	208	5YR	1.69	151.00	151.85	151.72	151.92	0.005813	1.11	1.52	5.00	0.63
Reach-1A	208	2YR	1.08	151.00	151.82		151.85	0.003290	0.81	1.34	4.49	0.47
Reach-1A	207	Regional	8.22	150.25	151.14		151.17	0.002964	1.50	22.90	57.96	0.53
Reach-1A	207	100YR	3.34	150.25	150.90	150.88	150.95	0.005205	1.56	9.43	51.17	0.67
Reach-1A	207	50YR	2.95	150.25	150.87	150.87	150.93	0.006039	1.62	7.96	50.30	0.71
Reach-1A	207	25YR	2.59	150.25	150.86	150.86	150.92	0.005566	1.53	7.35	49.94	0.68
Reach-1A	207	10YR	2.04	150.25	150.83	150.83	150.89	0.005023	1.41	6.16	49.22	0.64
Reach-1A	207	5YR	1.69	150.25	150.81	150.81	150.87	0.004649	1.32	5.27	48.68	0.61
Reach-1A	207	2YR	1.08	150.25	150.69	150.69	150.80	0.009274	1.54	1.44	10.55	0.83
Reach-1A	206.3	Regional	10.29	149.49	150.51	150.51	150.73	0.006219	2.36	10.20	28.41	0.80
Reach-1A	206.3	100YR	4.18	149.49	150.21	150.13	150.37	0.006329	1.81	3.12	16.43	0.76
Reach-1A	206.3	50YR	3.71	149.49	150.19	150.08	150.33	0.005905	1.70	2.74	13.67	0.73
Reach-1A	206.3	25YR	3.26	149.49	150.16	150.05	150.28	0.005467	1.58	2.40	10.87	0.69
Reach-1A	206.3	10YR	2.57	149.49	150.11		150.20	0.004817	1.39	1.98	5.89	0.64
Reach-1A	206.3	5YR	2.13	149.49	150.07		150.15	0.004496	1.26	1.76	4.85	0.61
Reach-1A	206.3	2YR	1.37	149.49	149.97		150.03	0.004237	1.04	1.33	4.28	0.57
Reach-1A	206.2	Regional	10.29	149.25	150.36		150.46	0.003131	1.54	12.39	33.24	0.56
Reach-1A	206.2	100YR	4.18	149.25	150.10		150.16	0.002573	1.06	5.36	23.20	0.48
Reach-1A	206.2	50YR	3.71	149.25	150.07		150.13	0.002537	1.02	4.70	22.36	0.47
Reach-1A	206.2	25YR	3.26	149.25	150.04		150.09	0.002526	0.97	4.02	21.45	0.46
Reach-1A	206.2	10YR	2.57	149.25	149.99		150.03	0.002420	0.88	3.02	10.39	0.44
Reach-1A	206.2	5YR	2.13	149.25	149.95		149.98	0.002348	0.81	2.62	8.08	0.43
Reach-1A	206.2	2YR	1.37	149.25	149.85		149.88	0.002087	0.69	1.98	6.35	0.40
Reach-1A	206.1	Regional	10.29	149.00	150.03	150.03	150.22	0.009685	2.35	10.79	31.18	0.92
Reach-1A	206.1	100YR	4.18	149.00	149.79	149.79	149.94	0.010953	1.86	4.34	21.51	0.91
Reach-1A	206.1	50YR	3.71	149.00	149.76	149.76	149.90	0.011294	1.81	3.77	19.59	0.91
Reach-1A	206.1	25YR	3.26	149.00	149.74	149.74	149.87	0.011392	1.73	3.28	17.65	0.91
Reach-1A	206.1	10YR	2.57	149.00	149.68	149.68	149.81	0.012478	1.64	2.47	14.35	0.93
Reach-1A	206.1	5YR	2.13	149.00	149.65	149.65	149.76	0.012646	1.55	2.04	12.73	0.92
Reach-1A	206.1	2YR	1.37	149.00	149.59	149.59	149.68	0.013844	1.36	1.29	9.59	0.92
Reach-1	205.1	Regional	19.22	148.20	149.22		149.30	0.002950	1.34	26.38	80.39	0.53
Reach-1	205.1	100YR	7.64	148.20	148.92		148.99	0.004685	1.18	7.15	26.86	0.62
Reach-1	205.1	50YR	6.77	148.20	148.88		148.95	0.004782	1.15	6.28	24.82	0.62
Reach-1	205.1	25YR	5.94	148.20	148.85		148.91	0.004786	1.11	5.50	22.85	0.61
Reach-1	205.1	10YR	4.67	148.20	148.79		148.85	0.004967	1.06	4.40	15.28	0.61
Reach-1	205.1	5YR	3.85	148.20	148.74		148.80	0.005111	1.02	3.77	13.35	0.61
Reach-1	205.1	2YR	2.45	148.20	148.64		148.69	0.006500	0.99	2.47	10.95	0.67
Reach-1	205	Regional	19.22	147.24	148.41	148.41	148.77	0.010673	2.64	7.28	10.54	1.01
Reach-1	205	100YR	7.64	147.24	148.04	148.04	148.25	0.012083	2.06	3.70	8.54	1.00
Reach-1	205	50YR	6.77	147.24	148.00	148.00	148.20	0.012333	2.00	3.39	8.32	1.00
Reach-1	205	25YR	5.94	147.24	147.96	147.96	148.15	0.013010	1.95	3.04	8.08	1.02
Reach-1	205	10YR	4.67	147.24	147.90	147.90	148.07	0.013146	1.81	2.58	7.75	1.00
Reach-1	205	5YR	3.85	147.24	147.86	147.85	148.00	0.013058	1.69	2.27	7.52	0.98
Reach-1	205	2YR	2.45	147.24	147.80		147.89	0.009627	1.31	1.87	7.20	0.82
Reach-1	204.75	Regional	19.22	146.00	147.79		147.92	0.001857	1.67	17.21	28.37	0.47
Reach-1	204.75	100YR	7.64	146.00	147.28		147.35	0.001734	1.16	7.72	15.02	0.42
Reach-1	204.75	50YR	6.77	146.00	147.19		147.26	0.002127	1.18	6.35	13.90	0.45
Reach-1	204.75	25YR	5.94	146.00	147.10		147.17	0.002639	1.20	5.17	12.05	0.49
Reach-1	204.75	10YR	4.67	146.00	146.95		147.03	0.003603	1.23	3.78	7.51	0.56
Reach-1	204.75	5YR	3.85	146.00	146.86		146.94	0.004449	1.25	3.07	7.01	0.60
Reach-1	204.75	2YR	2.45	146.00	146.68		146.76	0.006149	1.24	1.97	5.79	0.68
Reach-1	204.7	Regional	19.22	145.80	147.75	147.23	147.81	0.000687	1.15	24.50	34.03	0.29
Reach-1	204.7	100YR	7.64	145.80	147.02	146.57	147.17	0.002359	1.74	4.39	14.52	0.50
Reach-1	204.7	50YR	6.77	145.80	146.93	146.51	147.07	0.002423	1.67	4.05	13.52	0.50
Reach-1	204.7	25YR	5.94	145.80	146.83	146.45	146.96	0.002495	1.60	3.71	11.72	0.50
Reach-1	204.7	10YR	4.67	145.80	146.68	146.36	146.79	0.002633	1.48	3.16	9.39	0.50
Reach-1	204.7	5YR	3.85	145.80	146.57	146.29	146.67	0.002750	1.38	2.78	8.44	0.50
Reach-1	204.7	2YR	2.45	145.80	146.37	146.16	146.44	0.003043	1.19	2.06	6.73	0.50

HEC-RAS Plan: Existing Updated (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	204.6		Culvert									
Reach-1	204.55	Regional	19.22	145.40	146.83	146.83	147.54	0.009531	3.74	5.14	25.62	1.00
Reach-1	204.55	100YR	7.64	145.40	146.31	146.17	146.59	0.006786	2.33	3.27	9.86	0.78
Reach-1	204.55	50YR	6.77	145.40	146.29	146.11	146.52	0.005823	2.12	3.19	9.57	0.72
Reach-1	204.55	25YR	5.94	145.40	146.26	146.05	146.45	0.004933	1.92	3.10	9.27	0.66
Reach-1	204.55	10YR	4.67	145.40	146.20	145.96	146.34	0.003839	1.62	2.89	8.87	0.58
Reach-1	204.55	5YR	3.85	145.40	146.15	145.89	146.26	0.003236	1.42	2.71	8.57	0.52
Reach-1	204.55	2YR	2.45	145.40	146.04	145.76	146.10	0.002266	1.07	2.30	7.69	0.43
Reach-1	204.5	Regional	19.22	145.36	146.54	146.54	146.84	0.008813	2.46	9.43	23.13	0.93
Reach-1	204.5	100YR	7.64	145.36	146.26		146.39	0.006634	1.62	4.74	11.29	0.76
Reach-1	204.5	50YR	6.77	145.36	146.23		146.35	0.006350	1.53	4.43	10.54	0.73
Reach-1	204.5	25YR	5.94	145.36	146.20		146.30	0.005856	1.42	4.18	9.90	0.70
Reach-1	204.5	10YR	4.67	145.36	146.14		146.23	0.005361	1.29	3.61	9.18	0.66
Reach-1	204.5	5YR	3.85	145.36	146.09		146.17	0.005285	1.23	3.14	8.57	0.65
Reach-1	204.5	2YR	2.45	145.36	145.97		146.03	0.005693	1.13	2.17	7.07	0.65
Reach-1	204.25	Regional	19.22	145.11	146.33	146.33	146.57	0.008679	2.45	14.52	31.09	0.92
Reach-1	204.25	100YR	7.64	145.11	146.02	146.02	146.19	0.008917	1.91	5.88	23.93	0.87
Reach-1	204.25	50YR	6.77	145.11	145.99	145.99	146.15	0.009062	1.85	5.09	22.95	0.87
Reach-1	204.25	25YR	5.94	145.11	145.94	145.94	146.11	0.010062	1.86	4.05	19.07	0.91
Reach-1	204.25	10YR	4.67	145.11	145.84	145.84	146.02	0.011776	1.89	2.61	11.13	0.97
Reach-1	204.25	5YR	3.85	145.11	145.77	145.77	145.95	0.013458	1.90	2.03	5.70	1.02
Reach-1	204.25	2YR	2.45	145.11	145.66	145.66	145.81	0.014044	1.72	1.43	4.82	1.01
Reach-1	204	Regional	19.22	144.05	145.09	145.09	145.38	0.009668	2.87	14.36	25.22	1.01
Reach-1	204	100YR	7.64	144.05	144.80	144.80	144.97	0.008893	2.05	7.24	23.17	0.90
Reach-1	204	50YR	6.77	144.05	144.76	144.76	144.93	0.009105	1.99	6.47	22.94	0.90
Reach-1	204	25YR	5.94	144.05	144.72	144.72	144.88	0.010018	1.96	5.51	21.76	0.93
Reach-1	204	10YR	4.67	144.05	144.66	144.66	144.81	0.010227	1.82	4.37	19.84	0.92
Reach-1	204	5YR	3.85	144.05	144.63	144.63	144.76	0.010173	1.70	3.65	18.53	0.90
Reach-1	204	2YR	2.45	144.05	144.54	144.54	144.65	0.011206	1.50	2.22	15.61	0.90
Reach-1	203	Regional	20.34	142.50	145.01		145.04	0.000411	0.90	36.85	39.23	0.23
Reach-1	203	100YR	8.16	142.50	143.72	143.71	143.92	0.012788	2.00	4.07	10.06	1.01
Reach-1	203	50YR	7.22	142.50	143.67	143.67	143.87	0.012975	1.99	3.62	9.08	1.01
Reach-1	203	25YR	6.34	142.50	143.54	143.54	143.82	0.013101	2.33	2.73	5.32	1.04
Reach-1	203	10YR	4.99	142.50	143.46	143.46	143.70	0.012524	2.17	2.30	4.81	1.00
Reach-1	203	5YR	4.10	142.50	143.38	143.38	143.61	0.013015	2.09	1.96	4.44	1.01
Reach-1	203	2YR	2.61	142.50	143.23	143.23	143.42	0.014042	1.92	1.36	3.70	1.01
Reach-1	202.75	Regional	20.34	142.43	144.67	143.85	144.95	0.001783	2.36	8.63	35.92	0.50
Reach-1	202.75	100YR	8.16	142.43	143.65	143.20	143.80	0.002188	1.74	4.69	27.66	0.50
Reach-1	202.75	50YR	7.22	142.43	143.55	143.14	143.70	0.002248	1.67	4.32	26.88	0.50
Reach-1	202.75	25YR	6.34	142.43	143.46	143.08	143.59	0.002315	1.60	3.96	25.28	0.50
Reach-1	202.75	10YR	4.99	142.43	143.31	142.99	143.42	0.002442	1.48	3.38	20.87	0.50
Reach-1	202.75	5YR	4.10	142.43	143.20	142.92	143.30	0.002552	1.38	2.96	17.89	0.50
Reach-1	202.75	2YR	2.61	142.43	143.00	142.79	143.07	0.002823	1.19	2.19	14.99	0.50
Reach-1	202.5		Culvert									
Reach-1	202.25	Regional	20.34	142.28	143.69	143.69	144.41	0.015353	3.74	5.44	4.41	1.00
Reach-1	202.25	100YR	8.16	142.28	143.05	143.05	143.44	0.015075	2.75	2.97	3.85	1.00
Reach-1	202.25	50YR	7.22	142.28	142.99	142.99	143.35	0.015004	2.64	2.74	3.85	1.00
Reach-1	202.25	25YR	6.34	142.28	142.93	142.93	143.26	0.014956	2.52	2.51	3.85	1.00
Reach-1	202.25	10YR	4.99	142.28	142.83	142.83	143.11	0.015154	2.34	2.13	3.85	1.00
Reach-1	202.25	5YR	4.10	142.28	142.77	142.77	143.01	0.015225	2.19	1.87	3.85	1.00
Reach-1	202.25	2YR	2.61	142.28	142.70	142.64	142.83	0.009657	1.61	1.62	3.85	0.79
Reach-1	202	Regional	20.34	142.20	143.24		143.30	0.001777	1.33	29.18	49.31	0.44
Reach-1	202	100YR	8.16	142.20	142.70	142.70	142.85	0.010594	1.80	6.29	26.77	0.93
Reach-1	202	50YR	7.22	142.20	142.67	142.67	142.81	0.010874	1.74	5.60	25.20	0.93
Reach-1	202	25YR	6.34	142.20	142.64	142.64	142.78	0.011881	1.70	4.82	22.43	0.96
Reach-1	202	10YR	4.99	142.20	142.60	142.60	142.72	0.011592	1.55	4.01	20.98	0.93
Reach-1	202	5YR	4.10	142.20	142.57	142.57	142.67	0.012252	1.47	3.35	19.88	0.93
Reach-1	202	2YR	2.61	142.20	142.51	142.51	142.59	0.013697	1.29	2.18	18.14	0.94
Reach-1	201	Regional	20.34	141.65	143.21		143.25	0.000587	1.03	37.18	39.45	0.27
Reach-1	201	100YR	8.16	141.65	142.60		142.64	0.000895	0.89	15.07	31.97	0.31
Reach-1	201	50YR	7.22	141.65	142.53		142.56	0.001027	0.90	12.74	30.78	0.33
Reach-1	201	25YR	6.34	141.65	142.50		142.53	0.000928	0.83	11.86	30.31	0.31
Reach-1	201	10YR	4.99	141.65	142.40		142.43	0.001020	0.79	9.02	25.76	0.31
Reach-1	201	5YR	4.10	141.65	142.34		142.36	0.001004	0.74	7.55	23.14	0.31
Reach-1	201	2YR	2.61	141.65	142.25		142.27	0.000742	0.57	5.70	19.41	0.26

HEC-RAS Plan: Existing Updated (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	171	Regional	28.90	141.65	142.97	142.70	143.11	0.002516	1.90	27.97	37.97	0.55
Reach-1	171	100YR	8.17	141.65	142.44	142.21	142.50	0.002213	1.21	9.98	27.36	0.47
Reach-1	171	50YR	6.60	141.65	142.36	142.15	142.42	0.002210	1.13	8.15	24.25	0.46
Reach-1	171	25YR	6.10	141.65	142.34	142.13	142.40	0.002202	1.10	7.58	23.20	0.46
Reach-1	171	10YR	4.37	141.65	142.25	142.05	142.29	0.002182	0.97	5.57	19.13	0.44
Reach-1	171	5YR	3.52	141.65	142.19	142.01	142.23	0.002166	0.89	4.59	16.80	0.43
Reach-1	171	2YR	2.57	141.65	142.12	141.95	142.15	0.002101	0.79	3.54	13.88	0.41
Reach-1	170		Bridge									
Reach-1	169	Regional	28.90	141.65	142.70	142.70	142.99	0.007134	2.71	18.27	33.54	0.89
Reach-1	169	100YR	8.17	141.65	142.21	142.21	142.40	0.009752	1.96	4.98	17.76	0.92
Reach-1	169	50YR	6.60	141.65	142.15	142.15	142.32	0.010567	1.86	3.98	15.15	0.94
Reach-1	169	25YR	6.10	141.65	142.13	142.13	142.30	0.011146	1.83	3.63	14.16	0.95
Reach-1	169	10YR	4.37	141.65	142.05	142.05	142.19	0.013010	1.69	2.63	10.71	0.99
Reach-1	169	5YR	3.52	141.65	142.01	142.01	142.13	0.014215	1.59	2.21	8.88	1.01
Reach-1	169	2YR	2.57	141.65	141.95	141.95	142.06	0.014892	1.45	1.77	8.23	1.00
Reach-1	164	Regional	28.90	138.30	139.25		139.39	0.007256	1.51	18.32	23.62	0.61
Reach-1	164	100YR	8.17	138.30	138.83		138.86	0.002624	0.51	10.37	14.75	0.32
Reach-1	164	50YR	6.60	138.30	138.74		138.76	0.002349	0.41	9.12	13.62	0.29
Reach-1	164	25YR	6.10	138.30	138.69		138.72	0.002374	0.38	8.50	12.97	0.29
Reach-1	164	10YR	4.37	138.30	138.54		138.56	0.002100	0.28	6.77	10.44	0.25
Reach-1	164	5YR	3.52	138.30	138.46		138.47	0.001886	0.19	5.92	9.30	0.22
Reach-1	164	2YR	2.57	138.30	138.34		138.36	0.001562	0.07	4.96	7.74	0.16
Reach-1	163	Regional	28.90	137.20	138.47		138.55	0.005133	1.90	30.33	59.32	0.57
Reach-1	163	100YR	8.17	137.20	138.08	137.99	138.23	0.009915	1.99	7.75	50.21	0.74
Reach-1	163	50YR	6.60	137.20	138.02	137.97	138.17	0.010628	1.93	5.32	22.77	0.76
Reach-1	163	25YR	6.10	137.20	137.99	137.97	138.13	0.010185	1.84	4.82	15.66	0.74
Reach-1	163	10YR	4.37	137.20	137.90	137.86	138.02	0.009858	1.65	3.61	13.13	0.71
Reach-1	163	5YR	3.52	137.20	137.84	137.80	137.96	0.010879	1.59	2.82	11.19	0.73
Reach-1	163	2YR	2.57	137.20	137.74	137.72	137.86	0.015146	1.60	1.81	8.05	0.82
Reach-1	162	Regional	28.90	135.60	136.76	136.76	137.01	0.016983	3.06	16.52	33.14	1.02
Reach-1	162	100YR	8.17	135.60	136.46		136.55	0.008365	1.65	8.05	23.23	0.67
Reach-1	162	50YR	6.60	135.60	136.42	136.32	136.49	0.007713	1.51	7.02	21.71	0.63
Reach-1	162	25YR	6.10	135.60	136.39		136.46	0.007886	1.48	6.54	20.96	0.64
Reach-1	162	10YR	4.37	135.60	136.32		136.38	0.007899	1.34	5.01	18.41	0.62
Reach-1	162	5YR	3.52	135.60	136.28		136.33	0.007036	1.21	4.42	17.31	0.58
Reach-1	162	2YR	2.57	135.60	136.25		136.28	0.005238	0.99	3.87	16.23	0.49
Reach-1	161	Regional	28.90	134.10	135.30	135.17	135.36	0.005788	1.77	31.56	67.18	0.58
Reach-1	161	100YR	8.17	134.10	134.98	134.98	135.07	0.008814	1.68	10.93	62.89	0.67
Reach-1	161	50YR	6.60	134.10	134.95	134.95	135.03	0.009136	1.64	8.64	54.87	0.68
Reach-1	161	25YR	6.10	134.10	134.94	134.94	135.02	0.008737	1.59	8.14	52.96	0.66
Reach-1	161	10YR	4.37	134.10	134.89	134.89	134.97	0.008112	1.44	5.85	43.08	0.63
Reach-1	161	5YR	3.52	134.10	134.85	134.85	134.93	0.008870	1.43	4.23	34.42	0.65
Reach-1	161	2YR	2.57	134.10	134.76	134.69	134.87	0.012829	1.52	2.03	16.61	0.76
Reach-1	160	Regional	28.90	132.50	134.02		134.06	0.003131	1.45	37.31	64.17	0.42
Reach-1	160	100YR	8.17	132.50	133.61		133.64	0.002166	0.99	15.54	41.27	0.33
Reach-1	160	50YR	6.60	132.50	133.54		133.57	0.002221	0.96	12.79	37.14	0.33
Reach-1	160	25YR	6.10	132.50	133.52	133.29	133.54	0.002198	0.94	11.99	35.85	0.33
Reach-1	160	10YR	4.37	132.50	133.41		133.44	0.002411	0.92	8.52	29.61	0.34
Reach-1	160	5YR	3.52	132.50	133.35		133.38	0.002582	0.91	6.73	25.80	0.35
Reach-1	160	2YR	2.57	132.50	133.28		133.30	0.002499	0.84	5.01	21.54	0.34

14 MILE CREEK WEST

HEC-RAS MODEL RESULTS FOR

PHASE 1A DEVELOPMENT CONDITION

(Controlled flow rate)

- **14W-16 (Reach 1A)**
- **14W-12 (Reach 1)**
- **14W-14 (Reach 2A)**
- **14W-12A (Reach 2B and 2C)**

HEC-RAS Plan: P1A Control

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A	3081	Regional	8.23	154.25	154.63	154.59	154.73	0.007896	1.38	7.20	33.78	0.78
Reach-2A	3081	100YR	3.20	154.25	154.52	154.46	154.56	0.005252	0.85	3.97	24.21	0.59
Reach-2A	3081	50YR	2.83	154.25	154.51		154.54	0.005030	0.80	3.69	23.17	0.58
Reach-2A	3081	25YR	2.48	154.25	154.50		154.53	0.004751	0.74	3.42	22.17	0.55
Reach-2A	3081	10YR	1.94	154.25	154.47		154.49	0.005064	0.69	2.83	19.75	0.56
Reach-2A	3081	5YR	1.59	154.25	154.46		154.48	0.004548	0.62	2.58	18.63	0.52
Reach-2A	3081	2YR	1.00	154.25	154.42		154.44	0.003736	0.50	2.00	16.51	0.46
Reach-2A	228	Regional	8.23	153.98	154.24		154.27	0.005029	0.79	10.36	53.17	0.57
Reach-2A	228	100YR	3.20	153.98	154.13		154.15	0.006242	0.63	5.04	42.66	0.59
Reach-2A	228	50YR	2.83	153.98	154.12		154.14	0.006410	0.61	4.61	41.81	0.59
Reach-2A	228	25YR	2.48	153.98	154.11		154.13	0.006737	0.60	4.16	40.91	0.60
Reach-2A	228	10YR	1.94	153.98	154.10		154.11	0.005816	0.52	3.72	40.01	0.55
Reach-2A	228	5YR	1.59	153.98	154.08		154.10	0.006419	0.50	3.17	38.85	0.56
Reach-2A	228	2YR	1.00	153.98	154.06	154.04	154.07	0.007819	0.45	2.21	36.73	0.59
Reach-2A	227	Regional	8.23	153.04	153.32	153.32	153.42	0.015283	1.39	6.01	33.59	1.00
Reach-2A	227	100YR	3.20	153.04	153.24	153.22	153.29	0.011477	0.91	3.53	27.49	0.81
Reach-2A	227	50YR	2.83	153.04	153.23	153.21	153.27	0.011126	0.87	3.27	26.80	0.79
Reach-2A	227	25YR	2.48	153.04	153.23	153.20	153.26	0.010530	0.81	3.04	26.15	0.76
Reach-2A	227	10YR	1.94	153.04	153.20	153.19	153.23	0.013225	0.82	2.38	24.16	0.83
Reach-2A	227	5YR	1.59	153.04	153.19	153.17	153.22	0.011590	0.73	2.17	23.44	0.77
Reach-2A	227	2YR	1.00	153.04	153.17	153.15	153.19	0.009230	0.59	1.71	21.76	0.67
Reach-2A	226	Regional	8.23	152.44	152.76		152.79	0.003181	0.73	11.27	47.50	0.47
Reach-2A	226	100YR	3.20	152.44	152.63		152.64	0.003878	0.58	5.56	38.06	0.48
Reach-2A	226	50YR	2.83	152.44	152.61		152.63	0.003954	0.56	5.09	37.20	0.48
Reach-2A	226	25YR	2.48	152.44	152.60		152.62	0.004063	0.54	4.62	36.33	0.48
Reach-2A	226	10YR	1.94	152.44	152.59		152.60	0.003531	0.47	4.11	35.37	0.44
Reach-2A	226	5YR	1.59	152.44	152.57		152.58	0.003793	0.45	3.52	34.22	0.45
Reach-2A	226	2YR	1.00	152.44	152.54		152.55	0.004446	0.40	2.48	32.00	0.46
Reach-2A	225	Regional	8.23	151.75	152.27	152.22	152.35	0.005889	1.43	12.28	56.22	0.71
Reach-2A	225	100YR	3.20	151.75	152.12	152.07	152.17	0.005684	1.03	5.01	36.38	0.64
Reach-2A	225	50YR	2.83	151.75	152.10	152.06	152.15	0.005680	0.99	4.44	34.67	0.64
Reach-2A	225	25YR	2.48	151.75	152.09	152.04	152.13	0.005687	0.95	3.89	33.57	0.63
Reach-2A	225	10YR	1.94	151.75	152.04	152.01	152.09	0.007648	0.96	2.55	27.09	0.70
Reach-2A	225	5YR	1.59	151.75	152.03	151.98	152.06	0.007052	0.87	2.14	25.07	0.67
Reach-2A	225	2YR	1.00	151.75	151.99		152.01	0.006326	0.71	1.40	10.04	0.61
Reach-2A	224	Regional	8.23	151.25	151.74	151.65	151.82	0.004732	1.38	11.74	41.75	0.65
Reach-2A	224	100YR	3.20	151.25	151.55	151.50	151.60	0.005603	1.05	4.79	29.50	0.64
Reach-2A	224	50YR	2.83	151.25	151.53	151.48	151.58	0.005646	1.01	4.27	28.32	0.64
Reach-2A	224	25YR	2.48	151.25	151.51	151.46	151.56	0.005649	0.96	3.79	27.17	0.63
Reach-2A	224	10YR	1.94	151.25	151.50	151.43	151.53	0.004048	0.79	3.53	26.52	0.53
Reach-2A	224	5YR	1.59	151.25	151.48	151.41	151.50	0.004400	0.76	2.82	23.43	0.54
Reach-2A	224	2YR	1.00	151.25	151.42	151.38	151.45	0.004988	0.66	1.77	17.73	0.55
Reach-2A	223	Regional	8.23	150.26	151.00	151.00	151.14	0.010014	1.99	9.64	43.51	0.92
Reach-2A	223	100YR	3.20	150.26	150.83	150.83	150.93	0.007784	1.47	4.16	30.76	0.77
Reach-2A	223	50YR	2.83	150.26	150.81	150.81	150.90	0.007682	1.42	3.56	30.52	0.76
Reach-2A	223	25YR	2.48	150.26	150.79	150.79	150.88	0.007766	1.38	2.88	30.24	0.76
Reach-2A	223	10YR	1.94	150.26	150.67	150.67	150.81	0.014543	1.67	1.16	4.11	1.00
Reach-2A	223	5YR	1.59	150.26	150.64	150.63	150.76	0.013829	1.56	1.02	3.89	0.97
Reach-2A	223	2YR	1.00	150.26	150.57	150.55	150.66	0.013356	1.33	0.75	3.57	0.92
Reach-2A	222	Regional	8.23	149.74	150.40	150.30	150.46	0.003652	1.36	16.96	59.69	0.58
Reach-2A	222	100YR	3.20	149.74	150.22	150.15	150.26	0.003519	1.02	7.26	44.06	0.53
Reach-2A	222	50YR	2.83	149.74	150.20	150.13	150.24	0.003466	0.98	6.45	42.09	0.52
Reach-2A	222	25YR	2.48	149.74	150.18	150.10	150.21	0.003417	0.93	5.66	40.07	0.51
Reach-2A	222	10YR	1.94	149.74	150.15	150.05	150.18	0.003149	0.84	4.52	36.97	0.49
Reach-2A	222	5YR	1.59	149.74	150.12	150.01	150.15	0.003127	0.79	3.57	33.02	0.48
Reach-2A	222	2YR	1.00	149.74	150.05	149.94	150.08	0.002981	0.70	1.82	19.15	0.45
Reach-2A	221	Regional	8.23	149.23	149.71	149.71	149.86	0.009958	1.85	7.73	34.98	0.92
Reach-2A	221	100YR	3.20	149.23	149.53	149.53	149.63	0.012315	1.42	2.81	20.53	0.93
Reach-2A	221	50YR	2.83	149.23	149.51	149.51	149.60	0.012799	1.37	2.45	19.18	0.93
Reach-2A	221	25YR	2.48	149.23	149.49	149.49	149.58	0.013256	1.32	2.12	17.86	0.94
Reach-2A	221	10YR	1.94	149.23	149.45	149.45	149.54	0.016379	1.30	1.51	10.39	1.01
Reach-2A	221	5YR	1.59	149.23	149.43	149.43	149.51	0.016831	1.23	1.30	9.00	1.01
Reach-2A	221	2YR	1.00	149.23	149.38	149.38	149.44	0.018103	1.09	0.92	7.71	1.00
Reach-2B	231.1	Regional	8.23	148.25	149.79		149.79	0.000211	0.61	45.15	58.28	0.16
Reach-2B	231.1	100YR	3.20	148.25	149.29		149.30	0.000248	0.50	18.87	43.14	0.17
Reach-2B	231.1	50YR	2.83	148.25	149.24		149.25	0.000245	0.48	16.97	40.91	0.16
Reach-2B	231.1	25YR	2.48	148.25	149.20		149.21	0.000237	0.46	15.24	38.75	0.16

HEC-RAS Plan: P1A Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2B	231.1	10YR	1.94	148.25	149.13		149.13	0.000219	0.42	12.57	35.18	0.15
Reach-2B	231.1	5YR	1.59	148.25	149.08		149.08	0.000201	0.38	10.84	32.65	0.14
Reach-2B	231.1	2YR	1.00	148.25	148.98		148.98	0.000155	0.30	7.82	27.61	0.12
Reach-2B	231	Regional	8.23	148.25	149.79		149.79	0.000211	0.61	45.14	58.27	0.16
Reach-2B	231	100YR	3.20	148.25	149.29		149.29	0.000249	0.50	18.86	43.13	0.17
Reach-2B	231	50YR	2.83	148.25	149.24		149.25	0.000245	0.48	16.96	40.90	0.16
Reach-2B	231	25YR	2.48	148.25	149.20		149.21	0.000237	0.46	15.23	38.74	0.16
Reach-2B	231	10YR	1.94	148.25	149.13		149.13	0.000219	0.42	12.57	35.17	0.15
Reach-2B	231	5YR	1.59	148.25	149.08		149.08	0.000202	0.38	10.83	32.64	0.14
Reach-2B	231	2YR	1.00	148.25	148.97		148.98	0.000155	0.30	7.81	27.60	0.12
Reach-2C	220.3	Regional	8.23	148.25	149.79		149.79	0.000034	0.20	54.85	68.94	0.06
Reach-2C	220.3	100YR	3.20	148.25	149.29		149.29	0.000046	0.16	22.76	53.15	0.07
Reach-2C	220.3	50YR	2.83	148.25	149.25		149.25	0.000048	0.15	20.42	50.28	0.07
Reach-2C	220.3	25YR	2.48	148.25	149.20		149.20	0.000049	0.14	18.27	47.50	0.07
Reach-2C	220.3	10YR	1.94	148.25	149.13		149.13	0.000052	0.13	14.99	42.90	0.07
Reach-2C	220.3	5YR	1.59	148.25	149.08		149.08	0.000054	0.13	12.86	39.63	0.07
Reach-2C	220.3	2YR	1.00	148.25	148.98		148.98	0.000060	0.11	9.18	33.25	0.07
Reach-2C	220.2	Regional	8.23	148.57	149.41	149.41	149.75	0.009452	2.64	3.91	6.97	0.98
Reach-2C	220.2	100YR	3.20	148.57	149.09	149.07	149.27	0.010613	1.90	1.88	5.45	0.94
Reach-2C	220.2	50YR	2.83	148.57	149.07	149.04	149.22	0.009479	1.75	1.79	5.38	0.89
Reach-2C	220.2	25YR	2.48	148.57	149.05	149.01	149.18	0.008656	1.61	1.69	5.29	0.84
Reach-2C	220.2	10YR	1.94	148.57	149.01		149.11	0.007858	1.42	1.47	5.10	0.78
Reach-2C	220.2	5YR	1.59	148.57	148.98		149.06	0.007574	1.30	1.30	4.94	0.76
Reach-2C	220.2	2YR	1.00	148.57	148.90		148.96	0.007894	1.10	0.94	4.59	0.74
Reach-2C	220.1	Regional	8.23	148.25	149.28		149.31	0.001724	0.91	22.77	72.24	0.39
Reach-2C	220.1	100YR	3.20	148.25	148.95		149.01	0.004799	1.14	3.71	18.34	0.61
Reach-2C	220.1	50YR	2.83	148.25	148.91		148.97	0.005177	1.13	3.09	16.70	0.63
Reach-2C	220.1	25YR	2.48	148.25	148.87		148.94	0.005554	1.12	2.53	15.03	0.64
Reach-2C	220.1	10YR	1.94	148.25	148.82		148.88	0.006040	1.09	1.83	8.60	0.66
Reach-2C	220.1	5YR	1.59	148.25	148.77		148.83	0.006247	1.05	1.52	6.08	0.66
Reach-2C	220.1	2YR	1.00	148.25	148.69		148.73	0.006157	0.94	1.06	4.78	0.64
Reach-2C	220	Regional	8.23	148.25	149.28		149.31	0.001754	0.92	22.60	72.21	0.40
Reach-2C	220	100YR	3.20	148.25	148.94		149.00	0.005135	1.16	3.57	17.98	0.63
Reach-2C	220	50YR	2.83	148.25	148.90	148.81	148.97	0.005663	1.17	2.94	16.25	0.66
Reach-2C	220	25YR	2.48	148.25	148.86	148.78	148.93	0.006130	1.17	2.38	14.54	0.67
Reach-2C	220	10YR	1.94	148.25	148.80		148.87	0.006727	1.13	1.74	7.96	0.69
Reach-2C	220	5YR	1.59	148.25	148.76		148.82	0.007035	1.09	1.45	5.81	0.70
Reach-2C	220	2YR	1.00	148.25	148.68		148.73	0.007002	0.99	1.01	4.66	0.68
Reach-1A	210.5	Regional	8.22	155.11	155.51	155.48	155.55	0.010424	0.81	10.17	88.07	0.76
Reach-1A	210.5	100YR	3.34	155.11	155.43	155.42	155.46	0.013628	0.74	4.52	54.49	0.82
Reach-1A	210.5	50YR	2.95	155.11	155.42	155.41	155.45	0.013862	0.72	4.10	52.14	0.82
Reach-1A	210.5	25YR	2.59	155.11	155.41	155.40	155.44	0.014055	0.70	3.71	49.85	0.82
Reach-1A	210.5	10YR	2.04	155.11	155.40	155.39	155.42	0.014915	0.67	3.05	45.72	0.83
Reach-1A	210.5	5YR	1.69	155.11	155.39	155.38	155.41	0.015262	0.64	2.64	42.87	0.83
Reach-1A	210.5	2YR	1.08	155.11	155.36	155.35	155.38	0.015106	0.67	1.61	24.31	0.83
Reach-1A	210	Regional	8.22	154.96	155.27		155.31	0.006641	0.89	9.20	48.77	0.66
Reach-1A	210	100YR	3.34	154.96	155.17		155.19	0.006506	0.69	4.87	37.82	0.61
Reach-1A	210	50YR	2.95	154.96	155.15		155.18	0.006586	0.66	4.44	36.50	0.61
Reach-1A	210	25YR	2.59	154.96	155.14		155.16	0.006493	0.64	4.07	35.33	0.60
Reach-1A	210	10YR	2.04	154.96	155.13		155.14	0.006603	0.60	3.42	33.18	0.59
Reach-1A	210	5YR	1.69	154.96	155.11		155.13	0.006577	0.56	3.01	31.72	0.58
Reach-1A	210	2YR	1.08	154.96	155.09	155.06	155.10	0.006692	0.49	2.20	28.66	0.57
Reach-1A	209	Regional	8.22	154.46	154.73		154.76	0.003709	0.82	15.41	75.02	0.52
Reach-1A	209	100YR	3.34	154.46	154.63		154.64	0.003731	0.58	8.10	64.22	0.48
Reach-1A	209	50YR	2.95	154.46	154.62		154.63	0.003709	0.55	7.44	62.71	0.47
Reach-1A	209	25YR	2.59	154.46	154.61		154.62	0.003695	0.53	6.81	61.80	0.46
Reach-1A	209	10YR	2.04	154.46	154.59		154.60	0.003636	0.48	5.80	60.34	0.45
Reach-1A	209	5YR	1.69	154.46	154.58		154.59	0.003655	0.45	5.09	59.26	0.44
Reach-1A	209	2YR	1.08	154.46	154.56		154.56	0.003495	0.37	3.78	57.26	0.41
Reach-1A	208.3	Regional	8.22	152.95	153.44	153.44	153.59	0.010530	1.84	7.34	31.91	0.93
Reach-1A	208.3	100YR	3.34	152.95	153.27	153.27	153.37	0.013434	1.43	2.95	19.94	0.96
Reach-1A	208.3	50YR	2.95	152.95	153.26	153.26	153.35	0.013939	1.38	2.61	18.66	0.97
Reach-1A	208.3	25YR	2.59	152.95	153.24	153.24	153.33	0.014501	1.33	2.31	17.41	0.97
Reach-1A	208.3	10YR	2.04	152.95	153.21	153.21	153.29	0.015710	1.24	1.84	15.34	0.98
Reach-1A	208.3	5YR	1.69	152.95	153.19	153.19	153.26	0.016173	1.16	1.58	14.16	0.98
Reach-1A	208.3	2YR	1.08	152.95	153.15	153.15	153.21	0.019147	1.03	1.08	11.65	1.01

HEC-RAS Plan: P1A Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1A	208.2	Regional	8.22	152.50	153.04		153.11	0.003363	1.21	10.41	34.28	0.55
Reach-1A	208.2	100YR	3.34	152.50	152.87		152.90	0.002603	0.80	5.38	24.41	0.45
Reach-1A	208.2	50YR	2.95	152.50	152.85		152.88	0.002433	0.75	5.00	23.59	0.43
Reach-1A	208.2	25YR	2.59	152.50	152.83		152.86	0.002324	0.70	4.58	22.66	0.42
Reach-1A	208.2	10YR	2.04	152.50	152.80		152.82	0.002061	0.62	3.96	21.22	0.39
Reach-1A	208.2	5YR	1.69	152.50	152.78		152.80	0.001912	0.56	3.52	20.11	0.37
Reach-1A	208.2	2YR	1.08	152.50	152.75		152.76	0.001348	0.42	2.84	18.30	0.30
Reach-1A	208.1	Regional	8.22	152.51	152.93		152.97	0.003078	1.03	15.01	45.78	0.51
Reach-1A	208.1	100YR	3.34	152.51	152.72		152.75	0.006055	0.89	6.36	35.71	0.63
Reach-1A	208.1	50YR	2.95	152.51	152.70		152.73	0.007047	0.89	5.57	34.68	0.67
Reach-1A	208.1	25YR	2.59	152.51	152.68		152.71	0.007275	0.85	5.06	34.00	0.67
Reach-1A	208.1	10YR	2.04	152.51	152.66		152.68	0.008045	0.80	4.19	32.81	0.69
Reach-1A	208.1	5YR	1.69	152.51	152.64	152.61	152.66	0.008760	0.76	3.62	31.99	0.70
Reach-1A	208.1	2YR	1.08	152.51	152.58	152.58	152.62	0.028721	0.90	1.89	29.35	1.14
Reach-1A	208	Regional	8.22	151.00	152.20	152.20	152.43	0.009902	2.14	4.77	16.09	0.92
Reach-1A	208	100YR	3.34	151.00	152.03		152.11	0.006118	1.31	2.58	8.59	0.68
Reach-1A	208	50YR	2.95	151.00	152.01		152.09	0.005394	1.20	2.47	7.89	0.63
Reach-1A	208	25YR	2.59	151.00	151.98		152.05	0.005607	1.16	2.23	6.58	0.64
Reach-1A	208	10YR	2.04	151.00	151.91		151.98	0.005722	1.12	1.82	5.72	0.63
Reach-1A	208	5YR	1.69	151.00	151.86	151.72	151.92	0.005847	1.10	1.54	5.06	0.63
Reach-1A	208	2YR	1.08	151.00	151.82		151.85	0.003292	0.81	1.34	4.49	0.47
Reach-1A	207	Regional	8.22	150.25	151.14		151.17	0.003015	1.51	22.77	57.93	0.54
Reach-1A	207	100YR	3.34	150.25	150.89	150.88	150.95	0.005368	1.58	9.31	51.10	0.68
Reach-1A	207	50YR	2.95	150.25	150.87	150.87	150.93	0.006039	1.62	7.96	50.30	0.71
Reach-1A	207	25YR	2.59	150.25	150.86	150.86	150.92	0.005566	1.53	7.35	49.94	0.68
Reach-1A	207	10YR	2.04	150.25	150.83	150.83	150.89	0.005023	1.41	6.16	49.22	0.64
Reach-1A	207	5YR	1.69	150.25	150.81	150.81	150.87	0.004649	1.32	5.27	48.68	0.61
Reach-1A	207	2YR	1.08	150.25	150.69	150.69	150.80	0.009274	1.54	1.44	10.55	0.83
Reach-1A	206.3	Regional	10.21	149.49	150.50	150.50	150.73	0.006214	2.35	10.09	28.32	0.80
Reach-1A	206.3	100YR	4.15	149.49	150.21	150.13	150.37	0.006242	1.79	3.11	16.32	0.75
Reach-1A	206.3	50YR	3.68	149.49	150.18	150.08	150.33	0.005825	1.68	2.72	13.54	0.72
Reach-1A	206.3	25YR	3.23	149.49	150.16	150.05	150.28	0.005395	1.56	2.39	10.72	0.69
Reach-1A	206.3	10YR	2.55	149.49	150.11		150.20	0.004771	1.37	1.97	5.74	0.64
Reach-1A	206.3	5YR	2.11	149.49	150.06		150.14	0.004459	1.25	1.76	4.84	0.61
Reach-1A	206.3	2YR	1.36	149.49	149.97		150.02	0.004227	1.03	1.33	4.29	0.57
Reach-1A	206.2	Regional	10.21	149.25	150.35		150.46	0.003124	1.53	12.30	33.12	0.56
Reach-1A	206.2	100YR	4.15	149.25	150.10		150.16	0.002569	1.06	5.32	23.15	0.48
Reach-1A	206.2	50YR	3.68	149.25	150.07		150.12	0.002532	1.01	4.66	22.31	0.47
Reach-1A	206.2	25YR	3.23	149.25	150.04		150.09	0.002521	0.97	3.97	21.39	0.46
Reach-1A	206.2	10YR	2.55	149.25	149.99		150.03	0.002416	0.87	3.00	10.29	0.44
Reach-1A	206.2	5YR	2.11	149.25	149.95		149.98	0.002342	0.81	2.61	7.97	0.43
Reach-1A	206.2	2YR	1.36	149.25	149.85		149.88	0.002083	0.69	1.97	6.34	0.39
Reach-1A	206.1	Regional	10.21	149.00	150.03	150.03	150.21	0.009703	2.35	10.71	31.08	0.92
Reach-1A	206.1	100YR	4.15	149.00	149.79	149.79	149.93	0.010981	1.86	4.30	21.39	0.91
Reach-1A	206.1	50YR	3.68	149.00	149.76	149.76	149.90	0.011339	1.80	3.73	19.45	0.91
Reach-1A	206.1	25YR	3.23	149.00	149.73	149.73	149.87	0.011442	1.73	3.24	17.48	0.91
Reach-1A	206.1	10YR	2.55	149.00	149.68	149.68	149.81	0.012493	1.64	2.45	14.27	0.93
Reach-1A	206.1	5YR	2.11	149.00	149.65	149.65	149.76	0.012689	1.54	2.02	12.64	0.92
Reach-1A	206.1	2YR	1.36	149.00	149.58	149.58	149.67	0.014252	1.36	1.26	9.47	0.93
Reach-1	205.1	Regional	18.70	148.20	149.21		149.29	0.003024	1.34	25.40	79.67	0.54
Reach-1	205.1	100YR	7.43	148.20	148.91		148.98	0.004712	1.17	6.94	26.38	0.62
Reach-1	205.1	50YR	6.58	148.20	148.88		148.94	0.004799	1.14	6.09	24.36	0.62
Reach-1	205.1	25YR	5.77	148.20	148.84		148.91	0.004802	1.11	5.33	20.03	0.61
Reach-1	205.1	10YR	4.54	148.20	148.78		148.84	0.004941	1.05	4.32	14.87	0.61
Reach-1	205.1	5YR	3.74	148.20	148.74		148.79	0.004973	1.00	3.73	13.28	0.60
Reach-1	205.1	2YR	2.38	148.20	148.66		148.70	0.004919	0.89	2.68	11.37	0.58
Reach-1	205	Regional	18.70	147.24	148.40	148.40	148.75	0.010644	2.61	7.16	10.46	1.01
Reach-1	205	100YR	7.43	147.24	148.03	148.03	148.24	0.012129	2.05	3.63	8.49	1.00
Reach-1	205	50YR	6.58	147.24	147.99	147.99	148.19	0.012399	1.98	3.32	8.27	1.00
Reach-1	205	25YR	5.77	147.24	147.95	147.95	148.14	0.013058	1.94	2.98	8.04	1.02
Reach-1	205	10YR	4.54	147.24	147.89	147.89	148.06	0.013368	1.80	2.52	7.70	1.01
Reach-1	205	5YR	3.74	147.24	147.85	147.85	148.00	0.013860	1.71	2.19	7.45	1.01
Reach-1	205	2YR	2.38	147.24	147.76	147.76	147.88	0.015227	1.51	1.58	6.97	1.01
Reach-1	204.75	Regional	18.70	146.00	147.52	147.32	147.74	0.004133	2.13	11.56	17.80	0.67
Reach-1	204.75	100YR	7.43	146.00	147.12		147.23	0.003618	1.44	5.47	12.54	0.58
Reach-1	204.75	50YR	6.58	146.00	147.08		147.18	0.003600	1.37	4.95	11.67	0.57
Reach-1	204.75	25YR	5.77	146.00	147.03		147.12	0.003534	1.31	4.45	9.84	0.56

HEC-RAS Plan: P1A Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	204.75	10YR	4.54	146.00	146.95		147.03	0.003410	1.20	3.78	7.51	0.54
Reach-1	204.75	5YR	3.74	146.00	146.89		146.96	0.003334	1.12	3.34	7.23	0.53
Reach-1	204.75	2YR	2.38	146.00	146.77		146.81	0.003120	0.96	2.48	6.47	0.50
Reach-1	204.7	Regional	18.70	145.89	146.92	146.92	147.27	0.009831	2.63	7.43	13.42	0.99
Reach-1	204.7	100YR	7.43	145.89	146.54	146.54	146.76	0.012164	2.09	3.56	8.13	1.01
Reach-1	204.7	50YR	6.58	145.89	146.50	146.50	146.71	0.012330	2.03	3.23	7.76	1.01
Reach-1	204.7	25YR	5.77	145.89	146.45	146.45	146.65	0.012578	1.98	2.91	7.38	1.01
Reach-1	204.7	10YR	4.54	145.89	146.38	146.38	146.56	0.013043	1.88	2.41	6.80	1.01
Reach-1	204.7	5YR	3.74	145.89	146.34	146.34	146.50	0.013360	1.79	2.10	6.52	1.01
Reach-1	204.7	2YR	2.38	145.89	146.24	146.24	146.37	0.014394	1.59	1.50	5.92	1.01
Reach-1	204.55	Regional	18.70	145.49	146.77		146.94	0.003916	1.82	11.50	22.57	0.64
Reach-1	204.55	100YR	7.43	145.49	146.39		146.48	0.004117	1.35	5.51	10.81	0.60
Reach-1	204.55	50YR	6.58	145.49	146.35		146.43	0.003959	1.29	5.09	10.32	0.59
Reach-1	204.55	25YR	5.77	145.49	146.31		146.38	0.003752	1.23	4.69	9.84	0.57
Reach-1	204.55	10YR	4.54	145.49	146.24		146.30	0.003495	1.13	4.02	9.06	0.54
Reach-1	204.55	5YR	3.74	145.49	146.18		146.24	0.003468	1.06	3.53	8.74	0.53
Reach-1	204.55	2YR	2.38	145.49	146.06		146.11	0.003605	0.93	2.56	7.93	0.52
Reach-1	204.5	Regional	18.70	145.36	146.53	146.53	146.82	0.008707	2.43	9.22	22.92	0.92
Reach-1	204.5	100YR	7.43	145.36	146.25		146.38	0.006556	1.60	4.67	11.12	0.75
Reach-1	204.5	50YR	6.58	145.36	146.22		146.34	0.006196	1.50	4.38	10.43	0.72
Reach-1	204.5	25YR	5.77	145.36	146.20		146.30	0.005756	1.40	4.12	9.80	0.69
Reach-1	204.5	10YR	4.54	145.36	146.14		146.22	0.005318	1.28	3.54	9.10	0.66
Reach-1	204.5	5YR	3.74	145.36	146.08		146.16	0.005324	1.22	3.06	8.47	0.65
Reach-1	204.5	2YR	2.38	145.36	145.96		146.02	0.005698	1.12	2.12	6.99	0.65
Reach-1	204.25	Regional	18.70	145.11	146.32	146.32	146.56	0.008620	2.43	14.23	31.00	0.91
Reach-1	204.25	100YR	7.43	145.11	146.01	146.01	146.18	0.008954	1.90	5.69	23.70	0.87
Reach-1	204.25	50YR	6.58	145.11	145.98	145.98	146.14	0.009309	1.85	4.85	22.64	0.88
Reach-1	204.25	25YR	5.77	145.11	145.93	145.93	146.10	0.010333	1.86	3.83	18.23	0.92
Reach-1	204.25	10YR	4.54	145.11	145.83	145.83	146.01	0.012078	1.90	2.48	10.00	0.98
Reach-1	204.25	5YR	3.74	145.11	145.76	145.76	145.94	0.013485	1.89	1.98	5.64	1.02
Reach-1	204.25	2YR	2.38	145.11	145.65	145.65	145.80	0.014146	1.71	1.39	4.77	1.01
Reach-1	204	Regional	18.99	144.05	145.08	145.08	145.38	0.009649	2.85	14.24	25.18	1.00
Reach-1	204	100YR	7.59	144.05	144.79	144.79	144.96	0.008890	2.04	7.20	23.16	0.90
Reach-1	204	50YR	6.73	144.05	144.76	144.76	144.92	0.009079	1.98	6.45	22.93	0.90
Reach-1	204	25YR	5.92	144.05	144.72	144.72	144.88	0.010083	1.96	5.48	21.71	0.93
Reach-1	204	10YR	4.62	144.05	144.66	144.66	144.81	0.010227	1.81	4.32	19.77	0.92
Reach-1	204	5YR	3.81	144.05	144.62	144.62	144.76	0.010203	1.70	3.60	18.46	0.90
Reach-1	204	2YR	2.44	144.05	144.54	144.54	144.65	0.011213	1.50	2.21	15.59	0.90
Reach-1	203	Regional	19.14	142.50	144.90		144.94	0.000473	0.92	32.79	37.85	0.24
Reach-1	203	100YR	7.68	142.50	143.70	143.70	143.90	0.012664	1.98	3.87	9.64	1.00
Reach-1	203	50YR	6.81	142.50	143.65	143.65	143.85	0.013127	2.00	3.41	8.59	1.01
Reach-1	203	25YR	5.99	142.50	143.53	143.53	143.79	0.012593	2.26	2.65	5.22	1.01
Reach-1	203	10YR	4.67	142.50	143.43	143.43	143.66	0.012670	2.14	2.18	4.69	1.00
Reach-1	203	5YR	3.85	142.50	143.36	143.36	143.58	0.013272	2.08	1.85	4.32	1.01
Reach-1	203	2YR	2.45	142.50	143.22	143.22	143.40	0.014164	1.90	1.29	3.60	1.01
Reach-1	202.75	Regional	19.14	142.43	144.58	143.79	144.85	0.001807	2.31	8.29	35.25	0.50
Reach-1	202.75	100YR	7.68	142.43	143.60	143.17	143.75	0.002217	1.70	4.51	27.27	0.50
Reach-1	202.75	50YR	6.81	142.43	143.51	143.11	143.65	0.002278	1.64	4.16	26.53	0.50
Reach-1	202.75	25YR	5.99	142.43	143.42	143.06	143.55	0.002344	1.57	3.82	24.17	0.50
Reach-1	202.75	10YR	4.67	142.43	143.27	142.96	143.38	0.002479	1.44	3.23	19.77	0.50
Reach-1	202.75	5YR	3.85	142.43	143.17	142.90	143.26	0.002588	1.35	2.84	17.43	0.50
Reach-1	202.75	2YR	2.45	142.43	142.98	142.78	143.05	0.002864	1.17	2.10	14.31	0.50
Reach-1	202.5		Culvert									
Reach-1	202.25	Regional	19.14	142.28	143.64	143.64	144.32	0.015506	3.66	5.23	4.23	1.00
Reach-1	202.25	100YR	7.68	142.28	143.02	143.02	143.39	0.015082	2.70	2.85	3.85	1.00
Reach-1	202.25	50YR	6.81	142.28	142.96	142.96	143.31	0.015130	2.59	2.62	3.85	1.00
Reach-1	202.25	25YR	5.99	142.28	142.91	142.91	143.22	0.014966	2.48	2.42	3.85	1.00
Reach-1	202.25	10YR	4.67	142.28	142.81	142.81	143.08	0.015110	2.28	2.04	3.85	1.00
Reach-1	202.25	5YR	3.85	142.28	142.75	142.75	142.98	0.014808	2.12	1.81	3.85	0.99
Reach-1	202.25	2YR	2.45	142.28	142.69	142.63	142.81	0.009047	1.54	1.59	3.85	0.77
Reach-1	202	Regional	19.14	142.20	143.23		143.29	0.001599	1.26	29.01	49.28	0.42
Reach-1	202	100YR	7.68	142.20	142.69	142.69	142.83	0.010783	1.77	5.93	25.95	0.93
Reach-1	202	50YR	6.81	142.20	142.65	142.65	142.80	0.012701	1.79	4.98	22.79	1.00
Reach-1	202	25YR	5.99	142.20	142.63	142.63	142.76	0.011815	1.67	4.62	21.93	0.95
Reach-1	202	10YR	4.67	142.20	142.59	142.59	142.70	0.011723	1.52	3.79	20.61	0.93
Reach-1	202	5YR	3.85	142.20	142.56	142.56	142.66	0.012111	1.43	3.19	19.62	0.92

HEC-RAS Plan: P1A Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	202	2YR	2.45	142.20	142.50	142.50	142.58	0.014174	1.27	2.02	17.74	0.95
Reach-1	201	Regional	19.14	141.65	143.21		143.24	0.000520	0.97	37.18	39.45	0.26
Reach-1	201	100YR	7.68	141.65	142.60		142.63	0.000800	0.84	15.01	31.94	0.29
Reach-1	201	50YR	6.81	141.65	142.53		142.56	0.000925	0.85	12.67	30.74	0.31
Reach-1	201	25YR	5.99	141.65	142.50		142.53	0.000838	0.79	11.80	30.22	0.29
Reach-1	201	10YR	4.67	141.65	142.40		142.42	0.000911	0.75	8.94	25.62	0.30
Reach-1	201	5YR	3.85	141.65	142.34		142.36	0.000904	0.70	7.47	23.00	0.29
Reach-1	201	2YR	2.45	141.65	142.25		142.26	0.000668	0.54	5.64	19.28	0.24
Reach-1	171	Regional	28.90	141.65	142.97	142.70	143.11	0.002516	1.90	27.97	37.97	0.55
Reach-1	171	100YR	8.17	141.65	142.44	142.21	142.50	0.002213	1.21	9.98	27.36	0.47
Reach-1	171	50YR	6.60	141.65	142.36	142.15	142.42	0.002210	1.13	8.15	24.25	0.46
Reach-1	171	25YR	6.10	141.65	142.34	142.13	142.40	0.002202	1.10	7.58	23.20	0.46
Reach-1	171	10YR	4.37	141.65	142.25	142.05	142.29	0.002182	0.97	5.57	19.13	0.44
Reach-1	171	5YR	3.52	141.65	142.19	142.01	142.23	0.002166	0.89	4.59	16.80	0.43
Reach-1	171	2YR	2.57	141.65	142.12	141.95	142.15	0.002101	0.79	3.54	13.88	0.41
Reach-1	170		Bridge									
Reach-1	169	Regional	28.90	141.65	142.70	142.70	142.99	0.007134	2.71	18.27	33.54	0.89
Reach-1	169	100YR	8.17	141.65	142.21	142.21	142.40	0.009752	1.96	4.98	17.76	0.92
Reach-1	169	50YR	6.60	141.65	142.15	142.15	142.32	0.010567	1.86	3.98	15.15	0.94
Reach-1	169	25YR	6.10	141.65	142.13	142.13	142.30	0.011146	1.83	3.63	14.16	0.95
Reach-1	169	10YR	4.37	141.65	142.05	142.05	142.19	0.013010	1.69	2.63	10.71	0.99
Reach-1	169	5YR	3.52	141.65	142.01	142.01	142.13	0.014215	1.59	2.21	8.88	1.01
Reach-1	169	2YR	2.57	141.65	141.95	141.95	142.06	0.014892	1.45	1.77	8.23	1.00
Reach-1	164	Regional	28.90	138.30	139.25		139.39	0.007256	1.51	18.32	23.62	0.61
Reach-1	164	100YR	8.17	138.30	138.83		138.86	0.002624	0.51	10.37	14.75	0.32
Reach-1	164	50YR	6.60	138.30	138.74		138.76	0.002349	0.41	9.12	13.62	0.29
Reach-1	164	25YR	6.10	138.30	138.69		138.72	0.002374	0.38	8.50	12.97	0.29
Reach-1	164	10YR	4.37	138.30	138.54		138.56	0.002100	0.28	6.77	10.44	0.25
Reach-1	164	5YR	3.52	138.30	138.46		138.47	0.001886	0.19	5.92	9.30	0.22
Reach-1	164	2YR	2.57	138.30	138.34		138.36	0.001562	0.07	4.96	7.74	0.16
Reach-1	163	Regional	28.90	137.20	138.47		138.55	0.005133	1.90	30.33	59.32	0.57
Reach-1	163	100YR	8.17	137.20	138.08	137.99	138.23	0.009915	1.99	7.75	50.21	0.74
Reach-1	163	50YR	6.60	137.20	138.02	137.97	138.17	0.010628	1.93	5.32	22.77	0.76
Reach-1	163	25YR	6.10	137.20	137.99	137.97	138.13	0.010185	1.84	4.82	15.66	0.74
Reach-1	163	10YR	4.37	137.20	137.90	137.86	138.02	0.009858	1.65	3.61	13.13	0.71
Reach-1	163	5YR	3.52	137.20	137.84	137.80	137.96	0.010879	1.59	2.82	11.19	0.73
Reach-1	163	2YR	2.57	137.20	137.74	137.72	137.86	0.015146	1.60	1.81	8.05	0.82
Reach-1	162	Regional	28.90	135.60	136.76	136.76	137.01	0.016983	3.06	16.52	33.14	1.02
Reach-1	162	100YR	8.17	135.60	136.46		136.55	0.008365	1.65	8.05	23.23	0.67
Reach-1	162	50YR	6.60	135.60	136.42	136.32	136.49	0.007713	1.51	7.02	21.71	0.63
Reach-1	162	25YR	6.10	135.60	136.39		136.46	0.007886	1.48	6.54	20.96	0.64
Reach-1	162	10YR	4.37	135.60	136.32		136.38	0.007899	1.34	5.01	18.41	0.62
Reach-1	162	5YR	3.52	135.60	136.28		136.33	0.007036	1.21	4.42	17.31	0.58
Reach-1	162	2YR	2.57	135.60	136.25		136.28	0.005238	0.99	3.87	16.23	0.49
Reach-1	161	Regional	28.90	134.10	135.30	135.17	135.36	0.005788	1.77	31.56	67.18	0.58
Reach-1	161	100YR	8.17	134.10	134.98	134.98	135.07	0.008814	1.68	10.93	62.89	0.67
Reach-1	161	50YR	6.60	134.10	134.95	134.95	135.03	0.009136	1.64	8.64	54.87	0.68
Reach-1	161	25YR	6.10	134.10	134.94	134.94	135.02	0.008737	1.59	8.14	52.96	0.66
Reach-1	161	10YR	4.37	134.10	134.89	134.89	134.97	0.008112	1.44	5.85	43.08	0.63
Reach-1	161	5YR	3.52	134.10	134.85	134.85	134.93	0.008870	1.43	4.23	34.42	0.65
Reach-1	161	2YR	2.57	134.10	134.76	134.69	134.87	0.012829	1.52	2.03	16.61	0.76
Reach-1	160	Regional	28.90	132.50	134.02		134.06	0.003131	1.45	37.31	64.17	0.42
Reach-1	160	100YR	8.17	132.50	133.61		133.64	0.002166	0.99	15.54	41.27	0.33
Reach-1	160	50YR	6.60	132.50	133.54		133.57	0.002221	0.96	12.79	37.14	0.33
Reach-1	160	25YR	6.10	132.50	133.52	133.29	133.54	0.002198	0.94	11.99	35.85	0.33
Reach-1	160	10YR	4.37	132.50	133.41		133.44	0.002411	0.92	8.52	29.61	0.34
Reach-1	160	5YR	3.52	132.50	133.35		133.38	0.002582	0.91	6.73	25.80	0.35
Reach-1	160	2YR	2.57	132.50	133.28		133.30	0.002499	0.84	5.01	21.54	0.34

14 MILE CREEK WEST

HEC-RAS MODEL RESULTS FOR

PHASE 1B DEVELOPMENT CONDITION

(Controlled flow rate)

- **14W-16 (Reach 1A)**
- **14W-12 (Reach 1)**
- **14W-22 (Reach 2A and Reach 2A1)**
- **14W-21 (Reach 2A2)**
- **14W-12A (Reach 2B and 2C)**

HEC-RAS Plan: P1B Control

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A2	309	Regional	6.68	154.00	154.85		154.87	0.003862	1.59	18.11	46.87	0.58
Reach-2A2	309	100YR	2.58	154.00	154.61		154.63	0.004239	1.30	8.45	34.24	0.57
Reach-2A2	309	50YR	2.27	154.00	154.58		154.61	0.004329	1.27	7.59	32.89	0.57
Reach-2A2	309	25YR	1.99	154.00	154.56		154.58	0.004454	1.25	6.78	31.55	0.57
Reach-2A2	309	10YR	1.55	154.00	154.52		154.54	0.004707	1.21	5.45	29.23	0.58
Reach-2A2	309	5YR	1.27	154.00	154.48		154.51	0.004900	1.17	4.58	27.40	0.58
Reach-2A2	309	2YR	0.79	154.00	154.43		154.45	0.005026	1.07	3.07	23.51	0.58
Reach-2A2	308	Regional	6.68	153.50	154.45		154.50	0.005712	2.09	12.96	31.30	0.72
Reach-2A2	308	100YR	2.58	153.50	154.14		154.20	0.007360	1.78	5.30	18.71	0.76
Reach-2A2	308	50YR	2.27	153.50	154.11		154.16	0.007476	1.72	4.73	17.36	0.75
Reach-2A2	308	25YR	1.99	153.50	154.08		154.13	0.007643	1.67	4.18	15.99	0.75
Reach-2A2	308	10YR	1.55	153.50	154.02		154.07	0.007802	1.56	3.34	13.58	0.75
Reach-2A2	308	5YR	1.27	153.50	153.98		154.02	0.007911	1.48	2.84	12.66	0.74
Reach-2A2	308	2YR	0.79	153.50	153.91		153.95	0.008126	1.32	1.98	12.17	0.73
Reach-2A2	307	Regional	6.68	153.00	154.01		154.07	0.004882	2.03	10.74	16.30	0.67
Reach-2A2	307	100YR	2.58	153.00	153.70		153.73	0.004337	1.46	5.83	14.58	0.59
Reach-2A2	307	50YR	2.27	153.00	153.66		153.70	0.004304	1.40	5.34	14.30	0.58
Reach-2A2	307	25YR	1.99	153.00	153.63		153.66	0.004221	1.33	4.90	14.04	0.57
Reach-2A2	307	10YR	1.55	153.00	153.58		153.60	0.004165	1.24	4.13	13.57	0.56
Reach-2A2	307	5YR	1.27	153.00	153.54		153.56	0.004115	1.16	3.60	13.24	0.55
Reach-2A2	307	2YR	0.79	153.00	153.45		153.48	0.004278	1.04	2.52	12.53	0.54
Reach-2A2	306	Regional	6.68	152.75	153.48	153.48	153.67	0.023138	3.48	6.33	14.91	1.37
Reach-2A2	306	100YR	2.58	152.75	153.28	153.28	153.39	0.019000	2.46	3.46	13.22	1.17
Reach-2A2	306	50YR	2.27	152.75	153.26	153.26	153.37	0.018028	2.33	3.22	13.06	1.13
Reach-2A2	306	25YR	1.99	152.75	153.24	153.24	153.34	0.017652	2.23	2.95	12.89	1.11
Reach-2A2	306	10YR	1.55	152.75	153.21	153.21	153.29	0.016152	2.02	2.54	12.62	1.05
Reach-2A2	306	5YR	1.27	152.75	153.18	153.18	153.26	0.015173	1.88	2.24	12.43	1.01
Reach-2A2	306	2YR	0.79	152.75	153.14	153.14	153.20	0.011519	1.51	1.73	12.09	0.86
Reach-2A1	3081	Regional	6.68	154.25	154.63	154.56	154.69	0.005423	1.14	7.08	33.46	0.65
Reach-2A1	3081	100YR	2.58	154.25	154.49		154.52	0.006203	0.82	3.21	21.31	0.63
Reach-2A1	3081	50YR	2.27	154.25	154.47		154.51	0.006426	0.79	2.91	20.06	0.63
Reach-2A1	3081	25YR	1.99	154.25	154.46		154.49	0.006671	0.76	2.64	18.88	0.63
Reach-2A1	3081	10YR	1.55	154.25	154.44		154.46	0.007025	0.71	2.19	17.15	0.63
Reach-2A1	3081	5YR	1.27	154.25	154.41		154.44	0.007855	0.70	1.82	15.86	0.66
Reach-2A1	3081	2YR	0.79	154.25	154.38		154.40	0.008479	0.63	1.26	13.69	0.66
Reach-2A1	3071	Regional	6.68	153.56	154.20	154.20	154.31	0.008513	2.14	10.65	36.99	0.87
Reach-2A1	3071	100YR	2.58	153.56	154.02	154.02	154.12	0.008073	1.67	4.50	28.61	0.80
Reach-2A1	3071	50YR	2.27	153.56	154.00	154.00	154.10	0.008072	1.61	3.90	26.41	0.79
Reach-2A1	3071	25YR	1.99	153.56	153.98	153.98	154.07	0.008082	1.56	3.34	24.21	0.79
Reach-2A1	3071	10YR	1.55	153.56	153.94	153.94	154.03	0.008348	1.47	2.41	20.01	0.78
Reach-2A1	3071	5YR	1.27	153.56	153.91	153.90	153.99	0.007971	1.37	1.92	17.37	0.76
Reach-2A1	3071	2YR	0.79	153.56	153.84	153.81	153.91	0.008807	1.22	0.92	10.04	0.76
Reach-2A1	3061	Regional	6.68	152.85	153.61	153.61	153.75	0.008172	2.20	9.01	27.96	0.82
Reach-2A1	3061	100YR	2.58	152.85	153.42	153.42	153.53	0.006564	1.62	3.88	25.62	0.70
Reach-2A1	3061	50YR	2.27	152.85	153.38	153.38	153.50	0.007365	1.63	2.97	21.58	0.73
Reach-2A1	3061	25YR	1.99	152.85	153.34	153.34	153.47	0.008091	1.62	2.24	17.75	0.76
Reach-2A1	3061	10YR	1.55	152.85	153.25	153.25	153.40	0.012280	1.72	1.04	7.97	0.90
Reach-2A1	3061	5YR	1.27	152.85	153.18	153.18	153.34	0.016374	1.75	0.73	2.38	1.01
Reach-2A1	3061	2YR	0.79	152.85	153.09	153.09	153.21	0.017029	1.51	0.52	2.28	1.01
Reach-2A	305	Regional	6.68	152.12	152.95		152.98	0.003331	1.32	16.35	35.72	0.46
Reach-2A	305	100YR	2.58	152.12	152.72		152.74	0.003290	1.05	8.22	31.55	0.43
Reach-2A	305	50YR	2.27	152.12	152.69		152.72	0.003309	1.03	7.46	31.36	0.43
Reach-2A	305	25YR	1.99	152.12	152.67		152.69	0.003307	1.00	6.76	31.22	0.43
Reach-2A	305	10YR	1.55	152.12	152.63		152.65	0.003307	0.95	5.56	30.99	0.42
Reach-2A	305	5YR	1.27	152.12	152.61		152.63	0.003238	0.91	4.75	30.83	0.42
Reach-2A	305	2YR	0.79	152.12	152.55	152.42	152.57	0.003293	0.84	2.97	30.49	0.41
Reach-2A	304	Regional	6.68	151.63	152.45		152.48	0.003471	1.34	16.12	35.68	0.47
Reach-2A	304	100YR	2.58	151.63	152.22		152.25	0.003476	1.08	8.06	31.47	0.45
Reach-2A	304	50YR	2.27	151.63	152.20		152.22	0.003475	1.05	7.33	31.33	0.44
Reach-2A	304	25YR	1.99	151.63	152.18		152.20	0.003474	1.02	6.64	31.20	0.44
Reach-2A	304	10YR	1.55	151.63	152.14		152.16	0.003475	0.97	5.45	30.97	0.44
Reach-2A	304	5YR	1.27	151.63	152.11		152.13	0.003572	0.95	4.55	30.80	0.44
Reach-2A	304	2YR	0.79	151.63	152.05		152.08	0.003495	0.86	2.87	30.47	0.42
Reach-2A	303	Regional	6.68	151.46	152.29		152.31	0.003420	1.33	16.20	35.70	0.47
Reach-2A	303	100YR	2.58	151.46	152.05		152.08	0.003389	1.06	8.13	31.49	0.44
Reach-2A	303	50YR	2.27	151.46	152.03		152.05	0.003385	1.04	7.40	31.35	0.44
Reach-2A	303	25YR	1.99	151.46	152.01		152.03	0.003375	1.01	6.71	31.21	0.43
Reach-2A	303	10YR	1.55	151.46	151.97		151.99	0.003416	0.96	5.48	30.98	0.43
Reach-2A	303	5YR	1.27	151.46	151.94		151.97	0.003434	0.93	4.63	30.81	0.43
Reach-2A	303	2YR	0.79	151.46	151.88		151.91	0.003615	0.88	2.82	30.46	0.43

HEC-RAS Plan: P1B Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A	302	Regional	6.68	151.29	152.12		152.14	0.003443	1.34	16.17	35.69	0.47
Reach-2A	302	100YR	2.58	151.29	151.88		151.91	0.003416	1.07	8.11	31.48	0.44
Reach-2A	302	50YR	2.27	151.29	151.86		151.88	0.003410	1.04	7.38	31.34	0.44
Reach-2A	302	25YR	1.99	151.29	151.84		151.86	0.003351	1.00	6.73	31.22	0.43
Reach-2A	302	10YR	1.55	151.29	151.80		151.82	0.003337	0.96	5.54	30.99	0.43
Reach-2A	302	5YR	1.27	151.29	151.77		151.80	0.003293	0.92	4.71	30.83	0.42
Reach-2A	302	2YR	0.79	151.29	151.72		151.75	0.002958	0.81	3.15	30.52	0.39
Reach-2A	301	Regional	6.68	150.79	151.61		151.64	0.003472	1.34	16.12	35.68	0.47
Reach-2A	301	100YR	2.58	150.79	151.38		151.41	0.003504	1.08	8.03	31.47	0.45
Reach-2A	301	50YR	2.27	150.79	151.36		151.38	0.003510	1.05	7.30	31.33	0.45
Reach-2A	301	25YR	1.99	150.79	151.33		151.36	0.003558	1.03	6.57	31.19	0.45
Reach-2A	301	10YR	1.55	150.79	151.30		151.32	0.003639	0.99	5.34	30.95	0.44
Reach-2A	301	5YR	1.27	150.79	151.27		151.29	0.003689	0.96	4.48	30.78	0.44
Reach-2A	301	2YR	0.79	150.79	151.21	151.18	151.24	0.004143	0.93	2.60	30.41	0.46
Reach-2A	300	Regional	6.68	150.40	151.22	151.00	151.25	0.003568	1.35	15.97	35.66	0.48
Reach-2A	300	100YR	2.58	150.40	150.99	150.91	151.02	0.003454	1.07	8.07	31.47	0.45
Reach-2A	300	50YR	2.27	150.40	150.97	150.89	150.99	0.003446	1.04	7.35	31.34	0.44
Reach-2A	300	25YR	1.99	150.40	150.95	150.88	150.97	0.003386	1.01	6.70	31.21	0.43
Reach-2A	300	10YR	1.55	150.40	150.91	150.86	150.93	0.003288	0.95	5.57	30.99	0.42
Reach-2A	300	5YR	1.27	150.40	150.89	150.84	150.91	0.003238	0.91	4.75	30.83	0.42
Reach-2A	300	2YR	0.79	150.40	150.84	150.70	150.86	0.002830	0.79	3.23	30.54	0.38
Reach-2A	299	Regional	6.68	150.05	150.92		150.94	0.002655	1.21	17.64	35.94	0.42
Reach-2A	299	100YR	2.58	150.05	150.64		150.67	0.003483	1.08	8.05	31.47	0.45
Reach-2A	299	50YR	2.27	150.05	150.62		150.64	0.003537	1.05	7.28	31.32	0.45
Reach-2A	299	25YR	1.99	150.05	150.59		150.62	0.003667	1.04	6.50	31.17	0.45
Reach-2A	299	10YR	1.55	150.05	150.55		150.58	0.003905	1.02	5.19	30.92	0.46
Reach-2A	299	5YR	1.27	150.05	150.52		150.55	0.003914	0.98	4.37	30.76	0.46
Reach-2A	299	2YR	0.79	150.05	150.46	150.45	150.50	0.004561	0.97	2.44	30.38	0.48
Reach-2A	298	Regional	6.68	149.76	150.75		150.76	0.001204	0.89	23.42	38.50	0.29
Reach-2A	298	100YR	2.58	149.76	150.44		150.45	0.001474	0.77	11.52	36.60	0.30
Reach-2A	298	50YR	2.27	149.76	150.41		150.42	0.001539	0.76	10.37	36.41	0.30
Reach-2A	298	25YR	1.99	149.76	150.37		150.39	0.001573	0.74	9.27	35.10	0.30
Reach-2A	298	10YR	1.55	149.76	150.32		150.33	0.001659	0.72	7.45	33.08	0.31
Reach-2A	298	5YR	1.27	149.76	150.28		150.30	0.001776	0.71	6.23	32.86	0.31
Reach-2A	298	2YR	0.79	149.76	150.23		150.24	0.001594	0.62	4.38	32.52	0.29
Reach-2A	297	Regional	6.68	149.64	150.43	150.43	150.63	0.015814	2.77	5.89	35.45	1.00
Reach-2A	297	100YR	2.58	149.64	150.21	150.21	150.33	0.011485	1.91	3.26	31.34	0.81
Reach-2A	297	50YR	2.27	149.64	150.19	150.19	150.30	0.010908	1.81	2.99	31.21	0.78
Reach-2A	297	25YR	1.99	149.64	150.17	150.17	150.27	0.010418	1.72	2.72	31.08	0.76
Reach-2A	297	10YR	1.55	149.64	150.13	150.13	150.22	0.009635	1.57	2.24	30.84	0.72
Reach-2A	297	5YR	1.27	149.64	150.10	150.10	150.19	0.009090	1.47	1.88	30.67	0.69
Reach-2A	297	2YR	0.79	149.64	149.94	149.94	150.10	0.020766	1.73	0.46	1.50	1.00
Reach-2A	296.5		Culvert									
Reach-2A	296	Regional	6.68	149.44	150.23	150.23	150.43	0.015840	2.77	5.89	35.45	1.00
Reach-2A	296	100YR	2.58	149.44	150.01	150.01	150.13	0.011498	1.91	3.26	31.34	0.81
Reach-2A	296	50YR	2.27	149.44	149.99	149.99	150.10	0.011074	1.82	2.97	31.20	0.79
Reach-2A	296	25YR	1.99	149.44	149.97	149.97	150.07	0.010546	1.73	2.71	31.07	0.76
Reach-2A	296	10YR	1.55	149.44	149.93	149.93	150.02	0.009640	1.57	2.24	30.84	0.72
Reach-2A	296	5YR	1.27	149.44	149.90	149.90	149.99	0.009095	1.47	1.88	30.67	0.69
Reach-2A	296	2YR	0.79	149.44	149.74	149.74	149.90	0.020777	1.73	0.46	1.50	1.00
Reach-2B	231.1	Regional	0.86	148.25	149.33		149.33	0.000015	0.12	20.77	45.27	0.04
Reach-2B	231.1	100YR	0.64	148.25	149.07		149.07	0.000034	0.15	10.70	32.43	0.06
Reach-2B	231.1	50YR	0.57	148.25	149.04		149.05	0.000032	0.15	9.85	31.12	0.06
Reach-2B	231.1	25YR	0.50	148.25	149.02		149.02	0.000029	0.14	9.00	29.74	0.05
Reach-2B	231.1	10YR	0.40	148.25	148.97		148.97	0.000026	0.12	7.67	27.33	0.05
Reach-2B	231.1	5YR	0.33	148.25	148.94		148.94	0.000022	0.11	6.77	25.52	0.05
Reach-2B	231.1	2YR	0.21	148.25	148.87		148.87	0.000015	0.08	5.13	21.88	0.04
Reach-2B	231	Regional	0.86	148.25	149.33		149.33	0.000015	0.12	20.77	45.27	0.04
Reach-2B	231	100YR	0.64	148.25	149.07		149.07	0.000034	0.15	10.69	32.43	0.06
Reach-2B	231	50YR	0.57	148.25	149.04		149.05	0.000032	0.15	9.85	31.12	0.06
Reach-2B	231	25YR	0.50	148.25	149.02		149.02	0.000029	0.14	9.00	29.74	0.05
Reach-2B	231	10YR	0.40	148.25	148.97		148.97	0.000026	0.12	7.67	27.32	0.05
Reach-2B	231	5YR	0.33	148.25	148.94		148.94	0.000022	0.11	6.77	25.52	0.05
Reach-2B	231	2YR	0.21	148.25	148.87		148.87	0.000015	0.08	5.13	21.88	0.04
Reach-2B	220.3	Regional	0.86	148.25	149.33		149.33	0.000003	0.04	24.90	55.65	0.02
Reach-2B	220.3	100YR	0.64	148.25	149.07		149.07	0.000009	0.05	12.61	39.22	0.03
Reach-2B	220.3	50YR	0.57	148.25	149.04		149.04	0.000010	0.05	11.59	37.54	0.03
Reach-2B	220.3	25YR	0.50	148.25	149.02		149.02	0.000010	0.05	10.57	35.77	0.03

HEC-RAS Plan: P1B Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2B	220.3	10YR	0.40	148.25	148.97		148.97	0.000010	0.04	8.96	32.84	0.03
Reach-2B	220.3	5YR	0.33	148.25	148.94		148.94	0.000010	0.04	7.88	30.72	0.03
Reach-2B	220.3	2YR	0.21	148.25	148.87		148.87	0.000008	0.04	5.90	26.42	0.02
Reach-2B	220.2	Regional	0.86	148.57	149.32		149.33	0.000160	0.32	3.31	6.56	0.13
Reach-2B	220.2	100YR	0.64	148.57	149.06		149.07	0.000525	0.41	1.74	5.34	0.21
Reach-2B	220.2	50YR	0.57	148.57	149.04		149.04	0.000527	0.39	1.61	5.22	0.21
Reach-2B	220.2	25YR	0.50	148.57	149.01		149.01	0.000529	0.37	1.47	5.09	0.20
Reach-2B	220.2	10YR	0.40	148.57	148.96		148.97	0.000557	0.34	1.24	4.88	0.20
Reach-2B	220.2	5YR	0.33	148.57	148.93		148.93	0.000573	0.32	1.08	4.72	0.20
Reach-2B	220.2	2YR	0.21	148.57	148.86		148.87	0.000650	0.28	0.77	4.41	0.20
Reach-2C	220.15	Regional	7.29	148.50	149.30		149.32	0.001110	0.76	26.03	63.98	0.32
Reach-2C	220.15	100YR	2.90	148.50	149.02		149.04	0.002045	0.78	9.45	54.28	0.40
Reach-2C	220.15	50YR	2.56	148.50	148.99		149.01	0.002346	0.80	7.74	51.38	0.43
Reach-2C	220.15	25YR	2.24	148.50	148.96		148.98	0.002685	0.82	6.14	45.01	0.45
Reach-2C	220.15	10YR	1.75	148.50	148.90		148.93	0.003445	0.84	3.88	34.09	0.50
Reach-2C	220.15	5YR	1.43	148.50	148.86		148.89	0.004139	0.85	2.63	26.12	0.54
Reach-2C	220.15	2YR	0.90	148.50	148.78		148.81	0.005948	0.83	1.14	10.49	0.62
Reach-2C	220.1	Regional	7.29	148.25	149.27		149.29	0.001463	0.84	22.02	72.09	0.36
Reach-2C	220.1	100YR	2.90	148.25	148.94		149.00	0.003981	1.03	3.69	18.28	0.56
Reach-2C	220.1	50YR	2.56	148.25	148.91		148.96	0.004227	1.02	3.10	16.71	0.57
Reach-2C	220.1	25YR	2.24	148.25	148.87		148.93	0.004634	1.02	2.50	14.92	0.59
Reach-2C	220.1	10YR	1.75	148.25	148.81		148.86	0.005076	0.99	1.80	8.41	0.60
Reach-2C	220.1	5YR	1.43	148.25	148.77		148.82	0.005304	0.96	1.49	5.88	0.61
Reach-2C	220.1	2YR	0.90	148.25	148.68		148.72	0.005240	0.87	1.04	4.73	0.59
Reach-2C	220	Regional	7.29	148.25	149.27		149.29	0.001448	0.83	21.93	71.80	0.36
Reach-2C	220	100YR	2.90	148.25	148.94		148.99	0.004204	1.05	3.58	18.00	0.57
Reach-2C	220	50YR	2.56	148.25	148.90		148.96	0.004492	1.05	2.99	16.41	0.58
Reach-2C	220	25YR	2.24	148.25	148.87		148.92	0.004961	1.05	2.40	14.58	0.61
Reach-2C	220	10YR	1.75	148.25	148.80		148.86	0.005474	1.02	1.74	7.96	0.63
Reach-2C	220	5YR	1.43	148.25	148.76		148.81	0.005772	0.99	1.44	5.80	0.63
Reach-2C	220	2YR	0.90	148.25	148.68		148.72	0.005748	0.90	1.00	4.65	0.62
Reach-1A	210.5	Regional	8.11	155.11	155.51	155.48	155.54	0.010224	0.80	10.15	88.00	0.75
Reach-1A	210.5	100YR	3.29	155.11	155.43	155.42	155.46	0.013690	0.74	4.46	54.18	0.82
Reach-1A	210.5	50YR	2.92	155.11	155.42	155.41	155.45	0.013885	0.72	4.07	51.95	0.82
Reach-1A	210.5	25YR	2.56	155.11	155.41	155.40	155.44	0.014320	0.70	3.65	49.51	0.82
Reach-1A	210.5	10YR	2.02	155.11	155.40	155.39	155.42	0.015000	0.67	3.02	45.53	0.83
Reach-1A	210.5	5YR	1.67	155.11	155.39	155.38	155.41	0.015204	0.64	2.62	42.74	0.82
Reach-1A	210.5	2YR	1.06	155.11	155.36	155.35	155.38	0.014698	0.67	1.58	23.33	0.82
Reach-1A	210	Regional	8.11	154.96	155.26		155.30	0.006689	0.89	9.09	48.52	0.66
Reach-1A	210	100YR	3.29	154.96	155.16		155.19	0.006498	0.68	4.82	37.67	0.61
Reach-1A	210	50YR	2.92	154.96	155.15		155.18	0.006587	0.66	4.41	36.40	0.61
Reach-1A	210	25YR	2.56	154.96	155.14		155.16	0.006427	0.63	4.05	35.27	0.59
Reach-1A	210	10YR	2.02	154.96	155.12		155.14	0.006580	0.59	3.40	33.11	0.59
Reach-1A	210	5YR	1.67	154.96	155.11		155.13	0.006602	0.56	2.98	31.62	0.58
Reach-1A	210	2YR	1.06	154.96	155.08	155.06	155.10	0.006693	0.49	2.17	28.55	0.57
Reach-1A	209	Regional	8.11	154.46	154.73		154.76	0.003685	0.81	15.30	74.94	0.51
Reach-1A	209	100YR	3.29	154.46	154.63		154.64	0.003734	0.58	8.01	64.01	0.47
Reach-1A	209	50YR	2.92	154.46	154.62		154.63	0.003705	0.55	7.39	62.64	0.47
Reach-1A	209	25YR	2.56	154.46	154.61		154.62	0.003726	0.52	6.73	61.70	0.46
Reach-1A	209	10YR	2.02	154.46	154.59		154.60	0.003644	0.48	5.76	60.27	0.45
Reach-1A	209	5YR	1.67	154.46	154.58		154.59	0.003648	0.44	5.05	59.20	0.44
Reach-1A	209	2YR	1.06	154.46	154.56		154.56	0.003488	0.37	3.73	57.19	0.41
Reach-1A	208.3	Regional	8.11	152.95	153.44	153.44	153.59	0.010682	1.84	7.20	31.61	0.94
Reach-1A	208.3	100YR	3.29	152.95	153.27	153.27	153.37	0.013464	1.42	2.91	19.79	0.96
Reach-1A	208.3	50YR	2.92	152.95	153.26	153.26	153.35	0.013998	1.37	2.59	18.55	0.97
Reach-1A	208.3	25YR	2.56	152.95	153.24	153.24	153.33	0.014296	1.32	2.30	17.38	0.96
Reach-1A	208.3	10YR	2.02	152.95	153.21	153.21	153.29	0.015737	1.24	1.83	15.27	0.98
Reach-1A	208.3	5YR	1.67	152.95	153.19	153.19	153.26	0.016291	1.16	1.56	14.08	0.98
Reach-1A	208.3	2YR	1.06	152.95	153.15	153.15	153.21	0.019286	1.02	1.06	11.56	1.01
Reach-1A	208.2	Regional	8.11	152.50	153.04		153.10	0.003355	1.20	10.30	34.06	0.55
Reach-1A	208.2	100YR	3.29	152.50	152.87		152.90	0.002537	0.79	5.37	24.39	0.44
Reach-1A	208.2	50YR	2.92	152.50	152.85		152.88	0.002424	0.74	4.96	23.51	0.43
Reach-1A	208.2	25YR	2.56	152.50	152.83		152.85	0.002315	0.70	4.54	22.58	0.42
Reach-1A	208.2	10YR	2.02	152.50	152.80		152.82	0.002052	0.61	3.94	21.16	0.38
Reach-1A	208.2	5YR	1.67	152.50	152.78		152.80	0.001905	0.56	3.49	20.04	0.37
Reach-1A	208.2	2YR	1.06	152.50	152.75		152.75	0.001332	0.42	2.82	18.21	0.30
Reach-1A	208.1	Regional	8.11	152.51	152.93		152.97	0.003086	1.02	14.85	45.60	0.51
Reach-1A	208.1	100YR	3.29	152.51	152.71		152.75	0.006888	0.92	6.03	35.29	0.67
Reach-1A	208.1	50YR	2.92	152.51	152.70		152.73	0.007064	0.89	5.53	34.63	0.67

HEC-RAS Plan: P1B Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1A	208.1	25YR	2.56	152.51	152.68		152.71	0.007316	0.85	5.01	33.94	0.67
Reach-1A	208.1	10YR	2.02	152.51	152.66		152.68	0.008072	0.80	4.16	32.77	0.69
Reach-1A	208.1	5YR	1.67	152.51	152.64	152.61	152.66	0.008792	0.76	3.58	31.95	0.70
Reach-1A	208.1	2YR	1.06	152.51	152.58	152.58	152.61	0.030127	0.91	1.84	29.26	1.16
Reach-1A	208	Regional	8.11	151.00	152.19	152.19	152.42	0.009978	2.14	4.68	15.93	0.92
Reach-1A	208	100YR	3.29	151.00	152.04	151.91	152.12	0.005219	1.24	2.72	9.36	0.63
Reach-1A	208	50YR	2.92	151.00	152.01	151.88	152.08	0.005407	1.20	2.45	7.76	0.63
Reach-1A	208	25YR	2.56	151.00	151.97	151.84	152.04	0.005614	1.16	2.21	6.53	0.64
Reach-1A	208	10YR	2.02	151.00	151.91	151.78	151.97	0.005739	1.12	1.80	5.69	0.64
Reach-1A	208	5YR	1.67	151.00	151.86	151.72	151.92	0.005865	1.10	1.52	5.01	0.63
Reach-1A	208	2YR	1.06	151.00	151.81		151.85	0.003254	0.80	1.32	4.44	0.47
Reach-1A	207	Regional	8.11	150.25	151.13		151.16	0.003169	1.54	22.18	57.78	0.55
Reach-1A	207	100YR	3.29	150.25	150.88	150.88	150.95	0.006484	1.70	8.49	50.61	0.74
Reach-1A	207	50YR	2.92	150.25	150.87	150.87	150.93	0.005999	1.61	7.91	50.27	0.71
Reach-1A	207	25YR	2.56	150.25	150.85	150.85	150.92	0.005535	1.53	7.29	49.90	0.68
Reach-1A	207	10YR	2.02	150.25	150.83	150.83	150.89	0.005004	1.41	6.11	49.19	0.64
Reach-1A	207	5YR	1.67	150.25	150.81	150.81	150.87	0.004618	1.32	5.23	48.65	0.61
Reach-1A	207	2YR	1.06	150.25	150.69	150.69	150.79	0.009422	1.54	1.40	10.34	0.83
Reach-1A	206.3	Regional	10.06	149.49	150.51	150.50	150.72	0.005883	2.30	10.25	28.44	0.78
Reach-1A	206.3	100YR	4.09	149.49	150.28	150.12	150.39	0.003902	1.53	4.42	21.83	0.61
Reach-1A	206.3	50YR	3.62	149.49	150.24	150.07	150.35	0.003808	1.46	3.73	20.00	0.59
Reach-1A	206.3	25YR	3.18	149.49	150.21	150.04	150.30	0.003703	1.38	3.09	16.22	0.58
Reach-1A	206.3	10YR	2.51	149.49	150.15		150.23	0.003443	1.24	2.31	9.97	0.55
Reach-1A	206.3	5YR	2.08	149.49	150.10		150.17	0.003282	1.13	1.95	5.31	0.53
Reach-1A	206.3	2YR	1.33	149.49	150.00		150.05	0.002946	0.92	1.48	4.48	0.48
Reach-1A	206.2	Regional	10.06	149.25	150.19	150.19	150.39	0.007914	2.08	7.54	25.79	0.86
Reach-1A	206.2	100YR	4.09	149.25	149.90	149.90	150.06	0.012998	1.81	2.27	6.78	1.00
Reach-1A	206.2	50YR	3.62	149.25	149.87	149.87	150.02	0.013256	1.76	2.05	6.46	1.00
Reach-1A	206.2	25YR	3.18	149.25	149.83	149.83	149.98	0.013503	1.72	1.85	6.15	1.00
Reach-1A	206.2	10YR	2.51	149.25	149.78	149.78	149.92	0.014009	1.65	1.52	5.48	1.00
Reach-1A	206.2	5YR	2.08	149.25	149.74	149.74	149.87	0.014217	1.59	1.31	5.10	1.00
Reach-1A	206.2	2YR	1.33	149.25	149.65	149.65	149.76	0.015081	1.45	0.92	4.30	1.00
Reach-1A	206.15		Culvert									
Reach-1A	206.1	Regional	10.06	149.00	150.02	150.02	150.25	0.011183	2.50	8.28	30.78	0.99
Reach-1A	206.1	100YR	4.09	149.00	149.79	149.79	149.93	0.010664	1.82	4.00	21.19	0.90
Reach-1A	206.1	50YR	3.62	149.00	149.76	149.76	149.89	0.010706	1.75	3.59	19.44	0.89
Reach-1A	206.1	25YR	3.18	149.00	149.73	149.73	149.86	0.011101	1.70	3.15	17.32	0.89
Reach-1A	206.1	10YR	2.51	149.00	149.69	149.69	149.80	0.011020	1.57	2.55	14.66	0.87
Reach-1A	206.1	5YR	2.08	149.00	149.65	149.65	149.76	0.012479	1.53	2.01	12.59	0.91
Reach-1A	206.1	2YR	1.33	149.00	149.58	149.58	149.67	0.014637	1.36	1.22	9.27	0.94
Reach-1	205.1	Regional	18.06	148.20	149.20		149.27	0.003103	1.33	24.26	78.83	0.54
Reach-1	205.1	100YR	7.16	148.20	148.90		148.97	0.004741	1.16	6.67	25.75	0.62
Reach-1	205.1	50YR	6.35	148.20	148.87		148.93	0.004744	1.13	5.91	23.91	0.61
Reach-1	205.1	25YR	5.57	148.20	148.83		148.90	0.004825	1.10	5.16	18.47	0.61
Reach-1	205.1	10YR	4.39	148.20	148.78		148.83	0.004947	1.04	4.21	14.33	0.61
Reach-1	205.1	5YR	3.61	148.20	148.73		148.78	0.004980	0.99	3.63	13.11	0.60
Reach-1	205.1	2YR	2.30	148.20	148.65		148.69	0.004867	0.88	2.62	11.26	0.58
Reach-1	205	Regional	18.06	147.24	148.38	148.38	148.72	0.010717	2.59	6.97	10.38	1.01
Reach-1	205	100YR	7.16	147.24	148.02	148.02	148.23	0.012205	2.03	3.53	8.42	1.00
Reach-1	205	50YR	6.35	147.24	147.98	147.98	148.18	0.012883	1.99	3.19	8.19	1.02
Reach-1	205	25YR	5.57	147.24	147.94	147.94	148.13	0.013107	1.92	2.91	7.99	1.01
Reach-1	205	10YR	4.39	147.24	147.88	147.88	148.05	0.013460	1.79	2.46	7.66	1.01
Reach-1	205	5YR	3.61	147.24	147.84	147.84	147.99	0.013919	1.69	2.13	7.41	1.01
Reach-1	205	2YR	2.30	147.24	147.76	147.76	147.87	0.015620	1.50	1.53	6.93	1.02
Reach-1	204.75	Regional	18.06	146.00	147.50	147.30	147.71	0.004103	2.10	11.25	17.59	0.66
Reach-1	204.75	100YR	7.16	146.00	147.11		147.21	0.003611	1.42	5.30	12.27	0.57
Reach-1	204.75	50YR	6.35	146.00	147.07		147.16	0.003584	1.35	4.81	11.39	0.57
Reach-1	204.75	25YR	5.57	146.00	147.02		147.11	0.003516	1.29	4.33	9.36	0.56
Reach-1	204.75	10YR	4.39	146.00	146.94		147.01	0.003391	1.19	3.70	7.46	0.54
Reach-1	204.75	5YR	3.61	146.00	146.88		146.94	0.003314	1.11	3.26	7.17	0.52
Reach-1	204.75	2YR	2.30	146.00	146.76		146.80	0.003106	0.95	2.42	6.42	0.49
Reach-1	204.7	Regional	18.06	145.89	146.90	146.90	147.24	0.009955	2.60	7.20	13.11	0.99
Reach-1	204.7	100YR	7.16	145.89	146.53	146.53	146.74	0.012215	2.07	3.46	8.02	1.01
Reach-1	204.7	50YR	6.35	145.89	146.49	146.49	146.69	0.012412	2.02	3.14	7.66	1.01
Reach-1	204.7	25YR	5.57	145.89	146.44	146.44	146.64	0.012634	1.97	2.83	7.29	1.01
Reach-1	204.7	10YR	4.39	145.89	146.37	146.37	146.55	0.013138	1.87	2.35	6.75	1.01
Reach-1	204.7	5YR	3.61	145.89	146.33	146.33	146.49	0.013454	1.77	2.04	6.47	1.01
Reach-1	204.7	2YR	2.30	145.89	146.23	146.23	146.36	0.014454	1.57	1.46	5.86	1.01

HEC-RAS Plan: P1B Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	204.55	Regional	18.06	145.49	146.76		146.92	0.003896	1.80	11.16	21.73	0.63
Reach-1	204.55	100YR	7.16	145.49	146.37		146.46	0.004070	1.33	5.38	10.66	0.60
Reach-1	204.55	50YR	6.35	145.49	146.34		146.42	0.003879	1.27	4.99	10.20	0.58
Reach-1	204.55	25YR	5.57	145.49	146.30		146.37	0.003704	1.21	4.59	9.71	0.56
Reach-1	204.55	10YR	4.39	145.49	146.23		146.29	0.003477	1.12	3.93	9.01	0.54
Reach-1	204.55	5YR	3.61	145.49	146.17		146.23	0.003476	1.05	3.44	8.68	0.53
Reach-1	204.55	2YR	2.30	145.49	146.06		146.10	0.003616	0.92	2.49	7.87	0.52
Reach-1	204.5	Regional	18.06	145.36	146.51	146.51	146.80	0.008798	2.41	8.85	22.53	0.93
Reach-1	204.5	100YR	7.16	145.36	146.24		146.37	0.006474	1.57	4.57	10.89	0.74
Reach-1	204.5	50YR	6.35	145.36	146.22		146.33	0.005782	1.45	4.38	10.42	0.70
Reach-1	204.5	25YR	5.57	145.36	146.19		146.28	0.005650	1.38	4.04	9.71	0.68
Reach-1	204.5	10YR	4.39	145.36	146.13		146.21	0.005262	1.27	3.47	9.01	0.65
Reach-1	204.5	5YR	3.61	145.36	146.07		146.14	0.005370	1.21	2.97	8.35	0.65
Reach-1	204.5	2YR	2.30	145.36	145.95		146.01	0.005697	1.11	2.07	6.89	0.65
Reach-1	204.25	Regional	18.06	145.11	146.31	146.31	146.54	0.008563	2.40	13.85	30.89	0.91
Reach-1	204.25	100YR	7.16	145.11	146.00	146.00	146.17	0.009001	1.88	5.45	23.39	0.87
Reach-1	204.25	50YR	6.35	145.11	145.95	145.95	146.13	0.010418	1.91	4.32	20.12	0.93
Reach-1	204.25	25YR	5.57	145.11	145.91	145.91	146.09	0.010675	1.87	3.57	17.08	0.93
Reach-1	204.25	10YR	4.39	145.11	145.82	145.82	146.00	0.012549	1.91	2.34	8.76	0.99
Reach-1	204.25	5YR	3.61	145.11	145.75	145.75	145.93	0.013507	1.87	1.93	5.57	1.01
Reach-1	204.25	2YR	2.30	145.11	145.64	145.64	145.79	0.014238	1.70	1.35	4.70	1.01
Reach-1	204	Regional	18.35	144.05	145.07	145.07	145.36	0.009606	2.81	13.91	25.09	1.00
Reach-1	204	100YR	7.32	144.05	144.78	144.78	144.95	0.008868	2.02	6.99	23.09	0.89
Reach-1	204	50YR	6.50	144.05	144.75	144.75	144.91	0.008951	1.95	6.30	22.88	0.89
Reach-1	204	25YR	5.72	144.05	144.71	144.71	144.87	0.009907	1.93	5.35	21.50	0.92
Reach-1	204	10YR	4.47	144.05	144.65	144.65	144.80	0.010252	1.79	4.19	19.52	0.91
Reach-1	204	5YR	3.68	144.05	144.62	144.62	144.75	0.010311	1.68	3.47	18.20	0.90
Reach-1	204	2YR	2.36	144.05	144.54	144.54	144.64	0.011292	1.48	2.12	15.35	0.90
Reach-1	203	Regional	18.50	142.50	144.85		144.89	0.000513	0.94	30.64	37.21	0.25
Reach-1	203	100YR	7.42	142.50	143.68	143.68	143.88	0.013017	2.00	3.71	9.28	1.01
Reach-1	203	50YR	6.58	142.50	143.58	143.58	143.83	0.011912	2.26	2.92	5.56	0.99
Reach-1	203	25YR	5.79	142.50	143.52	143.52	143.77	0.012353	2.23	2.60	5.15	1.00
Reach-1	203	10YR	4.52	142.50	143.41	143.41	143.65	0.013010	2.15	2.11	4.61	1.01
Reach-1	203	5YR	3.72	142.50	143.35	143.35	143.56	0.013354	2.06	1.80	4.26	1.01
Reach-1	203	2YR	2.37	142.50	143.21	143.21	143.39	0.014213	1.89	1.26	3.56	1.01
Reach-1	202.75	Regional	18.50	142.43	144.53	143.76	144.80	0.001821	2.28	8.10	34.89	0.50
Reach-1	202.75	100YR	7.42	142.43	143.57	143.15	143.72	0.002235	1.69	4.40	27.05	0.50
Reach-1	202.75	50YR	6.58	142.43	143.49	143.10	143.62	0.002295	1.62	4.06	26.03	0.50
Reach-1	202.75	25YR	5.79	142.43	143.40	143.04	143.52	0.002362	1.55	3.73	23.52	0.50
Reach-1	202.75	10YR	4.52	142.43	143.25	142.95	143.36	0.002497	1.43	3.16	19.24	0.50
Reach-1	202.75	5YR	3.72	142.43	143.15	142.89	143.24	0.002608	1.34	2.78	17.19	0.50
Reach-1	202.75	2YR	2.37	142.43	142.96	142.77	143.03	0.002885	1.15	2.06	13.96	0.50
Reach-1	202.5		Culvert									
Reach-1	202.25	Regional	18.50	142.28	143.61	143.61	144.28	0.015465	3.60	5.13	4.15	1.00
Reach-1	202.25	100YR	7.42	142.28	143.01	143.01	143.37	0.014926	2.66	2.79	3.85	1.00
Reach-1	202.25	50YR	6.58	142.28	142.95	142.95	143.28	0.014965	2.56	2.57	3.85	1.00
Reach-1	202.25	25YR	5.79	142.28	142.89	142.89	143.20	0.015170	2.46	2.35	3.85	1.00
Reach-1	202.25	10YR	4.52	142.28	142.80	142.80	143.06	0.015000	2.25	2.01	3.85	1.00
Reach-1	202.25	5YR	3.72	142.28	142.75	142.74	142.97	0.014073	2.06	1.80	3.85	0.96
Reach-1	202.25	2YR	2.37	142.28	142.69	142.62	142.80	0.008686	1.51	1.57	3.85	0.75
Reach-1	202	Regional	18.50	142.20	143.23		143.28	0.001506	1.22	28.92	49.26	0.41
Reach-1	202	100YR	7.42	142.20	142.68	142.68	142.82	0.010868	1.75	5.74	25.51	0.93
Reach-1	202	50YR	6.58	142.20	142.64	142.64	142.79	0.012410	1.75	4.89	22.58	0.98
Reach-1	202	25YR	5.79	142.20	142.63	142.63	142.75	0.011562	1.63	4.53	21.79	0.94
Reach-1	202	10YR	4.52	142.20	142.59	142.59	142.70	0.011975	1.51	3.66	20.40	0.93
Reach-1	202	5YR	3.72	142.20	142.56	142.56	142.66	0.012476	1.42	3.07	19.43	0.93
Reach-1	202	2YR	2.37	142.20	142.49	142.49	142.58	0.014838	1.27	1.92	15.96	0.97
Reach-1	201	Regional	18.50	141.65	143.21		143.24	0.000486	0.94	37.17	39.45	0.25
Reach-1	201	100YR	7.42	141.65	142.60		142.63	0.000751	0.82	14.98	31.92	0.28
Reach-1	201	50YR	6.58	141.65	142.53		142.56	0.000869	0.83	12.64	30.72	0.30
Reach-1	201	25YR	5.79	141.65	142.50		142.52	0.000789	0.77	11.76	30.16	0.28
Reach-1	201	10YR	4.52	141.65	142.39		142.42	0.000861	0.73	8.90	25.56	0.29
Reach-1	201	5YR	3.72	141.65	142.33		142.36	0.000853	0.68	7.43	22.92	0.28
Reach-1	201	2YR	2.37	141.65	142.25		142.26	0.000632	0.52	5.61	19.22	0.24
Reach-1	171	Regional	28.90	141.65	142.97	142.70	143.11	0.002516	1.90	27.97	37.97	0.55
Reach-1	171	100YR	8.17	141.65	142.44	142.21	142.50	0.002213	1.21	9.98	27.36	0.47
Reach-1	171	50YR	6.60	141.65	142.36	142.15	142.42	0.002210	1.13	8.15	24.25	0.46
Reach-1	171	25YR	6.10	141.65	142.34	142.13	142.40	0.002202	1.10	7.58	23.20	0.46
Reach-1	171	10YR	4.37	141.65	142.25	142.05	142.29	0.002182	0.97	5.57	19.13	0.44

HEC-RAS Plan: P1B Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	171	5YR	3.52	141.65	142.19	142.01	142.23	0.002166	0.89	4.59	16.80	0.43
Reach-1	171	2YR	2.57	141.65	142.12	141.95	142.15	0.002101	0.79	3.54	13.88	0.41
Reach-1	170		Bridge									
Reach-1	169	Regional	28.90	141.65	142.70	142.70	142.99	0.007134	2.71	18.27	33.54	0.89
Reach-1	169	100YR	8.17	141.65	142.21	142.21	142.40	0.009752	1.96	4.98	17.76	0.92
Reach-1	169	50YR	6.60	141.65	142.15	142.15	142.32	0.010567	1.86	3.98	15.15	0.94
Reach-1	169	25YR	6.10	141.65	142.13	142.13	142.30	0.011146	1.83	3.63	14.16	0.95
Reach-1	169	10YR	4.37	141.65	142.05	142.05	142.19	0.013010	1.69	2.63	10.71	0.99
Reach-1	169	5YR	3.52	141.65	142.01	142.01	142.13	0.014215	1.59	2.21	8.88	1.01
Reach-1	169	2YR	2.57	141.65	141.95	141.95	142.06	0.014892	1.45	1.77	8.23	1.00
Reach-1	164	Regional	28.90	138.30	139.25		139.39	0.007256	1.51	18.32	23.62	0.61
Reach-1	164	100YR	8.17	138.30	138.83		138.86	0.002624	0.51	10.37	14.75	0.32
Reach-1	164	50YR	6.60	138.30	138.74		138.76	0.002349	0.41	9.12	13.62	0.29
Reach-1	164	25YR	6.10	138.30	138.69		138.72	0.002374	0.38	8.50	12.97	0.29
Reach-1	164	10YR	4.37	138.30	138.54		138.56	0.002100	0.28	6.77	10.44	0.25
Reach-1	164	5YR	3.52	138.30	138.46		138.47	0.001886	0.19	5.92	9.30	0.22
Reach-1	164	2YR	2.57	138.30	138.34		138.36	0.001562	0.07	4.96	7.74	0.16
Reach-1	163	Regional	28.90	137.20	138.47		138.55	0.005133	1.90	30.33	59.32	0.57
Reach-1	163	100YR	8.17	137.20	138.08	137.99	138.23	0.009915	1.99	7.75	50.21	0.74
Reach-1	163	50YR	6.60	137.20	138.02	137.97	138.17	0.010628	1.93	5.32	22.77	0.76
Reach-1	163	25YR	6.10	137.20	137.99	137.97	138.13	0.010185	1.84	4.82	15.66	0.74
Reach-1	163	10YR	4.37	137.20	137.90	137.86	138.02	0.009858	1.65	3.61	13.13	0.71
Reach-1	163	5YR	3.52	137.20	137.84	137.80	137.96	0.010879	1.59	2.82	11.19	0.73
Reach-1	163	2YR	2.57	137.20	137.74	137.72	137.86	0.015146	1.60	1.81	8.05	0.82
Reach-1	162	Regional	28.90	135.60	136.76	136.76	137.01	0.016983	3.06	16.52	33.14	1.02
Reach-1	162	100YR	8.17	135.60	136.46		136.55	0.008365	1.65	8.05	23.23	0.67
Reach-1	162	50YR	6.60	135.60	136.42	136.32	136.49	0.007713	1.51	7.02	21.71	0.63
Reach-1	162	25YR	6.10	135.60	136.39		136.46	0.007886	1.48	6.54	20.96	0.64
Reach-1	162	10YR	4.37	135.60	136.32		136.38	0.007899	1.34	5.01	18.41	0.62
Reach-1	162	5YR	3.52	135.60	136.28		136.33	0.007036	1.21	4.42	17.31	0.58
Reach-1	162	2YR	2.57	135.60	136.25		136.28	0.005238	0.99	3.87	16.23	0.49
Reach-1	161	Regional	28.90	134.10	135.30	135.17	135.36	0.005788	1.77	31.56	67.18	0.58
Reach-1	161	100YR	8.17	134.10	134.98	134.98	135.07	0.008814	1.68	10.93	62.89	0.67
Reach-1	161	50YR	6.60	134.10	134.95	134.95	135.03	0.009136	1.64	8.64	54.87	0.68
Reach-1	161	25YR	6.10	134.10	134.94	134.94	135.02	0.008737	1.59	8.14	52.96	0.66
Reach-1	161	10YR	4.37	134.10	134.89	134.89	134.97	0.008112	1.44	5.85	43.08	0.63
Reach-1	161	5YR	3.52	134.10	134.85	134.85	134.93	0.008870	1.43	4.23	34.42	0.65
Reach-1	161	2YR	2.57	134.10	134.76	134.69	134.87	0.012829	1.52	2.03	16.61	0.76
Reach-1	160	Regional	28.90	132.50	134.02		134.06	0.003131	1.45	37.31	64.17	0.42
Reach-1	160	100YR	8.17	132.50	133.61		133.64	0.002166	0.99	15.54	41.27	0.33
Reach-1	160	50YR	6.60	132.50	133.54		133.57	0.002221	0.96	12.79	37.14	0.33
Reach-1	160	25YR	6.10	132.50	133.52	133.29	133.54	0.002198	0.94	11.99	35.85	0.33
Reach-1	160	10YR	4.37	132.50	133.41		133.44	0.002411	0.92	8.52	29.61	0.34
Reach-1	160	5YR	3.52	132.50	133.35		133.38	0.002582	0.91	6.73	25.80	0.35
Reach-1	160	2YR	2.57	132.50	133.28		133.30	0.002499	0.84	5.01	21.54	0.34

14 MILE CREEK WEST

HEC-RAS MODEL RESULTS FOR

PHASE 2 DEVELOPMENT CONDITION

(Controlled flow rate)

- **14W-16 (Reach 1A)**
- **14W-12 (Reach 1)**
- **14W-22 (Reach 2A and Reach 2A1)**
- **14W-21 (Reach 2A2)**
- **14W-12A (Reach 2B and 2C)**

HEC-RAS Plan: Phase 2 Control

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A1	3081	Regional	6.52	154.25	154.63	154.55	154.69	0.005462	1.13	6.91	33.03	0.65
Reach-2A1	3081	100YR	2.51	154.25	154.49		154.52	0.006249	0.81	3.14	21.03	0.63
Reach-2A1	3081	50YR	2.22	154.25	154.47		154.50	0.006473	0.78	2.86	19.85	0.63
Reach-2A1	3081	25YR	1.94	154.25	154.46		154.49	0.006868	0.75	2.57	18.58	0.64
Reach-2A1	3081	10YR	1.51	154.25	154.43		154.46	0.007056	0.70	2.14	17.00	0.63
Reach-2A1	3081	5YR	1.23	154.25	154.41		154.43	0.007825	0.69	1.78	15.72	0.65
Reach-2A1	3081	2YR	0.77	154.25	154.38		154.40	0.006348	0.56	1.37	14.15	0.57
Reach-2A1	3071	Regional	6.52	153.56	154.19	154.19	154.31	0.008434	2.12	10.49	36.97	0.86
Reach-2A1	3071	100YR	2.51	153.56	154.02	154.02	154.12	0.008070	1.66	4.37	28.13	0.80
Reach-2A1	3071	50YR	2.22	153.56	154.00	154.00	154.09	0.008070	1.61	3.80	26.04	0.79
Reach-2A1	3071	25YR	1.94	153.56	153.98	153.98	154.07	0.007955	1.54	3.27	23.93	0.78
Reach-2A1	3071	10YR	1.51	153.56	153.93	153.93	154.02	0.008386	1.46	2.33	19.58	0.78
Reach-2A1	3071	5YR	1.23	153.56	153.90	153.90	153.99	0.008102	1.36	1.82	16.78	0.76
Reach-2A1	3071	2YR	0.77	153.56	153.81	153.81	153.90	0.012914	1.37	0.67	7.22	0.91
Reach-2A1	3061	Regional	6.52	152.85	153.60	153.60	153.75	0.008344	2.20	8.75	27.90	0.83
Reach-2A1	3061	100YR	2.51	152.85	153.40	153.40	153.52	0.007139	1.66	3.52	24.10	0.73
Reach-2A1	3061	50YR	2.22	152.85	153.37	153.37	153.49	0.007532	1.63	2.82	20.86	0.74
Reach-2A1	3061	25YR	1.94	152.85	153.34	153.34	153.46	0.008274	1.62	2.11	16.96	0.77
Reach-2A1	3061	10YR	1.51	152.85	153.24	153.24	153.39	0.013302	1.75	0.94	6.56	0.93
Reach-2A1	3061	5YR	1.23	152.85	153.18	153.18	153.33	0.016273	1.73	0.71	2.38	1.01
Reach-2A1	3061	2YR	0.77	152.85	153.14		153.22	0.008987	1.21	0.64	2.34	0.74
Reach-2A2	309	Regional	0.52	154.00	154.37	154.35	154.40	0.007133	1.13	1.81	19.62	0.67
Reach-2A2	309	100YR	0.18	154.00	154.30	154.27	154.32	0.004711	0.76	0.69	11.50	0.52
Reach-2A2	309	50YR	0.16	154.00	154.29	154.26	154.31	0.004651	0.74	0.59	10.53	0.51
Reach-2A2	309	25YR	0.14	154.00	154.28	154.24	154.30	0.004413	0.70	0.51	9.60	0.49
Reach-2A2	309	10YR	0.10	154.00	154.24	154.19	154.26	0.006467	0.73	0.21	5.10	0.58
Reach-2A2	309	5YR	0.08	154.00	154.23	154.17	154.25	0.004792	0.61	0.19	4.47	0.49
Reach-2A2	309	2YR	0.04	154.00	154.13	154.12	154.16	0.014795	0.74	0.05	0.60	0.80
Reach-2A2	308	Regional	0.52	153.50	153.89		153.91	0.005451	1.03	1.67	12.00	0.59
Reach-2A2	308	100YR	0.18	153.50	153.77	153.77	153.81	0.009047	0.98	0.41	7.93	0.70
Reach-2A2	308	50YR	0.16	153.50	153.76	153.76	153.80	0.009303	0.95	0.34	6.90	0.71
Reach-2A2	308	25YR	0.14	153.50	153.75	153.74	153.79	0.010242	0.95	0.25	5.49	0.73
Reach-2A2	308	10YR	0.10	153.50	153.74	153.69	153.77	0.006259	0.72	0.21	4.78	0.57
Reach-2A2	308	5YR	0.08	153.50	153.71	153.67	153.74	0.009440	0.76	0.11	1.42	0.67
Reach-2A2	308	2YR	0.04	153.50	153.70	153.62	153.70	0.003034	0.41	0.10	0.79	0.38
Reach-2A2	307	Regional	0.52	153.00	153.37		153.40	0.006954	1.12	1.52	11.90	0.66
Reach-2A2	307	100YR	0.18	153.00	153.30	153.27	153.32	0.004191	0.73	0.72	11.23	0.49
Reach-2A2	307	50YR	0.16	153.00	153.29	153.26	153.31	0.004048	0.70	0.63	10.49	0.48
Reach-2A2	307	25YR	0.14	153.00	153.29	153.24	153.30	0.003754	0.66	0.55	9.70	0.46
Reach-2A2	307	10YR	0.10	153.00	153.24	153.19	153.27	0.005922	0.71	0.23	5.15	0.55
Reach-2A2	307	5YR	0.08	153.00	153.24	153.17	153.26	0.003918	0.57	0.22	5.02	0.45
Reach-2A2	307	2YR	0.04	153.00	153.12	153.12	153.16	0.023842	0.89	0.05	0.56	1.00
Reach-2A2	306	Regional	0.52	152.75	153.14		153.17	0.004784	0.98	1.76	12.11	0.55
Reach-2A2	306	100YR	0.18	152.75	153.02	153.02	153.06	0.009908	1.01	0.39	7.60	0.73
Reach-2A2	306	50YR	0.16	152.75	153.01	153.01	153.05	0.010613	1.00	0.30	6.41	0.75
Reach-2A2	306	25YR	0.14	152.75	152.99	152.99	153.04	0.012383	1.01	0.21	4.76	0.80
Reach-2A2	306	10YR	0.10	152.75	152.99	152.94	153.02	0.006154	0.72	0.22	4.87	0.56
Reach-2A2	306	5YR	0.08	152.75	152.94	152.92	152.98	0.013382	0.86	0.09	0.77	0.79
Reach-2A2	306	2YR	0.04	152.75	153.03		153.03	0.000341	0.20	0.50	9.02	0.14
Reach-2A	305	Regional	6.52	152.12	152.91		152.94	0.004081	1.42	15.02	35.50	0.51
Reach-2A	305	100YR	2.51	152.12	152.66		152.70	0.006059	1.33	6.40	31.15	0.58
Reach-2A	305	50YR	2.22	152.12	152.64		152.68	0.006197	1.31	5.76	31.03	0.58
Reach-2A	305	25YR	1.94	152.12	152.62		152.66	0.006338	1.29	5.11	30.91	0.59
Reach-2A	305	10YR	1.51	152.12	152.58	152.58	152.63	0.007247	1.31	3.86	30.66	0.62
Reach-2A	305	5YR	1.23	152.12	152.56	152.56	152.61	0.006654	1.22	3.28	30.55	0.59
Reach-2A	305	2YR	0.77	152.12	152.47	152.42	152.58	0.013183	1.47	0.57	30.01	0.80
Reach-2A	304	Regional	6.52	151.63	152.64		152.65	0.001167	0.89	22.81	36.79	0.28
Reach-2A	304	100YR	2.51	151.63	152.32		152.33	0.001330	0.74	11.46	34.89	0.28
Reach-2A	304	50YR	2.22	151.63	152.29		152.30	0.001375	0.73	10.39	34.71	0.29
Reach-2A	304	25YR	1.94	151.63	152.26		152.27	0.001417	0.72	9.33	34.52	0.29
Reach-2A	304	10YR	1.51	151.63	152.20		152.21	0.001442	0.68	7.51	31.37	0.29
Reach-2A	304	5YR	1.23	151.63	152.17		152.18	0.001498	0.66	6.33	31.14	0.29
Reach-2A	304	2YR	0.77	151.63	152.11	152.02	152.12	0.001255	0.56	4.64	30.81	0.26
Reach-2A	303	Regional	6.67	151.46	152.25	152.25	152.45	0.015673	2.76	5.90	35.46	0.99
Reach-2A	303	100YR	2.58	151.46	152.03	152.03	152.15	0.011440	1.90	3.26	31.34	0.80
Reach-2A	303	50YR	2.27	151.46	152.01	152.01	152.12	0.011015	1.82	2.98	31.21	0.78
Reach-2A	303	25YR	1.98	151.46	151.98	151.98	152.09	0.010530	1.73	2.70	31.07	0.76
Reach-2A	303	10YR	1.55	151.46	151.95	151.95	152.04	0.009639	1.57	2.24	30.84	0.72
Reach-2A	303	5YR	1.27	151.46	151.92	151.92	152.01	0.009095	1.47	1.88	30.67	0.69
Reach-2A	303	2YR	0.79	151.46	151.76	151.76	151.92	0.020777	1.73	0.46	1.50	1.00

HEC-RAS Plan: Phase 2 Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A	302.5		Culvert									
Reach-2A	302	Regional	6.67	151.29	152.25	152.08	152.35	0.006414	2.01	8.00	36.48	0.66
Reach-2A	302	100YR	2.58	151.29	151.96	151.86	152.02	0.004955	1.40	4.51	34.77	0.54
Reach-2A	302	50YR	2.27	151.29	151.93	151.84	151.99	0.004812	1.34	4.15	34.60	0.53
Reach-2A	302	25YR	1.98	151.29	151.91	151.82	151.96	0.004568	1.27	3.81	33.33	0.51
Reach-2A	302	10YR	1.55	151.29	151.86	151.78	151.90	0.004292	1.16	3.21	31.32	0.49
Reach-2A	302	5YR	1.27	151.29	151.82	151.75	151.86	0.004059	1.08	2.78	31.10	0.47
Reach-2A	302	2YR	0.79	151.29	151.75	151.59	151.78	0.003402	0.90	1.92	30.68	0.42
Reach-2A	301	Regional	6.67	150.79	151.61		151.64	0.003472	1.34	16.10	35.68	0.47
Reach-2A	301	100YR	2.58	150.79	151.38		151.41	0.003504	1.08	8.03	31.47	0.45
Reach-2A	301	50YR	2.27	150.79	151.36		151.38	0.003510	1.05	7.30	31.33	0.45
Reach-2A	301	25YR	1.98	150.79	151.33		151.36	0.003563	1.03	6.54	31.18	0.45
Reach-2A	301	10YR	1.55	150.79	151.30		151.32	0.003639	0.99	5.34	30.95	0.44
Reach-2A	301	5YR	1.27	150.79	151.27		151.29	0.003690	0.96	4.48	30.78	0.44
Reach-2A	301	2YR	0.79	150.79	151.21	151.18	151.24	0.004141	0.93	2.60	30.41	0.46
Reach-2A	300	Regional	6.67	150.40	151.22	151.00	151.25	0.003568	1.35	15.96	35.66	0.48
Reach-2A	300	100YR	2.58	150.40	150.99	150.91	151.02	0.003454	1.07	8.07	31.47	0.45
Reach-2A	300	50YR	2.27	150.40	150.97	150.89	150.99	0.003446	1.04	7.35	31.34	0.44
Reach-2A	300	25YR	1.98	150.40	150.95	150.88	150.97	0.003381	1.01	6.68	31.21	0.43
Reach-2A	300	10YR	1.55	150.40	150.91	150.86	150.93	0.003288	0.95	5.57	30.99	0.42
Reach-2A	300	5YR	1.27	150.40	150.89	150.84	150.91	0.003237	0.91	4.75	30.83	0.42
Reach-2A	300	2YR	0.79	150.40	150.84	150.70	150.86	0.002832	0.79	3.23	30.54	0.38
Reach-2A	299	Regional	6.67	150.05	150.92		150.94	0.002660	1.21	17.61	35.93	0.42
Reach-2A	299	100YR	2.58	150.05	150.64		150.67	0.003483	1.08	8.05	31.47	0.45
Reach-2A	299	50YR	2.27	150.05	150.62		150.64	0.003537	1.05	7.28	31.32	0.45
Reach-2A	299	25YR	1.98	150.05	150.59		150.62	0.003678	1.04	6.47	31.17	0.45
Reach-2A	299	10YR	1.55	150.05	150.55		150.58	0.003905	1.02	5.19	30.92	0.46
Reach-2A	299	5YR	1.27	150.05	150.52		150.55	0.003916	0.98	4.37	30.76	0.46
Reach-2A	299	2YR	0.79	150.05	150.46	150.45	150.50	0.004557	0.96	2.44	30.38	0.48
Reach-2A	298	Regional	6.67	149.76	150.75		150.76	0.001208	0.89	23.37	38.49	0.29
Reach-2A	298	100YR	2.58	149.76	150.44		150.45	0.001474	0.77	11.52	36.60	0.30
Reach-2A	298	50YR	2.27	149.76	150.41		150.42	0.001539	0.76	10.37	36.41	0.30
Reach-2A	298	25YR	1.98	149.76	150.37		150.38	0.001574	0.74	9.22	34.96	0.30
Reach-2A	298	10YR	1.55	149.76	150.32		150.33	0.001659	0.72	7.45	33.08	0.31
Reach-2A	298	5YR	1.27	149.76	150.28		150.30	0.001775	0.71	6.23	32.86	0.31
Reach-2A	298	2YR	0.79	149.76	150.23		150.24	0.001596	0.62	4.38	32.52	0.29
Reach-2A	297	Regional	6.67	149.64	150.43	150.43	150.63	0.015647	2.76	5.90	35.46	0.99
Reach-2A	297	100YR	2.58	149.64	150.21	150.21	150.33	0.011485	1.91	3.26	31.34	0.81
Reach-2A	297	50YR	2.27	149.64	150.19	150.19	150.30	0.010908	1.81	2.99	31.21	0.78
Reach-2A	297	25YR	1.98	149.64	150.16	150.16	150.27	0.010575	1.73	2.69	31.06	0.76
Reach-2A	297	10YR	1.55	149.64	150.13	150.13	150.22	0.009635	1.57	2.24	30.84	0.72
Reach-2A	297	5YR	1.27	149.64	150.10	150.10	150.19	0.009090	1.47	1.88	30.67	0.69
Reach-2A	297	2YR	0.79	149.64	149.94	149.94	150.10	0.020766	1.73	0.46	1.50	1.00
Reach-2A	296.5		Culvert									
Reach-2A	296	Regional	6.67	149.44	150.23	150.23	150.43	0.015792	2.77	5.89	35.45	1.00
Reach-2A	296	100YR	2.58	149.44	150.01	150.01	150.13	0.011498	1.91	3.26	31.34	0.81
Reach-2A	296	50YR	2.27	149.44	149.99	149.99	150.10	0.011074	1.82	2.97	31.20	0.79
Reach-2A	296	25YR	1.98	149.44	149.97	149.97	150.07	0.010411	1.72	2.71	31.07	0.76
Reach-2A	296	10YR	1.55	149.44	149.93	149.93	150.02	0.009640	1.57	2.24	30.84	0.72
Reach-2A	296	5YR	1.27	149.44	149.90	149.90	149.99	0.009095	1.47	1.88	30.67	0.69
Reach-2A	296	2YR	0.79	149.44	149.74	149.74	149.90	0.020777	1.73	0.46	1.50	1.00
Reach-2B	231.1	Regional	0.22	148.25	149.32		149.32	0.000001	0.03	20.24	44.68	0.01
Reach-2B	231.1	100YR	0.09	148.25	149.05		149.05	0.000001	0.02	10.04	31.41	0.01
Reach-2B	231.1	50YR	0.08	148.25	149.02		149.02	0.000001	0.02	9.16	29.99	0.01
Reach-2B	231.1	25YR	0.07	148.25	148.99		148.99	0.000001	0.02	8.31	28.53	0.01
Reach-2B	231.1	10YR	0.06	148.25	148.95		148.95	0.000001	0.02	7.02	26.04	0.01
Reach-2B	231.1	5YR	0.05	148.25	148.91		148.91	0.000001	0.02	6.14	24.18	0.01
Reach-2B	231.1	2YR	0.04	148.25	148.84		148.84	0.000001	0.02	4.62	20.60	0.01
Reach-2B	231	Regional	0.22	148.25	149.32		149.32	0.000001	0.03	20.24	44.68	0.01
Reach-2B	231	100YR	0.09	148.25	149.05		149.05	0.000001	0.02	10.04	31.41	0.01
Reach-2B	231	50YR	0.08	148.25	149.02		149.02	0.000001	0.02	9.16	29.99	0.01
Reach-2B	231	25YR	0.07	148.25	148.99		148.99	0.000001	0.02	8.31	28.53	0.01
Reach-2B	231	10YR	0.06	148.25	148.95		148.95	0.000001	0.02	7.02	26.04	0.01
Reach-2B	231	5YR	0.05	148.25	148.91		148.91	0.000001	0.02	6.14	24.18	0.01
Reach-2B	231	2YR	0.04	148.25	148.84		148.84	0.000001	0.02	4.62	20.60	0.01
Reach-2B	220.3	Regional	0.22	148.25	149.32		149.32	0.000000	0.01	24.24	54.88	0.00
Reach-2B	220.3	100YR	0.09	148.25	149.05		149.05	0.000000	0.01	11.80	37.89	0.00

HEC-RAS Plan: Phase 2 Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2B	220.3	50YR	0.08	148.25	149.02		149.02	0.000000	0.01	10.74	36.08	0.00
Reach-2B	220.3	25YR	0.07	148.25	148.99		148.99	0.000000	0.01	9.72	34.24	0.00
Reach-2B	220.3	10YR	0.06	148.25	148.95		148.95	0.000000	0.01	8.18	31.32	0.00
Reach-2B	220.3	5YR	0.05	148.25	148.91		148.91	0.000000	0.01	7.11	29.12	0.00
Reach-2B	220.3	2YR	0.04	148.25	148.84		148.84	0.000000	0.01	5.28	24.91	0.01
Reach-2B	220.2	Regional	0.22	148.57	149.32		149.32	0.000011	0.08	3.27	6.53	0.03
Reach-2B	220.2	100YR	0.09	148.57	149.05		149.05	0.000011	0.06	1.69	5.29	0.03
Reach-2B	220.2	50YR	0.08	148.57	149.02		149.02	0.000012	0.06	1.54	5.15	0.03
Reach-2B	220.2	25YR	0.07	148.57	148.99		148.99	0.000012	0.05	1.39	5.02	0.03
Reach-2B	220.2	10YR	0.06	148.57	148.95		148.95	0.000015	0.05	1.16	4.80	0.03
Reach-2B	220.2	5YR	0.05	148.57	148.91		148.91	0.000017	0.05	0.99	4.64	0.03
Reach-2B	220.2	2YR	0.04	148.57	148.84		148.84	0.000034	0.06	0.69	4.32	0.05
Reach-2C	220.15	Regional	6.89	148.50	149.29		149.31	0.001046	0.74	25.53	63.80	0.31
Reach-2C	220.15	100YR	2.66	148.50	149.01		149.03	0.001959	0.76	8.87	53.88	0.39
Reach-2C	220.15	50YR	2.34	148.50	148.98		149.00	0.002254	0.77	7.15	49.13	0.42
Reach-2C	220.15	25YR	2.05	148.50	148.94		148.97	0.002648	0.80	5.57	42.52	0.45
Reach-2C	220.15	10YR	1.61	148.50	148.89		148.92	0.003495	0.83	3.45	31.57	0.50
Reach-2C	220.15	5YR	1.31	148.50	148.84		148.88	0.004200	0.84	2.31	23.66	0.54
Reach-2C	220.15	2YR	0.83	148.50	148.76		148.80	0.006130	0.82	1.03	8.40	0.62
Reach-2C	220.1	Regional	6.89	148.25	149.27		149.29	0.001325	0.79	21.68	70.54	0.34
Reach-2C	220.1	100YR	2.66	148.25	148.95		148.99	0.003267	0.94	3.74	18.41	0.50
Reach-2C	220.1	50YR	2.34	148.25	148.91		148.95	0.003468	0.93	3.13	16.80	0.51
Reach-2C	220.1	25YR	2.05	148.25	148.87		148.92	0.003877	0.94	2.50	14.92	0.54
Reach-2C	220.1	10YR	1.61	148.25	148.81		148.85	0.004377	0.92	1.78	8.30	0.56
Reach-2C	220.1	5YR	1.31	148.25	148.77		148.81	0.004423	0.88	1.49	5.89	0.56
Reach-2C	220.1	2YR	0.83	148.25	148.68		148.72	0.004463	0.80	1.04	4.73	0.54
Reach-2C	220	Regional	6.89	148.25	149.26		149.29	0.001341	0.80	21.56	69.95	0.35
Reach-2C	220	100YR	2.66	148.25	148.94		148.99	0.003412	0.95	3.65	18.19	0.52
Reach-2C	220	50YR	2.34	148.25	148.91		148.95	0.003640	0.95	3.04	16.56	0.53
Reach-2C	220	25YR	2.05	148.25	148.87		148.91	0.004098	0.96	2.42	14.65	0.55
Reach-2C	220	10YR	1.61	148.25	148.80		148.85	0.004664	0.94	1.73	7.92	0.58
Reach-2C	220	5YR	1.31	148.25	148.76		148.80	0.004735	0.90	1.46	5.82	0.57
Reach-2C	220	2YR	0.83	148.25	148.68		148.71	0.004818	0.82	1.01	4.66	0.56
Reach-1A	210.5	Regional	7.95	155.11	155.51	155.48	155.54	0.010377	0.80	9.96	87.44	0.75
Reach-1A	210.5	100YR	3.23	155.11	155.42	155.42	155.45	0.017144	0.80	4.05	51.87	0.91
Reach-1A	210.5	50YR	2.86	155.11	155.41	155.41	155.44	0.018756	0.80	3.59	49.12	0.94
Reach-1A	210.5	25YR	2.51	155.11	155.40	155.40	155.44	0.020449	0.79	3.16	46.44	0.97
Reach-1A	210.5	10YR	1.98	155.11	155.39	155.39	155.42	0.021917	0.76	2.59	42.57	0.99
Reach-1A	210.5	5YR	1.63	155.11	155.38	155.38	155.41	0.021439	0.75	2.19	36.65	0.97
Reach-1A	210.5	2YR	1.04	155.11	155.35	155.35	155.38	0.023228	0.79	1.32	21.62	1.02
Reach-1A	210	Regional	7.95	154.96	155.26		155.30	0.006634	0.88	8.99	48.29	0.65
Reach-1A	210	100YR	3.23	154.96	155.17		155.19	0.005322	0.63	5.11	38.53	0.55
Reach-1A	210	50YR	2.86	154.96	155.16		155.18	0.005111	0.60	4.75	37.46	0.54
Reach-1A	210	25YR	2.51	154.96	155.15		155.17	0.004946	0.57	4.39	36.32	0.53
Reach-1A	210	10YR	1.98	154.96	155.14		155.15	0.004650	0.52	3.79	34.42	0.50
Reach-1A	210	5YR	1.63	154.96	155.12		155.14	0.004361	0.48	3.38	33.04	0.48
Reach-1A	210	2YR	1.04	154.96	155.10		155.11	0.003892	0.40	2.58	30.14	0.44
Reach-1A	209	Regional	7.95	154.46	154.73		154.76	0.003720	0.81	15.04	74.74	0.52
Reach-1A	209	100YR	3.23	154.46	154.62		154.63	0.004647	0.61	7.32	62.55	0.52
Reach-1A	209	50YR	2.86	154.46	154.61		154.62	0.004799	0.59	6.66	61.59	0.52
Reach-1A	209	25YR	2.51	154.46	154.60		154.61	0.004977	0.57	6.01	60.64	0.53
Reach-1A	209	10YR	1.98	154.46	154.58	154.55	154.59	0.005290	0.53	4.99	59.12	0.53
Reach-1A	209	5YR	1.63	154.46	154.57	154.54	154.58	0.005687	0.50	4.25	57.99	0.54
Reach-1A	209	2YR	1.04	154.46	154.54	154.52	154.55	0.006352	0.44	2.98	55.99	0.54
Reach-1A	208.3	Regional	7.95	152.95	153.44	153.44	153.58	0.010597	1.82	7.10	31.39	0.93
Reach-1A	208.3	100YR	3.23	152.95	153.29	153.27	153.37	0.009318	1.26	3.36	21.38	0.81
Reach-1A	208.3	50YR	2.86	152.95	153.28	153.25	153.35	0.009095	1.19	3.05	20.31	0.79
Reach-1A	208.3	25YR	2.51	152.95	153.26	153.24	153.33	0.008812	1.12	2.77	19.25	0.77
Reach-1A	208.3	10YR	1.98	152.95	153.24	153.21	153.29	0.008456	1.01	2.31	17.42	0.74
Reach-1A	208.3	5YR	1.63	152.95	153.22	153.19	153.27	0.007913	0.92	2.03	16.18	0.71
Reach-1A	208.3	2YR	1.04	152.95	153.19	153.15	153.22	0.007270	0.75	1.48	13.70	0.65
Reach-1A	208.2	Regional	8.10	152.50	152.96	152.90	153.06	0.006255	1.46	7.52	29.31	0.73
Reach-1A	208.2	100YR	3.29	152.50	152.74	152.74	152.83	0.014534	1.35	2.69	17.81	0.98
Reach-1A	208.2	50YR	2.91	152.50	152.72	152.72	152.81	0.014789	1.30	2.43	16.99	0.97
Reach-1A	208.2	25YR	2.55	152.50	152.71	152.71	152.79	0.015380	1.25	2.18	16.13	0.98
Reach-1A	208.2	10YR	2.01	152.50	152.68	152.68	152.75	0.016206	1.15	1.81	14.92	0.98
Reach-1A	208.2	5YR	1.67	152.50	152.67	152.67	152.73	0.017581	1.10	1.55	14.01	1.00
Reach-1A	208.2	2YR	1.06	152.50	152.63	152.63	152.68	0.019872	0.96	1.11	12.19	1.01
Reach-1A	208.15		Culvert									

HEC-RAS Plan: Phase 2 Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1A	208.1	Regional	8.10	152.50	152.94	152.78	152.99	0.002973	1.03	9.41	46.28	0.50
Reach-1A	208.1	100YR	3.29	152.50	152.71	152.66	152.75	0.006839	0.92	4.28	35.23	0.67
Reach-1A	208.1	50YR	2.91	152.50	152.70	152.65	152.73	0.006959	0.88	3.96	34.55	0.67
Reach-1A	208.1	25YR	2.55	152.50	152.68	152.64	152.71	0.007211	0.84	3.62	33.85	0.67
Reach-1A	208.1	10YR	2.01	152.50	152.66	152.62	152.68	0.007926	0.79	3.05	32.67	0.68
Reach-1A	208.1	5YR	1.67	152.50	152.64	152.61	152.66	0.008623	0.75	2.67	31.86	0.69
Reach-1A	208.1	2YR	1.06	152.50	152.58	152.58	152.62	0.025938	0.87	1.47	29.30	1.09
Reach-1A	208	Regional	8.10	151.00	152.19	152.19	152.42	0.009984	2.14	4.68	15.91	0.92
Reach-1A	208	100YR	3.29	151.00	152.04	151.91	152.12	0.005218	1.24	2.72	9.36	0.63
Reach-1A	208	50YR	2.91	151.00	152.01	151.88	152.08	0.005412	1.19	2.45	7.73	0.63
Reach-1A	208	25YR	2.55	151.00	151.97	151.84	152.04	0.005616	1.16	2.20	6.52	0.64
Reach-1A	208	10YR	2.01	151.00	151.91	151.78	151.97	0.005740	1.12	1.80	5.67	0.64
Reach-1A	208	5YR	1.67	151.00	151.86	151.72	151.92	0.005865	1.10	1.52	5.01	0.63
Reach-1A	208	2YR	1.06	151.00	151.81		151.85	0.003254	0.80	1.32	4.44	0.47
Reach-1A	207	Regional	8.10	150.25	151.13		151.16	0.003180	1.54	22.13	57.77	0.55
Reach-1A	207	100YR	3.29	150.25	150.88	150.88	150.95	0.006484	1.70	8.49	50.61	0.74
Reach-1A	207	50YR	2.91	150.25	150.87	150.87	150.93	0.005987	1.61	7.90	50.26	0.71
Reach-1A	207	25YR	2.55	150.25	150.85	150.85	150.92	0.005525	1.52	7.27	49.89	0.68
Reach-1A	207	10YR	2.01	150.25	150.83	150.83	150.89	0.004995	1.40	6.08	49.17	0.64
Reach-1A	207	5YR	1.67	150.25	150.81	150.81	150.87	0.004618	1.32	5.23	48.65	0.61
Reach-1A	207	2YR	1.06	150.25	150.69	150.69	150.79	0.009422	1.54	1.40	10.34	0.83
Reach-1A	206.3	Regional	10.04	149.49	150.51	150.50	150.72	0.005886	2.30	10.21	28.41	0.78
Reach-1A	206.3	100YR	4.08	149.49	150.28	150.12	150.39	0.003883	1.52	4.42	21.82	0.60
Reach-1A	206.3	50YR	3.61	149.49	150.24	150.07	150.35	0.003818	1.46	3.70	19.83	0.59
Reach-1A	206.3	25YR	3.17	149.49	150.21	150.04	150.30	0.003710	1.38	3.07	16.05	0.58
Reach-1A	206.3	10YR	2.51	149.49	150.15		150.23	0.003440	1.24	2.31	9.96	0.55
Reach-1A	206.3	5YR	2.08	149.49	150.10		150.17	0.003276	1.13	1.95	5.31	0.53
Reach-1A	206.3	2YR	1.33	149.49	150.00		150.05	0.002946	0.92	1.48	4.48	0.48
Reach-1A	206.2	Regional	10.04	149.25	150.19	150.19	150.39	0.007824	2.07	7.57	25.82	0.85
Reach-1A	206.2	100YR	4.08	149.25	149.90	149.90	150.06	0.012928	1.80	2.27	6.78	0.99
Reach-1A	206.2	50YR	3.61	149.25	149.87	149.87	150.02	0.013177	1.76	2.05	6.46	1.00
Reach-1A	206.2	25YR	3.17	149.25	149.83	149.83	149.98	0.013417	1.71	1.85	6.15	1.00
Reach-1A	206.2	10YR	2.51	149.25	149.78	149.78	149.92	0.014009	1.65	1.52	5.48	1.00
Reach-1A	206.2	5YR	2.08	149.25	149.74	149.74	149.87	0.014217	1.59	1.31	5.10	1.00
Reach-1A	206.2	2YR	1.33	149.25	149.65	149.65	149.76	0.015081	1.45	0.92	4.30	1.00
Reach-1A	206.15		Culvert									
Reach-1A	206.1	Regional	10.04	149.00	150.02	150.02	150.25	0.011091	2.49	8.29	30.81	0.98
Reach-1A	206.1	100YR	4.08	149.00	149.78	149.78	149.92	0.010675	1.82	3.99	21.14	0.90
Reach-1A	206.1	50YR	3.61	149.00	149.76	149.76	149.89	0.010757	1.75	3.58	19.37	0.89
Reach-1A	206.1	25YR	3.17	149.00	149.73	149.73	149.86	0.011260	1.71	3.12	17.17	0.90
Reach-1A	206.1	10YR	2.51	149.00	149.69	149.69	149.80	0.011020	1.57	2.55	14.66	0.87
Reach-1A	206.1	5YR	2.08	149.00	149.65	149.65	149.76	0.012479	1.53	2.01	12.59	0.91
Reach-1A	206.1	2YR	1.33	149.00	149.58	149.58	149.67	0.014637	1.36	1.22	9.27	0.94
Reach-1	205.1	Regional	17.72	148.20	149.19		149.27	0.003146	1.33	23.66	78.38	0.55
Reach-1	205.1	100YR	7.02	148.20	148.89		148.96	0.004756	1.16	6.53	25.42	0.62
Reach-1	205.1	50YR	6.20	148.20	148.86		148.93	0.004762	1.12	5.76	23.52	0.61
Reach-1	205.1	25YR	5.42	148.20	148.83		148.89	0.004842	1.09	5.03	17.97	0.61
Reach-1	205.1	10YR	4.25	148.20	148.77		148.82	0.004948	1.04	4.10	13.90	0.61
Reach-1	205.1	5YR	3.51	148.20	148.73		148.78	0.004915	0.98	3.57	13.01	0.60
Reach-1	205.1	2YR	2.25	148.20	148.65		148.69	0.004851	0.87	2.58	11.18	0.58
Reach-1	205	Regional	17.72	147.24	148.37	148.37	148.71	0.010758	2.58	6.87	10.33	1.01
Reach-1	205	100YR	7.02	147.24	148.01	148.01	148.22	0.012251	2.02	3.48	8.38	1.00
Reach-1	205	50YR	6.20	147.24	147.97	147.97	148.17	0.012918	1.97	3.14	8.15	1.02
Reach-1	205	25YR	5.42	147.24	147.93	147.93	148.12	0.013146	1.90	2.85	7.95	1.01
Reach-1	205	10YR	4.25	147.24	147.87	147.87	148.03	0.013574	1.77	2.40	7.61	1.01
Reach-1	205	5YR	3.51	147.24	147.83	147.83	147.98	0.014280	1.69	2.08	7.37	1.02
Reach-1	205	2YR	2.25	147.24	147.75	147.75	147.87	0.015774	1.50	1.50	6.91	1.02
Reach-1	204.75	Regional	17.72	146.00	147.49	147.29	147.70	0.004083	2.08	11.09	17.48	0.66
Reach-1	204.75	100YR	7.02	146.00	147.10		147.20	0.003610	1.41	5.22	12.13	0.57
Reach-1	204.75	50YR	6.20	146.00	147.06		147.15	0.003572	1.34	4.72	10.95	0.56
Reach-1	204.75	25YR	5.42	146.00	147.01		147.10	0.003502	1.28	4.24	8.99	0.55
Reach-1	204.75	10YR	4.25	146.00	146.93		147.00	0.003376	1.17	3.63	7.42	0.54
Reach-1	204.75	5YR	3.51	146.00	146.87		146.93	0.003300	1.10	3.20	7.12	0.52
Reach-1	204.75	2YR	2.25	146.00	146.75		146.80	0.003101	0.94	2.39	6.37	0.49
Reach-1	204.7	Regional	17.72	145.89	146.89	146.89	147.23	0.010041	2.59	7.07	12.91	0.99
Reach-1	204.7	100YR	7.02	145.89	146.52	146.52	146.74	0.012222	2.06	3.40	7.96	1.01
Reach-1	204.7	50YR	6.20	145.89	146.48	146.48	146.68	0.012450	2.01	3.08	7.59	1.01
Reach-1	204.7	25YR	5.42	145.89	146.44	146.44	146.63	0.012681	1.96	2.77	7.21	1.01

HEC-RAS Plan: Phase 2 Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	204.7	10YR	4.25	145.89	146.37	146.37	146.54	0.013218	1.85	2.30	6.70	1.01
Reach-1	204.7	5YR	3.51	145.89	146.32	146.32	146.48	0.013519	1.76	2.00	6.43	1.01
Reach-1	204.7	2YR	2.25	145.89	146.23	146.23	146.36	0.014532	1.57	1.44	5.82	1.01
Reach-1	204.55	Regional	17.72	145.49	146.75		146.91	0.003858	1.78	11.02	21.36	0.63
Reach-1	204.55	100YR	7.02	145.49	146.37		146.46	0.004044	1.32	5.31	10.58	0.60
Reach-1	204.55	50YR	6.20	145.49	146.33		146.41	0.003860	1.26	4.91	10.10	0.58
Reach-1	204.55	25YR	5.42	145.49	146.29		146.36	0.003680	1.20	4.50	9.60	0.56
Reach-1	204.55	10YR	4.25	145.49	146.22		146.28	0.003465	1.10	3.85	8.95	0.54
Reach-1	204.55	5YR	3.51	145.49	146.16		146.22	0.003482	1.04	3.38	8.63	0.53
Reach-1	204.55	2YR	2.25	145.49	146.05		146.09	0.003632	0.92	2.45	7.82	0.52
Reach-1	204.5	Regional	17.72	145.36	146.50	146.50	146.79	0.009028	2.42	8.56	22.22	0.93
Reach-1	204.5	100YR	7.02	145.36	146.24		146.36	0.006290	1.55	4.55	10.85	0.73
Reach-1	204.5	50YR	6.20	145.36	146.21		146.32	0.005917	1.45	4.28	10.17	0.70
Reach-1	204.5	25YR	5.42	145.36	146.18		146.27	0.005658	1.37	3.95	9.61	0.68
Reach-1	204.5	10YR	4.25	145.36	146.12		146.20	0.005234	1.25	3.39	8.91	0.65
Reach-1	204.5	5YR	3.51	145.36	146.06		146.14	0.005409	1.21	2.90	8.25	0.65
Reach-1	204.5	2YR	2.25	145.36	145.94		146.01	0.005771	1.11	2.02	6.82	0.65
Reach-1	204.25	Regional	17.72	145.11	146.30	146.30	146.53	0.008539	2.39	13.64	30.83	0.91
Reach-1	204.25	100YR	7.02	145.11	145.99	145.99	146.16	0.009317	1.89	5.22	23.12	0.89
Reach-1	204.25	50YR	6.20	145.11	145.95	145.95	146.12	0.009946	1.87	4.31	20.09	0.90
Reach-1	204.25	25YR	5.42	145.11	145.90	145.90	146.08	0.010607	1.86	3.46	16.52	0.93
Reach-1	204.25	10YR	4.25	145.11	145.80	145.80	145.99	0.012925	1.92	2.23	7.66	1.00
Reach-1	204.25	5YR	3.51	145.11	145.75	145.75	145.92	0.013507	1.86	1.89	5.51	1.01
Reach-1	204.25	2YR	2.25	145.11	145.64	145.64	145.78	0.014279	1.69	1.33	4.67	1.01
Reach-1	204	Regional	18.01	144.05	145.06	145.06	145.35	0.009587	2.79	13.73	25.04	1.00
Reach-1	204	100YR	7.18	144.05	144.78	144.78	144.95	0.008859	2.01	6.89	23.06	0.89
Reach-1	204	50YR	6.35	144.05	144.74	144.74	144.91	0.009685	1.99	5.95	22.46	0.92
Reach-1	204	25YR	5.57	144.05	144.71	144.71	144.86	0.009859	1.91	5.23	21.31	0.92
Reach-1	204	10YR	4.33	144.05	144.65	144.65	144.79	0.010275	1.78	4.06	19.29	0.91
Reach-1	204	5YR	3.58	144.05	144.61	144.61	144.74	0.010390	1.67	3.37	18.00	0.90
Reach-1	204	2YR	2.31	144.05	144.53	144.53	144.64	0.011382	1.48	2.07	15.16	0.91
Reach-1	203	Regional	18.16	142.50	144.81		144.86	0.000538	0.95	29.49	36.91	0.25
Reach-1	203	100YR	7.27	142.50	143.67	143.67	143.87	0.013060	2.00	3.63	9.11	1.01
Reach-1	203	50YR	6.43	142.50	143.55	143.55	143.82	0.012872	2.32	2.78	5.39	1.03
Reach-1	203	25YR	5.64	142.50	143.50	143.50	143.76	0.012463	2.23	2.53	5.07	1.01
Reach-1	203	10YR	4.38	142.50	143.40	143.40	143.64	0.013022	2.13	2.06	4.55	1.01
Reach-1	203	5YR	3.62	142.50	143.34	143.34	143.55	0.013427	2.05	1.76	4.21	1.01
Reach-1	203	2YR	2.32	142.50	143.20	143.20	143.38	0.014270	1.88	1.23	3.53	1.01
Reach-1	202.75	Regional	18.16	142.43	144.51	143.74	144.77	0.001829	2.27	8.00	34.69	0.50
Reach-1	202.75	100YR	7.27	142.43	143.56	143.14	143.70	0.002245	1.67	4.34	26.92	0.50
Reach-1	202.75	50YR	6.43	142.43	143.47	143.09	143.60	0.002307	1.61	4.00	25.56	0.50
Reach-1	202.75	25YR	5.64	142.43	143.38	143.03	143.50	0.002376	1.54	3.67	23.03	0.50
Reach-1	202.75	10YR	4.38	142.43	143.23	142.94	143.34	0.002514	1.41	3.10	18.75	0.50
Reach-1	202.75	5YR	3.62	142.43	143.14	142.88	143.23	0.002624	1.33	2.73	17.00	0.50
Reach-1	202.75	2YR	2.32	142.43	142.96	142.76	143.02	0.002899	1.14	2.03	13.79	0.50
Reach-1	202.5		Culvert									
Reach-1	202.25	Regional	18.16	142.28	143.59	143.59	144.25	0.015737	3.60	5.05	4.08	1.00
Reach-1	202.25	100YR	7.27	142.28	142.99	142.99	143.35	0.014995	2.64	2.75	3.85	1.00
Reach-1	202.25	50YR	6.43	142.28	142.94	142.94	143.27	0.015095	2.54	2.53	3.85	1.00
Reach-1	202.25	25YR	5.64	142.28	142.88	142.88	143.18	0.015009	2.43	2.32	3.85	1.00
Reach-1	202.25	10YR	4.38	142.28	142.79	142.79	143.04	0.015106	2.23	1.96	3.85	1.00
Reach-1	202.25	5YR	3.62	142.28	142.74	142.73	142.95	0.013796	2.03	1.78	3.85	0.95
Reach-1	202.25	2YR	2.32	142.28	142.69	142.61	142.80	0.008472	1.48	1.57	3.85	0.74
Reach-1	202	Regional	18.16	142.20	143.23		143.28	0.001458	1.20	28.88	49.26	0.40
Reach-1	202	100YR	7.27	142.20	142.67	142.67	142.81	0.010884	1.74	5.63	25.27	0.93
Reach-1	202	50YR	6.43	142.20	142.64	142.64	142.78	0.012481	1.74	4.78	22.33	0.98
Reach-1	202	25YR	5.64	142.20	142.62	142.62	142.75	0.011478	1.61	4.45	21.67	0.93
Reach-1	202	10YR	4.38	142.20	142.58	142.58	142.69	0.012071	1.50	3.55	20.23	0.93
Reach-1	202	5YR	3.62	142.20	142.55	142.55	142.65	0.012248	1.40	3.02	19.37	0.92
Reach-1	202	2YR	2.32	142.20	142.49	142.49	142.57	0.015247	1.28	1.86	14.86	0.98
Reach-1	201	Regional	18.16	141.65	143.21		143.24	0.000468	0.92	37.17	39.44	0.24
Reach-1	201	100YR	7.27	141.65	142.60		142.63	0.000723	0.80	14.96	31.91	0.28
Reach-1	201	50YR	6.43	141.65	142.52		142.55	0.000834	0.81	12.61	30.71	0.29
Reach-1	201	25YR	5.64	141.65	142.50		142.52	0.000752	0.75	11.73	30.12	0.28
Reach-1	201	10YR	4.38	141.65	142.39		142.42	0.000815	0.71	8.86	25.50	0.28
Reach-1	201	5YR	3.62	141.65	142.33		142.35	0.000815	0.66	7.40	22.87	0.28
Reach-1	201	2YR	2.32	141.65	142.25		142.26	0.000610	0.51	5.59	19.18	0.23
Reach-1	171	Regional	28.90	141.65	142.97	142.70	143.11	0.002516	1.90	27.97	37.97	0.55

HEC-RAS Plan: Phase 2 Control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	171	100YR	8.17	141.65	142.44	142.21	142.50	0.002213	1.21	9.98	27.36	0.47
Reach-1	171	50YR	6.60	141.65	142.36	142.15	142.42	0.002210	1.13	8.15	24.25	0.46
Reach-1	171	25YR	6.10	141.65	142.34	142.13	142.40	0.002202	1.10	7.58	23.20	0.46
Reach-1	171	10YR	4.37	141.65	142.25	142.05	142.29	0.002182	0.97	5.57	19.13	0.44
Reach-1	171	5YR	3.52	141.65	142.19	142.01	142.23	0.002166	0.89	4.59	16.80	0.43
Reach-1	171	2YR	2.57	141.65	142.12	141.95	142.15	0.002101	0.79	3.54	13.88	0.41
Reach-1	170		Bridge									
Reach-1	169	Regional	28.90	141.65	142.70	142.70	142.99	0.007134	2.71	18.27	33.54	0.89
Reach-1	169	100YR	8.17	141.65	142.21	142.21	142.40	0.009752	1.96	4.98	17.76	0.92
Reach-1	169	50YR	6.60	141.65	142.15	142.15	142.32	0.010567	1.86	3.98	15.15	0.94
Reach-1	169	25YR	6.10	141.65	142.13	142.13	142.30	0.011146	1.83	3.63	14.16	0.95
Reach-1	169	10YR	4.37	141.65	142.05	142.05	142.19	0.013010	1.69	2.63	10.71	0.99
Reach-1	169	5YR	3.52	141.65	142.01	142.01	142.13	0.014215	1.59	2.21	8.88	1.01
Reach-1	169	2YR	2.57	141.65	141.95	141.95	142.06	0.014892	1.45	1.77	8.23	1.00
Reach-1	164	Regional	28.90	138.30	139.25		139.39	0.007256	1.51	18.32	23.62	0.61
Reach-1	164	100YR	8.17	138.30	138.83		138.86	0.002624	0.51	10.37	14.75	0.32
Reach-1	164	50YR	6.60	138.30	138.74		138.76	0.002349	0.41	9.12	13.62	0.29
Reach-1	164	25YR	6.10	138.30	138.69		138.72	0.002374	0.38	8.50	12.97	0.29
Reach-1	164	10YR	4.37	138.30	138.54		138.56	0.002100	0.28	6.77	10.44	0.25
Reach-1	164	5YR	3.52	138.30	138.46		138.47	0.001886	0.19	5.92	9.30	0.22
Reach-1	164	2YR	2.57	138.30	138.34		138.36	0.001562	0.07	4.96	7.74	0.16
Reach-1	163	Regional	28.90	137.20	138.47		138.55	0.005133	1.90	30.33	59.32	0.57
Reach-1	163	100YR	8.17	137.20	138.08	137.99	138.23	0.009915	1.99	7.75	50.21	0.74
Reach-1	163	50YR	6.60	137.20	138.02	137.97	138.17	0.010628	1.93	5.32	22.77	0.76
Reach-1	163	25YR	6.10	137.20	137.99	137.97	138.13	0.010185	1.84	4.82	15.66	0.74
Reach-1	163	10YR	4.37	137.20	137.90	137.86	138.02	0.009858	1.65	3.61	13.13	0.71
Reach-1	163	5YR	3.52	137.20	137.84	137.80	137.96	0.010879	1.59	2.82	11.19	0.73
Reach-1	163	2YR	2.57	137.20	137.74	137.72	137.86	0.015146	1.60	1.81	8.05	0.82
Reach-1	162	Regional	28.90	135.60	136.76	136.76	137.01	0.016983	3.06	16.52	33.14	1.02
Reach-1	162	100YR	8.17	135.60	136.46		136.55	0.008365	1.65	8.05	23.23	0.67
Reach-1	162	50YR	6.60	135.60	136.42	136.32	136.49	0.007713	1.51	7.02	21.71	0.63
Reach-1	162	25YR	6.10	135.60	136.39		136.46	0.007886	1.48	6.54	20.96	0.64
Reach-1	162	10YR	4.37	135.60	136.32		136.38	0.007899	1.34	5.01	18.41	0.62
Reach-1	162	5YR	3.52	135.60	136.28		136.33	0.007036	1.21	4.42	17.31	0.58
Reach-1	162	2YR	2.57	135.60	136.25		136.28	0.005238	0.99	3.87	16.23	0.49
Reach-1	161	Regional	28.90	134.10	135.30	135.17	135.36	0.005788	1.77	31.56	67.18	0.58
Reach-1	161	100YR	8.17	134.10	134.98	134.98	135.07	0.008814	1.68	10.93	62.89	0.67
Reach-1	161	50YR	6.60	134.10	134.95	134.95	135.03	0.009136	1.64	8.64	54.87	0.68
Reach-1	161	25YR	6.10	134.10	134.94	134.94	135.02	0.008737	1.59	8.14	52.96	0.66
Reach-1	161	10YR	4.37	134.10	134.89	134.89	134.97	0.008112	1.44	5.85	43.08	0.63
Reach-1	161	5YR	3.52	134.10	134.85	134.85	134.93	0.008870	1.43	4.23	34.42	0.65
Reach-1	161	2YR	2.57	134.10	134.76	134.69	134.87	0.012829	1.52	2.03	16.61	0.76
Reach-1	160	Regional	28.90	132.50	134.02		134.06	0.003131	1.45	37.31	64.17	0.42
Reach-1	160	100YR	8.17	132.50	133.61		133.64	0.002166	0.99	15.54	41.27	0.33
Reach-1	160	50YR	6.60	132.50	133.54		133.57	0.002221	0.96	12.79	37.14	0.33
Reach-1	160	25YR	6.10	132.50	133.52	133.29	133.54	0.002198	0.94	11.99	35.85	0.33
Reach-1	160	10YR	4.37	132.50	133.41		133.44	0.002411	0.92	8.52	29.61	0.34
Reach-1	160	5YR	3.52	132.50	133.35		133.38	0.002582	0.91	6.73	25.80	0.35
Reach-1	160	2YR	2.57	132.50	133.28		133.30	0.002499	0.84	5.01	21.54	0.34

14 MILE CREEK WEST

HEC-RAS MODEL RESULTS FOR

ULTIMATE DEVELOPMENT CONDITION

(Controlled flow rate)

- **14W-16 (Reach 1A)**
- **14W-12 (Reach 1)**
- **14W-22 (Reach 2A and Reach 2A1)**
- **14W-21 (Reach 2A2)**
- **14W-12A (Reach 2B and 2C)**

HEC-RAS Plan: Ultiamte control

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A1	3081	Regional	6.35	154.25	154.62	154.55	154.68	0.005506	1.12	6.74	32.57	0.65
Reach-2A1	3081	100YR	2.45	154.25	154.48		154.52	0.006284	0.81	3.08	20.80	0.63
Reach-2A1	3081	50YR	2.16	154.25	154.47		154.50	0.006529	0.78	2.80	19.60	0.63
Reach-2A1	3081	25YR	1.89	154.25	154.45		154.48	0.006958	0.75	2.52	18.34	0.64
Reach-2A1	3081	10YR	1.47	154.25	154.43		154.45	0.007146	0.70	2.09	16.82	0.64
Reach-2A1	3081	5YR	1.20	154.25	154.41		154.43	0.007826	0.69	1.75	15.61	0.65
Reach-2A1	3081	2YR	0.75	154.25	154.38		154.40	0.006287	0.55	1.35	14.06	0.57
Reach-2A1	3071	Regional	6.35	153.56	154.19	154.19	154.30	0.008350	2.10	10.32	36.94	0.86
Reach-2A1	3071	100YR	2.45	153.56	154.01	154.01	154.11	0.008075	1.65	4.25	27.71	0.80
Reach-2A1	3071	50YR	2.16	153.56	153.99	153.99	154.09	0.008074	1.59	3.68	25.57	0.79
Reach-2A1	3071	25YR	1.89	153.56	153.97	153.97	154.06	0.008001	1.53	3.16	23.46	0.78
Reach-2A1	3071	10YR	1.47	153.56	153.93	153.93	154.02	0.008345	1.45	2.26	19.21	0.78
Reach-2A1	3071	5YR	1.20	153.56	153.90	153.89	153.98	0.008175	1.36	1.75	16.36	0.76
Reach-2A1	3071	2YR	0.75	153.56	153.80	153.80	153.90	0.013344	1.37	0.63	6.68	0.92
Reach-2A1	3061	Regional	6.35	152.85	153.59	153.59	153.74	0.008247	2.18	8.60	27.86	0.82
Reach-2A1	3061	100YR	2.45	152.85	153.39	153.39	153.52	0.007475	1.67	3.28	23.07	0.74
Reach-2A1	3061	50YR	2.16	152.85	153.37	153.37	153.49	0.007651	1.63	2.67	20.10	0.75
Reach-2A1	3061	25YR	1.89	152.85	153.33	153.33	153.45	0.008496	1.63	1.98	16.12	0.77
Reach-2A1	3061	10YR	1.47	152.85	153.22	153.22	153.38	0.014332	1.77	0.87	5.22	0.96
Reach-2A1	3061	5YR	1.20	152.85	153.17	153.17	153.32	0.016259	1.71	0.70	2.37	1.01
Reach-2A1	3061	2YR	0.75	152.85	153.13		153.21	0.009641	1.23	0.61	2.33	0.77
Reach-2A2	309	Regional	0.52	154.00	154.37	154.35	154.40	0.006593	1.10	1.88	19.95	0.64
Reach-2A2	309	100YR	0.18	154.00	154.30	154.27	154.32	0.004707	0.76	0.69	11.50	0.52
Reach-2A2	309	50YR	0.16	154.00	154.29	154.26	154.31	0.004636	0.73	0.59	10.54	0.51
Reach-2A2	309	25YR	0.14	154.00	154.28	154.24	154.30	0.004410	0.70	0.51	9.61	0.49
Reach-2A2	309	10YR	0.10	154.00	154.24	154.19	154.26	0.006723	0.74	0.21	4.93	0.59
Reach-2A2	309	5YR	0.08	154.00	154.23	154.17	154.25	0.005034	0.62	0.18	4.25	0.50
Reach-2A2	309	2YR	0.04	154.00	154.13	154.12	154.16	0.014795	0.74	0.05	0.60	0.80
Reach-2A2	308	Regional	0.52	153.50	153.88		153.91	0.005958	1.06	1.61	11.97	0.61
Reach-2A2	308	100YR	0.18	153.50	153.77	153.77	153.81	0.009056	0.98	0.41	7.93	0.70
Reach-2A2	308	50YR	0.16	153.50	153.76	153.76	153.80	0.009351	0.96	0.33	6.88	0.71
Reach-2A2	308	25YR	0.14	153.50	153.75	153.74	153.79	0.010261	0.95	0.25	5.48	0.73
Reach-2A2	308	10YR	0.10	153.50	153.74	153.69	153.77	0.006006	0.71	0.22	4.94	0.56
Reach-2A2	308	5YR	0.08	153.50	153.71	153.67	153.74	0.008699	0.74	0.11	1.74	0.65
Reach-2A2	308	2YR	0.04	153.50	153.70	153.62	153.70	0.003034	0.41	0.10	0.79	0.38
Reach-2A2	307	Regional	0.52	153.00	153.38		153.41	0.006345	1.08	1.58	11.93	0.63
Reach-2A2	307	100YR	0.18	153.00	153.30	153.27	153.32	0.004188	0.73	0.72	11.23	0.49
Reach-2A2	307	50YR	0.16	153.00	153.29	153.26	153.31	0.004045	0.70	0.63	10.49	0.48
Reach-2A2	307	25YR	0.14	153.00	153.29	153.24	153.30	0.003751	0.66	0.55	9.70	0.46
Reach-2A2	307	10YR	0.10	153.00	153.24	153.19	153.27	0.006233	0.72	0.22	4.95	0.57
Reach-2A2	307	5YR	0.08	153.00	153.24	153.17	153.25	0.004213	0.59	0.20	4.73	0.46
Reach-2A2	307	2YR	0.04	153.00	153.12	153.12	153.16	0.023842	0.89	0.05	0.56	1.00
Reach-2A2	306	Regional	0.52	152.75	153.13		153.16	0.005465	1.03	1.67	12.05	0.59
Reach-2A2	306	100YR	0.18	152.75	153.02	153.02	153.06	0.009908	1.01	0.39	7.60	0.73
Reach-2A2	306	50YR	0.16	152.75	153.01	153.01	153.05	0.010613	1.00	0.30	6.41	0.75
Reach-2A2	306	25YR	0.14	152.75	152.99	152.99	153.04	0.012383	1.01	0.21	4.76	0.80
Reach-2A2	306	10YR	0.10	152.75	152.99	152.94	153.02	0.005838	0.71	0.23	5.07	0.55
Reach-2A2	306	5YR	0.08	152.75	152.95	152.92	152.98	0.011637	0.81	0.10	0.79	0.74
Reach-2A2	306	2YR	0.04	152.75	153.02		153.02	0.000448	0.22	0.41	7.95	0.16
Reach-2A	305	Regional	6.35	152.12	152.90		152.94	0.004140	1.41	14.68	35.44	0.51
Reach-2A	305	100YR	2.45	152.12	152.66		152.70	0.006084	1.33	6.27	31.13	0.58
Reach-2A	305	50YR	2.16	152.12	152.63		152.68	0.006246	1.31	5.62	31.00	0.58
Reach-2A	305	25YR	1.89	152.12	152.61		152.66	0.006355	1.29	5.00	30.88	0.59
Reach-2A	305	10YR	1.47	152.12	152.57	152.57	152.63	0.007356	1.31	3.73	30.64	0.62
Reach-2A	305	5YR	1.20	152.12	152.55	152.55	152.61	0.006792	1.22	3.16	30.52	0.59
Reach-2A	305	2YR	0.75	152.12	152.47	152.41	152.57	0.012138	1.42	0.64	30.02	0.76
Reach-2A	304	Regional	6.35	151.63	152.63		152.64	0.001168	0.88	22.41	36.73	0.28
Reach-2A	304	100YR	2.45	151.63	152.32		152.33	0.001340	0.74	11.23	34.85	0.28
Reach-2A	304	50YR	2.16	151.63	152.29		152.29	0.001379	0.72	10.17	34.67	0.29
Reach-2A	304	25YR	1.89	151.63	152.25		152.26	0.001433	0.71	9.09	34.21	0.29
Reach-2A	304	10YR	1.47	151.63	152.20		152.21	0.001439	0.67	7.36	31.34	0.29
Reach-2A	304	5YR	1.20	151.63	152.16		152.17	0.001526	0.66	6.17	31.11	0.29
Reach-2A	304	2YR	0.75	151.63	152.11	151.92	152.12	0.001297	0.57	4.47	30.78	0.26
Reach-2A	303	Regional	6.50	151.46	152.24	152.24	152.44	0.015638	2.74	5.80	35.41	0.99
Reach-2A	303	100YR	2.51	151.46	152.03	152.03	152.14	0.011428	1.89	3.19	31.31	0.80
Reach-2A	303	50YR	2.21	151.46	152.00	152.00	152.11	0.010960	1.80	2.92	31.18	0.78
Reach-2A	303	25YR	1.93	151.46	151.98	151.98	152.09	0.010282	1.70	2.67	31.05	0.75
Reach-2A	303	10YR	1.51	151.46	151.94	151.94	152.04	0.009678	1.57	2.18	30.81	0.72
Reach-2A	303	5YR	1.23	151.46	151.91	151.91	152.00	0.008977	1.45	1.83	30.64	0.69
Reach-2A	303	2YR	0.77	151.46	151.76	151.76	151.91	0.020431	1.71	0.45	1.50	0.99

HEC-RAS Plan: Ultiamte control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2A	302.5		Culvert									
Reach-2A	302	Regional	6.50	151.29	152.24	152.07	152.33	0.006364	1.99	7.88	36.42	0.65
Reach-2A	302	100YR	2.51	151.29	151.96	151.86	152.01	0.004912	1.38	4.44	34.74	0.54
Reach-2A	302	50YR	2.21	151.29	151.93	151.83	151.98	0.004781	1.32	4.07	34.56	0.53
Reach-2A	302	25YR	1.93	151.29	151.90	151.81	151.95	0.004519	1.25	3.75	32.84	0.51
Reach-2A	302	10YR	1.51	151.29	151.85	151.77	151.90	0.004247	1.15	3.16	31.29	0.49
Reach-2A	302	5YR	1.23	151.29	151.82	151.74	151.86	0.004031	1.07	2.71	31.07	0.47
Reach-2A	302	2YR	0.77	151.29	151.75	151.59	151.78	0.003416	0.90	1.86	30.65	0.42
Reach-2A	301	Regional	6.50	150.79	151.61		151.63	0.003470	1.33	15.83	35.63	0.47
Reach-2A	301	100YR	2.51	150.79	151.38		151.40	0.003530	1.08	7.85	31.43	0.45
Reach-2A	301	50YR	2.21	150.79	151.35		151.38	0.003513	1.05	7.15	31.30	0.45
Reach-2A	301	25YR	1.93	150.79	151.33		151.35	0.003589	1.03	6.40	31.15	0.45
Reach-2A	301	10YR	1.51	150.79	151.29		151.32	0.003663	0.99	5.22	30.92	0.45
Reach-2A	301	5YR	1.23	150.79	151.26		151.29	0.003690	0.95	4.36	30.76	0.44
Reach-2A	301	2YR	0.77	150.79	151.20	151.09	151.24	0.004079	0.92	2.54	30.40	0.46
Reach-2A	300	Regional	6.50	150.40	151.21	151.00	151.24	0.003575	1.35	15.67	35.61	0.48
Reach-2A	300	100YR	2.51	150.40	150.99	150.90	151.01	0.003476	1.07	7.89	31.44	0.45
Reach-2A	300	50YR	2.21	150.40	150.97	150.89	150.99	0.003441	1.04	7.21	31.31	0.44
Reach-2A	300	25YR	1.93	150.40	150.94	150.88	150.97	0.003357	1.00	6.57	31.18	0.43
Reach-2A	300	10YR	1.51	150.40	150.91	150.86	150.93	0.003250	0.94	5.48	30.97	0.42
Reach-2A	300	5YR	1.23	150.40	150.88	150.84	150.90	0.003240	0.90	4.62	30.81	0.42
Reach-2A	300	2YR	0.77	150.40	150.83	150.70	150.85	0.002882	0.79	3.11	30.51	0.39
Reach-2A	299	Regional	6.50	150.05	150.91		150.93	0.002684	1.21	17.25	35.87	0.42
Reach-2A	299	100YR	2.51	150.05	150.64		150.66	0.003474	1.07	7.90	31.44	0.45
Reach-2A	299	50YR	2.21	150.05	150.61		150.64	0.003547	1.05	7.13	31.29	0.45
Reach-2A	299	25YR	1.93	150.05	150.59		150.61	0.003737	1.04	6.30	31.13	0.46
Reach-2A	299	10YR	1.51	150.05	150.55		150.57	0.003919	1.02	5.07	30.90	0.46
Reach-2A	299	5YR	1.23	150.05	150.52		150.55	0.003903	0.98	4.25	30.74	0.46
Reach-2A	299	2YR	0.77	150.05	150.46	150.45	150.49	0.004433	0.95	2.41	30.37	0.47
Reach-2A	298	Regional	6.50	149.76	150.74		150.75	0.001210	0.89	22.96	38.43	0.29
Reach-2A	298	100YR	2.51	149.76	150.43		150.44	0.001496	0.77	11.25	36.56	0.30
Reach-2A	298	50YR	2.21	149.76	150.40		150.41	0.001551	0.76	10.15	36.38	0.30
Reach-2A	298	25YR	1.93	149.76	150.37		150.38	0.001569	0.74	9.02	34.37	0.30
Reach-2A	298	10YR	1.51	149.76	150.32		150.33	0.001666	0.71	7.30	33.05	0.31
Reach-2A	298	5YR	1.23	149.76	150.28		150.29	0.001801	0.71	6.04	32.83	0.31
Reach-2A	298	2YR	0.77	149.76	150.22		150.23	0.001664	0.63	4.20	32.49	0.30
Reach-2A	297	Regional	6.50	149.64	150.42	150.42	150.62	0.015665	2.74	5.80	35.40	0.99
Reach-2A	297	100YR	2.51	149.64	150.21	150.21	150.32	0.011217	1.88	3.22	31.32	0.80
Reach-2A	297	50YR	2.21	149.64	150.18	150.18	150.29	0.011032	1.81	2.91	31.17	0.78
Reach-2A	297	25YR	1.93	149.64	150.16	150.16	150.27	0.010329	1.70	2.66	31.05	0.75
Reach-2A	297	10YR	1.51	149.64	150.12	150.12	150.22	0.009664	1.56	2.18	30.81	0.72
Reach-2A	297	5YR	1.23	149.64	150.09	150.09	150.18	0.008958	1.45	1.83	30.64	0.69
Reach-2A	297	2YR	0.77	149.64	149.94	149.94	150.09	0.020625	1.71	0.45	1.50	1.00
Reach-2A	296.5		Culvert									
Reach-2A	296	Regional	6.50	149.44	150.22	150.22	150.42	0.015635	2.74	5.80	35.41	0.99
Reach-2A	296	100YR	2.51	149.44	150.00	150.00	150.12	0.011702	1.91	3.16	31.29	0.81
Reach-2A	296	50YR	2.21	149.44	149.98	149.98	150.09	0.010741	1.79	2.94	31.19	0.77
Reach-2A	296	25YR	1.93	149.44	149.96	149.96	150.07	0.010422	1.71	2.65	31.04	0.76
Reach-2A	296	10YR	1.51	149.44	149.92	149.92	150.02	0.009679	1.57	2.18	30.81	0.72
Reach-2A	296	5YR	1.23	149.44	149.89	149.89	149.98	0.008977	1.45	1.83	30.64	0.69
Reach-2A	296	2YR	0.77	149.44	149.74	149.74	149.89	0.020430	1.71	0.45	1.50	0.99
Reach-2B	231.1	Regional	0.22	148.25	149.30		149.30	0.000001	0.03	19.59	43.96	0.01
Reach-2B	231.1	100YR	0.09	148.25	149.04		149.04	0.000001	0.02	9.83	31.08	0.01
Reach-2B	231.1	50YR	0.08	148.25	149.02		149.02	0.000001	0.02	8.99	29.71	0.01
Reach-2B	231.1	25YR	0.07	148.25	148.99		148.99	0.000001	0.02	8.16	28.25	0.01
Reach-2B	231.1	10YR	0.06	148.25	148.94		148.94	0.000001	0.02	6.89	25.77	0.01
Reach-2B	231.1	5YR	0.05	148.25	148.91		148.91	0.000001	0.02	6.04	23.97	0.01
Reach-2B	231.1	2YR	0.04	148.25	148.84		148.84	0.000001	0.02	4.53	20.35	0.01
Reach-2B	231	Regional	0.22	148.25	149.30		149.30	0.000001	0.03	19.59	43.96	0.01
Reach-2B	231	100YR	0.09	148.25	149.04		149.04	0.000001	0.02	9.83	31.08	0.01
Reach-2B	231	50YR	0.08	148.25	149.02		149.02	0.000001	0.02	8.99	29.71	0.01
Reach-2B	231	25YR	0.07	148.25	148.99		148.99	0.000001	0.02	8.16	28.25	0.01
Reach-2B	231	10YR	0.06	148.25	148.94		148.94	0.000001	0.02	6.89	25.77	0.01
Reach-2B	231	5YR	0.05	148.25	148.91		148.91	0.000001	0.02	6.04	23.97	0.01
Reach-2B	231	2YR	0.04	148.25	148.84		148.84	0.000001	0.02	4.53	20.35	0.01
Reach-2B	220.3	Regional	0.22	148.25	149.30		149.30	0.000000	0.01	23.44	53.95	0.00
Reach-2B	220.3	100YR	0.09	148.25	149.04		149.04	0.000000	0.01	11.55	37.47	0.00

HEC-RAS Plan: Ultiamte control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-2B	220.3	50YR	0.08	148.25	149.02		149.02	0.000000	0.01	10.54	35.71	0.00
Reach-2B	220.3	25YR	0.07	148.25	148.99		148.99	0.000000	0.01	9.54	33.91	0.00
Reach-2B	220.3	10YR	0.06	148.25	148.94		148.94	0.000000	0.01	8.02	31.00	0.00
Reach-2B	220.3	5YR	0.05	148.25	148.91		148.91	0.000000	0.01	7.00	28.88	0.00
Reach-2B	220.3	2YR	0.04	148.25	148.84		148.84	0.000000	0.01	5.16	24.62	0.01
Reach-2B	220.2	Regional	0.22	148.57	149.30		149.30	0.000012	0.08	3.17	6.46	0.03
Reach-2B	220.2	100YR	0.09	148.57	149.04		149.04	0.000012	0.06	1.65	5.26	0.03
Reach-2B	220.2	50YR	0.08	148.57	149.02		149.02	0.000012	0.06	1.51	5.13	0.03
Reach-2B	220.2	25YR	0.07	148.57	148.99		148.99	0.000013	0.06	1.36	5.00	0.03
Reach-2B	220.2	10YR	0.06	148.57	148.94		148.94	0.000016	0.06	1.13	4.78	0.03
Reach-2B	220.2	5YR	0.05	148.57	148.91		148.91	0.000018	0.05	0.97	4.62	0.04
Reach-2B	220.2	2YR	0.04	148.57	148.84		148.84	0.000037	0.06	0.67	4.30	0.05
Reach-2C	220.15	Regional	6.72	148.50	149.28		149.29	0.001110	0.75	24.50	63.45	0.32
Reach-2C	220.15	100YR	2.59	148.50	149.00		149.02	0.002063	0.77	8.42	53.57	0.40
Reach-2C	220.15	50YR	2.29	148.50	148.97		148.99	0.002361	0.78	6.79	47.71	0.43
Reach-2C	220.15	25YR	2.00	148.50	148.94		148.96	0.002742	0.80	5.29	41.26	0.45
Reach-2C	220.15	10YR	1.56	148.50	148.88		148.91	0.003543	0.83	3.28	30.52	0.51
Reach-2C	220.15	5YR	1.28	148.50	148.84		148.87	0.004324	0.84	2.19	22.70	0.55
Reach-2C	220.15	2YR	0.80	148.50	148.76		148.79	0.006294	0.81	0.99	7.35	0.63
Reach-2C	220.1	Regional	6.72	148.25	149.25		149.27	0.001436	0.81	20.42	67.45	0.36
Reach-2C	220.1	100YR	2.59	148.25	148.94		148.98	0.003388	0.94	3.56	17.95	0.51
Reach-2C	220.1	50YR	2.29	148.25	148.90		148.95	0.003659	0.94	2.96	16.32	0.53
Reach-2C	220.1	25YR	2.00	148.25	148.86		148.91	0.003993	0.94	2.38	14.53	0.54
Reach-2C	220.1	10YR	1.56	148.25	148.81		148.85	0.004237	0.90	1.76	8.12	0.55
Reach-2C	220.1	5YR	1.28	148.25	148.76		148.80	0.004566	0.88	1.45	5.81	0.56
Reach-2C	220.1	2YR	0.80	148.25	148.68		148.71	0.004489	0.79	1.01	4.66	0.54
Reach-2C	220	Regional	6.72	148.25	149.25		149.27	0.001456	0.82	20.30	67.37	0.36
Reach-2C	220	100YR	2.59	148.25	148.93		148.98	0.003546	0.96	3.47	17.71	0.52
Reach-2C	220	50YR	2.29	148.25	148.90		148.94	0.003854	0.96	2.87	16.06	0.54
Reach-2C	220	25YR	2.00	148.25	148.86		148.91	0.004229	0.96	2.30	14.24	0.56
Reach-2C	220	10YR	1.56	148.25	148.80		148.84	0.004504	0.92	1.71	7.75	0.57
Reach-2C	220	5YR	1.28	148.25	148.76		148.80	0.004905	0.91	1.41	5.74	0.58
Reach-2C	220	2YR	0.80	148.25	148.67		148.70	0.004854	0.82	0.98	4.59	0.57
Reach-1A	210.5	Regional	7.87	155.11	155.51	155.48	155.54	0.010424	0.80	9.87	87.19	0.76
Reach-1A	210.5	100YR	3.19	155.11	155.42	155.42	155.45	0.017873	0.81	3.95	51.31	0.93
Reach-1A	210.5	50YR	2.83	155.11	155.41	155.41	155.44	0.018893	0.80	3.55	48.89	0.94
Reach-1A	210.5	25YR	2.48	155.11	155.40	155.40	155.43	0.021783	0.81	3.06	45.80	1.00
Reach-1A	210.5	10YR	1.96	155.11	155.39	155.39	155.42	0.021733	0.76	2.58	42.39	0.98
Reach-1A	210.5	5YR	1.62	155.11	155.38	155.38	155.41	0.021410	0.74	2.18	36.46	0.97
Reach-1A	210.5	2YR	1.03	155.11	155.35	155.35	155.38	0.023162	0.78	1.31	21.56	1.02
Reach-1A	210	Regional	7.87	154.96	155.26		155.30	0.006635	0.88	8.92	48.15	0.65
Reach-1A	210	100YR	3.19	154.96	155.17		155.19	0.005158	0.62	5.12	38.56	0.55
Reach-1A	210	50YR	2.83	154.96	155.16		155.18	0.005098	0.60	4.72	37.37	0.54
Reach-1A	210	25YR	2.48	154.96	155.15		155.17	0.004753	0.56	4.41	36.40	0.52
Reach-1A	210	10YR	1.96	154.96	155.14		155.15	0.004548	0.52	3.79	34.43	0.50
Reach-1A	210	5YR	1.62	154.96	155.12		155.14	0.004380	0.48	3.36	32.97	0.48
Reach-1A	210	2YR	1.03	154.96	155.10		155.11	0.003949	0.40	2.55	30.03	0.44
Reach-1A	209	Regional	7.87	154.46	154.73		154.75	0.003691	0.80	14.97	74.69	0.51
Reach-1A	209	100YR	3.19	154.46	154.61		154.63	0.004819	0.62	7.17	62.33	0.53
Reach-1A	209	50YR	2.83	154.46	154.60		154.62	0.004856	0.59	6.58	61.48	0.53
Reach-1A	209	25YR	2.48	154.46	154.59	154.56	154.61	0.005209	0.58	5.87	60.43	0.54
Reach-1A	209	10YR	1.96	154.46	154.58	154.55	154.59	0.005460	0.53	4.90	58.99	0.54
Reach-1A	209	5YR	1.62	154.46	154.57	154.54	154.58	0.005656	0.50	4.24	57.98	0.54
Reach-1A	209	2YR	1.03	154.46	154.54	154.52	154.55	0.006243	0.44	2.97	55.99	0.54
Reach-1A	208.3	Regional	7.87	152.95	153.43	153.43	153.58	0.010767	1.82	6.98	31.13	0.94
Reach-1A	208.3	100YR	3.19	152.95	153.30	153.27	153.37	0.008873	1.23	3.39	21.50	0.79
Reach-1A	208.3	50YR	2.83	152.95	153.28	153.25	153.35	0.008901	1.18	3.05	20.31	0.79
Reach-1A	208.3	25YR	2.48	152.95	153.27	153.23	153.33	0.008289	1.10	2.81	19.42	0.75
Reach-1A	208.3	10YR	1.96	152.95	153.24	153.21	153.29	0.008109	1.00	2.33	17.51	0.73
Reach-1A	208.3	5YR	1.62	152.95	153.22	153.19	153.26	0.007973	0.92	2.01	16.11	0.71
Reach-1A	208.3	2YR	1.03	152.95	153.18	153.15	153.21	0.007420	0.76	1.46	13.60	0.66
Reach-1A	208.2	Regional	8.02	152.50	152.99	152.87	153.06	0.003739	1.14	8.37	31.24	0.56
Reach-1A	208.2	100YR	3.25	152.50	152.73	152.73	152.81	0.016387	1.26	2.60	17.53	1.00
Reach-1A	208.2	50YR	2.88	152.50	152.72	152.72	152.80	0.016119	1.19	2.42	16.94	0.98
Reach-1A	208.2	25YR	2.53	152.50	152.71	152.71	152.78	0.017499	1.17	2.17	16.12	1.01
Reach-1A	208.2	10YR	1.99	152.50	152.69	152.69	152.75	0.017729	1.09	1.82	14.96	1.00
Reach-1A	208.2	5YR	1.65	152.50	152.67	152.67	152.72	0.017793	1.04	1.59	14.16	0.99
Reach-1A	208.2	2YR	1.05	152.50	152.63	152.63	152.68	0.019258	0.94	1.12	12.24	0.99
Reach-1A	208.15		Culvert									

HEC-RAS Plan: Ultiamte control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1A	208.1	Regional	8.02	152.50	152.94	152.78	152.99	0.002936	1.02	9.39	46.23	0.50
Reach-1A	208.1	100YR	3.25	152.50	152.71	152.66	152.75	0.006797	0.91	4.26	35.18	0.67
Reach-1A	208.1	50YR	2.88	152.50	152.69	152.65	152.73	0.006969	0.88	3.93	34.50	0.67
Reach-1A	208.1	25YR	2.53	152.50	152.68	152.64	152.71	0.007260	0.84	3.60	33.80	0.67
Reach-1A	208.1	10YR	1.99	152.50	152.65	152.62	152.68	0.008255	0.80	3.00	32.56	0.69
Reach-1A	208.1	5YR	1.65	152.50	152.64	152.61	152.66	0.008446	0.74	2.67	31.86	0.69
Reach-1A	208.1	2YR	1.05	152.50	152.58	152.58	152.62	0.025451	0.86	1.47	29.30	1.08
Reach-1A	208	Regional	8.02	151.00	152.19	152.19	152.42	0.010298	2.15	4.55	15.64	0.94
Reach-1A	208	100YR	3.25	151.00	152.04	151.91	152.11	0.005248	1.24	2.68	9.18	0.63
Reach-1A	208	50YR	2.88	151.00	152.01	151.88	152.08	0.005430	1.19	2.43	7.61	0.63
Reach-1A	208	25YR	2.53	151.00	151.97	151.84	152.04	0.005603	1.16	2.19	6.50	0.64
Reach-1A	208	10YR	1.99	151.00	151.91	151.77	151.97	0.005522	1.10	1.81	5.70	0.62
Reach-1A	208	5YR	1.65	151.00	151.85	151.71	151.91	0.006011	1.10	1.49	4.93	0.64
Reach-1A	208	2YR	1.05	151.00	151.81		151.84	0.003241	0.80	1.32	4.42	0.47
Reach-1A	207	Regional	8.02	150.25	151.12		151.15	0.003467	1.59	21.33	57.57	0.58
Reach-1A	207	100YR	3.25	150.25	150.88	150.88	150.95	0.006432	1.69	8.43	50.58	0.74
Reach-1A	207	50YR	2.88	150.25	150.87	150.87	150.93	0.005951	1.61	7.84	50.23	0.71
Reach-1A	207	25YR	2.53	150.25	150.85	150.85	150.91	0.005524	1.52	7.22	49.86	0.68
Reach-1A	207	10YR	1.99	150.25	150.83	150.83	150.89	0.005206	1.43	5.90	49.06	0.65
Reach-1A	207	5YR	1.65	150.25	150.81	150.81	150.87	0.004480	1.30	5.24	48.66	0.60
Reach-1A	207	2YR	1.05	150.25	150.69	150.69	150.79	0.009489	1.54	1.38	10.24	0.83
Reach-1A	206.3	Regional	9.44	149.49	150.49	150.47	150.69	0.005789	2.24	9.65	27.88	0.77
Reach-1A	206.3	100YR	3.91	149.49	150.26	150.10	150.37	0.003867	1.50	4.16	21.50	0.60
Reach-1A	206.3	50YR	3.47	149.49	150.23	150.07	150.33	0.003755	1.43	3.51	18.80	0.59
Reach-1A	206.3	25YR	3.05	149.49	150.20	150.03	150.29	0.003662	1.36	2.92	15.00	0.57
Reach-1A	206.3	10YR	2.41	149.49	150.14		150.21	0.003379	1.21	2.22	9.04	0.54
Reach-1A	206.3	5YR	1.96	149.49	150.09		150.15	0.003208	1.10	1.88	5.04	0.52
Reach-1A	206.3	2YR	1.24	149.49	149.99		150.03	0.002911	0.89	1.41	4.40	0.47
Reach-1A	206.2	Regional	9.44	149.25	150.17	150.17	150.37	0.008128	2.05	6.96	25.12	0.86
Reach-1A	206.2	100YR	3.91	149.25	149.89	149.89	150.05	0.013023	1.79	2.19	6.67	1.00
Reach-1A	206.2	50YR	3.47	149.25	149.85	149.85	150.01	0.013417	1.75	1.98	6.35	1.00
Reach-1A	206.2	25YR	3.05	149.25	149.82	149.82	149.97	0.013562	1.70	1.79	6.05	1.00
Reach-1A	206.2	10YR	2.41	149.25	149.77	149.77	149.91	0.014203	1.65	1.46	5.38	1.01
Reach-1A	206.2	5YR	1.96	149.25	149.72	149.72	149.85	0.014476	1.57	1.25	4.98	1.00
Reach-1A	206.2	2YR	1.24	149.25	149.64	149.64	149.75	0.015180	1.42	0.87	4.19	1.00
Reach-1A	206.15		Culvert									
Reach-1A	206.1	Regional	9.44	149.00	150.00	150.00	150.22	0.011026	2.44	7.90	30.06	0.98
Reach-1A	206.1	100YR	3.91	149.00	149.77	149.77	149.91	0.011173	1.82	3.77	20.21	0.91
Reach-1A	206.1	50YR	3.47	149.00	149.75	149.75	149.88	0.010629	1.72	3.47	18.91	0.88
Reach-1A	206.1	25YR	3.05	149.00	149.72	149.72	149.85	0.011365	1.69	3.00	16.55	0.90
Reach-1A	206.1	10YR	2.41	149.00	149.68	149.68	149.79	0.010889	1.54	2.47	14.37	0.87
Reach-1A	206.1	5YR	1.96	149.00	149.64	149.64	149.75	0.012891	1.51	1.87	12.06	0.92
Reach-1A	206.1	2YR	1.24	149.00	149.57	149.57	149.66	0.015143	1.34	1.13	8.80	0.95
Reach-1	205.1	Regional	16.97	148.20	149.17		149.25	0.003275	1.33	22.23	77.31	0.55
Reach-1	205.1	100YR	6.78	148.20	148.89		148.95	0.004707	1.14	6.34	24.96	0.61
Reach-1	205.1	50YR	6.00	148.20	148.85		148.92	0.004785	1.12	5.55	23.00	0.61
Reach-1	205.1	25YR	5.27	148.20	148.82		148.88	0.004863	1.09	4.90	17.46	0.61
Reach-1	205.1	10YR	4.17	148.20	148.76		148.82	0.004935	1.03	4.05	13.81	0.61
Reach-1	205.1	5YR	3.40	148.20	148.72		148.77	0.004889	0.97	3.49	12.88	0.60
Reach-1	205.1	2YR	2.17	148.20	148.64		148.68	0.004877	0.86	2.51	11.03	0.58
Reach-1	205	Regional	16.97	147.24	148.35	148.35	148.68	0.010632	2.53	6.70	10.25	1.00
Reach-1	205	100YR	6.78	147.24	148.00	148.00	148.20	0.012703	2.02	3.36	8.30	1.01
Reach-1	205	50YR	6.00	147.24	147.96	147.96	148.15	0.012966	1.96	3.07	8.10	1.01
Reach-1	205	25YR	5.27	147.24	147.93	147.93	148.11	0.013167	1.88	2.80	7.91	1.01
Reach-1	205	10YR	4.17	147.24	147.87	147.87	148.03	0.013710	1.77	2.36	7.59	1.01
Reach-1	205	5YR	3.40	147.24	147.82	147.82	147.97	0.014517	1.68	2.02	7.33	1.02
Reach-1	205	2YR	2.17	147.24	147.75	147.75	147.86	0.015631	1.48	1.47	6.81	1.02
Reach-1	204.75	Regional	16.97	146.00	147.47	147.28	147.67	0.004038	2.04	10.73	17.23	0.66
Reach-1	204.75	100YR	6.78	146.00	147.09	146.88	147.19	0.003611	1.39	5.07	11.87	0.57
Reach-1	204.75	50YR	6.00	146.00	147.05	146.83	147.14	0.003555	1.33	4.59	10.39	0.56
Reach-1	204.75	25YR	5.27	146.00	147.00	146.79	147.08	0.003488	1.27	4.16	7.74	0.55
Reach-1	204.75	10YR	4.17	146.00	146.93	146.72	146.99	0.003370	1.16	3.58	7.39	0.53
Reach-1	204.75	5YR	3.40	146.00	146.86	146.67	146.92	0.003283	1.08	3.13	7.06	0.52
Reach-1	204.75	2YR	2.17	146.00	146.74	146.56	146.79	0.003049	0.93	2.34	6.30	0.49
Reach-1	204.7	Regional	16.97	145.89	146.87	146.87	147.20	0.010243	2.56	6.80	12.46	0.99
Reach-1	204.7	100YR	6.78	145.89	146.51	146.51	146.72	0.012233	2.04	3.32	7.86	1.00
Reach-1	204.7	50YR	6.00	145.89	146.47	146.47	146.67	0.012505	2.00	3.00	7.49	1.01
Reach-1	204.7	25YR	5.27	145.89	146.43	146.43	146.62	0.012726	1.94	2.71	7.15	1.01

HEC-RAS Plan: Ultiamte control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	204.7	10YR	4.17	145.89	146.36	146.36	146.53	0.013232	1.84	2.26	6.67	1.01
Reach-1	204.7	5YR	3.40	145.89	146.31	146.31	146.47	0.013607	1.74	1.95	6.39	1.01
Reach-1	204.7	2YR	2.17	145.89	146.22	146.22	146.35	0.014640	1.55	1.40	5.76	1.01
Reach-1	204.55	Regional	16.97	145.49	146.73		146.89	0.003849	1.75	10.61	20.63	0.63
Reach-1	204.55	100YR	6.78	145.49	146.36		146.44	0.003999	1.31	5.19	10.44	0.59
Reach-1	204.55	50YR	6.00	145.49	146.32		146.40	0.003804	1.25	4.81	9.99	0.57
Reach-1	204.55	25YR	5.27	145.49	146.28		146.35	0.003648	1.19	4.42	9.50	0.56
Reach-1	204.55	10YR	4.17	145.49	146.21		146.27	0.003462	1.10	3.80	8.92	0.54
Reach-1	204.55	5YR	3.40	145.49	146.15		146.21	0.003492	1.03	3.30	8.58	0.53
Reach-1	204.55	2YR	2.17	145.49	146.04		146.08	0.003642	0.91	2.39	7.73	0.52
Reach-1	204.5	Regional	16.97	145.36	146.48	146.48	146.77	0.009095	2.39	8.14	21.77	0.93
Reach-1	204.5	100YR	6.78	145.36	146.23		146.35	0.006224	1.52	4.46	10.63	0.73
Reach-1	204.5	50YR	6.00	145.36	146.21		146.31	0.005795	1.42	4.22	10.01	0.69
Reach-1	204.5	25YR	5.27	145.36	146.17		146.27	0.005616	1.36	3.88	9.52	0.68
Reach-1	204.5	10YR	4.17	145.36	146.11		146.19	0.005233	1.25	3.35	8.85	0.65
Reach-1	204.5	5YR	3.40	145.36	146.05		146.13	0.005450	1.20	2.83	8.14	0.65
Reach-1	204.5	2YR	2.17	145.36	145.94		146.00	0.005792	1.11	1.96	6.71	0.65
Reach-1	204.25	Regional	16.97	145.11	146.28	146.28	146.51	0.008508	2.35	13.16	30.69	0.90
Reach-1	204.25	100YR	6.78	145.11	145.98	145.98	146.15	0.009367	1.88	5.00	22.84	0.89
Reach-1	204.25	50YR	6.00	145.11	145.94	145.94	146.11	0.010324	1.88	4.03	19.02	0.92
Reach-1	204.25	25YR	5.27	145.11	145.89	145.89	146.07	0.010724	1.85	3.30	15.67	0.93
Reach-1	204.25	10YR	4.17	145.11	145.80	145.80	145.98	0.013077	1.92	2.18	7.09	1.01
Reach-1	204.25	5YR	3.40	145.11	145.74	145.74	145.91	0.013521	1.84	1.84	5.45	1.01
Reach-1	204.25	2YR	2.17	145.11	145.63	145.63	145.77	0.014363	1.68	1.29	4.60	1.01
Reach-1	204	Regional	17.26	144.05	145.05	145.05	145.32	0.009548	2.75	13.32	24.93	0.99
Reach-1	204	100YR	6.95	144.05	144.77	144.77	144.94	0.008843	1.98	6.70	23.01	0.89
Reach-1	204	50YR	6.16	144.05	144.73	144.73	144.90	0.009497	1.95	5.84	22.28	0.91
Reach-1	204	25YR	5.43	144.05	144.70	144.70	144.86	0.009828	1.89	5.12	21.12	0.91
Reach-1	204	10YR	4.31	144.05	144.65	144.65	144.79	0.010278	1.77	4.04	19.26	0.91
Reach-1	204	5YR	3.48	144.05	144.61	144.61	144.73	0.010465	1.66	3.26	17.80	0.90
Reach-1	204	2YR	2.23	144.05	144.53	144.53	144.63	0.011570	1.46	1.97	14.86	0.91
Reach-1	203	Regional	17.41	142.50	144.75		144.79	0.000600	0.97	26.98	36.04	0.27
Reach-1	203	100YR	7.04	142.50	143.66	143.66	143.86	0.013112	2.00	3.52	8.85	1.01
Reach-1	203	50YR	6.24	142.50	143.53	143.53	143.81	0.013375	2.34	2.67	5.25	1.05
Reach-1	203	25YR	5.49	142.50	143.49	143.49	143.74	0.012385	2.21	2.48	5.01	1.00
Reach-1	203	10YR	4.37	142.50	143.40	143.40	143.63	0.013021	2.13	2.05	4.55	1.01
Reach-1	203	5YR	3.52	142.50	143.33	143.33	143.54	0.013109	2.02	1.74	4.19	1.00
Reach-1	203	2YR	2.25	142.50	143.19	143.19	143.37	0.014335	1.87	1.20	3.48	1.01
Reach-1	202.75	Regional	17.41	142.43	144.45	143.71	144.71	0.001846	2.24	7.78	34.22	0.50
Reach-1	202.75	100YR	7.04	142.43	143.53	143.13	143.67	0.002261	1.66	4.25	26.73	0.50
Reach-1	202.75	50YR	6.24	142.43	143.45	143.07	143.58	0.002323	1.59	3.92	24.96	0.50
Reach-1	202.75	25YR	5.49	142.43	143.37	143.02	143.48	0.002391	1.52	3.60	22.54	0.50
Reach-1	202.75	10YR	4.37	142.43	143.23	142.94	143.34	0.002516	1.41	3.09	18.71	0.50
Reach-1	202.75	5YR	3.52	142.43	143.13	142.87	143.21	0.002641	1.31	2.68	16.81	0.50
Reach-1	202.75	2YR	2.25	142.43	142.95	142.76	143.01	0.002919	1.13	1.99	13.62	0.50
Reach-1	202.5		Culvert									
Reach-1	202.25	Regional	17.41	142.28	143.56	143.56	144.20	0.015842	3.54	4.91	3.97	1.00
Reach-1	202.25	100YR	7.04	142.28	142.98	142.98	143.33	0.014945	2.61	2.69	3.85	1.00
Reach-1	202.25	50YR	6.24	142.28	142.93	142.93	143.25	0.014984	2.51	2.48	3.85	1.00
Reach-1	202.25	25YR	5.49	142.28	142.87	142.87	143.17	0.015129	2.41	2.27	3.85	1.00
Reach-1	202.25	10YR	4.37	142.28	142.79	142.79	143.04	0.015213	2.24	1.95	3.85	1.00
Reach-1	202.25	5YR	3.52	142.28	142.74	142.72	142.94	0.013423	1.99	1.77	3.85	0.94
Reach-1	202.25	2YR	2.25	142.28	142.68	142.61	142.79	0.008222	1.45	1.55	3.85	0.73
Reach-1	202	Regional	17.41	142.20	143.23		143.28	0.001353	1.15	28.78	49.24	0.39
Reach-1	202	100YR	7.04	142.20	142.66	142.66	142.81	0.012141	1.78	5.23	24.04	0.98
Reach-1	202	50YR	6.24	142.20	142.64	142.64	142.77	0.011840	1.69	4.77	22.30	0.96
Reach-1	202	25YR	5.49	142.20	142.62	142.62	142.74	0.011349	1.59	4.37	21.55	0.93
Reach-1	202	10YR	4.37	142.20	142.58	142.58	142.69	0.012086	1.50	3.54	20.21	0.93
Reach-1	202	5YR	3.52	142.20	142.55	142.55	142.64	0.012200	1.39	2.96	19.27	0.92
Reach-1	202	2YR	2.25	142.20	142.48	142.48	142.57	0.015587	1.27	1.80	13.50	0.99
Reach-1	201	Regional	17.41	141.65	143.21		143.24	0.000431	0.89	37.16	39.44	0.23
Reach-1	201	100YR	7.04	141.65	142.60		142.62	0.000681	0.78	14.93	31.90	0.27
Reach-1	201	50YR	6.24	141.65	142.52		142.55	0.000790	0.79	12.58	30.69	0.29
Reach-1	201	25YR	5.49	141.65	142.49		142.52	0.000717	0.73	11.70	30.07	0.27
Reach-1	201	10YR	4.37	141.65	142.39		142.42	0.000812	0.70	8.86	25.49	0.28
Reach-1	201	5YR	3.52	141.65	142.33		142.35	0.000777	0.64	7.37	22.81	0.27
Reach-1	201	2YR	2.25	141.65	142.25		142.26	0.000579	0.50	5.57	19.12	0.23
Reach-1	171	Regional	28.90	141.65	142.97	142.70	143.11	0.002516	1.90	27.97	37.97	0.55

HEC-RAS Plan: Ultiamte control (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1	171	100YR	8.17	141.65	142.44	142.21	142.50	0.002213	1.21	9.98	27.36	0.47
Reach-1	171	50YR	6.60	141.65	142.36	142.15	142.42	0.002210	1.13	8.15	24.25	0.46
Reach-1	171	25YR	6.10	141.65	142.34	142.13	142.40	0.002202	1.10	7.58	23.20	0.46
Reach-1	171	10YR	4.37	141.65	142.25	142.05	142.29	0.002182	0.97	5.57	19.13	0.44
Reach-1	171	5YR	3.52	141.65	142.19	142.01	142.23	0.002166	0.89	4.59	16.80	0.43
Reach-1	171	2YR	2.57	141.65	142.12	141.95	142.15	0.002101	0.79	3.54	13.88	0.41
Reach-1	170		Bridge									
Reach-1	169	Regional	28.90	141.65	142.70	142.70	142.99	0.007134	2.71	18.27	33.54	0.89
Reach-1	169	100YR	8.17	141.65	142.21	142.21	142.40	0.009752	1.96	4.98	17.76	0.92
Reach-1	169	50YR	6.60	141.65	142.15	142.15	142.32	0.010567	1.86	3.98	15.15	0.94
Reach-1	169	25YR	6.10	141.65	142.13	142.13	142.30	0.011146	1.83	3.63	14.16	0.95
Reach-1	169	10YR	4.37	141.65	142.05	142.05	142.19	0.013010	1.69	2.63	10.71	0.99
Reach-1	169	5YR	3.52	141.65	142.01	142.01	142.13	0.014215	1.59	2.21	8.88	1.01
Reach-1	169	2YR	2.57	141.65	141.95	141.95	142.06	0.014892	1.45	1.77	8.23	1.00
Reach-1	164	Regional	28.90	138.30	139.25		139.39	0.007256	1.51	18.32	23.62	0.61
Reach-1	164	100YR	8.17	138.30	138.83		138.86	0.002624	0.51	10.37	14.75	0.32
Reach-1	164	50YR	6.60	138.30	138.74		138.76	0.002349	0.41	9.12	13.62	0.29
Reach-1	164	25YR	6.10	138.30	138.69		138.72	0.002374	0.38	8.50	12.97	0.29
Reach-1	164	10YR	4.37	138.30	138.54		138.56	0.002100	0.28	6.77	10.44	0.25
Reach-1	164	5YR	3.52	138.30	138.46		138.47	0.001886	0.19	5.92	9.30	0.22
Reach-1	164	2YR	2.57	138.30	138.34		138.36	0.001562	0.07	4.96	7.74	0.16
Reach-1	163	Regional	28.90	137.20	138.47		138.55	0.005133	1.90	30.33	59.32	0.57
Reach-1	163	100YR	8.17	137.20	138.08	137.99	138.23	0.009915	1.99	7.75	50.21	0.74
Reach-1	163	50YR	6.60	137.20	138.02	137.97	138.17	0.010628	1.93	5.32	22.77	0.76
Reach-1	163	25YR	6.10	137.20	137.99	137.97	138.13	0.010185	1.84	4.82	15.66	0.74
Reach-1	163	10YR	4.37	137.20	137.90	137.86	138.02	0.009858	1.65	3.61	13.13	0.71
Reach-1	163	5YR	3.52	137.20	137.84	137.80	137.96	0.010879	1.59	2.82	11.19	0.73
Reach-1	163	2YR	2.57	137.20	137.74	137.72	137.86	0.015146	1.60	1.81	8.05	0.82
Reach-1	162	Regional	28.90	135.60	136.76	136.76	137.01	0.016983	3.06	16.52	33.14	1.02
Reach-1	162	100YR	8.17	135.60	136.46		136.55	0.008365	1.65	8.05	23.23	0.67
Reach-1	162	50YR	6.60	135.60	136.42	136.32	136.49	0.007713	1.51	7.02	21.71	0.63
Reach-1	162	25YR	6.10	135.60	136.39		136.46	0.007886	1.48	6.54	20.96	0.64
Reach-1	162	10YR	4.37	135.60	136.32		136.38	0.007899	1.34	5.01	18.41	0.62
Reach-1	162	5YR	3.52	135.60	136.28		136.33	0.007036	1.21	4.42	17.31	0.58
Reach-1	162	2YR	2.57	135.60	136.25		136.28	0.005238	0.99	3.87	16.23	0.49
Reach-1	161	Regional	28.90	134.10	135.30	135.17	135.36	0.005788	1.77	31.56	67.18	0.58
Reach-1	161	100YR	8.17	134.10	134.98	134.98	135.07	0.008814	1.68	10.93	62.89	0.67
Reach-1	161	50YR	6.60	134.10	134.95	134.95	135.03	0.009136	1.64	8.64	54.87	0.68
Reach-1	161	25YR	6.10	134.10	134.94	134.94	135.02	0.008737	1.59	8.14	52.96	0.66
Reach-1	161	10YR	4.37	134.10	134.89	134.89	134.97	0.008112	1.44	5.85	43.08	0.63
Reach-1	161	5YR	3.52	134.10	134.85	134.85	134.93	0.008870	1.43	4.23	34.42	0.65
Reach-1	161	2YR	2.57	134.10	134.76	134.69	134.87	0.012829	1.52	2.03	16.61	0.76
Reach-1	160	Regional	28.90	132.50	134.02		134.06	0.003131	1.45	37.31	64.17	0.42
Reach-1	160	100YR	8.17	132.50	133.61		133.64	0.002166	0.99	15.54	41.27	0.33
Reach-1	160	50YR	6.60	132.50	133.54		133.57	0.002221	0.96	12.79	37.14	0.33
Reach-1	160	25YR	6.10	132.50	133.52	133.29	133.54	0.002198	0.94	11.99	35.85	0.33
Reach-1	160	10YR	4.37	132.50	133.41		133.44	0.002411	0.92	8.52	29.61	0.34
Reach-1	160	5YR	3.52	132.50	133.35		133.38	0.002582	0.91	6.73	25.80	0.35
Reach-1	160	2YR	2.57	132.50	133.28		133.30	0.002499	0.84	5.01	21.54	0.34

14 MILE CREEK WEST 14W-11A

HEC-RAS MODEL RESULTS FOR

EXISTING, PHASE 1A AND 1B CONDITION

(Controlled flow rate)

- **14W-11 (Reach 1B)**
- **14W-11A (Reach 1B)**

HEC-RAS Plan: 00-Existing_Phase 1A_Phase 1B River: RIVER-1 Reach: Reach-1B

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1B	14	Regional	3.06	154.75	155.22		155.29	0.004399	1.17	3.51	15.65	0.60
Reach-1B	14	100 Yr	1.53	154.75	155.13		155.16	0.002941	0.79	2.24	11.81	0.47
Reach-1B	14	50 Yr	1.35	154.75	155.12		155.14	0.002739	0.74	2.07	11.21	0.45
Reach-1B	14	25 Yr	1.17	154.75	155.09		155.12	0.002691	0.70	1.84	10.35	0.44
Reach-1B	14	10 Yr	0.91	154.75	155.07		155.09	0.002333	0.61	1.59	9.30	0.40
Reach-1B	14	5 Yr	0.73	154.75	155.05		155.06	0.002083	0.54	1.40	8.42	0.37
Reach-1B	14	2 Yr	0.42	154.75	155.00		155.01	0.001683	0.40	1.04	6.41	0.32
Reach-1B	13	Regional	3.06	154.75	155.17		155.20	0.002853	0.79	4.63	22.86	0.46
Reach-1B	13	100 Yr	1.53	154.75	155.08		155.10	0.002532	0.58	2.79	17.45	0.41
Reach-1B	13	50 Yr	1.35	154.75	155.07		155.08	0.002510	0.55	2.55	16.61	0.40
Reach-1B	13	25 Yr	1.17	154.75	155.01		155.04	0.005704	0.67	1.75	13.42	0.58
Reach-1B	13	10 Yr	0.91	154.75	154.99		155.01	0.005909	0.62	1.46	12.17	0.57
Reach-1B	13	5 Yr	0.73	154.75	154.97		154.99	0.006144	0.60	1.22	11.12	0.58
Reach-1B	13	2 Yr	0.42	154.75	154.93		154.94	0.005531	0.50	0.84	9.22	0.53
Reach-1B	12.1	Regional	3.06	154.46	154.66	154.65	154.72	0.015778	1.09	2.81	21.24	0.95
Reach-1B	12.1	100 Yr	1.53	154.46	154.60	154.59	154.64	0.017575	0.92	1.66	17.32	0.95
Reach-1B	12.1	50 Yr	1.35	154.46	154.59	154.59	154.63	0.017547	0.89	1.52	16.79	0.94
Reach-1B	12.1	25 Yr	1.17	154.46	154.64	154.58	154.65	0.003566	0.49	2.41	19.95	0.45
Reach-1B	12.1	10 Yr	0.91	154.46	154.62	154.56	154.63	0.003448	0.45	2.04	18.70	0.43
Reach-1B	12.1	5 Yr	0.73	154.46	154.61	154.55	154.61	0.003248	0.41	1.78	17.78	0.41
Reach-1B	12.1	2 Yr	0.42	154.46	154.57		154.58	0.003422	0.35	1.19	15.46	0.41
Reach-1B	12	Regional	3.06	153.95	154.15	154.08	154.17	0.003316	0.61	5.32	32.39	0.46
Reach-1B	12	100 Yr	1.53	153.95	154.10	154.04	154.11	0.003108	0.45	3.49	30.71	0.42
Reach-1B	12	50 Yr	1.35	153.95	154.09	154.04	154.10	0.003084	0.43	3.24	30.46	0.41
Reach-1B	12	25 Yr	1.17	153.95	154.04	154.03	154.06	0.018384	0.69	1.70	28.96	0.90
Reach-1B	12	10 Yr	0.91	153.95	154.03	154.03	154.05	0.018796	0.63	1.45	28.71	0.89
Reach-1B	12	5 Yr	0.73	153.95	154.02	154.02	154.04	0.021098	0.60	1.22	28.48	0.92
Reach-1B	12	2 Yr	0.42	153.95	154.01	154.00	154.02	0.016608	0.45	0.94	28.19	0.78
Reach-1B	11.1	Regional	3.06	152.98	153.10	153.10	153.16	0.018353	1.05	3.00	27.89	1.00
Reach-1B	11.1	100 Yr	1.53	152.98	153.06	153.06	153.10	0.021263	0.83	1.86	26.99	1.00
Reach-1B	11.1	50 Yr	1.35	152.98	153.06	153.06	153.09	0.021738	0.80	1.71	26.87	1.00
Reach-1B	11.1	25 Yr	1.17	152.98	153.10	153.05	153.11	0.003021	0.42	2.89	27.80	0.40
Reach-1B	11.1	10 Yr	0.91	152.98	153.08	153.05	153.09	0.002951	0.37	2.49	27.49	0.39
Reach-1B	11.1	5 Yr	0.73	152.98	153.07	153.03	153.08	0.002892	0.34	2.18	27.25	0.38
Reach-1B	11.1	2 Yr	0.42	152.98	153.05	153.02	153.05	0.003245	0.28	1.50	26.70	0.38
Reach-1B	11	Regional	3.06	152.00	152.76		152.76	0.000034	0.16	22.46	35.52	0.06
Reach-1B	11	100 Yr	1.53	152.00	152.52		152.52	0.000031	0.12	14.52	31.85	0.05
Reach-1B	11	50 Yr	1.35	152.00	152.21		152.21	0.000507	0.27	5.35	26.99	0.18
Reach-1B	11	25 Yr	1.17	152.00	152.06	152.06	152.09	0.022054	0.78	1.52	24.68	1.00
Reach-1B	11	10 Yr	0.91	152.00	152.05	152.05	152.08	0.023305	0.72	1.28	24.53	1.00
Reach-1B	11	5 Yr	0.73	152.00	152.05	152.05	152.07	0.024744	0.67	1.10	24.42	1.00
Reach-1B	11	2 Yr	0.42	152.00	152.04	152.04	152.05	0.017862	0.49	0.87	24.27	0.82
Reach-1B	10	Regional	3.79	150.20	152.76		152.76	0.000004	0.13	56.28	37.58	0.03
Reach-1B	10	100 Yr	2.06	150.20	152.52		152.52	0.000002	0.08	47.77	34.95	0.02
Reach-1B	10	50 Yr	1.82	150.20	152.21		152.21	0.000003	0.08	37.47	31.47	0.02
Reach-1B	10	25 Yr	1.58	150.20	151.92		151.92	0.000004	0.09	28.70	28.05	0.02
Reach-1B	10	10 Yr	1.24	150.20	151.63		151.63	0.000005	0.09	21.26	24.44	0.02
Reach-1B	10	5 Yr	1.01	150.20	151.49		151.49	0.000005	0.08	17.95	22.65	0.02
Reach-1B	10	2 Yr	0.59	150.20	151.23		151.23	0.000004	0.06	12.47	19.33	0.02
Reach-1B	9	Regional	3.79	149.70	152.74	150.91	152.75	0.001388	0.49	7.76	30.58	0.31
Reach-1B	9	100 Yr	2.06	149.70	152.48	150.50	152.51	0.000153	0.81	2.53	28.93	0.16
Reach-1B	9	50 Yr	1.82	149.70	152.17	150.44	152.20	0.000177	0.81	2.25	26.99	0.16
Reach-1B	9	25 Yr	1.58	149.70	151.88	150.37	151.91	0.000203	0.80	1.98	25.15	0.17
Reach-1B	9	10 Yr	1.24	149.70	151.60	150.27	151.63	0.000197	0.72	1.73	23.43	0.17
Reach-1B	9	5 Yr	1.01	149.70	151.47	150.20	151.49	0.000166	0.63	1.61	22.60	0.15
Reach-1B	9	2 Yr	0.59	149.70	151.22	150.05	151.23	0.000094	0.43	1.38	21.05	0.11
Reach-1B	8.5		Culvert									
Reach-1B	8	Regional	3.79	149.30	150.51	150.51	151.13	0.008348	3.47	1.09	24.66	1.00
Reach-1B	8	100 Yr	2.06	149.30	150.11	150.11	150.52	0.009577	2.83	0.73	20.19	1.01
Reach-1B	8	50 Yr	1.82	149.30	150.04	150.04	150.42	0.009844	2.72	0.67	19.49	1.01
Reach-1B	8	25 Yr	1.58	149.30	149.98	149.98	150.32	0.010144	2.59	0.61	18.46	1.00
Reach-1B	8	10 Yr	1.24	149.30	149.88	149.88	150.17	0.010720	2.39	0.52	16.03	1.01
Reach-1B	8	5 Yr	1.01	149.30	149.80	149.80	150.06	0.011173	2.23	0.45	14.28	1.00
Reach-1B	8	2 Yr	0.59	149.30	149.65	149.65	149.83	0.012651	1.87	0.32	10.63	1.01
Reach-1B	7	Regional	3.79	147.50	147.85	147.77	147.90	0.005406	0.98	3.88	15.42	0.62
Reach-1B	7	100 Yr	2.06	147.50	147.76	147.69	147.79	0.005407	0.81	2.55	13.51	0.59

HEC-RAS Plan: 00-Existing_Phase 1A_Phase 1B River: RIVER-1 Reach: Reach-1B (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1B	7	50 Yr	1.82	147.50	147.74	147.68	147.77	0.005407	0.78	2.34	13.03	0.59
Reach-1B	7	25 Yr	1.58	147.50	147.73	147.66	147.75	0.005406	0.75	2.11	12.52	0.58
Reach-1B	7	10 Yr	1.24	147.50	147.70	147.64	147.72	0.005405	0.70	1.78	11.72	0.57
Reach-1B	7	5 Yr	1.01	147.50	147.68	147.62	147.70	0.005400	0.66	1.54	11.12	0.56
Reach-1B	7	2 Yr	0.59	147.50	147.63	147.59	147.65	0.005409	0.56	1.06	9.78	0.54

14 MILE CREEK WEST 14W-11A

HEC-RAS MODEL RESULTS FOR

PHASE 2 AND ULTIMATE CONDITION

(Controlled flow rate)

- **14W-11 (Reach 1B)**
- **14W-23 (Reach 1B)**

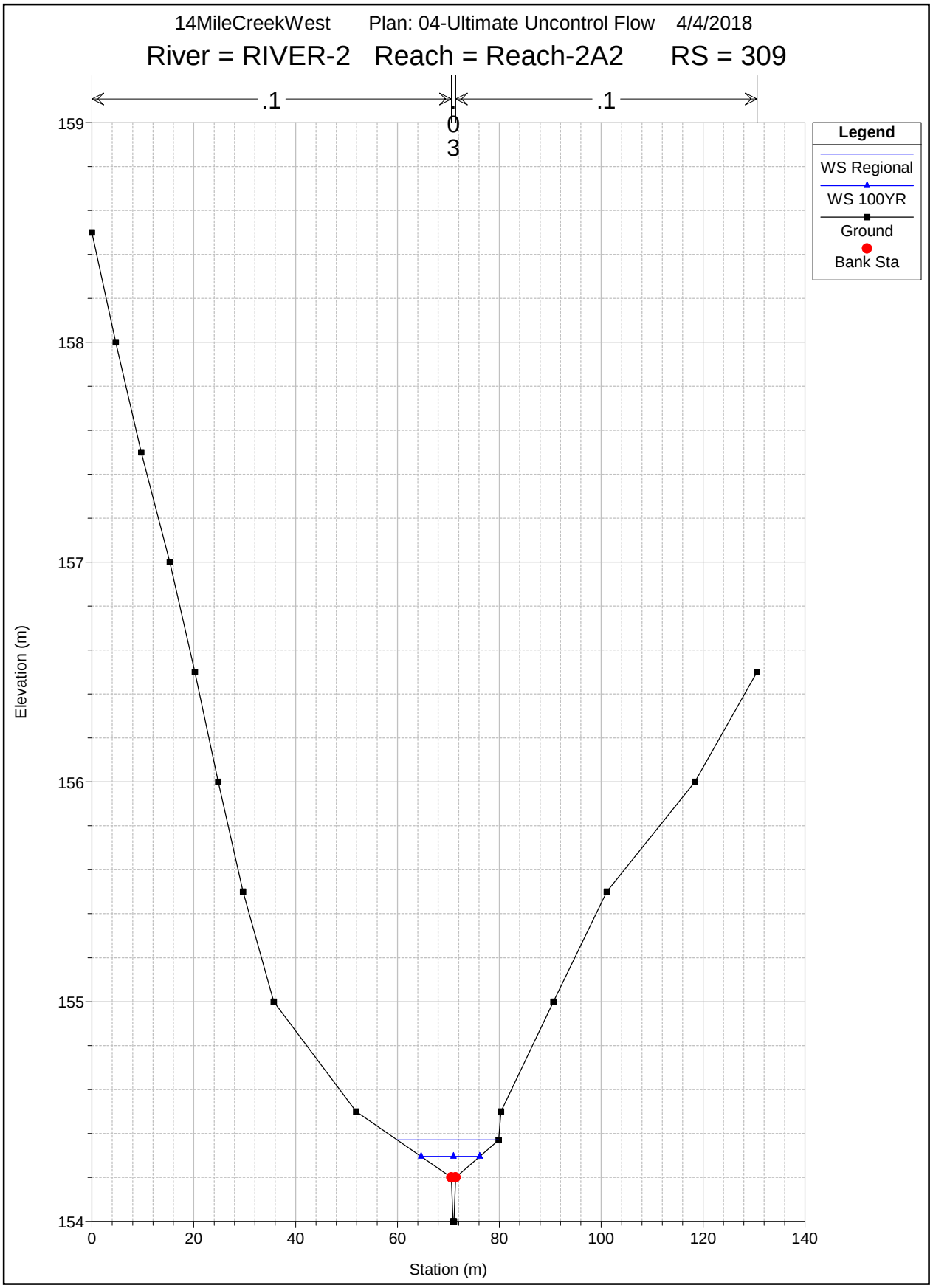
HEC-RAS Plan: 01-Phase 2 and Ultimate River: RIVER-1 Reach: Reach-1B

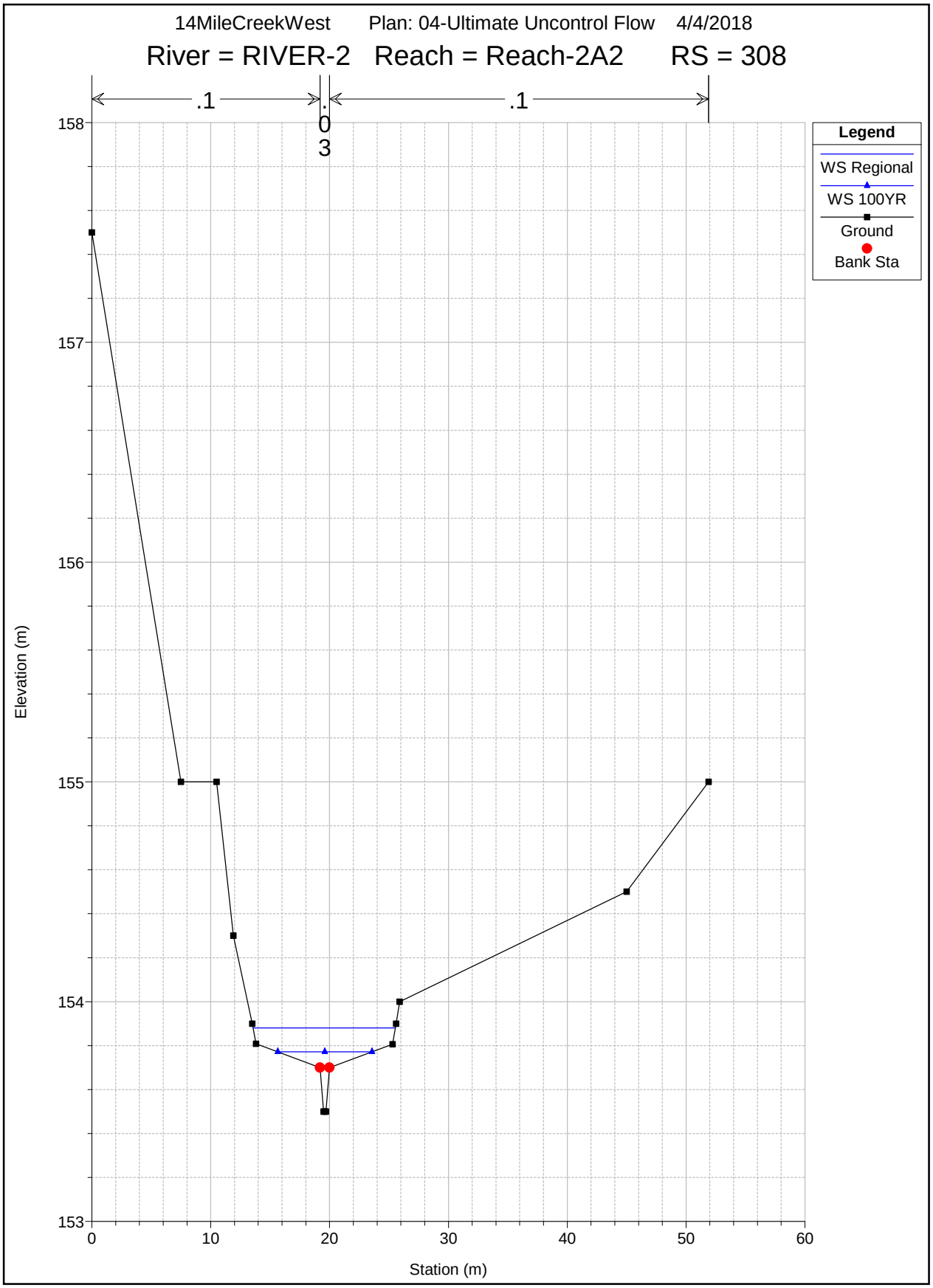
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1B	14	Regional	2.69	154.75	155.20		155.26	0.004390	1.11	3.11	14.56	0.59
Reach-1B	14	100 Yr	1.27	154.75	155.10		155.13	0.002797	0.73	1.94	10.75	0.45
Reach-1B	14	50 Yr	1.12	154.75	155.09		155.11	0.002572	0.68	1.81	10.22	0.43
Reach-1B	14	25 Yr	0.97	154.75	155.08		155.10	0.002361	0.62	1.67	9.62	0.41
Reach-1B	14	10 Yr	0.75	154.75	155.05		155.07	0.002106	0.54	1.43	8.53	0.38
Reach-1B	14	5 Yr	0.60	154.75	155.03		155.04	0.001915	0.48	1.26	7.66	0.35
Reach-1B	14	2 Yr	0.34	154.75	154.98		154.99	0.001433	0.36	0.94	6.14	0.29
Reach-1B	13	Regional	2.69	154.75	155.11		155.15	0.005224	0.91	3.26	18.98	0.60
Reach-1B	13	100 Yr	1.27	154.75	155.01		155.04	0.006901	0.73	1.73	13.36	0.63
Reach-1B	13	50 Yr	1.12	154.75	155.00		155.03	0.007128	0.70	1.59	12.69	0.64
Reach-1B	13	25 Yr	0.97	154.75	154.98		155.01	0.007654	0.70	1.39	11.87	0.65
Reach-1B	13	10 Yr	0.75	154.75	154.96		154.98	0.008749	0.69	1.09	10.51	0.68
Reach-1B	13	5 Yr	0.60	154.75	154.94		154.96	0.010056	0.69	0.88	9.42	0.72
Reach-1B	13	2 Yr	0.34	154.75	154.89		154.92	0.012836	0.65	0.52	7.27	0.78
Reach-1B	12.9	Regional	2.69	154.20	154.92		154.93	0.003442	0.93	9.94	36.41	0.35
Reach-1B	12.9	100 Yr	1.27	154.20	154.79		154.80	0.003475	0.82	5.65	29.19	0.34
Reach-1B	12.9	50 Yr	1.12	154.20	154.77		154.78	0.003486	0.80	5.12	28.18	0.34
Reach-1B	12.9	25 Yr	0.97	154.20	154.75		154.76	0.003474	0.78	4.52	25.90	0.34
Reach-1B	12.9	10 Yr	0.75	154.20	154.71		154.72	0.003466	0.74	3.57	21.85	0.33
Reach-1B	12.9	5 Yr	0.60	154.20	154.67		154.68	0.003468	0.71	2.87	18.31	0.33
Reach-1B	12.9	2 Yr	0.34	154.20	154.61		154.62	0.003354	0.63	1.83	15.66	0.31
Reach-1B	12.8	Regional	2.69	153.99	154.71		154.72	0.003399	0.92	10.00	36.60	0.35
Reach-1B	12.8	100 Yr	1.27	153.99	154.58		154.59	0.003367	0.81	5.72	29.38	0.33
Reach-1B	12.8	50 Yr	1.12	153.99	154.56		154.57	0.003437	0.80	5.15	28.29	0.34
Reach-1B	12.8	25 Yr	0.97	153.99	154.54		154.55	0.003441	0.77	4.54	26.04	0.33
Reach-1B	12.8	10 Yr	0.75	153.99	154.50		154.51	0.003445	0.74	3.58	21.94	0.33
Reach-1B	12.8	5 Yr	0.60	153.99	154.46		154.47	0.003443	0.70	2.88	18.39	0.33
Reach-1B	12.8	2 Yr	0.34	153.99	154.39		154.40	0.003677	0.65	1.76	15.63	0.33
Reach-1B	12.7	Regional	2.69	153.78	154.50		154.51	0.003468	0.93	9.90	36.21	0.35
Reach-1B	12.7	100 Yr	1.27	153.78	154.37		154.38	0.003443	0.81	5.66	29.14	0.34
Reach-1B	12.7	50 Yr	1.12	153.78	154.35		154.36	0.003376	0.79	5.18	28.23	0.33
Reach-1B	12.7	25 Yr	0.97	153.78	154.33		154.34	0.003385	0.77	4.56	26.05	0.33
Reach-1B	12.7	10 Yr	0.75	153.78	154.29		154.30	0.003371	0.73	3.61	22.03	0.33
Reach-1B	12.7	5 Yr	0.60	153.78	154.26		154.26	0.003373	0.70	2.91	18.52	0.32
Reach-1B	12.7	2 Yr	0.34	153.78	154.20		154.20	0.002974	0.60	1.91	15.69	0.30
Reach-1B	12.6	Regional	2.69	153.55	154.27		154.28	0.003478	0.93	9.93	36.62	0.35
Reach-1B	12.6	100 Yr	1.27	153.55	154.14		154.15	0.003477	0.82	5.66	29.34	0.34
Reach-1B	12.6	50 Yr	1.12	153.55	154.12		154.13	0.003668	0.82	5.02	27.92	0.35
Reach-1B	12.6	25 Yr	0.97	153.55	154.10		154.11	0.003674	0.80	4.41	25.57	0.34
Reach-1B	12.6	10 Yr	0.75	153.55	154.06		154.07	0.003724	0.76	3.45	21.35	0.34
Reach-1B	12.6	5 Yr	0.60	153.55	154.02		154.03	0.003730	0.73	2.77	17.75	0.34
Reach-1B	12.6	2 Yr	0.34	153.55	153.95		153.96	0.004456	0.71	1.63	15.58	0.36
Reach-1B	12.5	Regional	2.69	153.32	154.05		154.06	0.003048	0.88	11.11	43.22	0.33
Reach-1B	12.5	100 Yr	1.27	153.32	153.92		153.93	0.003033	0.77	6.14	32.33	0.32
Reach-1B	12.5	50 Yr	1.12	153.32	153.92		153.92	0.002507	0.70	5.98	31.80	0.29
Reach-1B	12.5	25 Yr	0.97	153.32	153.89		153.90	0.002508	0.68	5.27	29.29	0.29
Reach-1B	12.5	10 Yr	0.75	153.32	153.85		153.86	0.002497	0.65	4.19	24.98	0.28
Reach-1B	12.5	5 Yr	0.60	153.32	153.82		153.83	0.002391	0.61	3.46	21.63	0.27
Reach-1B	12.5	2 Yr	0.34	153.32	153.75		153.75	0.002201	0.53	2.14	15.78	0.26
Reach-1B	12.4	Regional	2.69	153.14	153.76	153.67	153.79	0.010559	1.48	6.76	33.55	0.60
Reach-1B	12.4	100 Yr	1.27	153.14	153.66	153.58	153.68	0.008314	1.16	3.87	23.21	0.51
Reach-1B	12.4	50 Yr	1.12	153.14	153.57	153.57	153.63	0.022384	1.69	2.19	15.80	0.82
Reach-1B	12.4	25 Yr	0.97	153.14	153.56	153.56	153.61	0.020069	1.57	2.05	15.74	0.77
Reach-1B	12.4	10 Yr	0.75	153.14	153.55	153.55	153.59	0.016044	1.38	1.84	15.66	0.69
Reach-1B	12.4	5 Yr	0.60	153.14	153.53	153.53	153.57	0.014714	1.29	1.59	15.57	0.65
Reach-1B	12.4	2 Yr	0.34	153.14	153.50	153.50	153.53	0.010663	1.04	1.11	15.38	0.55
Reach-1B	11.1	Regional	2.69	152.98	153.09	153.09	153.14	0.018584	1.00	2.75	27.70	0.99
Reach-1B	11.1	100 Yr	1.27	152.98	153.05	153.05	153.08	0.022091	0.78	1.64	26.81	1.00
Reach-1B	11.1	50 Yr	1.12	152.98	153.10	153.05	153.10	0.002979	0.41	2.82	27.75	0.40
Reach-1B	11.1	25 Yr	0.97	152.98	153.09	153.04	153.10	0.002962	0.38	2.58	27.57	0.39
Reach-1B	11.1	10 Yr	0.75	152.98	153.07	153.03	153.08	0.002885	0.34	2.22	27.28	0.38
Reach-1B	11.1	5 Yr	0.60	152.98	153.06	153.03	153.07	0.002788	0.31	1.96	27.07	0.36
Reach-1B	11.1	2 Yr	0.34	152.98	153.04	153.01	153.05	0.002614	0.24	1.41	26.62	0.33
Reach-1B	11	Regional	2.69	152.00	152.73		152.73	0.000031	0.15	21.40	35.05	0.06
Reach-1B	11	100 Yr	1.27	152.00	152.14		152.15	0.001617	0.37	3.58	25.95	0.31
Reach-1B	11	50 Yr	1.12	152.00	152.06	152.06	152.09	0.022700	0.78	1.47	24.65	1.01
Reach-1B	11	25 Yr	0.97	152.00	152.06	152.06	152.08	0.023211	0.74	1.33	24.56	1.00

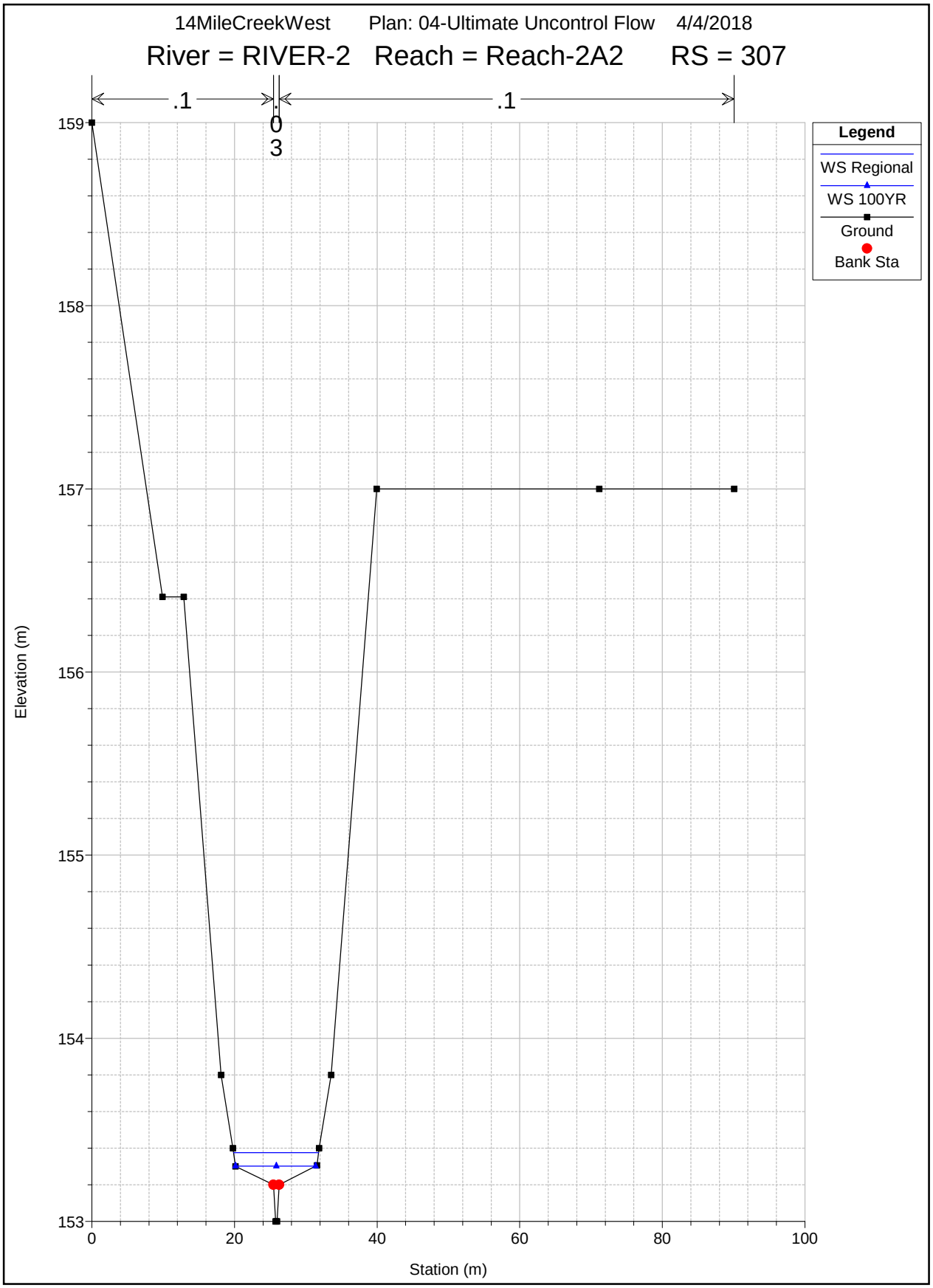
HEC-RAS Plan: 01-Phase 2 and Ultimate River: RIVER-1 Reach: Reach-1B (Continued)

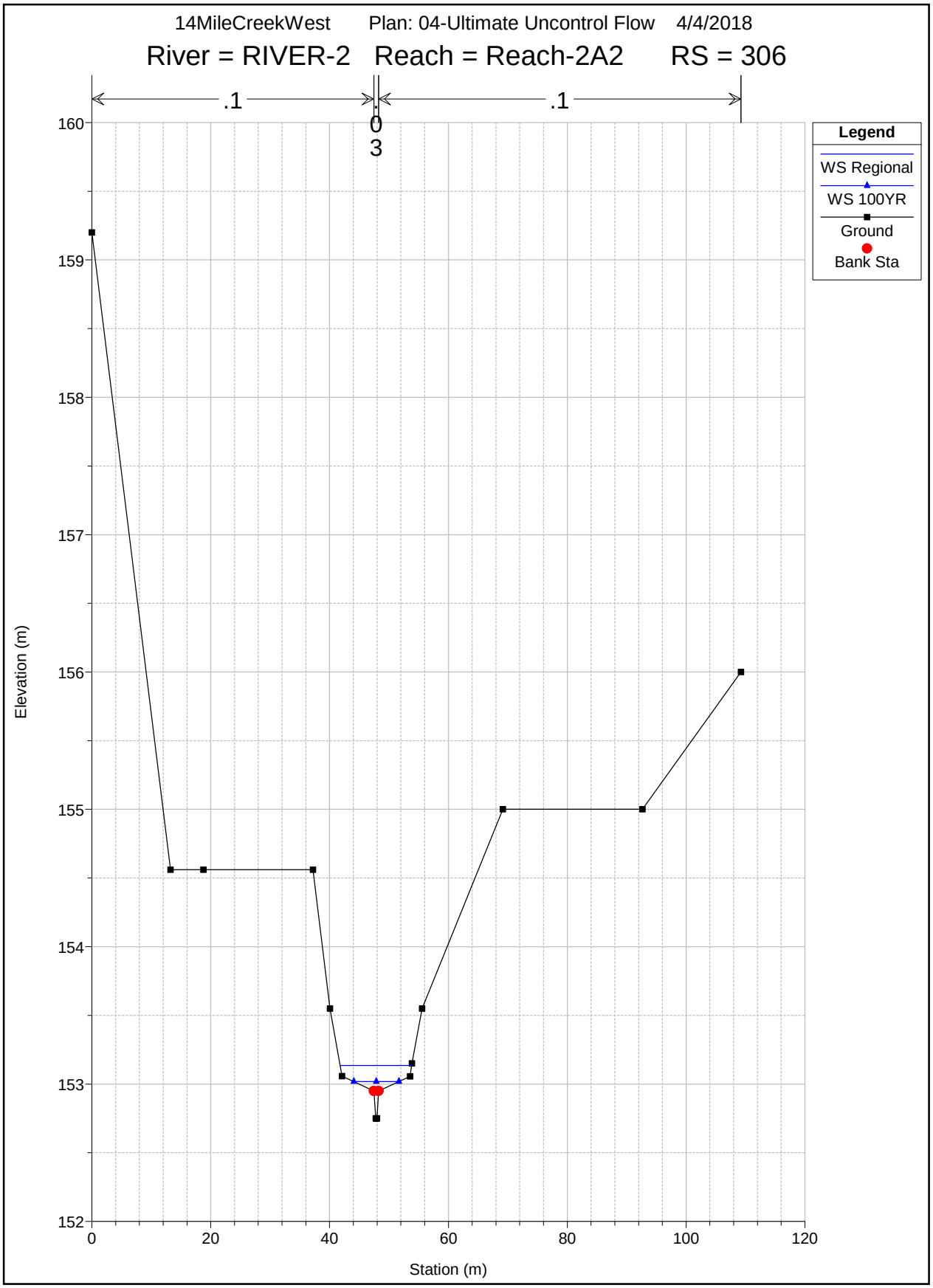
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach-1B	11	10 Yr	0.75	152.00	152.05	152.05	152.07	0.024965	0.68	1.12	24.43	1.01
Reach-1B	11	5 Yr	0.60	152.00	152.04	152.04	152.06	0.027484	0.64	0.95	24.32	1.03
Reach-1B	11	2 Yr	0.34	152.00	152.03	152.03	152.04	0.033778	0.54	0.63	24.11	1.07
Reach-1B	10	Regional	3.38	150.20	152.73		152.73	0.000004	0.11	55.17	37.24	0.02
Reach-1B	10	100 Yr	1.77	150.20	152.15		152.15	0.000003	0.08	35.44	30.74	0.02
Reach-1B	10	50 Yr	1.56	150.20	151.90		151.90	0.000004	0.09	28.14	27.80	0.02
Reach-1B	10	25 Yr	1.35	150.20	151.71		151.71	0.000005	0.09	23.10	25.39	0.02
Reach-1B	10	10 Yr	1.06	150.20	151.52		151.52	0.000005	0.08	18.62	23.03	0.02
Reach-1B	10	5 Yr	0.86	150.20	151.40		151.40	0.000004	0.07	15.98	21.52	0.02
Reach-1B	10	2 Yr	0.50	150.20	151.17		151.17	0.000004	0.06	11.26	18.51	0.02
Reach-1B	9	Regional	3.38	149.70	152.71	150.82	152.72	0.001665	0.49	6.84	30.39	0.33
Reach-1B	9	100 Yr	1.77	149.70	152.10	150.43	152.14	0.000183	0.81	2.19	26.58	0.17
Reach-1B	9	50 Yr	1.56	149.70	151.86	150.37	151.89	0.000204	0.80	1.96	25.03	0.17
Reach-1B	9	25 Yr	1.35	149.70	151.67	150.31	151.70	0.000206	0.75	1.79	23.87	0.17
Reach-1B	9	10 Yr	1.06	149.70	151.50	150.22	151.52	0.000174	0.65	1.63	22.77	0.15
Reach-1B	9	5 Yr	0.86	149.70	151.38	150.15	151.40	0.000142	0.56	1.53	22.07	0.14
Reach-1B	9	2 Yr	0.50	149.70	151.16	150.01	151.17	0.000077	0.38	1.33	20.66	0.10
Reach-1B	8.5		Culvert									
Reach-1B	8	Regional	3.38	149.30	150.42	150.42	150.99	0.008583	3.34	1.01	23.67	1.01
Reach-1B	8	100 Yr	1.77	149.30	150.03	150.03	150.40	0.009904	2.69	0.66	19.34	1.01
Reach-1B	8	50 Yr	1.56	149.30	149.97	149.97	150.31	0.010169	2.58	0.60	18.33	1.00
Reach-1B	8	25 Yr	1.35	149.30	149.91	149.91	150.22	0.010499	2.46	0.55	16.85	1.00
Reach-1B	8	10 Yr	1.06	149.30	149.82	149.82	150.08	0.011081	2.27	0.47	14.66	1.00
Reach-1B	8	5 Yr	0.86	149.30	149.75	149.75	149.98	0.011609	2.11	0.41	13.04	1.00
Reach-1B	8	2 Yr	0.50	149.30	149.61	149.61	149.77	0.013117	1.77	0.28	9.75	1.01
Reach-1B	7	Regional	3.38	147.50	147.83	147.76	147.88	0.005410	0.94	3.59	15.02	0.62
Reach-1B	7	100 Yr	1.77	147.50	147.74	147.67	147.77	0.005406	0.77	2.29	12.93	0.59
Reach-1B	7	50 Yr	1.56	147.50	147.72	147.66	147.75	0.005406	0.74	2.09	12.48	0.58
Reach-1B	7	25 Yr	1.35	147.50	147.71	147.65	147.73	0.005407	0.71	1.89	11.99	0.57
Reach-1B	7	10 Yr	1.06	147.50	147.68	147.63	147.70	0.005408	0.67	1.59	11.25	0.56
Reach-1B	7	5 Yr	0.86	147.50	147.66	147.61	147.68	0.005401	0.62	1.38	10.68	0.56
Reach-1B	7	2 Yr	0.50	147.50	147.62	147.58	147.63	0.005400	0.53	0.95	9.44	0.53

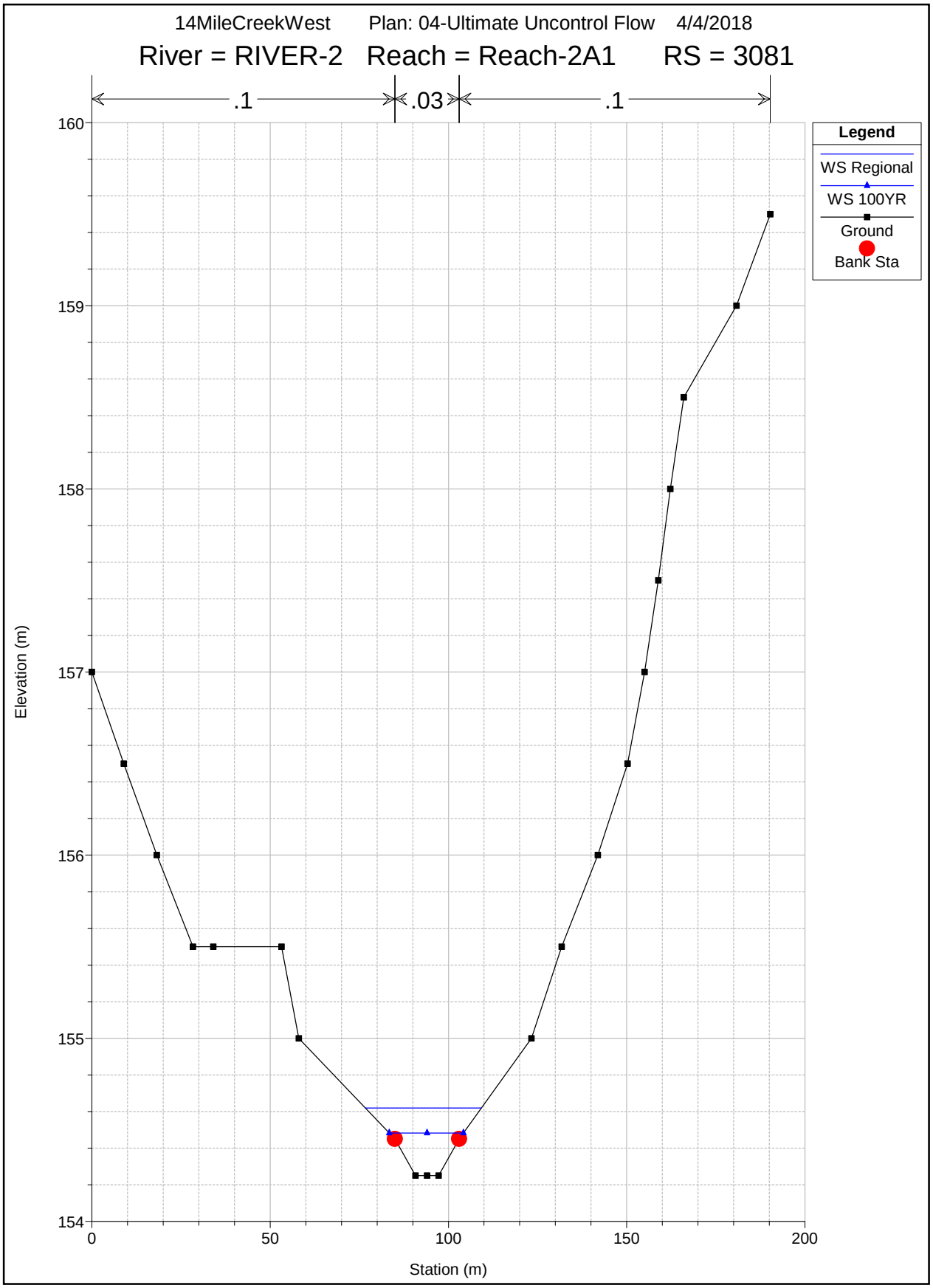
Appendix 6.2 – Proposed Cross Sections

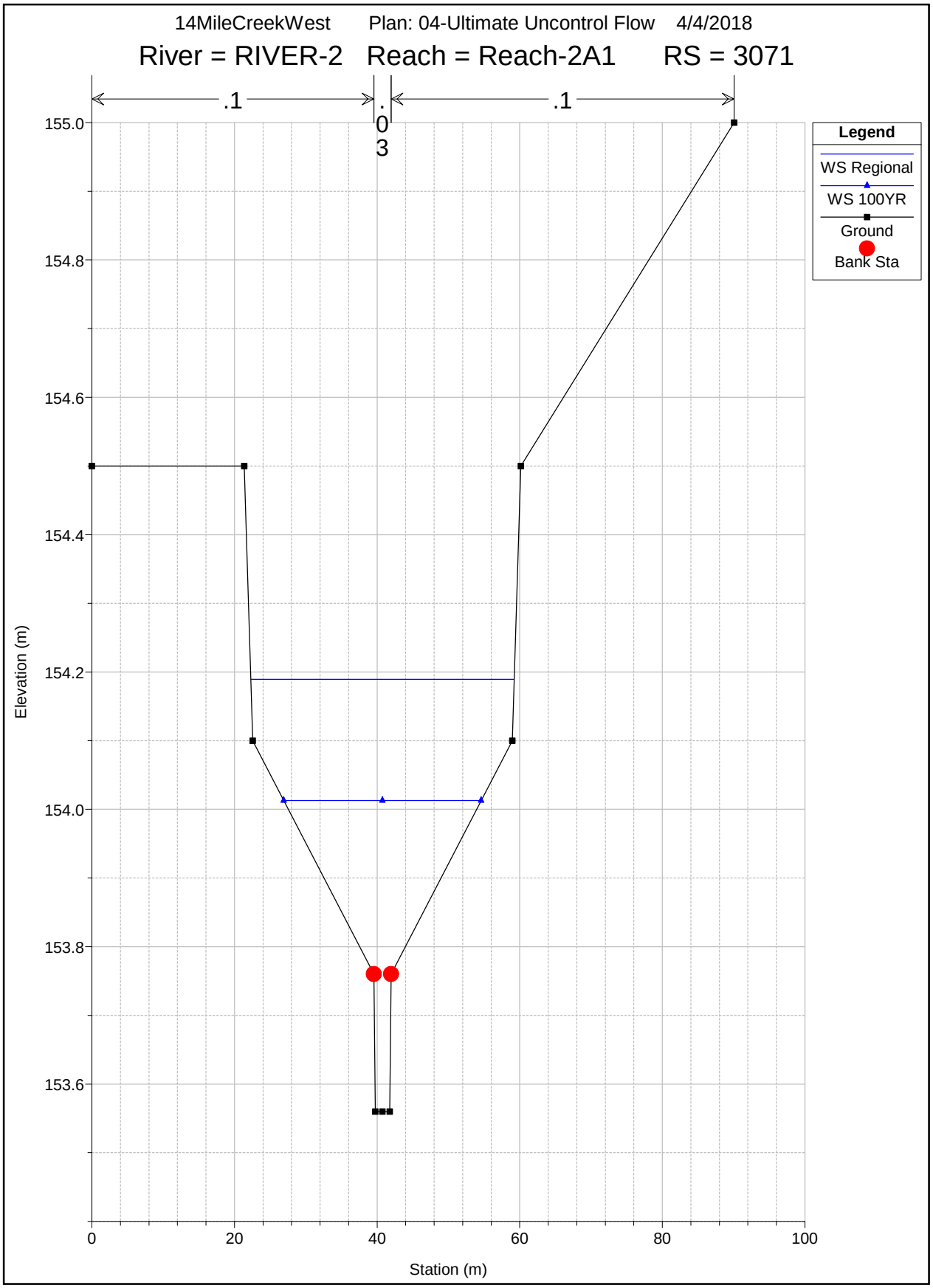

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A2 RS = 309
.1
0
3
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
159
158
157
156
155
154
0
20
40
60
80
100
120
140
Station (m)

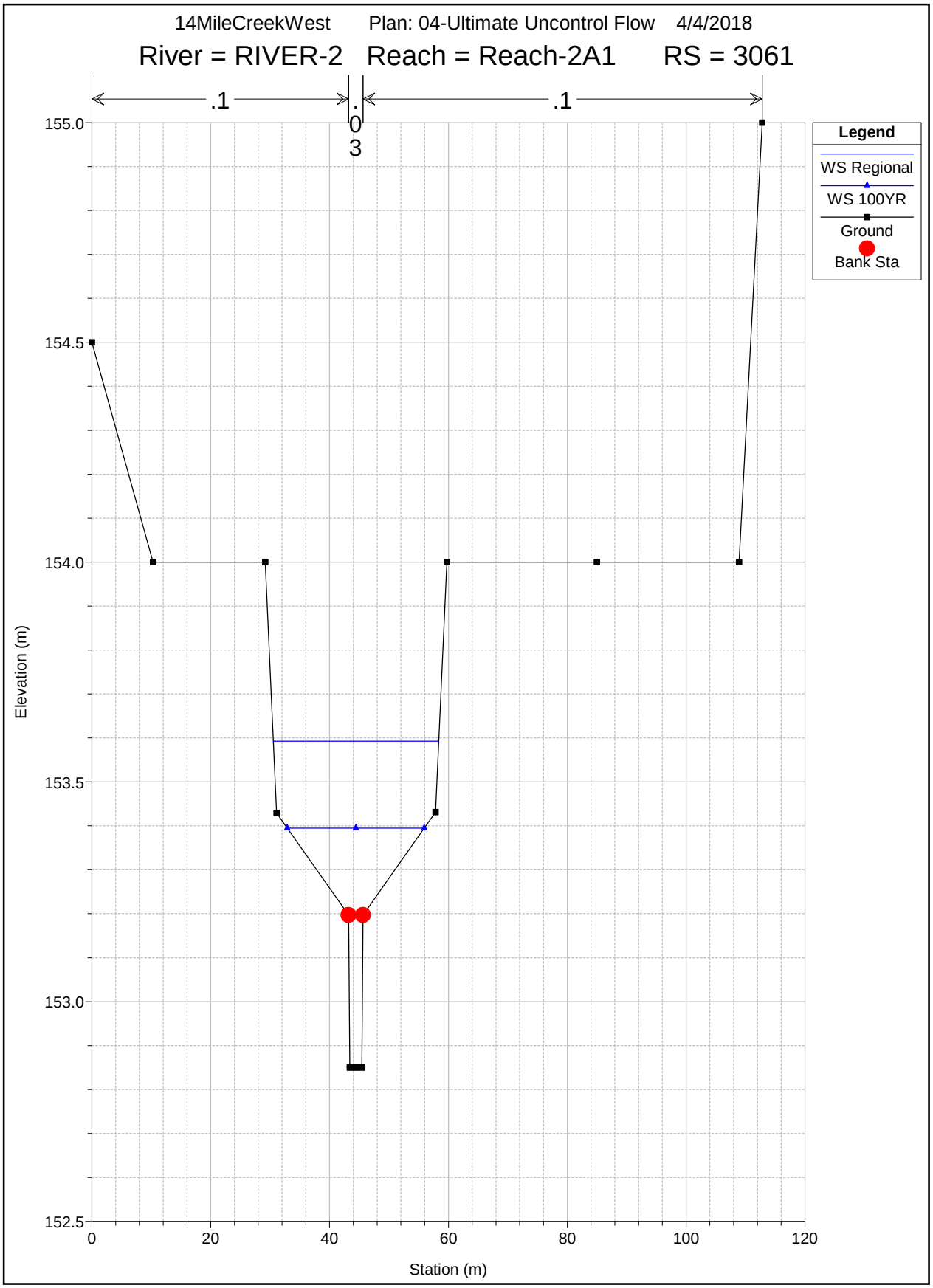

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A2 RS = 308
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
158
157
156
155
154
153
0
10
20
30
40
50
60

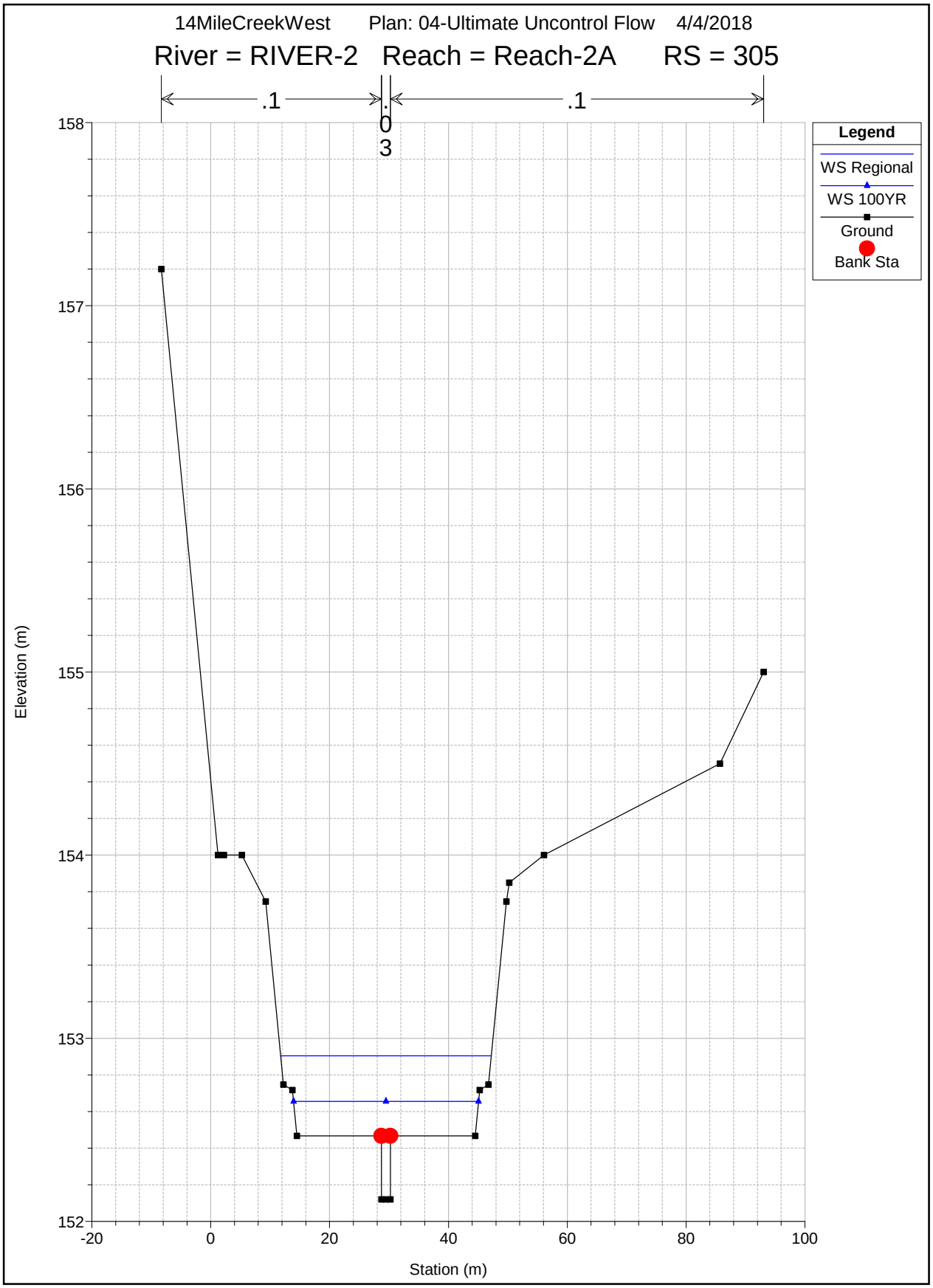

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A2 RS = 307
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
159
158
157
156
155
154
153
0
20
40
60
80
100

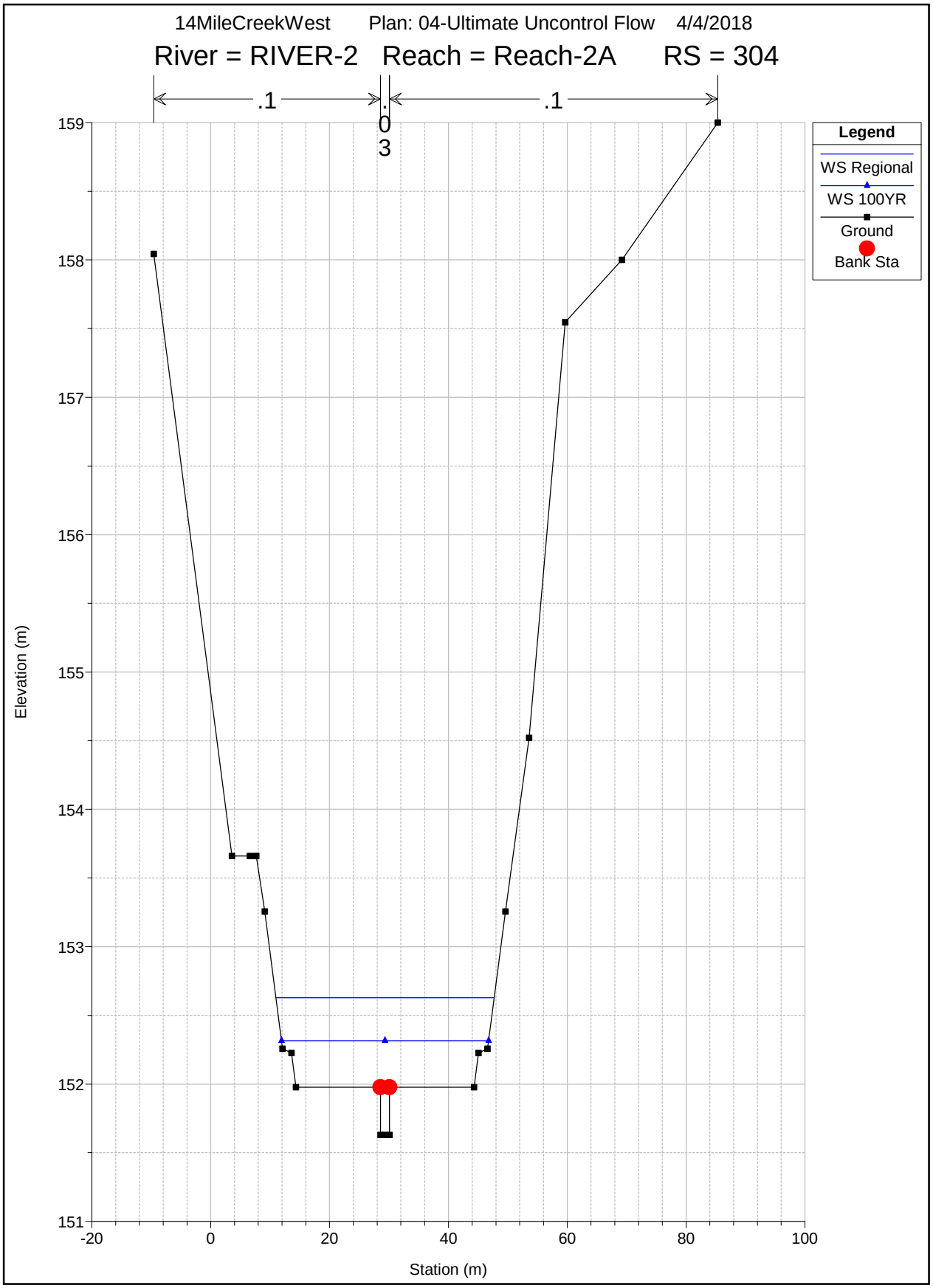

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A2 RS = 306
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
160
159
158
157
156
155
154
153
152
0
20
40
60
80
100
120

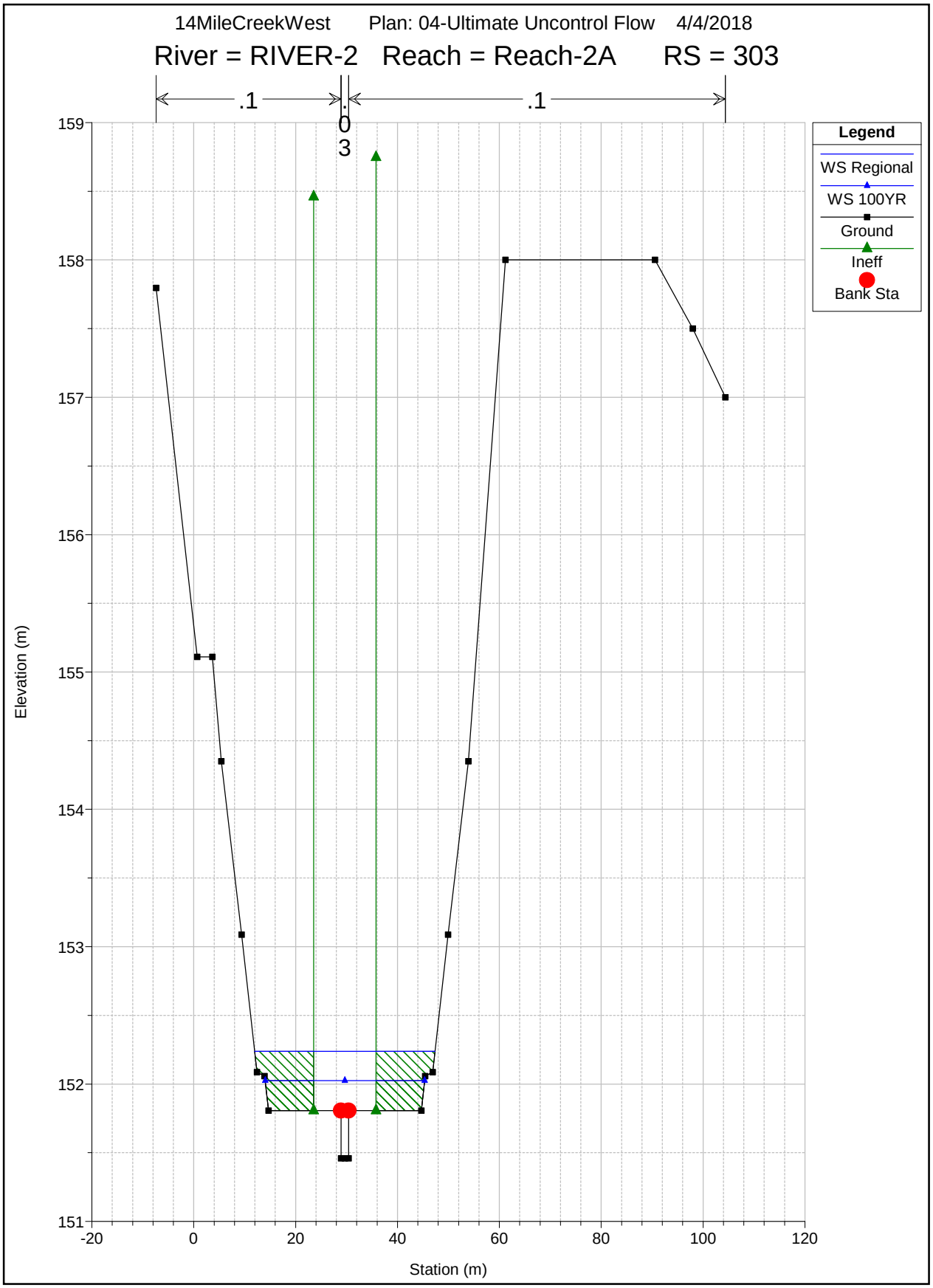

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A1 RS = 3081
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
160
159
158
157
156
155
154
0
50
100
150
200
Station (m)

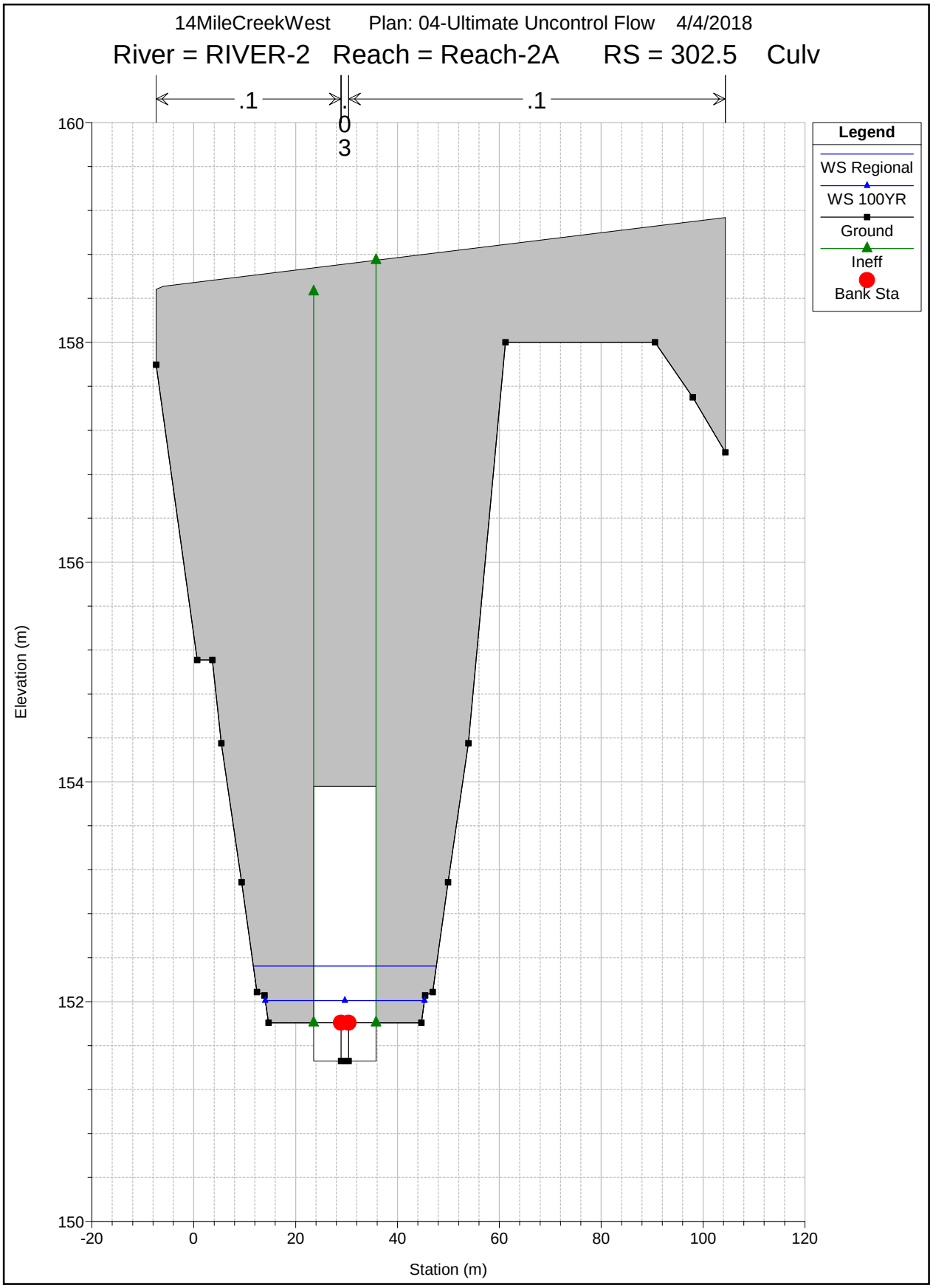

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A1 RS = 3071
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
155.0
154.8
154.6
154.4
154.2
154.0
153.8
153.6
Elevation (m)
0
20
40
60
80
100
Station (m)

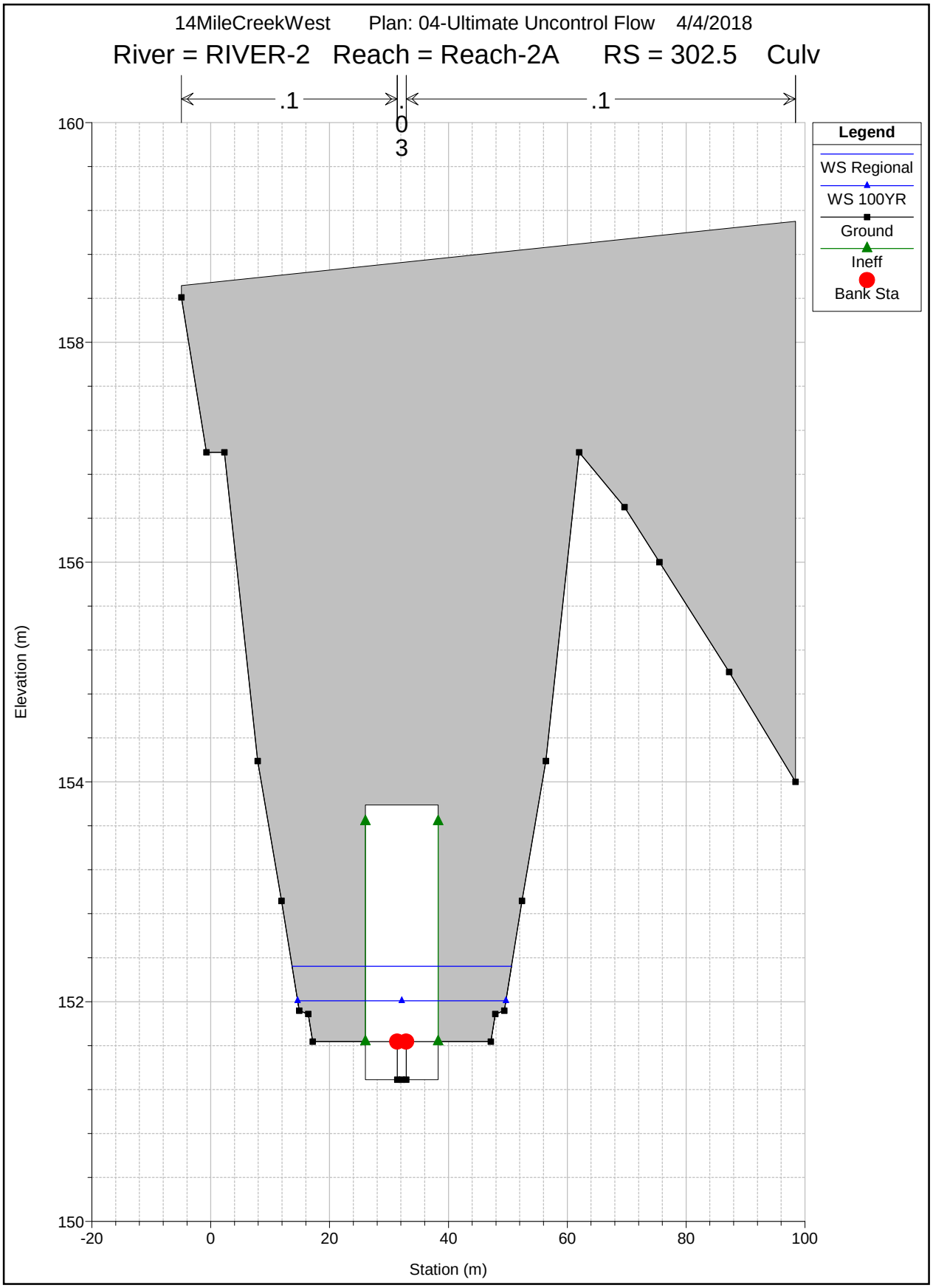

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A1 RS = 3061
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
155.0
154.5
154.0
153.5
153.0
152.5
Elevation (m)
0
20
40
60
80
100
120
Station (m)

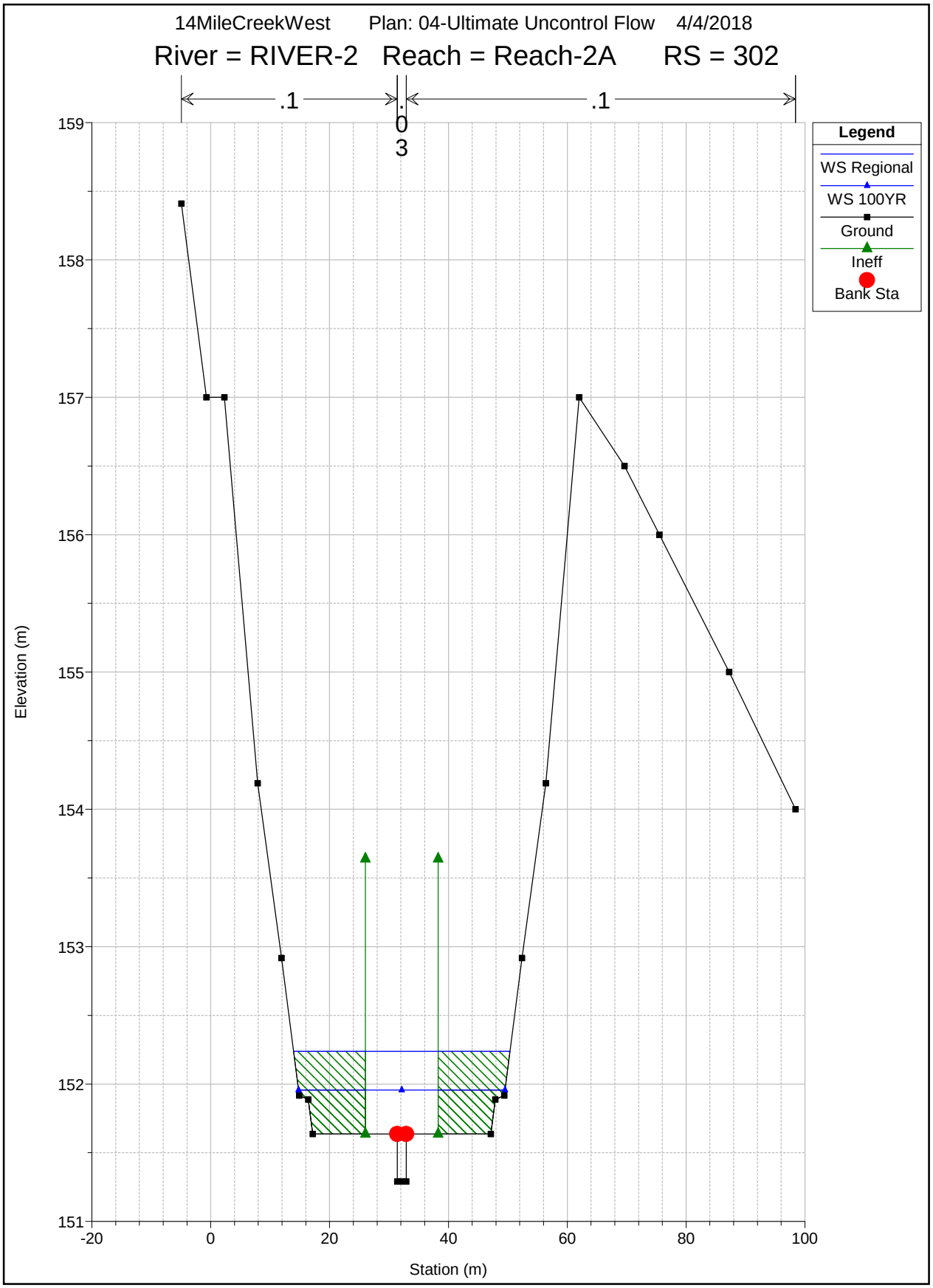

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 305
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
158
157
156
155
154
153
152
-20
0
20
40
60
80
100

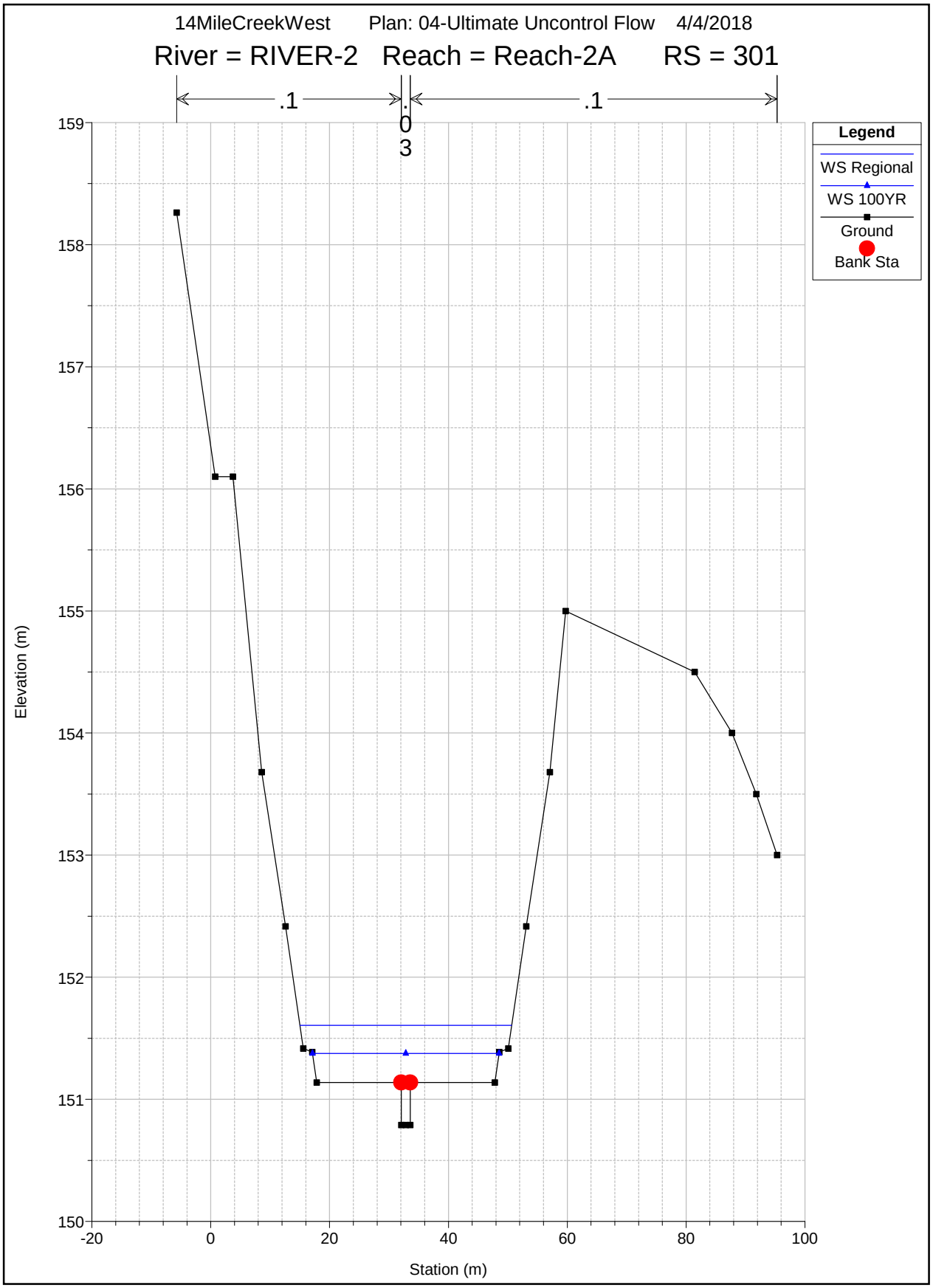

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 304
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
159
158
157
156
155
154
153
152
151
-20
0
20
40
60
80
100

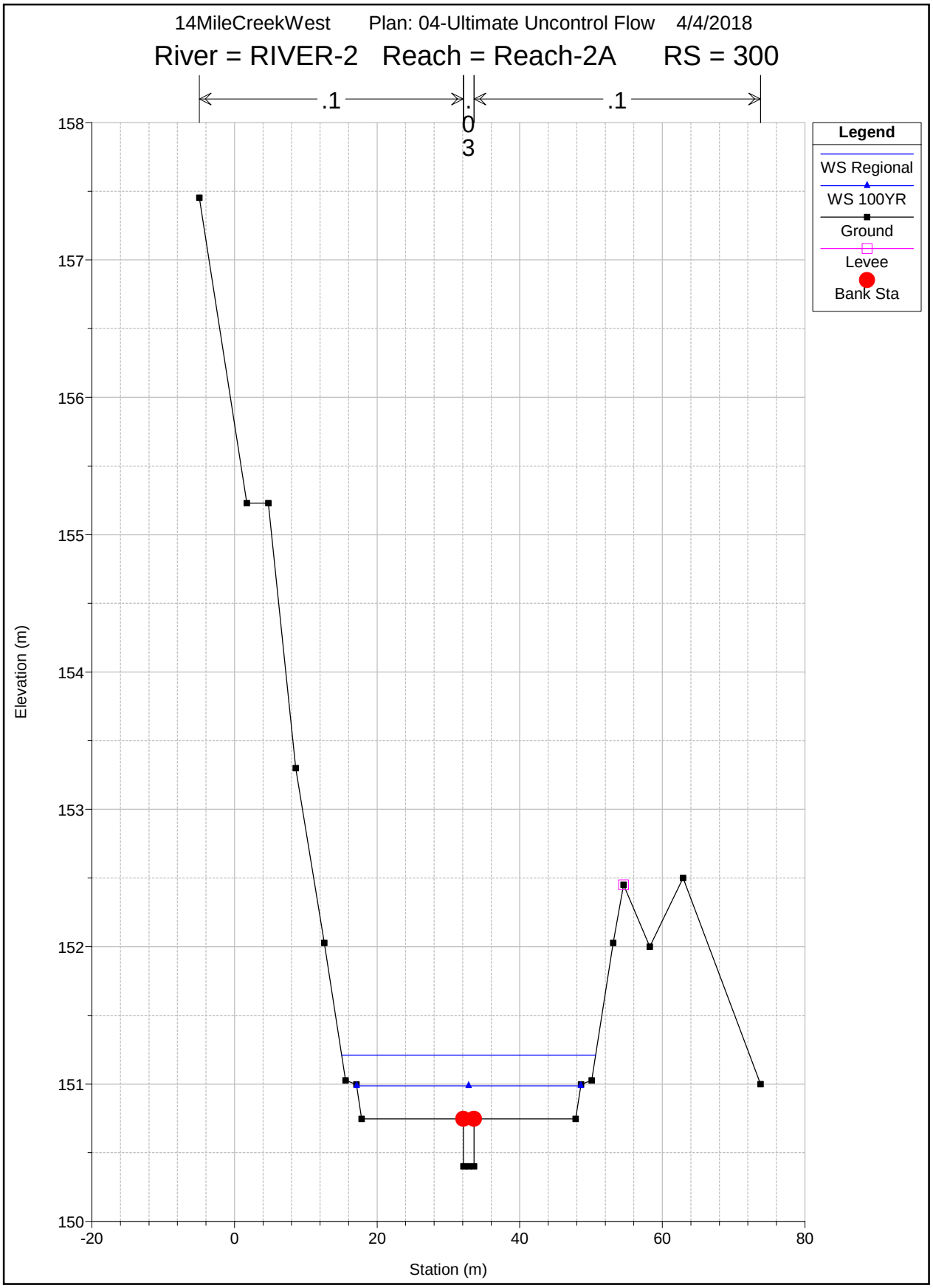

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 303
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
159
158
157
156
155
154
153
152
151
-20
0
20
40
60
80
100
120

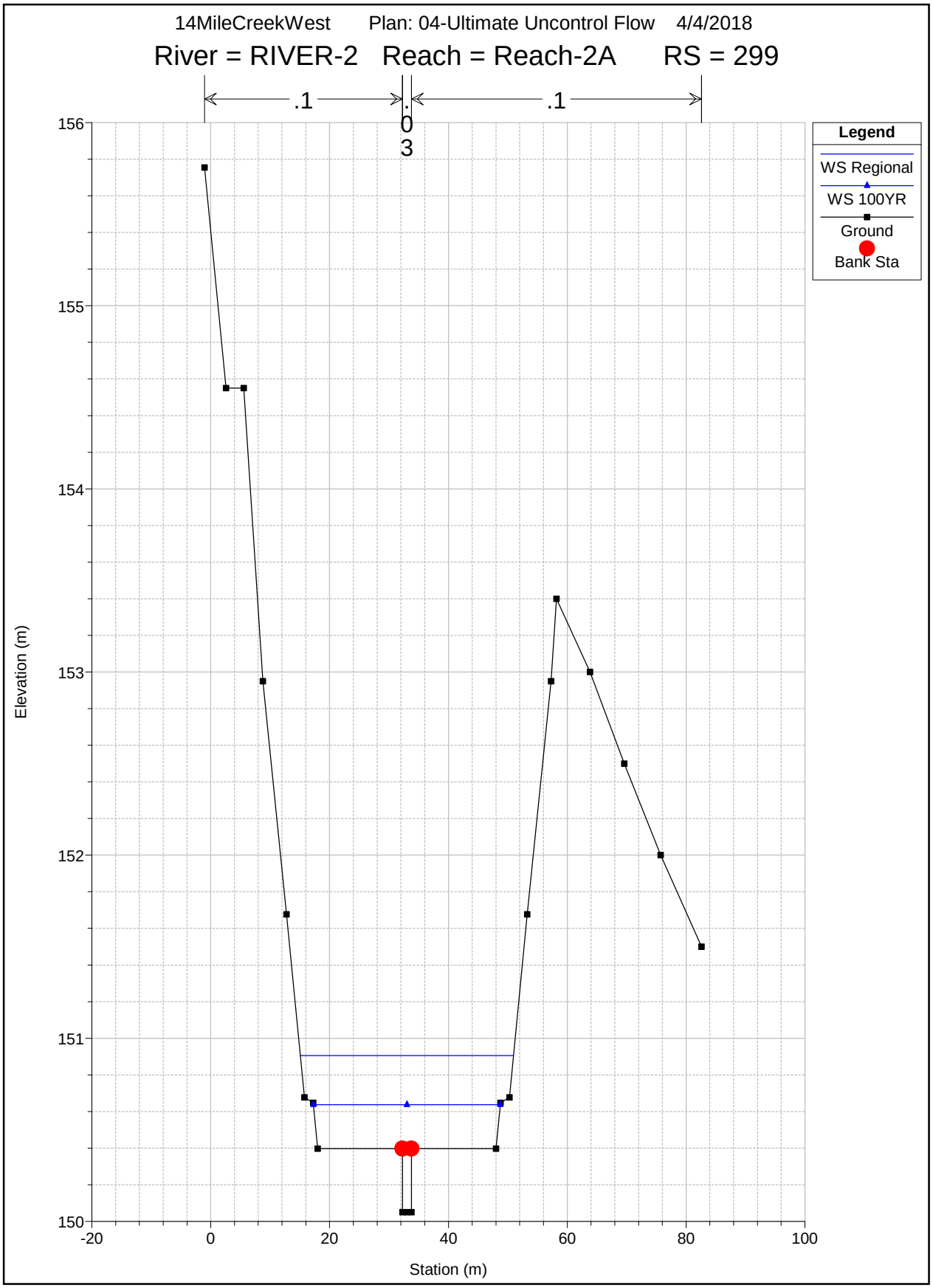

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 302.5 Culv
.1
.
0
3
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
160
158
156
154
152
150
Elevation (m)
-20
0
20
40
60
80
100
120
Station (m)

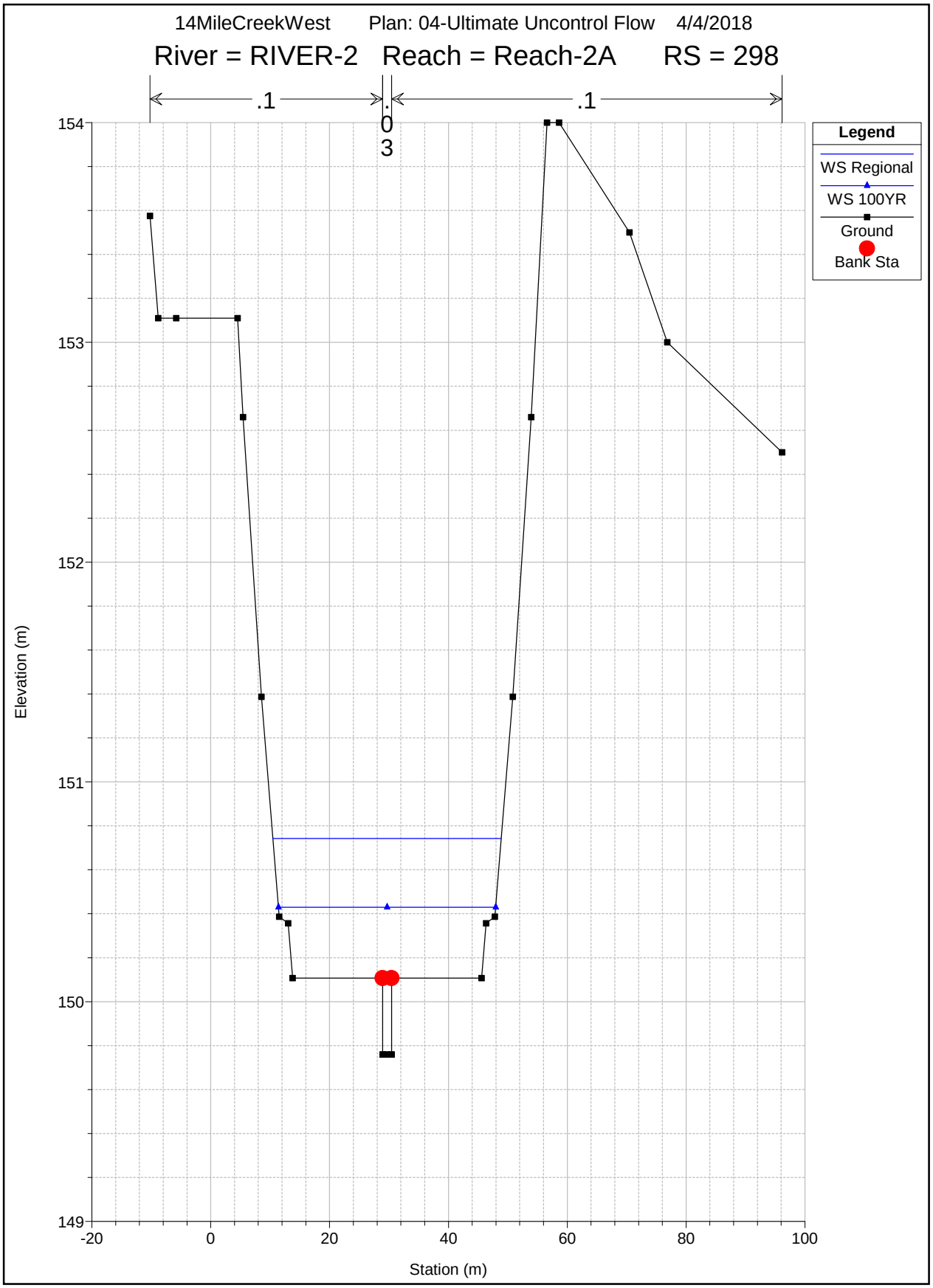

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 302.5 Culv
.1
.
0
3
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
160
158
156
154
152
150
Elevation (m)
-20
0
20
40
60
80
100
Station (m)

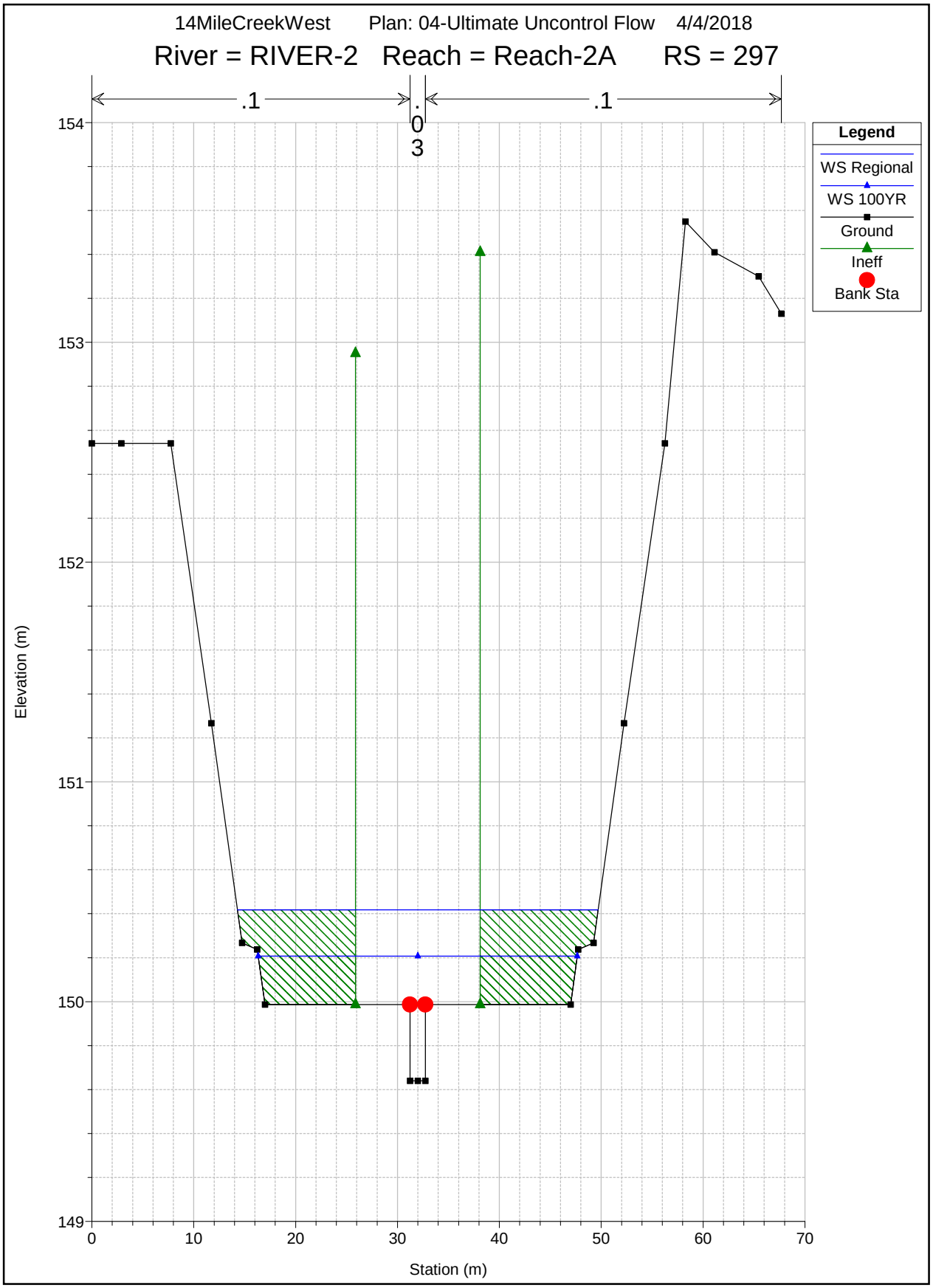

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 302
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
159
158
157
156
155
154
153
152
151
-20
0
20
40
60
80
100

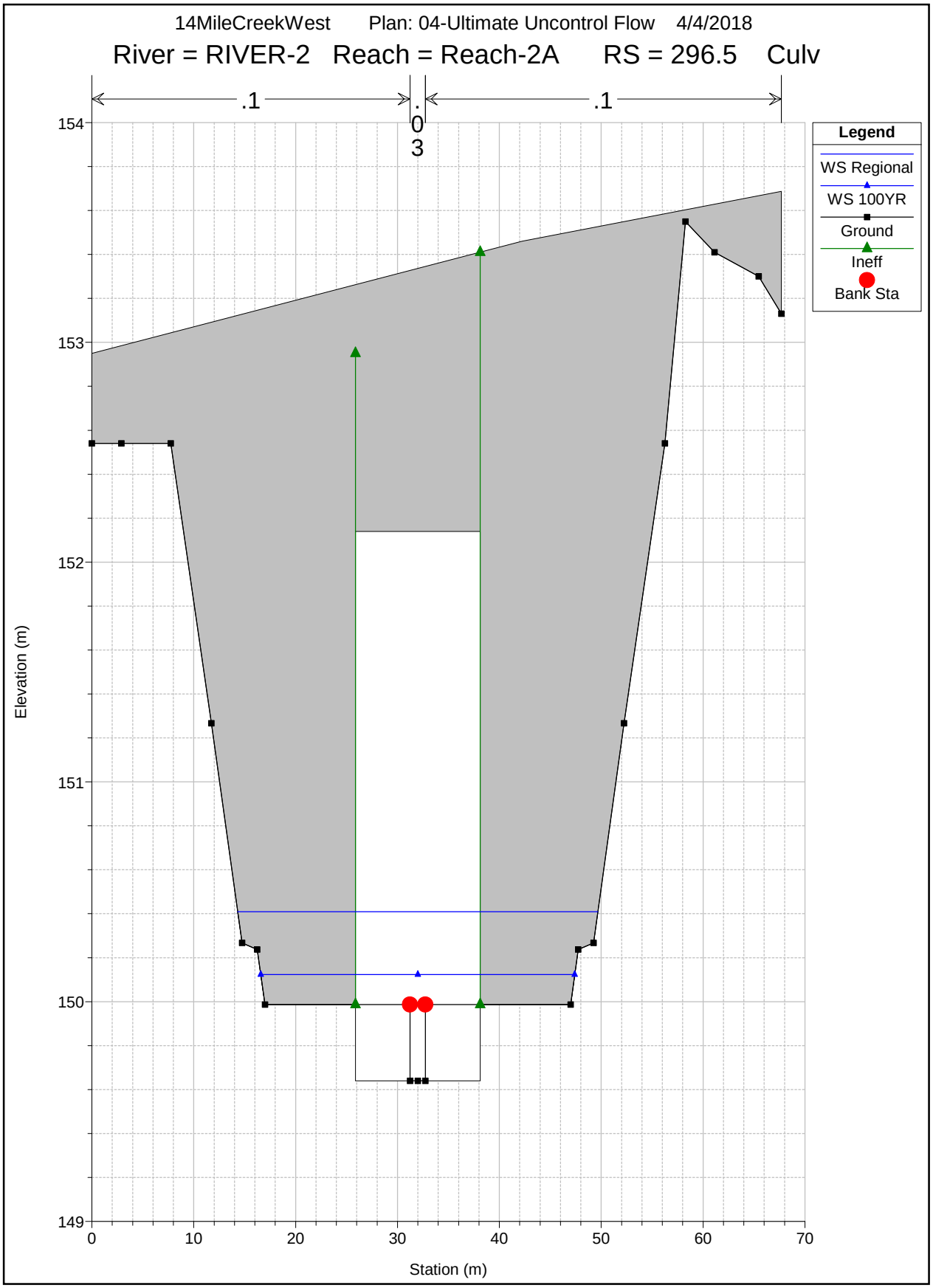

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 301
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
159
158
157
156
155
154
153
152
151
150
-20
0
20
40
60
80
100

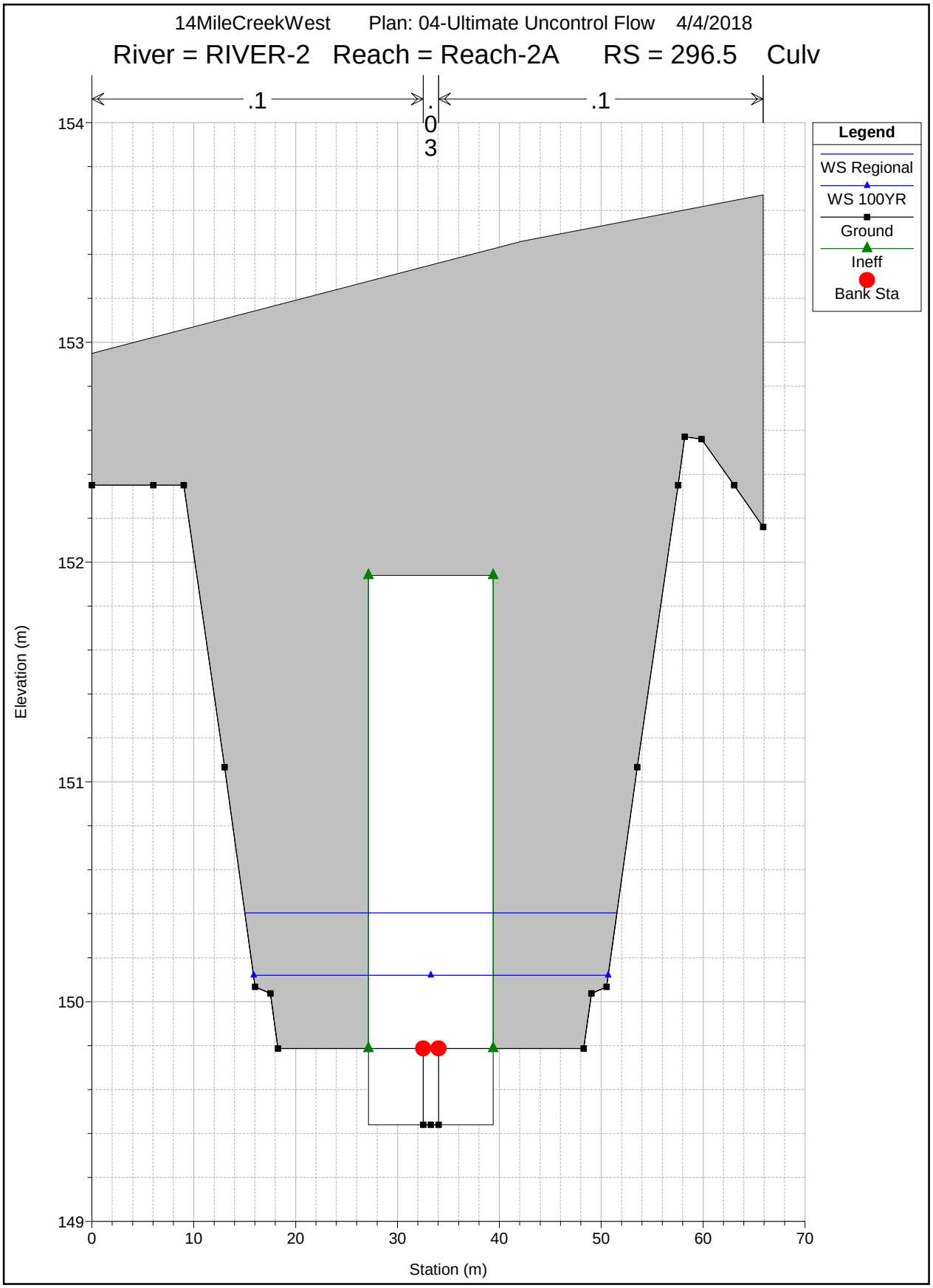

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 300
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
158
157
156
155
154
153
152
151
150
-20
0
20
40
60
80

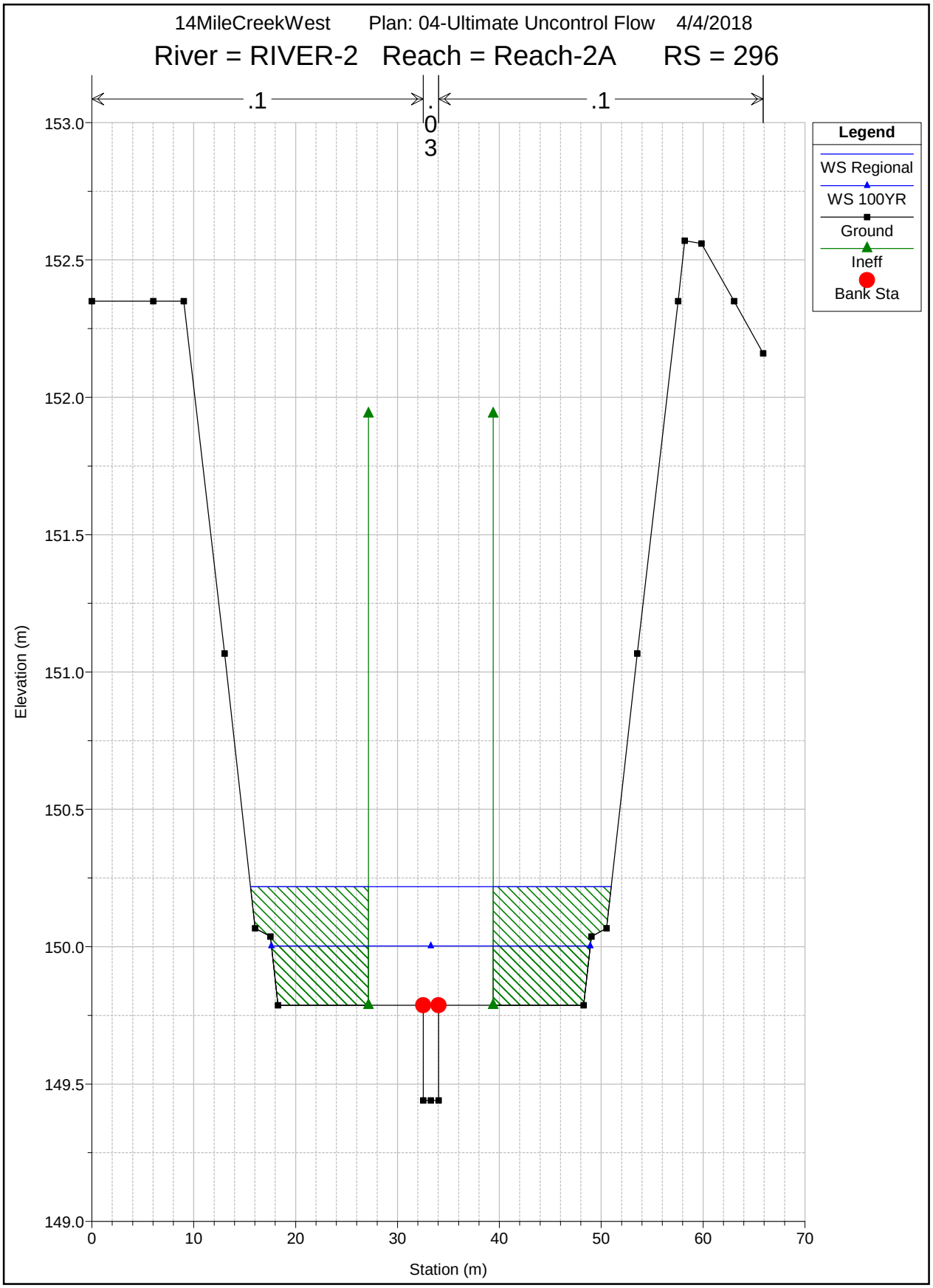

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 299
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
156
155
154
153
152
151
150
-20
0
20
40
60
80
100

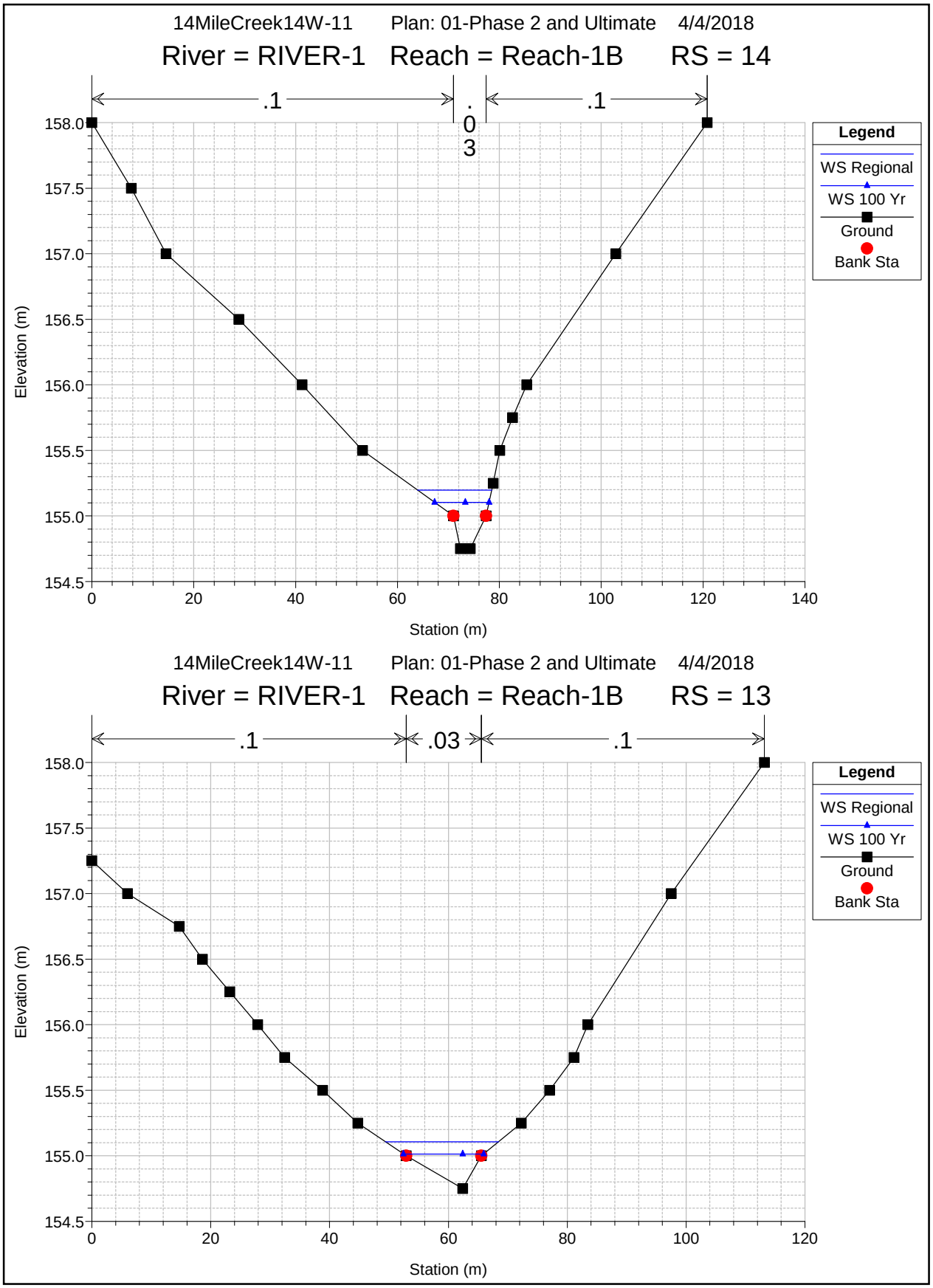

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 298
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Bank Sta
Elevation (m)
Station (m)
154
153
152
151
150
149
-20
0
20
40
60
80
100

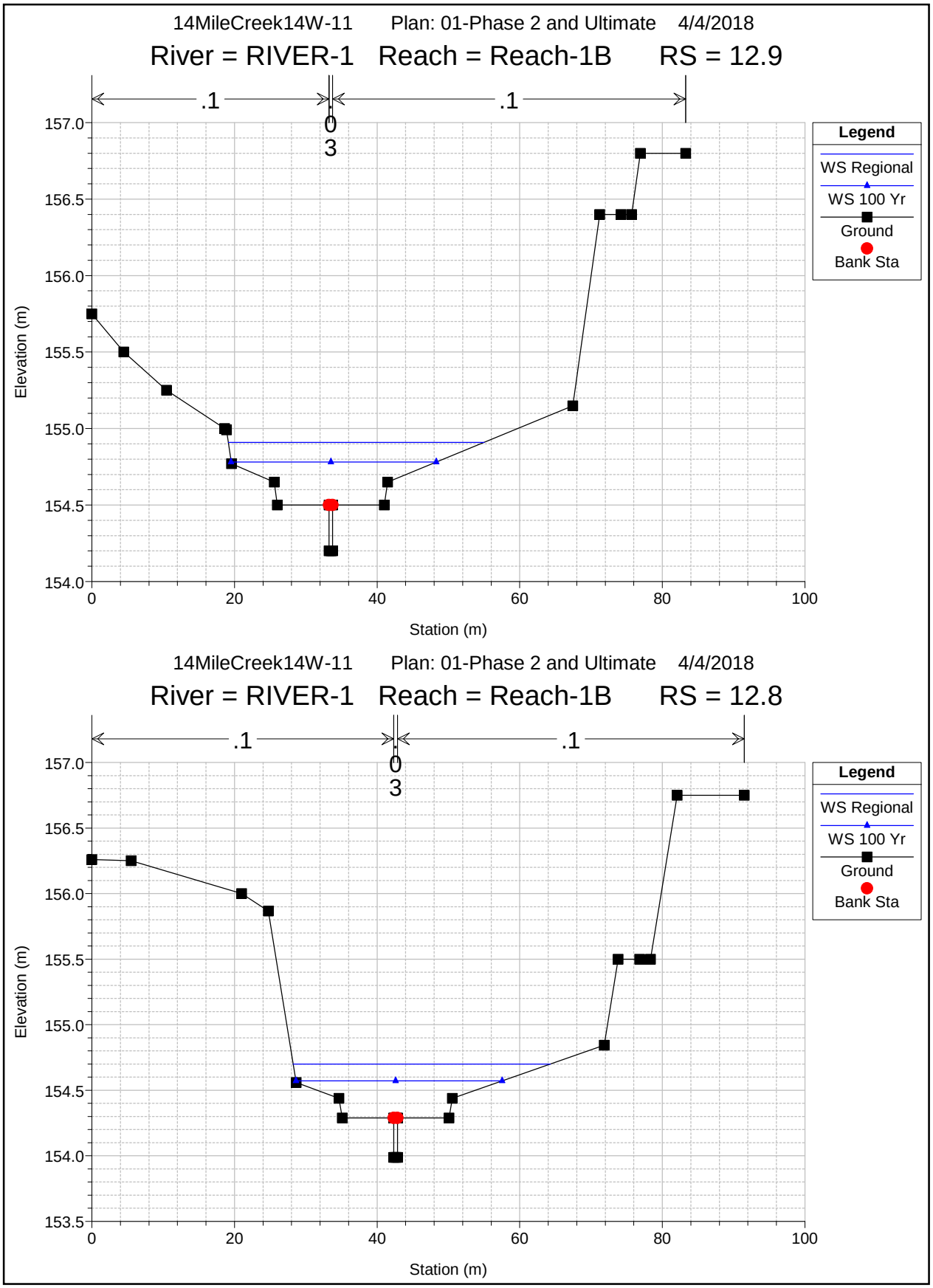

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 297
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
154
153
152
151
150
149
0
10
20
30
40
50
60
70

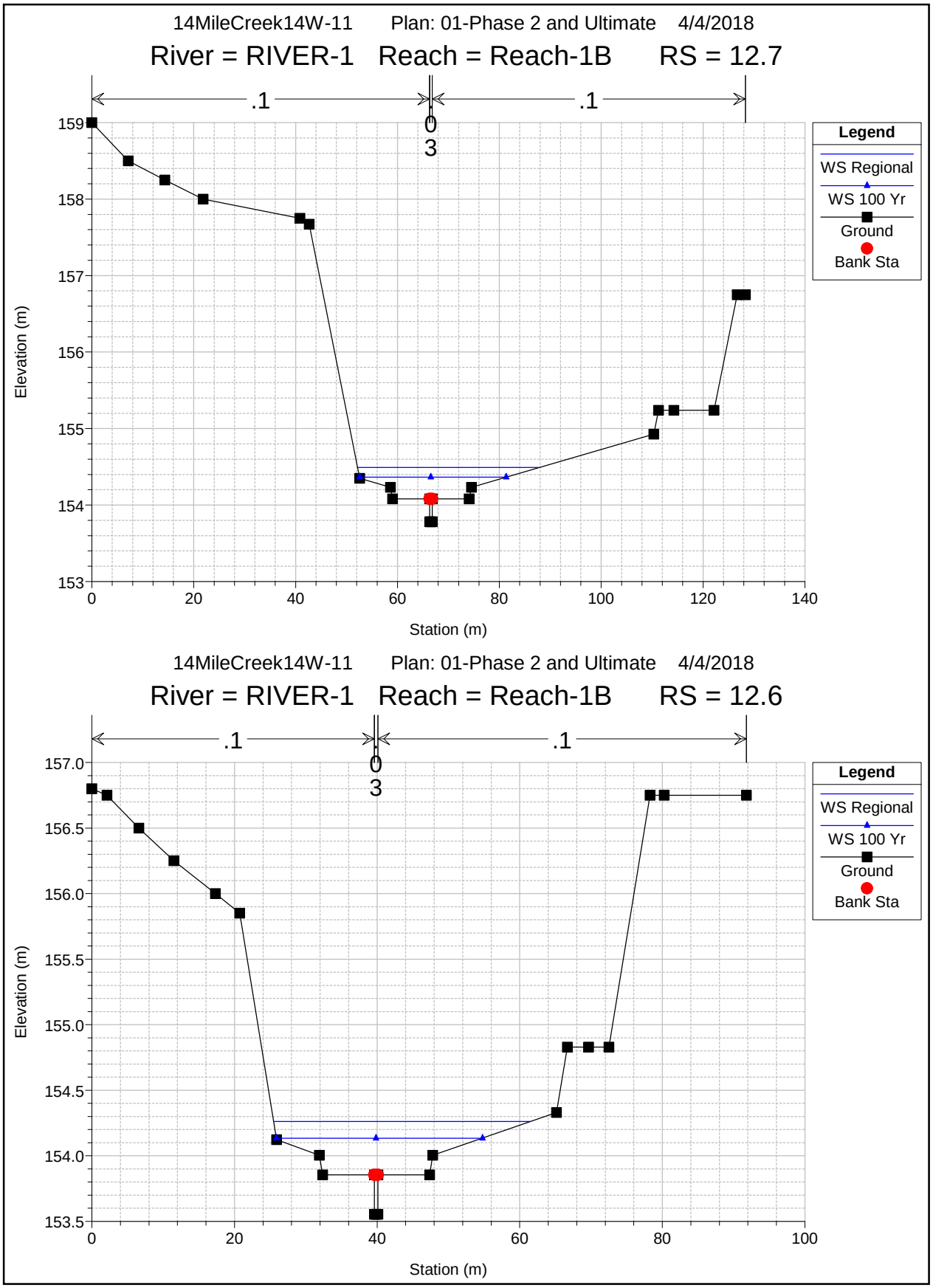

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 296.5 Culv
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
154
153
152
151
150
149
0
10
20
30
40
50
60
70

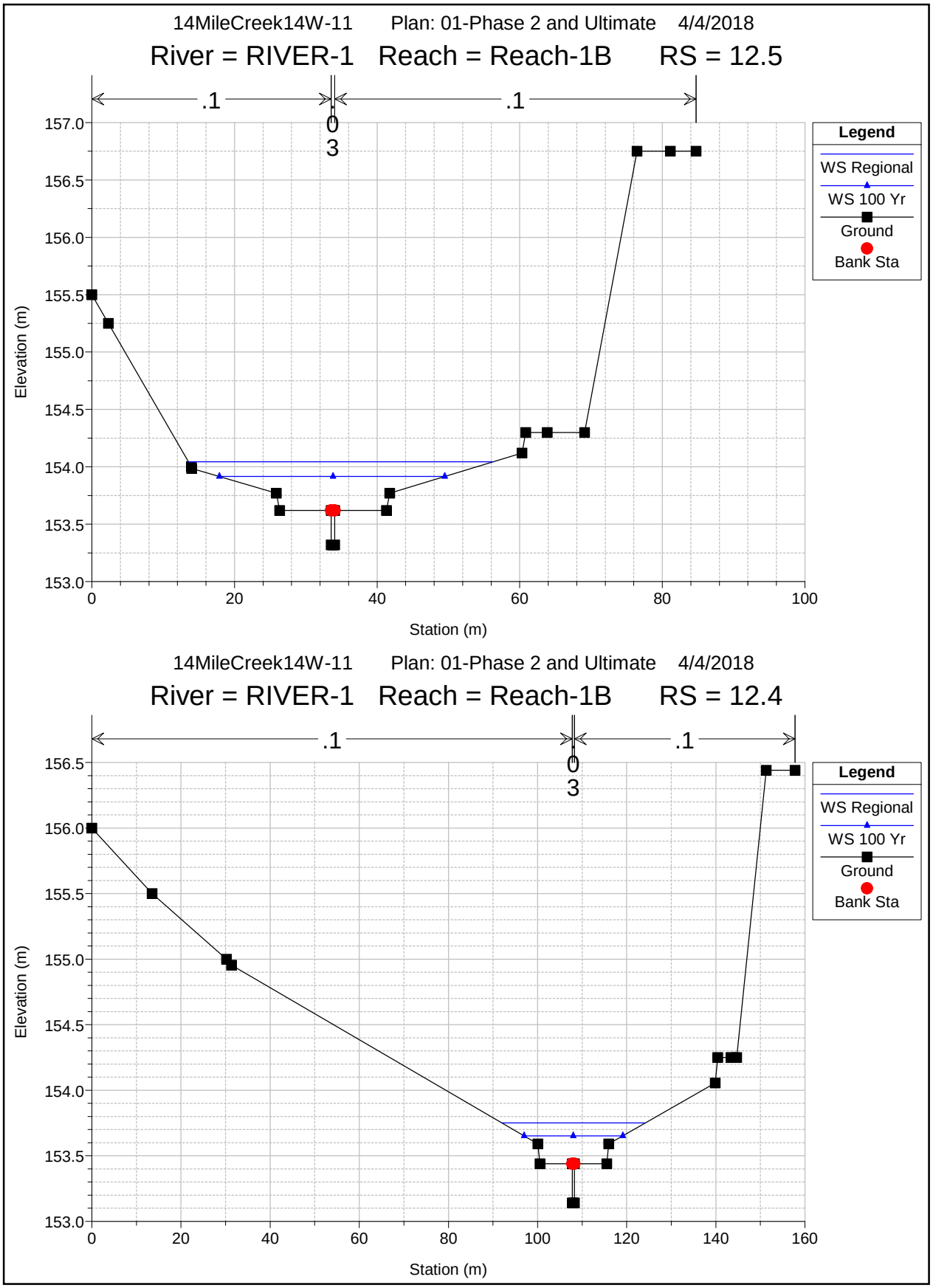

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 296.5 Culv
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
154
153
152
151
150
149
0
10
20
30
40
50
60
70

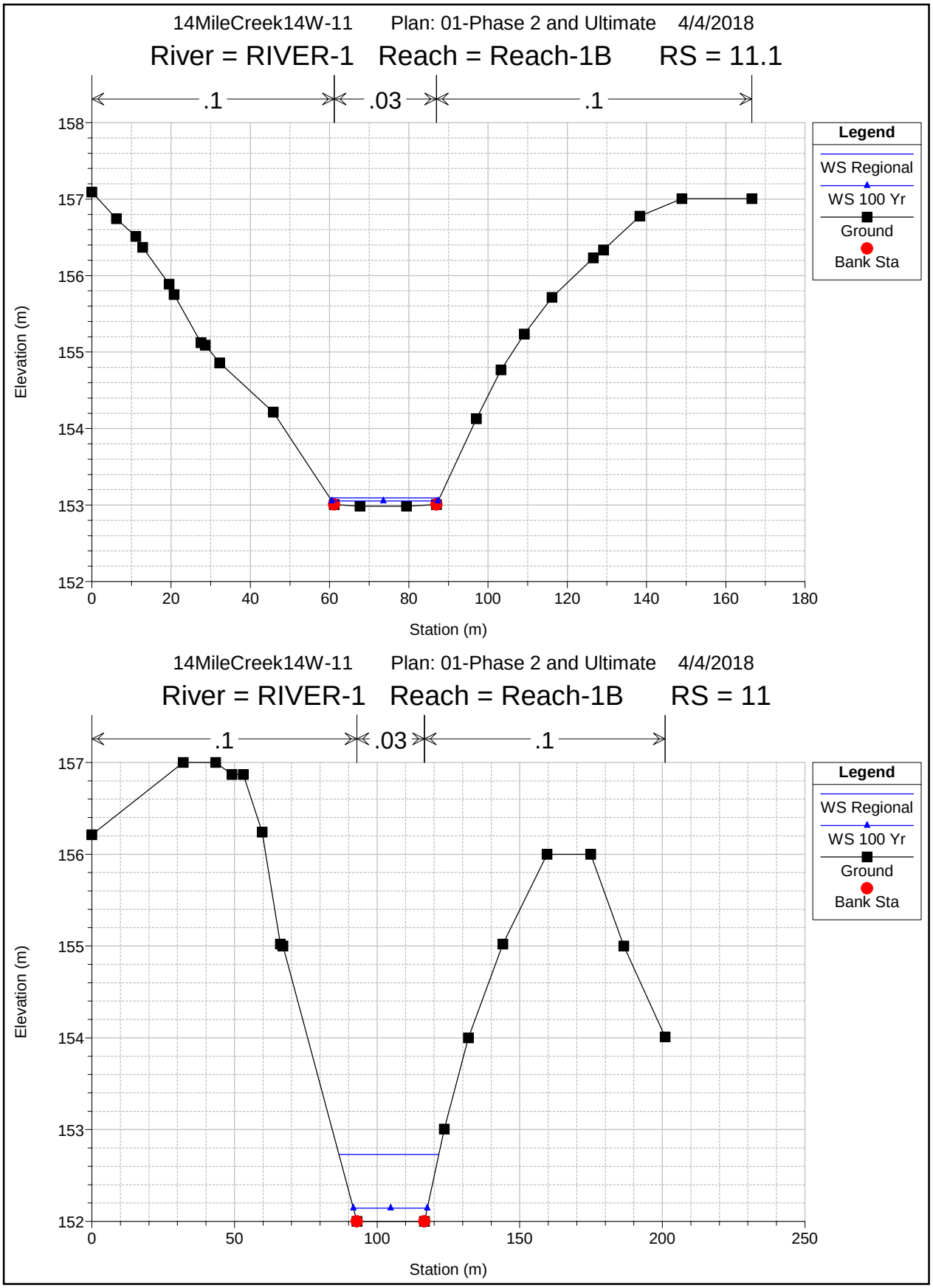

14MileCreekWest Plan: 04-Ultimate Uncontrol Flow 4/4/2018
River = RIVER-2 Reach = Reach-2A RS = 296
.1
.03
.1
Legend
WS Regional
WS 100YR
Ground
Ineff
Bank Sta
Elevation (m)
153.0
152.5
152.0
151.5
151.0
150.5
150.0
149.5
149.0
0
10
20
30
40
50
60
70
Station (m)

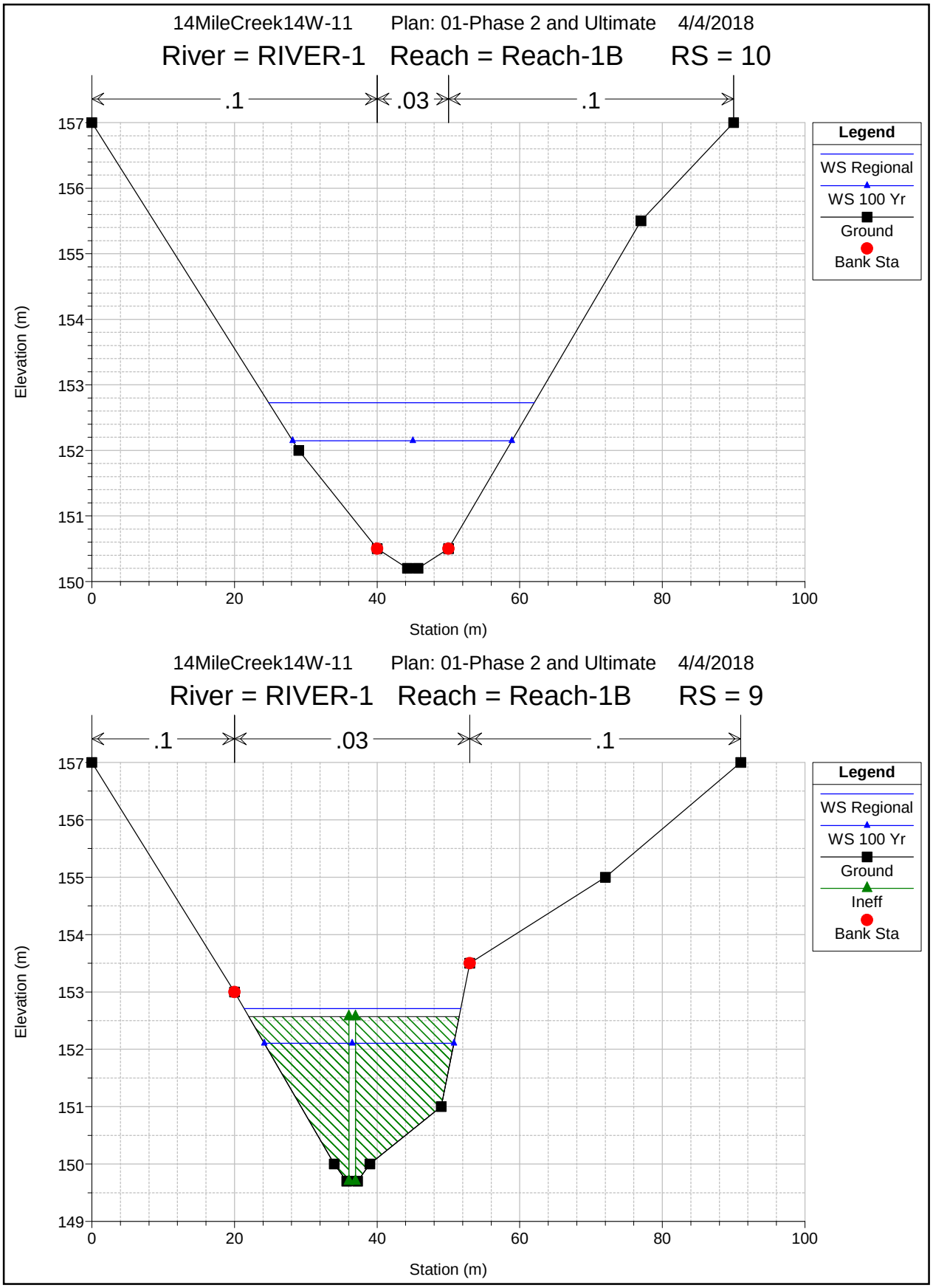

14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 14
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 13
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)

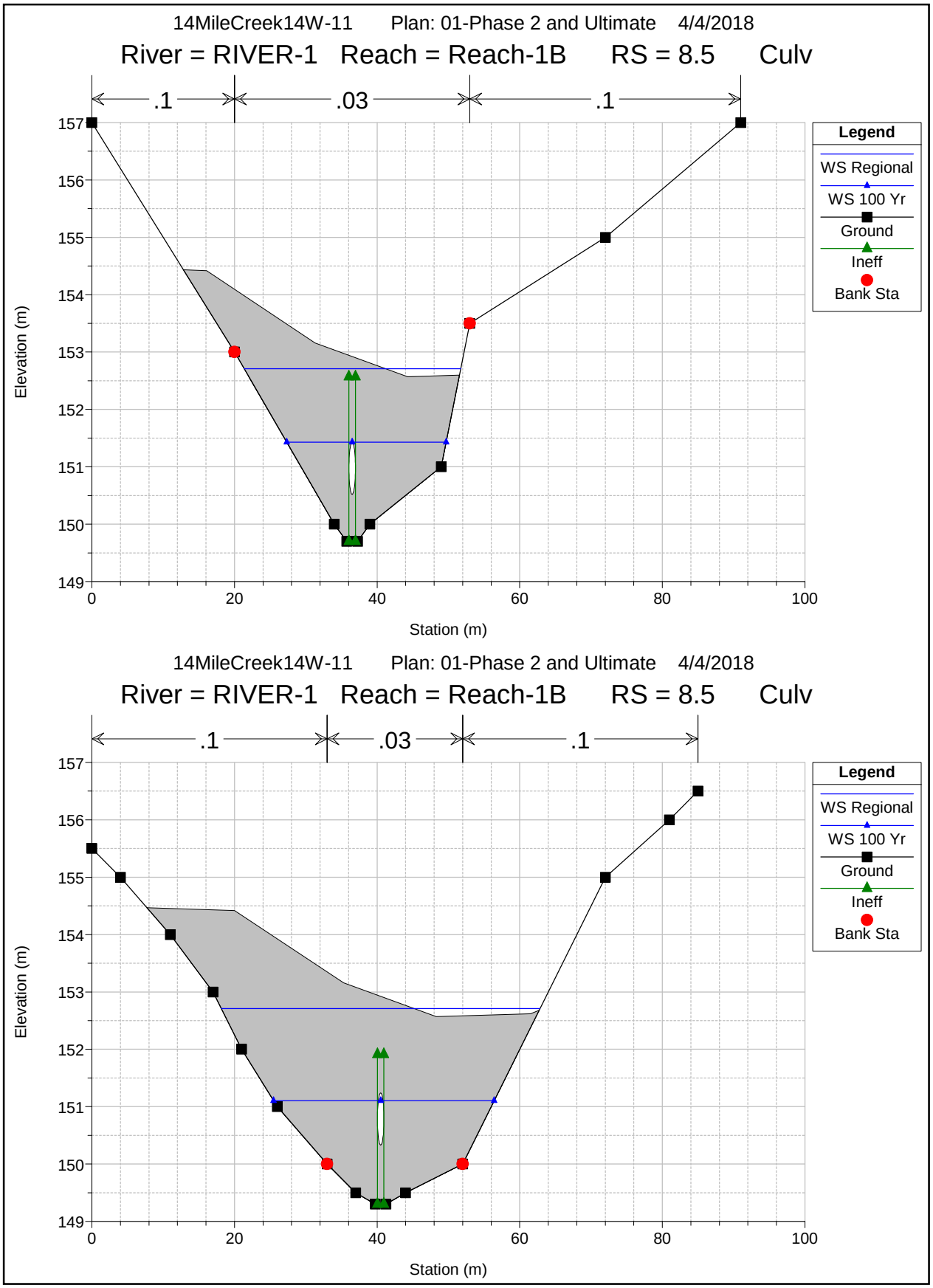

14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 12.9
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 12.8
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)

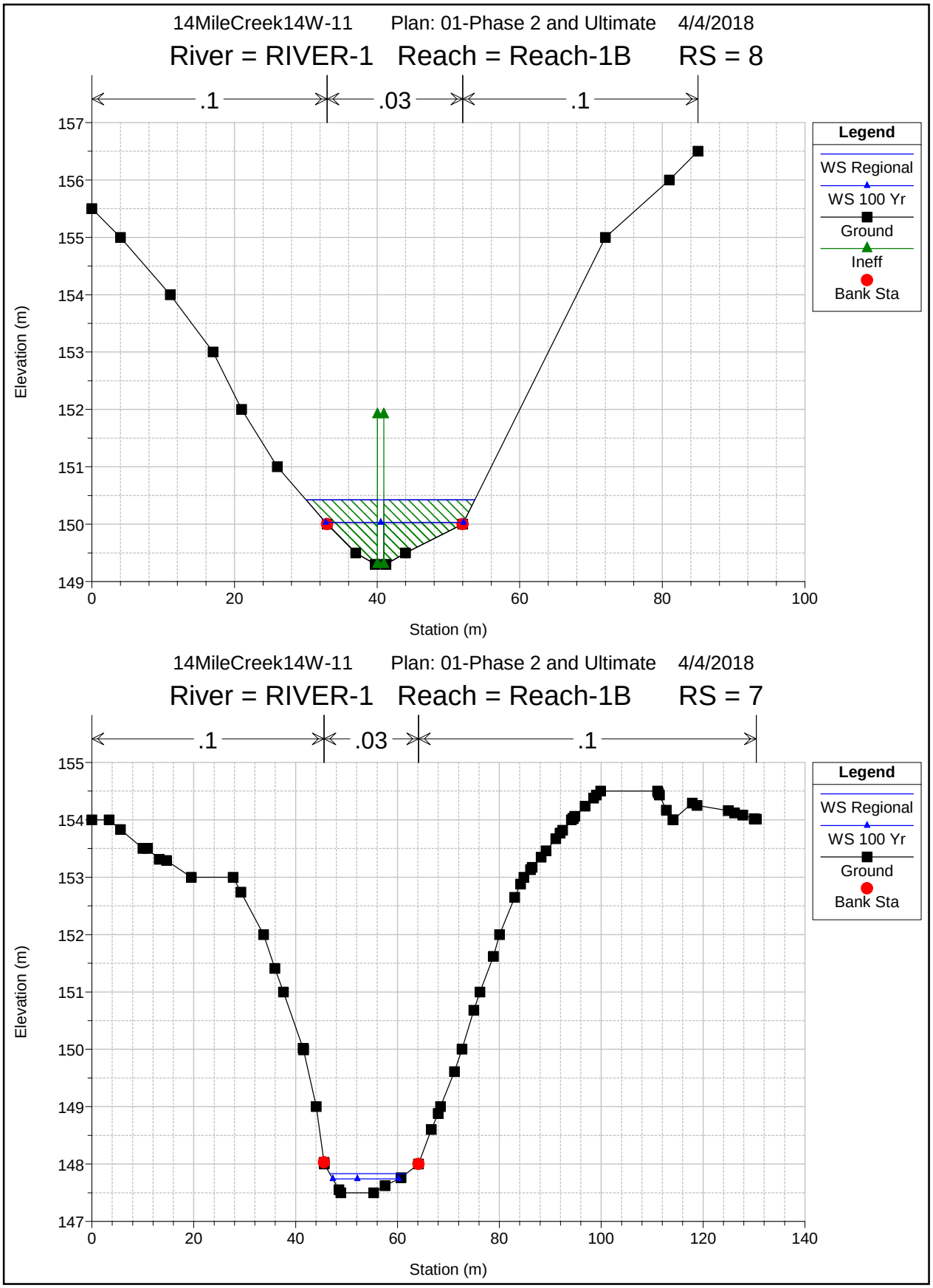

14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 12.7
.1
0
3
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
159
158
157
156
155
154
153
0
20
40
60
80
100
120
140
Station (m)
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 12.6
.1
0
3
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
157.0
156.5
156.0
155.5
155.0
154.5
154.0
153.5
0
20
40
60
80
100
Station (m)


14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 12.5
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 12.4
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)


14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 11.1
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 11
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)


14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 10
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta
Elevation (m)
Station (m)
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 9
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 8.5 Culv
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
157
156
155
154
153
152
151
150
149
0
20
40
60
80
100
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 8.5 Culv
.1
.03
.1
Legend
WS Regional
WS 100 Yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 8
.1
.03
.1
Elevation (m)
Station (m)
Legend
WS Regional
WS 100 Yr
Ground
Ineff
Bank Sta
14MileCreek14W-11 Plan: 01-Phase 2 and Ultimate 4/4/2018
River = RIVER-1 Reach = Reach-1B RS = 7
.1
.03
.1
Elevation (m)
Station (m)
Legend
WS Regional
WS 100 Yr
Ground
Bank Sta

Appendix 6.3 – Proposed Crossings

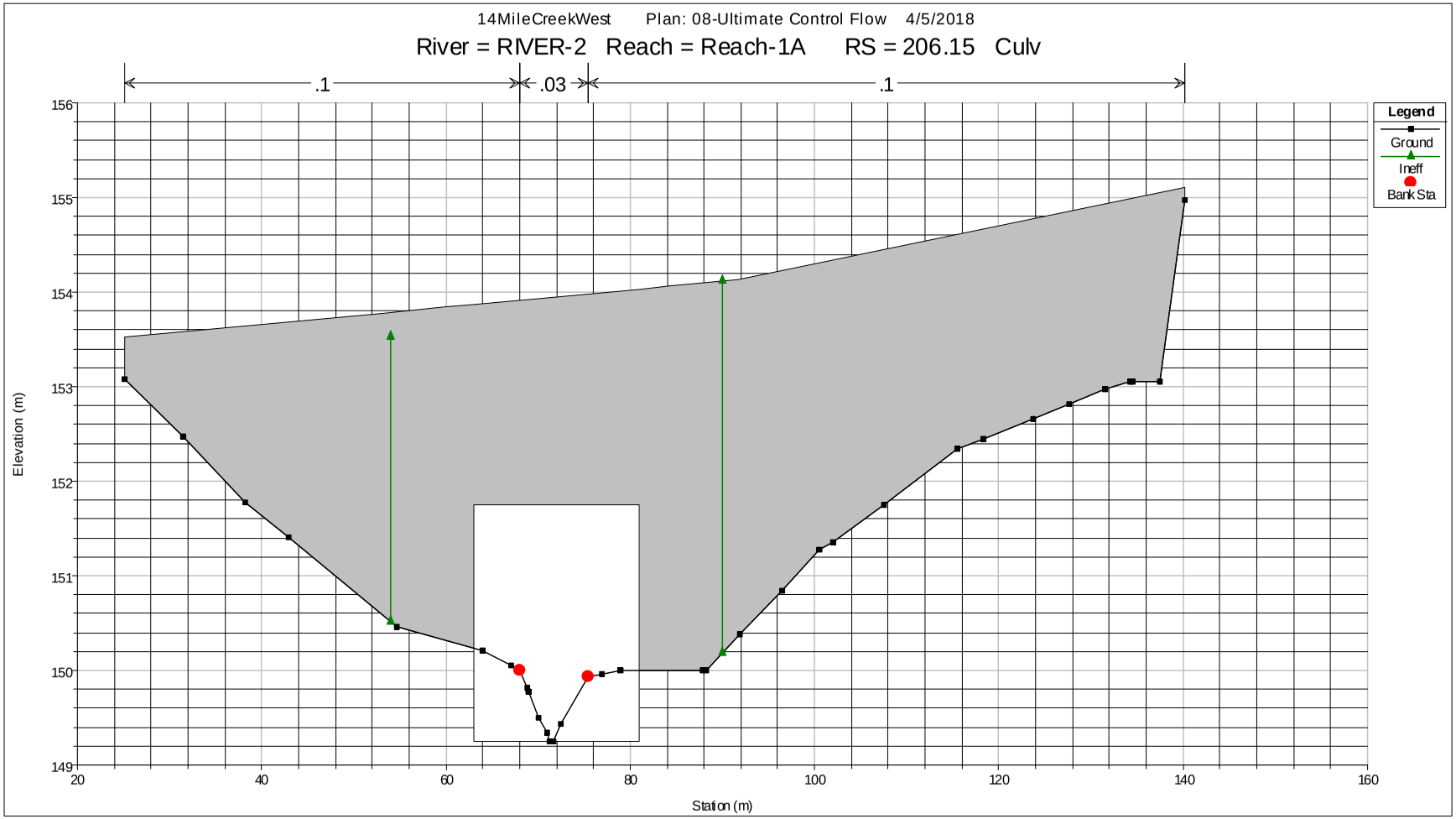
Table 3.4 New Burhamthorpe Road Crossings

Crossing ID	River	Reach	EIS/FSSR	Location	Structure	Rise (m)	Span (m)	Length (m)	Upstream and Downstream invert (m)	Upstream and Downstream Obvert (m)	Road Deck elevation (m)	Soffit Elevation (m)
XS 206.15	2	1A	14W-16	Burnhamthorpe Rd Extension	Open Bottom Conc. Box Culvert	2.5	18	28	149.25 / 149.0	151.75 / 151.75	154.0 (Average)	151.8
XS 296.5	2	2A	14W-22	Burnhamthorpe Rd Extension	Open Bottom Conc. Box Culvert	2.5	12.25	32	149.64 / 149.44	152.14 / 151.94	153.4 (Average)	152.1

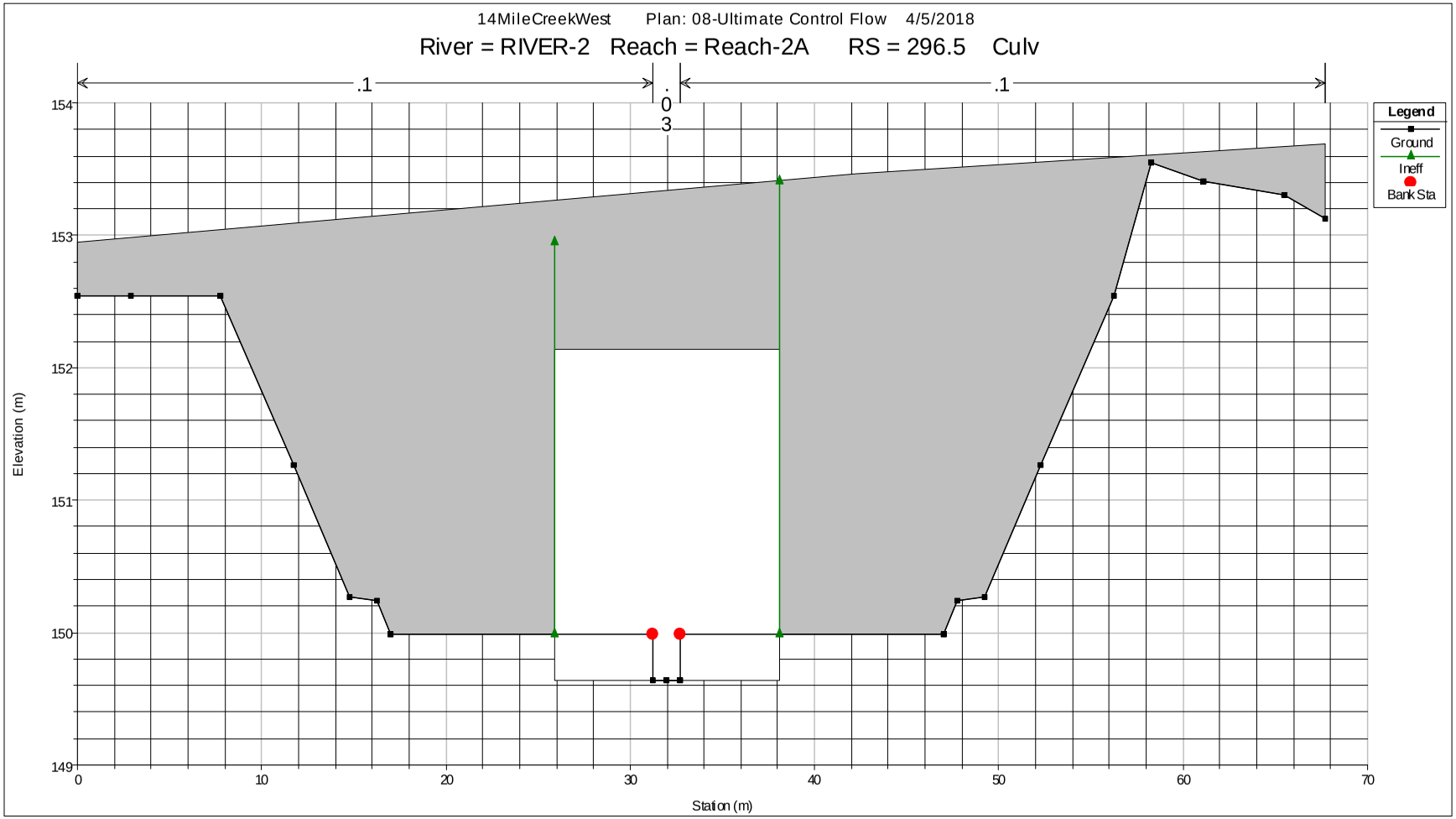
Table 3.7 New Avenue One Crossings

Crossing ID	River	Reach	EIS/FSSR	Location	Structure	Rise (m)	Span (m)	Length (m)	Upstream / Downstream invert (m)	Upstream /Downstream Obvert (m)	Road Deck elevation (m)	Soffit Elevation (m)
XS 208.15	2	1A	14W-16	Avenue One	Open Bottom Conc. Box Culvert	2.5	18	22	152.50 / 152.53	155 / 155	159.3 (Average)	155.0
XS 302.5	2	2A	14W-22	Avenue One	Open Bottom Conc. Box Culvert	2.5	12.25	22	151.46 / 151.29	153.96 / 153.79	158.7 (Average)	153.96

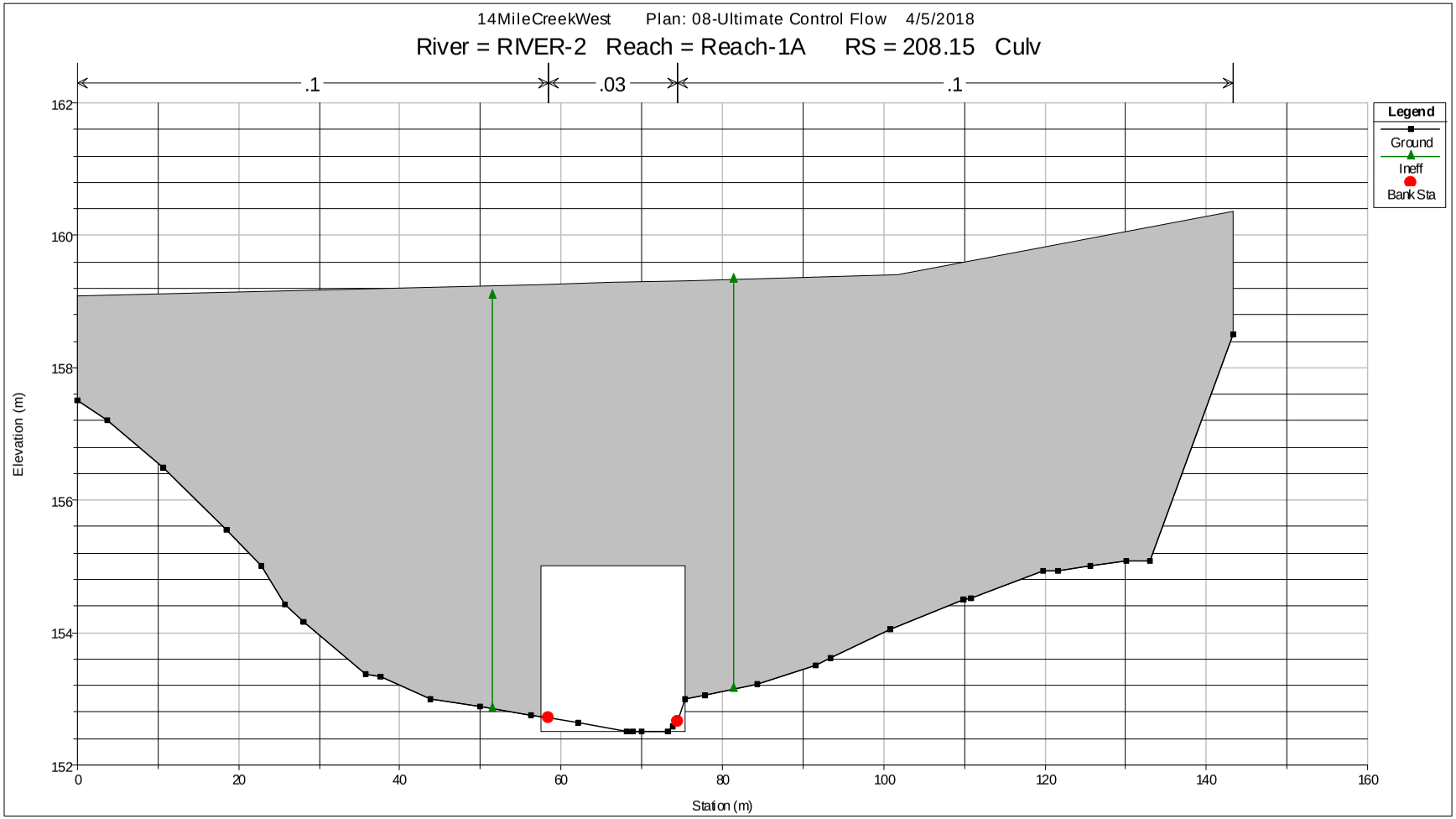
New Burhamthorpe Road Crossings – Crossing ID 206.15



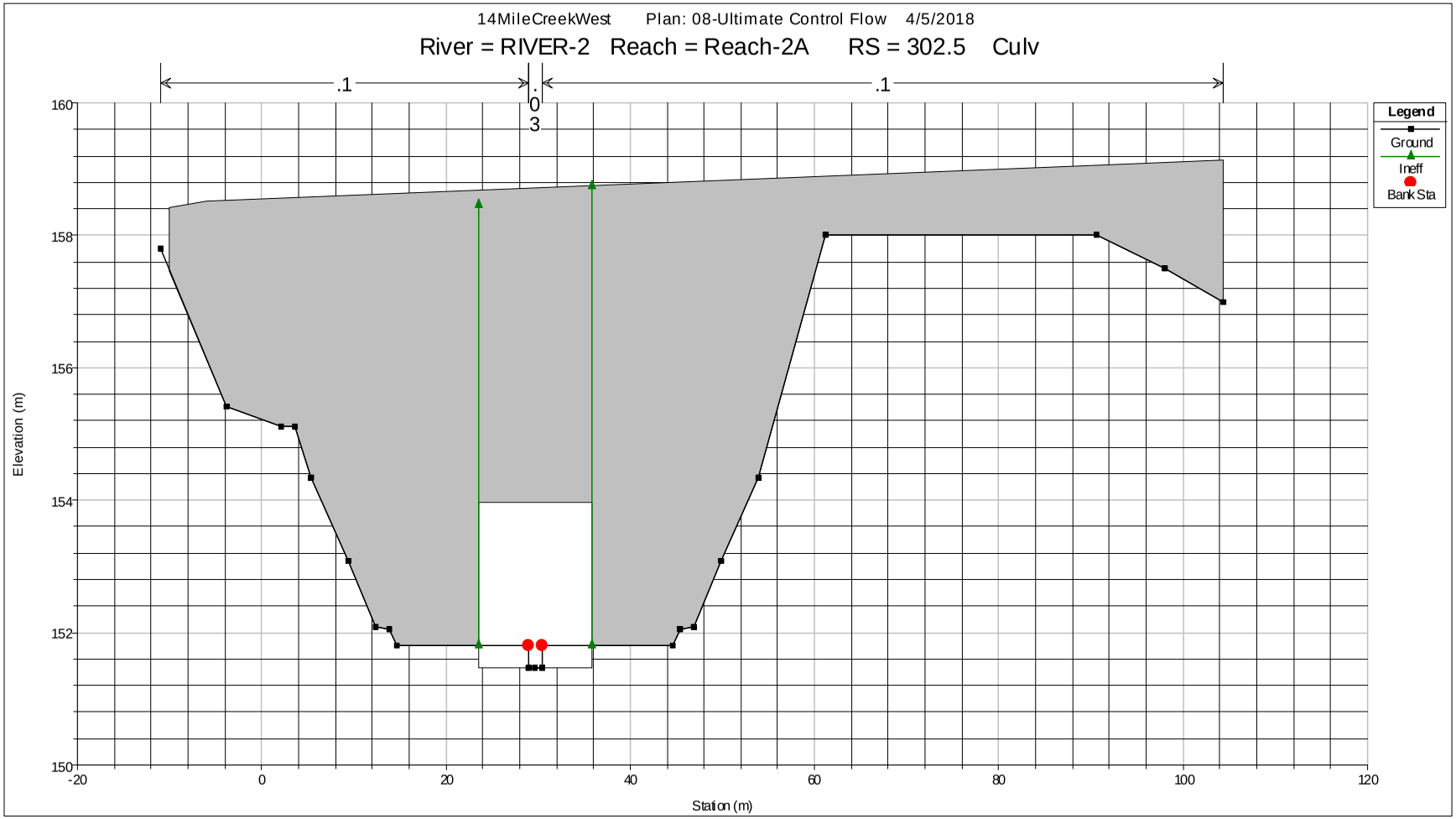
New Burhamthorpe Road Crossings – Crossing ID 296.5



Avenue One Road Crossings – Crossing ID 208.15



Avenue One Road Crossings – Crossing ID 302.5



Appendix 6.4 – Corridor Width Delineation

Technical Memorandum – Meander Belt Width Estimation

Meander Belt Width Estimation

All watercourses within the study limit have been significantly altered, presumably to accomadate agricultural practices. Therefore, meander belt widths of the existing streams cannot be determined from the historical movement and they were estimated using the following two empirical methods:

- PARISH Geomorphic Ltd., 2004
- Annable, 1996

The following sections discuss the two methods and the parameters used in each method.

PARISH Geomorphic Method

This procedure uses the following empirical relation that predicts meander belt width from drainage area and stream power of the watercourse:

$$Wb = -14.827 + 8.319 (\ln SP \times DA) + 2 \times S \quad \text{Eq.1}$$

$$SP = \Upsilon Qs \quad \text{Eq.2}$$

Where
SP = stream power (Wm^{-2})
Υ = specific weight of water (9806 $kg/m^2/s^2$)
Q = 2 year flow (m^3s^{-1})
s = channel gradient (m/m)
Wb = meander belt width (m)
DA = drainage area (km^2)
R^2 = correlation coefficient of regression = 0.73
S = standard error of equation = 8.63

The standard error term (2 x S) in Eq.1 represents a factor of safety to allow for potential under prediction of the actual meander belt width while also allowing for natural migration tendencies and hydrologic regime changes.

The 2 year flow rates for reaches in the study area were estimated based on unit flow rates recommended by the NOCSS and reach drainage areas. The channel gradient for each reach was calculated using the topographic mapping for the study area.

Annable Method

Annable has developed geomorphologic relationships of rural watercourses in Southern Ontario using 47 river data consisting of stream types B, C, E and F. The type of watercourses in the study area could not be identified since it has been significantly altered to accommodate the agricultural practices. Therefore, the following empirical equation for meander belt width developed based on data from all stream types was used:

$\Gamma = 35.2\ Q^{0.53}$ Eq.3

Where Q = bankfull discharge (m^3/s)

The bankfull discharge is estimated as 1.5 year flow based on unit flow rates recommended by the NOCSS and reach drainage areas

Results

The estimated meander belt width for the reaches in the study area is presented in Table 1 which shows reasonable agreement between the two methods.

Table 1 Estimated Meander Belt Widths

Reach	Scenario	Drainage Area (km2)	2 – Year Peak Flow (m3/s)[c]	Bankfull Discharge (m3/s)[b]	Channel Gradient (m/m)	Meander Belt Width (m)		Selected Meander Belt Width (m)
						PARISH Geomorphic	Annable	
14W-12	Existing	3.88	2.33	2.05	0.008	57.0	51.5	**57**
	Post-Development	3.95	2.37	2.09	0.008	57.3	52	
14W-16	Existing	2.22	1.44	1.27	0.0053	45.0	40.0	**45**
	Post-Development	2.22	1.44	1.27	0.0053	45.0	40.0	
14W-14	Existing	1.39	0.82	0.73	0.0028	31.1	29.8	**31**
	Post-Development (14W-22)	1.29	0.71	0.64	0.0041	31.6	27.8	
14W-13	Existing	0.073	0.010	0.003	0.0032	_[a]	1.6	**2**
	Post-Development (14W-21)	0.073	0.010	0.003	0.0032	_[a]	1.6	
14W-12A	Existing	1.7	0.98	0.84	0.006	29	32	32
	Post-Development (14W-12A)	1.71	_	_	0.006	_	_	
14W-11A	Existing	0.45	0.180	0.210	0.006	15.4	15.5	**16**
	Post-Development	0.39	0.150	0.210	0.0053	12.0	15.5	

[a] PARISH empirical relation is not applicable for reaches satisfying the following criteria: 2-Year Discharge (m^3/s) x Channel Slope (m/m) x Drainage Area (km^2) < 6×10^{-4}

[b] Bankfull discharges have been determined from Annable's empirical relationships.

[c] The 2-year peak flow rates have been determined by combining the peak flow rates from GAWSER simulations for areas north of Highway 407 and the peak flow rates determined from unit flow rates for areas south of Highway 407. Thereafter the results were cross-checked following the proposed condition hydrologic modelling.

			From Table 1 Appendix 6.7 Submission 3, post dev values; also WE report								WE		
		Refence Node	Area (ha)	Area (km2)	2yr flow	Channel Slope	WE slope	Parish Check (1 is valid)	Parish Method	WE Report Node	Bankful flow (1.5 yr)	Annable Method	Selected Meander Belt Width
Interim P1A	14W-11	5	57.7	0.577	0.59			0	-	-	0.520	24.89	25
	14W-11A	9	49.75	0.4975	0.42	0.0053		1	22.27	-	0.368	20.73	23
	14W-12	3	411.7	4.1169	2.8	0.008	0.0196	1	59.06	XSC2	2.545	57.75	60
	14W-12A	2	174.1	1.741	1.00	0.006	0.0196	1	40.94	XSC2	0.902	33.32	41
	14W-13	2C	166.9	1.6693	0.95	0.0032	0.0071	1	34.94	XSE1	0.855	32.40	35
	14W-14	2C	166.9	1.6693	0.95	0.0041	0.0071	1	37.00	XSE1	0.855	32.40	37
	14W-16	1	203.74	2.0374	1.36	0.0053	0.0071	1	43.78	XSD1	1.235	39.37	44
Interim P1B	14W-11	5	57.7	0.577	0.59			0	-	-	0.520	24.89	25
	14W-11A	9	49.8	0.4975	0.42	0.0053		1	22.27	-	0.368	20.73	23
	14W-12	3	411.4	4.1139	2.78	0.008	0.0196	1	59.00	XSC2	2.532	57.59	59
	14W-12A	2	10.8	0.1081	0.3	0.006	0.0196	0	-	XSC2	0.275	17.76	18
	14W-16	1	200.8	2.008	1.33	0.0053	0.0071	1	43.47	XSD1	1.205	38.86	44
	14W-21	8	11.6	0.116	0.040	0.0071	0.0071	0	-	XSD1	0.033	5.80	6
	14W-22	2B	142.0	1.4199	0.79	0.0071	0.0071	1	38.69	XSD1	0.710	29.36	39
Interim P2	14W-11	5	53.3	0.5329	0.5			0	-	-	0.440	22.78	23
	14W-12	3	418.2	4.1816	3.52	0.008	0.0196	1	61.10	XSC2	3.230	65.53	66
	14W-12A	2	5.7	0.0569	0.18	0.006	0.0196	0	-	XSC2	0.168	13.69	14
	14W-16	1	200.4	2.0041	1.33	0.0053	0.0071	1	43.45	XSD1	1.205	38.86	44
	14W-21	8	11.6	0.116	0.04	0.0071	0.0071	0	-	XSD1	0.033	5.80	6
	14W-22	2B	141.9	1.4185	0.79	0.0071	0.0071	1	38.68	XSD1	0.710	29.36	39
	14W-23	9	45.7	0.4572	0.34			0	-	-	0.297	18.49	19
Ultimate	14W-11	5	53.3	0.5329	0.5			0	-	-	0.440	22.78	23
	14W-12	3	411.5	4.1149	3.98	0.008	0.0196	1	61.98	XSC2	3.663	70.05	71
	14W-12A	2	5.7	0.0569	0.18	0.006	0.0196	0	-	XSC2	0.168	13.69	14
	14W-16	1	198.0	1.9797	1.83	0.0053	0.0071	1	46.01	XSD1	1.673	46.24	47
	14W-21	8	11.6	0.116	0.04	0.0071	0.0071	0	-	XSD1	0.033	5.80	6
	14W-22	2B	138.5	1.3846	0.77	0.0071	0.0071	1	38.26	XSD1	0.693	28.99	39
	14W-23	9	45.72	0.4572	0.34			0	-	-	0.297	18.49	19

Development Phasing	Reach	Refence Node	Corridor Width (m, Interim EIR FSS)	Area (ha)	2yr flow	Parish Method	Annable Method	Selected Meander Belt Width	Factor of Safety	Top of Bank Width	Hazard Allowance	Redside Dace/ widened corridor	Meander Belt with NOCSS Setbacks	Total Corridor Width
Interim P1A	14W-11	5		57.7	0.59	-	24.9	25	3	31	15	0	61	61
	14W-11A	9		49.8	0.42	22.3	20.7	23	3	29	15	0	59	59
	14W-12	3		411.7	2.8	59.1	57.8	60	6	72	15	132	102	132
	14W-12A	2		174.1	1	40.9	33.3	41	4.1	49.2	15	109.2	79.2	109.2
	14W-13	2C		166.9	0.95	34.9	32.4	35	3.5	42	7.5	0	57	57
	14W-14	2C		166.9	0.95	37.0	32.4	37	3.7	44.4	15	0	74.4	74.4
	14W-16	1		203.7	1.36	43.8	39.4	44	4.4	52.8	15	112.8	82.8	112.8
Interim P1B	14W-11	5		57.7	0.59	-	24.9	25	3	31	15	0	61	61
	14W-11A	9		49.8	0.42	22.3	20.7	23	3	29	15	0	59	59
	14W-12	3		411.4	2.78	59.0	57.6	59	5.9	70.8	15	130.8	100.8	130.8
	14W-12A	2		10.8	0.3	-	17.8	18	3	24	15	84	54	84
	14W-16	1		200.8	1.33	43.5	38.9	44	4.4	52.8	15	112.8	82.8	112.8
	14W-21	8		11.6	0.04	-	5.8	6	3	12	7.5	0	27	27
	14W-22	2B		142.0	0.79	38.7	29.4	39	3.9	46.8	15	0	76.8	76.8
Interim P2	14W-11	5		53.3	0.5	-	22.8	23	3	29	15	0	59	59
	14W-12	3		418.2	3.52	61.1	65.5	66	6.6	79.2	15	139.2	109.2	139.2
	14W-12A	2		5.7	0.18	-	13.7	14	3	20	15	80	50	80
	14W-16	1		200.4	1.33	43.5	38.9	44	4.4	52.8	15	112.8	82.8	112.8
	14W-21	8		11.6	0.04	-	5.8	6	3	12	7.5	0	27	27
	14W-22	2B		141.9	0.79	38.7	29.4	39	3.9	46.8	15	0	76.8	76.8
	14W-23	9		45.7	0.34	-	18.5	19	3	25	15	0	55	55
Ultimate	14W-11	5		53.3	0.5	-	22.8	23	3	29	15	0	59	59
	14W-12	3		411.5	3.98	62.0	70.0	71	7.1	85.2	15	145.2	115.2	145.2
	14W-12A	2		5.7	0.18	-	13.7	14	3	20	15	80	50	80
	14W-16	1		198.0	1.83	46.0	46.2	47	4.7	56.4	15	116.4	86.4	116.4
	14W-21	8		11.6	0.04	-	5.8	6	3	12	7.5	0	27	27
	14W-22	2B		138.5	0.77	38.3	29.0	39	3.9	46.8	15	0	76.8	76.8
	14W-23	9		45.7	0.34	-	18.5	19	3	25	15	0	55	55

Appendix 6.5 – EXP Report

The new identity of **Trow Associates**

January 3, 2013

Project: BRM-00603264-A0

Mr. Asif Quader, Ph.D., P.Eng.
McCormick Rankin
2655 North Sheridan Way, Suite 300
Mississauga, Ontario
L5K 2P8

via email: AQuader@mrc.ca

Slope Stability
14 Mile Creek
Oakville, Ontario

Dear Sirs

A slope stability analyses was undertaken for a portion of the 14 Mile Creek tributary located at the north end of Zenon Drive in Oakville, Ontario. The site location is shown on Drawing 1.

The purpose of the slope stability analysis was to determine the Top of Bank for the above site. This project was authorized by Mr. Asif Quader, Ph.D., P.Eng. of McCormick Rankin.

The Top of Bank includes the following allowances:

1. Stable slope allowance
2. Erosion allowance if the creek is within 15 m of the base of the slope

Once the Top of Bank (TOB) is established additional set backs will be required from the TOB by the Halton Conservation Authority. This includes a 6 m set back for Erosion access allowance.

Slope Conditions

The slope at this site is about 6 m high. The elevation of the top of the slope is about 158 m and the elevation of the base is at about 152 m. These elevations were obtained from the site survey supplied by the client and part of this survey is included as Drawing 1.

The top 2 m of the slope are at about 18 degrees to the horizontal and the bottom 4 m are at about 30 degrees to the horizontal.

The slope is covered by mature trees. There are no signs of failures or water seepage from the slope. There is no evidence of creek erosion at the base of the slope. The bankfull width of the creek is approximately 15 m.

Procedure

The fieldwork was carried out on December 10, 2012. At that time two boreholes were advanced to a depth of about 9 m by a drilling subcontractor using solid stem continuous flight augers. The fieldwork was supervised by a geotechnical engineer from exp Services Inc. (**exp**)

Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 750 mm. All samples were logged in the field and then returned to the **exp** laboratory for testing and detailed examination by the project engineer.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. Piezometers were installed in the boreholes for long term water level observations.

The borehole locations were laid out by **exp** personnel. The ground surface elevations were referenced to an existing well on the site. The geodetic elevation was supplied by the client.

As well as visual examination in the laboratory, all of the soil samples were tested for natural moisture content and natural unit weight where possible. Two samples were subjected to grain size analyses and tested for Atterberg Limits. The grains size curves for the silt till and Atterberg Limits test results are appended to this report.

Subsurface Conditions

The borehole locations are shown on Drawing 1 and detailed subsurface conditions are presented on the borehole logs, Drawings 2 and 3. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report.

The boreholes encountered about 0.6 m of weathered till consisting of clayey silt with rootlets. This layer was found to be in a loose condition.

Below about 0.6 m, the boreholes encountered sandy silt till. The till contains some clay and a trace to some gravel. It is brown and hard with undrained shear strengths in excess of 225 kPa. The plasticity index of the till ranges from 11 to 14 percent indicating a low plasticity till.

In Borehole 1, very dense red brown shale of the Queenston Formation was found at about 9 m or Elevation 146.0 m.

Groundwater seepage was not observed during drilling and both boreholes were dry and open to almost their complete depths at the completion of drilling. After nine days the water levels in Boreholes 1 and 2 were at 6.9 and 4.3 m respectively. The water levels in the boreholes were below the creek level.

Stability Analysis

The slope stability analysis was undertaken using the PC Slope/W program. This program uses the Bishop's Method for the stability analysis. Effective stress analysis, which is indicative of long term stability, was undertaken.

The steepest section of the slope was used for the analysis and this section is identified as Line A-A on Drawing 1.

The average stratigraphy of the site and the soil properties assumed for the analysis are given on Table 1. The groundwater was assumed to be at the same level of the creek. This is considered to be a conservative assumption.

Table 1: Soil Properties used in Effective Stress Analysis

Material	Unit Weight (kN/m^3)	Shear Strength (kPa)	Phi (degrees)
Silt Till	22.0	5	28
Alluvium	20.0	5	25
Shale	Failure prevented through the shale		

Using the above soil parameters the existing slope was found to have a factor of safety of 1.6 for effective stress analysis The stability analysis is shown on Drawing S1.

Top of Bank

Based on the results of the stability analysis, the existing slope has a factor of safety in excess of 1.5. Therefore the physical top of slope can be assumed to be the location of the stable slope line. The Halton Region Conservation Authority should be contacted to establish the physical top of slope in the field.

As previously mentioned an allowance for erosion by the creek is required for the slope. The erosion allowance is based on the guidelines in the Ontario Ministry of Natural Resources publication: Technical Guide, River & Stream Systems: Erosion Hazard Limit, Table 3. Using this table, the Toe Erosion Allowance is 2 m based on a bank full width of 5 to 30 m and stiff to hard cohesive soil.

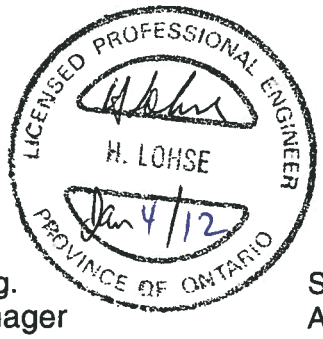
Closure

When design and specifications based on the results reported herein are required, **exp** should be retained for a general review to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, **exp** will assume no responsibility for interpretation of the recommendations in the report.

This report has been prepared for and is intended for the exclusive use of McCormick Rankin and its clients and engineers. Any use which a third party makes of this report, or any part thereof, of any reliance on or decision to be made based on it, are the responsibility of such third parties. **Exp** accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or actions based on this report. The contents of this report should not be relied upon by any other party without the express written consent of **exp**. The findings are relevant for the dates of our site visits and should not be relied upon to represent conditions at later dates.

We trust that this report is satisfactory for your purposes. Should you have any questions about this submission, please do not hesitate to contact this office.

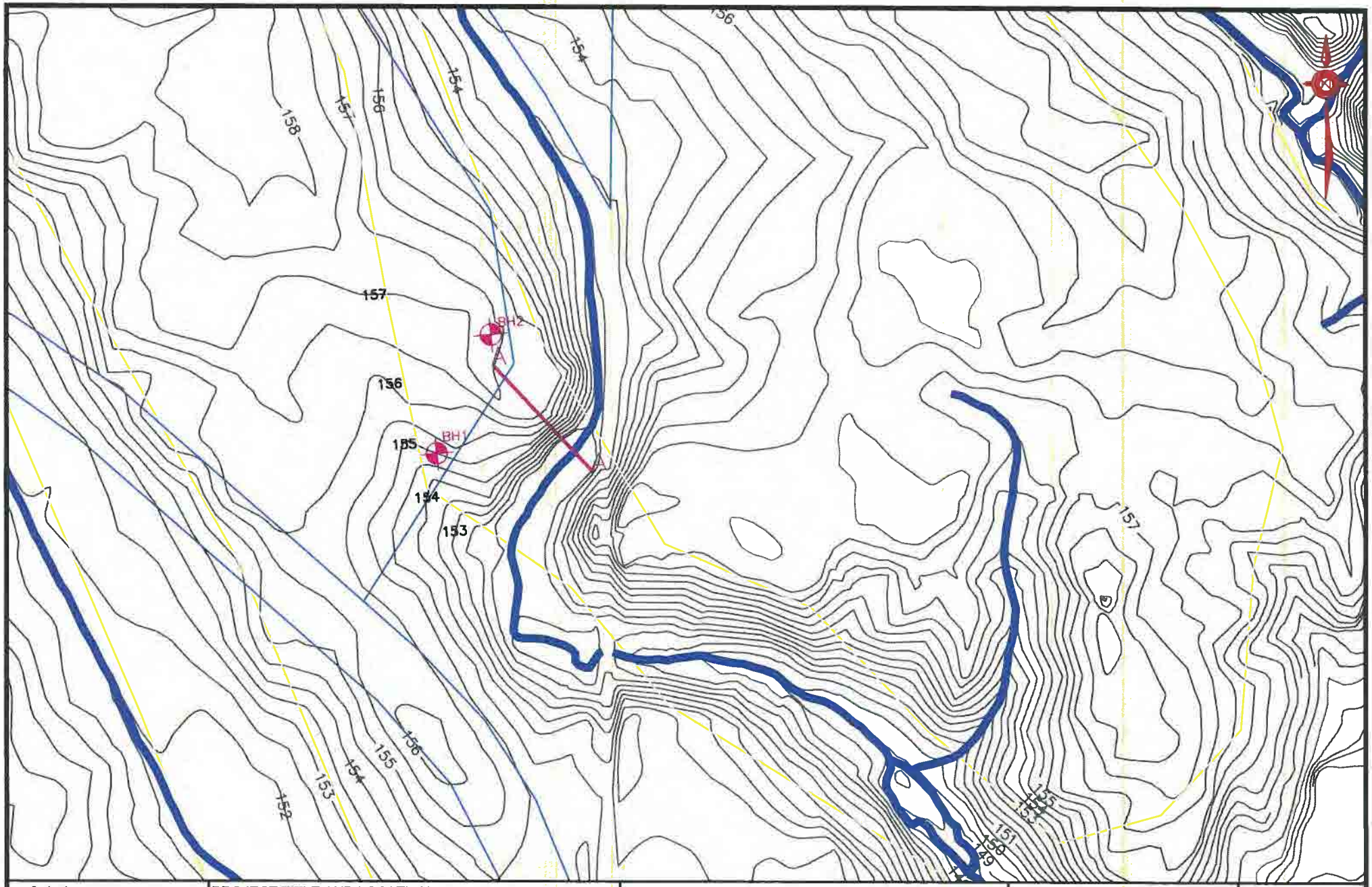
exp Services Inc.



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Senior Project Manager

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Drawings and Laboratory Results



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BUILDINGS • EARTH & ENVIRONMENT • ENERGY
INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY

PROJECT TITLE AND LOCATION:

14 MILE CREEK
OAKVILLE, ONTARIO

DRAWING TITLE:

BOREHOLE LOCATION PLAN

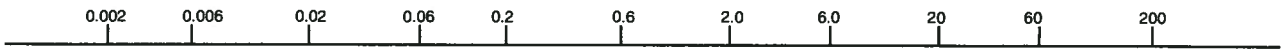
PROJECT NO.: BRM-00603264-A0	DWN.: NW
SCALE: NTS	CHK.: HL
DATE: JANUARY 2013	DWG. No.: 1

Notes On Sample Descriptions Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by exp Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

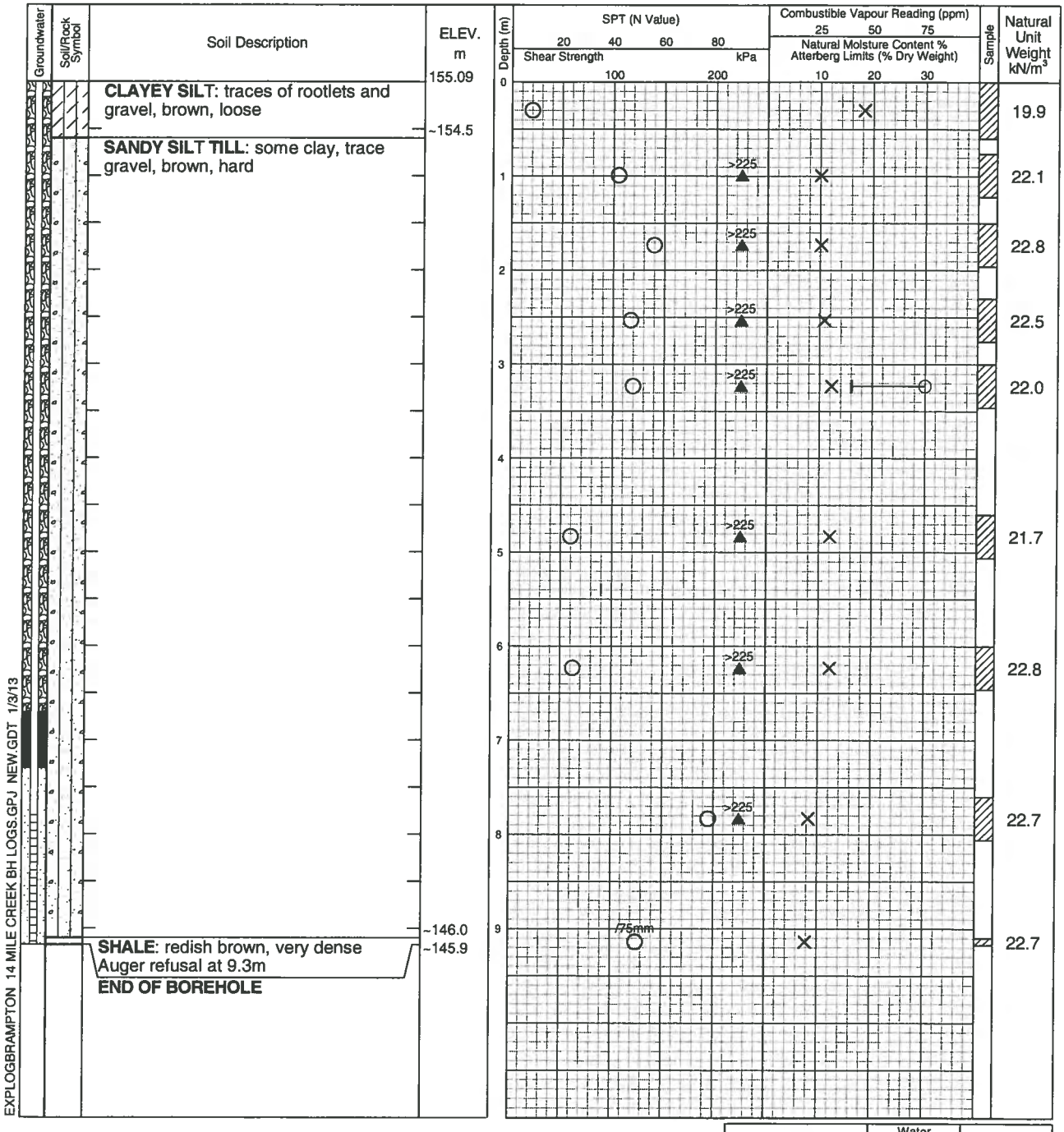
2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH 1

Project No. BRM-00603264-AO
Drawing No. 2
Project: Stable Slope Line
Sheet No. 1 of 1
Location: 14 Mile Creek at North End of Zenon Drive, Oakville, Ontario
Located on west side of creek
Date Drilled: December 10, 2012
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



EXPLOGBRAMPTON 14 MILE CREEK BH LOGS.GPJ NEW.GDT 1/3/13

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion Dec 19, 2012	dry 6.91	open

exp.

Log of Borehole BH 2

Project No. BRM-00603264-AO
Drawing No. 3
Project: Stable Slope Line
Sheet No. 1 of 1
Location: 14 Mile Creek at North End of Zenon Drive, Oakville, Ontario
Located on west side of creek
Date Drilled: December 10, 2012
Drill Type: Solid Stem Augers
Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		CLAYEY SILT: traces of rootlets and gravel, brown, loose	157.18	0	>225			21.4
			~156.6	1	>225			22.5
		SANDY SILT TILL: some clay, trace gravel, brown, hard		2	>225			22.1
				3	>225			22.4
				4	>225			22.3
				5	>225			22.3
				6	>225			22.6
				7	>225			22.8
				8	>225			22.8
				9	>225			23.7
			~147.6					
		END OF BOREHOLE						

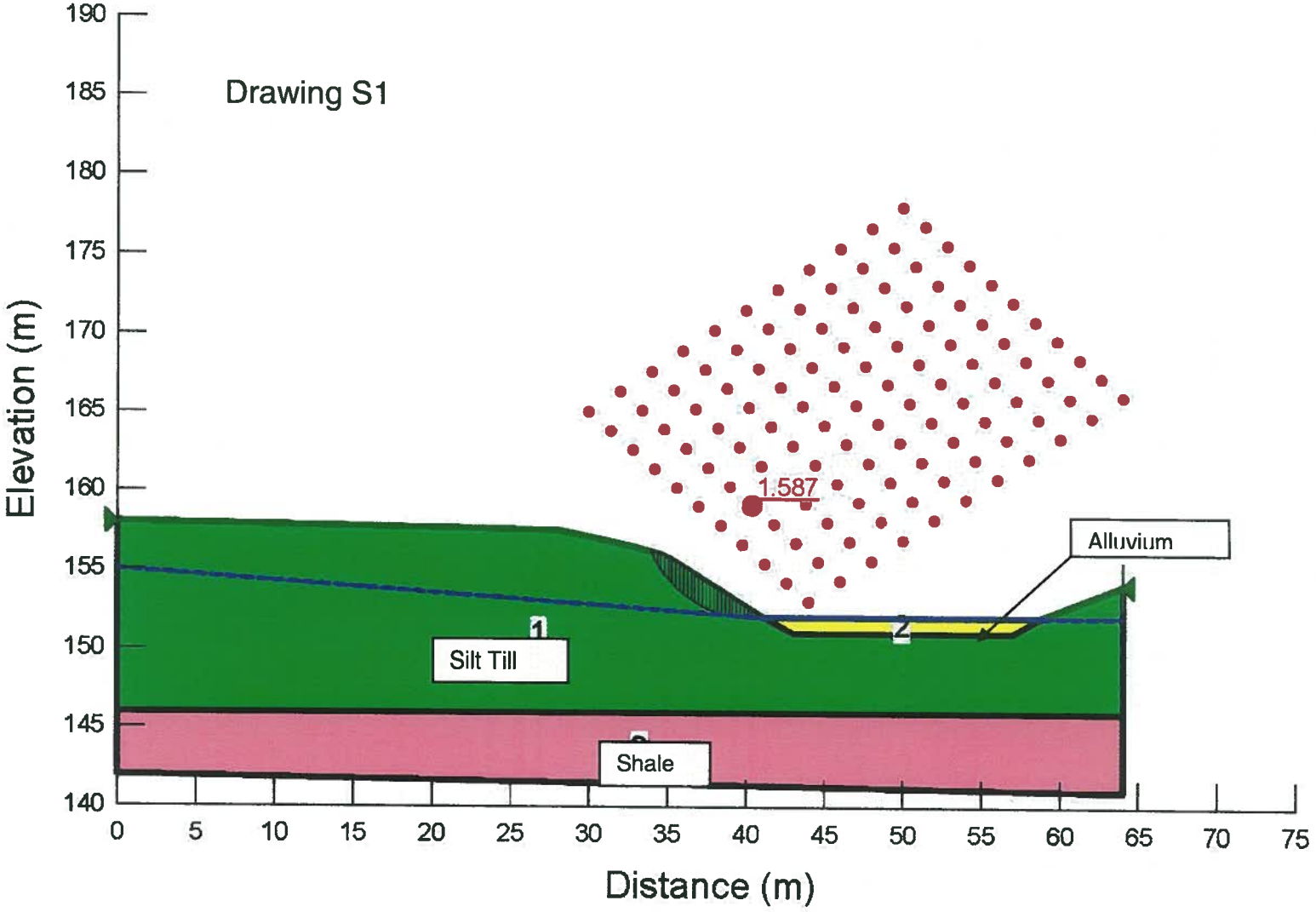
Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	dry	open
Dec 19, 2012	4.31	

EXPLOGBRAMPTON 14 MILE CREEK BH LOGS.GPJ NEW.GDT 1/3/13

exp.

Project BRM-000603264-A0
Stable Slope Line
14 Mile Creek at Zenon Drive
Oakville, Ontario

Drawing S1



exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis & Hydrometer Test Report

ST08

Sample Test No.: 186275-2 **Report No.:** 1 **Date Reported:** 17-Dec-12

Project No.: brm-00603264-a0
Project Name: GEO HL - 14 Mile Creek at Zenon Drive, Oakville, Ontario - Slope Stability Analysis

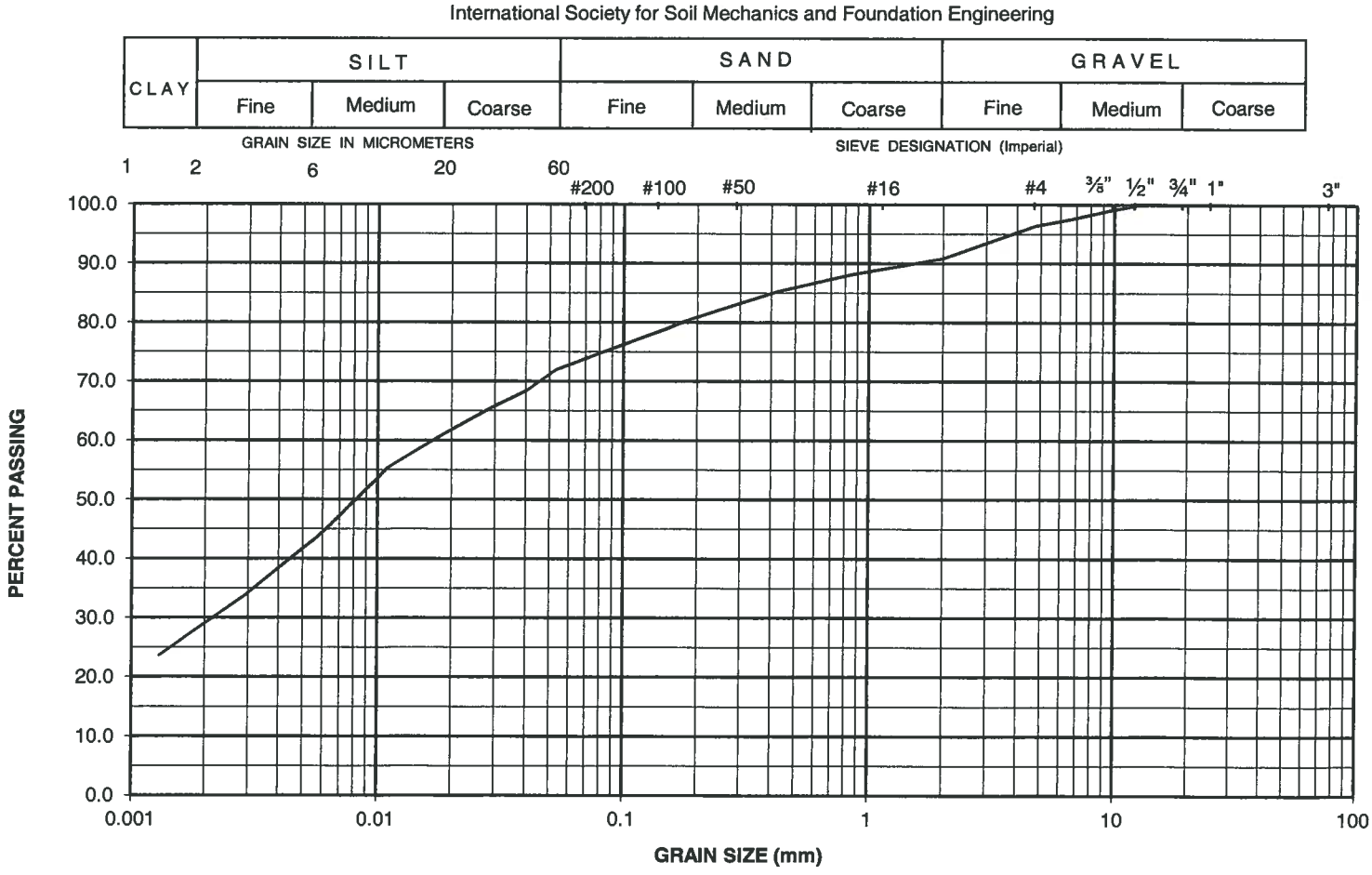
Grain Size Proportion (%)

Gravel (> 2.0mm):	**9.1**
Sand (> 60μm, < 2.0mm):	**18.4**
Silt (> 2μm), < 60μm):	**44.4**
Clay (< 2μm):	**28.1**

Sample Information

Location: BH 1
Sample Method: SS
Sample No.: 5
Depth: 3.0 - 3.5m
Sample Description: Clayey Silt;some Sand;trace Gravel;Brown
Sampled By: Nicole Wyld
Sampling Date: 12/10/2012
Date Received: 12/12/2012
Client Sample ID:
Comments:

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
26.5	100.0	**0.0404**	68.5
22.4	100.0	**0.0290**	65.6
19	100.0	**0.0187**	61.2
16	100.0	**0.0111**	55.5
13.2	100.0	**0.0080**	49.7
12.5	100.0	**0.0058**	43.9
9.5	99.1	**0.0029**	33.8
6.7	97.6	**0.0013**	23.7
4.75	96.5		
2	90.9		
0.85	88.2		
0.425	85.3		
0.25	82.2		
0.18	80.4		
0.15	79.0		
0.075	74.4		
0.053	72.0		



Project Manager: Holger Lohse **Approved By:** *Original Signed By*
Willie Rodych, Lab Supervisor
Date Approved: 17-Dec-12

exp Services Inc.
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Ontario, Canada, L6T 4V1
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Fax: (905) 793-0641

Grain Size Analysis & Hydrometer Test Report

ST08

Sample Test No.: 186276-2 **Report No.:** 2 **Date Reported:** 17-Dec-12

Project No.: brm-00603264-a0
Project Name: GEO HL - 14 Mile Creek at Zenon Drive, Oakville, Ontario - Slope Stability Analysis

Grain Size Proportion (%)

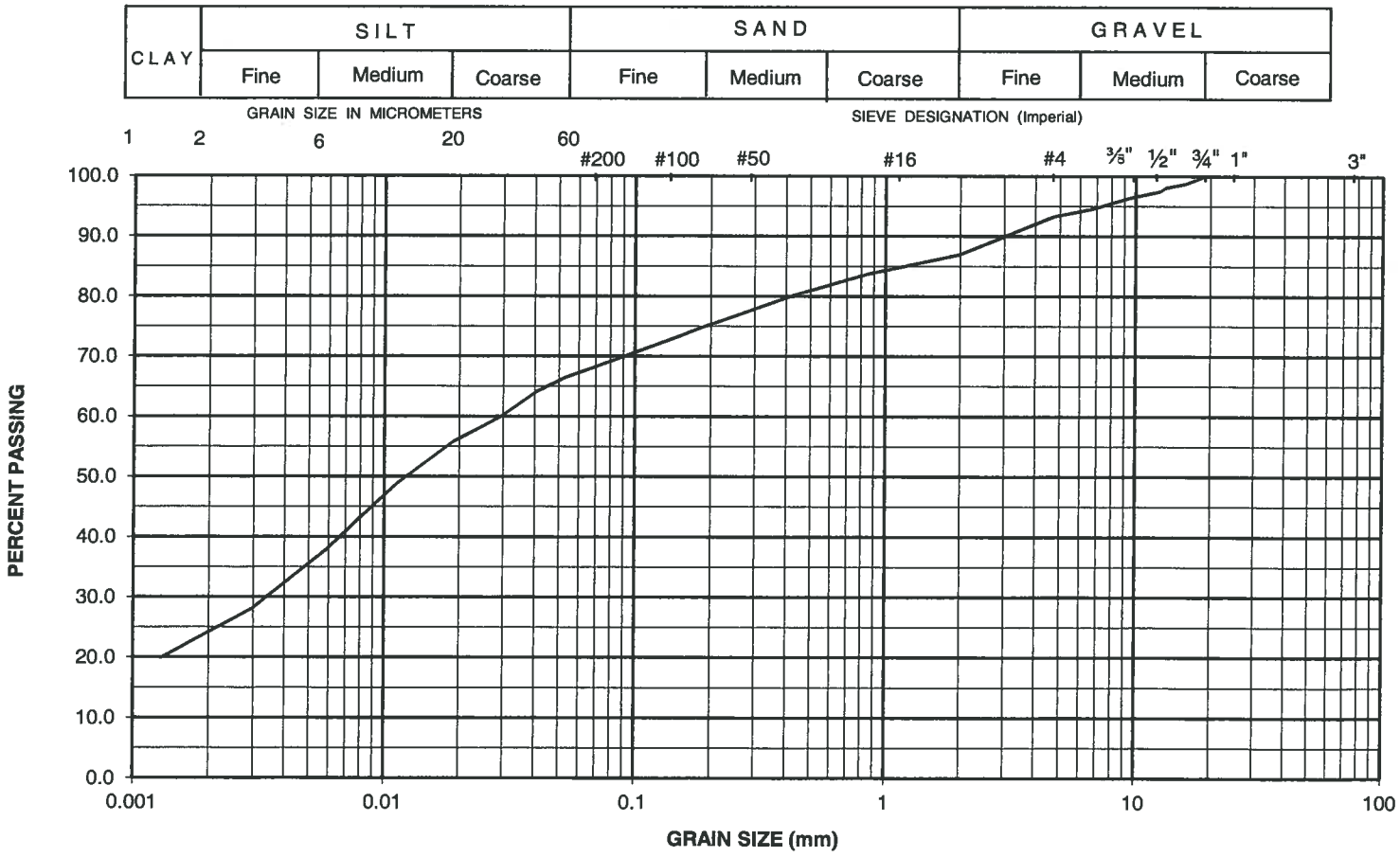
Gravel (> 2.0mm):	**13.0**
Sand (> 60µm, < 2.0mm):	**19.5**
Silt (> 2µm), < 60µm):	**44.2**
Clay (< 2µm):	**23.3**

Sample Information

Location: BH 2
Sample Method: SS
Sample No.: 7
Depth: 6.1 - 6.6m
Sample Description: Clayey Silt, some Sand and Gravel; Brown
Sampled By: Nicole Wyld
Sampling Date: 12/10/2012
Date Received: 12/12/2012
Client Sample ID:
Comments:

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
26.5	100.0	**0.0407**	64.1
22.4	100.0	**0.0294**	60.0
19	100.0	**0.0189**	55.8
16	98.8	**0.0113**	48.9
13.2	98.1	**0.0081**	43.4
12.5	97.5	**0.0059**	37.9
9.5	96.4	**0.0030**	28.2
6.7	94.6	**0.0013**	19.9
4.75	93.4		
2	87.0		
0.85	83.7		
0.425	80.2		
0.25	76.7		
0.18	74.6		
0.15	73.3		
0.075	68.8		
0.053	66.5		

International Society for Soil Mechanics and Foundation Engineering



Project Manager: Holger Lohse **Approved By:** *Original Signed By*
Willie Rodych, Lab Supervisor
Date Approved: 17-Dec-12

Trow Associates Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Plasticity Index Test Report

ST03

Project No.: Brm-00603264 **Date Reported:** December 17,2012

Sample Number: BH1 SS5 (3.0 - 3.5m)

Sample Info: Date Sampled: 12/10/2012; Date Received: 12/12/2012; Lab.No:

Liquid Limit

Trial Number	1	2	3	4	
Number of Blows	20	16	37	27	
Moisture Tin No.	27	5	11	25	
Mass of Soil and Tin, g	24.921	28.775	26.821	27.260	
Mass of Dry Soil and Tin, g	22.586	25.836	24.571	24.785	
Mass of Tin, g	15.163	16.651	16.745	16.636	
Mass of Water, g	2.335	2.939	2.250	2.475	
Mass of Dry Soil, g	7.423	9.185	7.826	8.149	
Water Content, %	31.5%	32.0%	28.8%	30.4%	

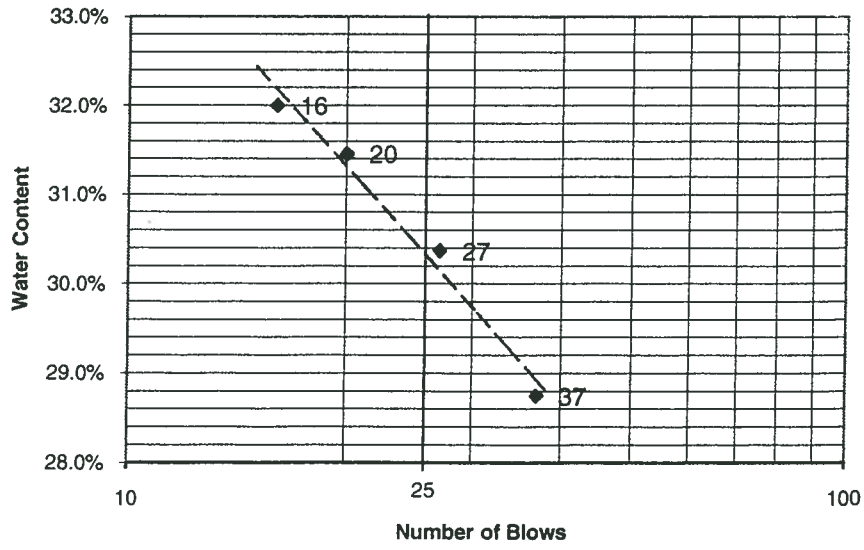
Plasticity Limit

Trial Number	1	2	3
Moisture Tin No.	4	22	2
Mass of Soil and Tin, g	23.592	24.524	23.602
Mass of Dry Soil and Tin, g	22.447	23.415	22.637
Mass of Tin, g	15.505	16.476	16.83
Mass of Water, g	1.145	1.109	0.965
Mass of Dry Soil, g	6.942	6.939	5.807
Water Content, %	16.5%	16.0%	16.6%

Summary of Results

Liquid Limit:	30
Plastic Limit:	16
Plasticity Index:	14

Flow Curve



Project Manager:

Approved By: Willie Rodych
(Lab Supervisor)

Trow

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Fax: (905) 793-0641

Plasticity Index Test Report

ST03

Project No.: Brm-00603264 **Date Reported:** December 17,2012

Sample Number: BH2 SS7 (6.1 - 6.6m)

Sample Info: Date Sampled: 12/10/2012; Date Received: 12/12/2012; Lab.No:

Liquid Limit

Trial Number	1	2	3	4	
Number of Blows	26	22	16	41	
Moisture Tin No.	17	14	34	16	
Mass of Soil and Tin, g	28.960	27.188	26.220	27.001	
Mass of Dry Soil and Tin, g	26.469	25.014	24.165	24.980	
Mass of Tin, g	16.707	16.684	16.589	16.745	
Mass of Water, g	2.491	2.174	2.055	2.021	
Mass of Dry Soil, g	9.762	8.330	7.576	8.235	
Water Content, %	25.5%	26.1%	27.1%	24.5%	

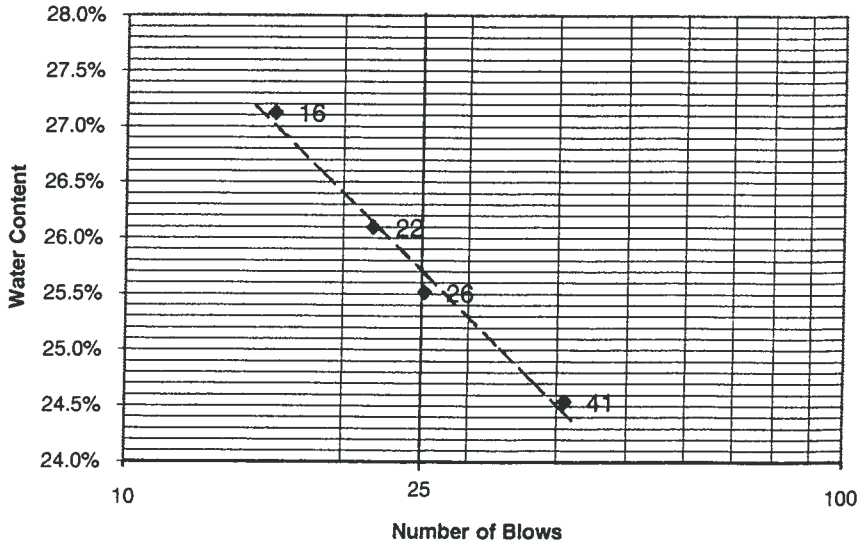
Plasticity Limit

Trial Number	1	2	3
Moisture Tin No.	21	15	20
Mass of Soil and Tin, g	23.075	24.425	25.341
Mass of Dry Soil and Tin, g	22.101	23.398	24.215
Mass of Tin, g	15.575	16.521	16.686
Mass of Water, g	0.974	1.027	1.126
Mass of Dry Soil, g	6.526	6.877	7.529
Water Content, %	14.9%	14.9%	15.0%

Summary of Results

Liquid Limit:	26
Plastic Limit:	15
Plasticity Index:	11

Flow Curve



Project Manager:

Approved By: Willie Rodych
(Lab Supervisor)

Appendix 6.6 – Stream Length and Drainage Density

Stream Length and Density Requirements

The pattern and arrangement of natural stream channels determines the efficiency of the drainage system. Generally, (with all other variables constant), the time required for water to flow a given distance is directly proportional to length. Drainage density affects the magnitude of streamflow from a drainage basin and the relationship between drainage density and streamflow may be expressed as;

$$Q \ \alpha \ (\text{Drainage Density})^n.$$

Therefore, changes in drainage density in a catchment due to stream diversion/rehabilitation will primarily affect the magnitude of stream flow.

Pre-Development Condition

The following stream reaches of the 14 Mile Creek flow generally from north to south direction through the proposed development area as shown in Figure 7.4.5:

Subcatchment-FM-1001

- 14W-12: High Constraint Stream (573 m)
- 14W-16: Medium Constraint Stream (421 m)
- 14W-14: Medium Constraint Stream (801 m)
- 14W-13: Low Constraint Stream (960 m)
- 14W-12A: High Constraint Stream (106 m)
- 14W-14A: Man-Made Pond (300 m) - Considered Medium Constraint by NOCSS.

Subcatchment-FM-1109

- 14W -11: High Constraint Stream (196 m)
- 14W-11A: Medium Constraint Stream (225 m)

Stream lengths shown in parentheses correspond to stream lengths within the site boundary. Overall drainage densities calculated at the Dundas Street culvert catchments are based on the stream lengths provided in Table 5.8.1 of NOCSS and are presented in Table 1.

Table 1 Pre-Development Drainage Densities at Dundas Street Culverts

Subcatchment ID	Outlet	Drainage Area (km^2)	Stream Length (km)[a]	Drainage Density (km/km^2)	Area Weighted Drainage Density (km/km^2)
FM-1001	FM-D4	3.97	18.79	4.73	5.05
FM-1109	FM-D5	3.51	18.88	5.38	

[a] Includes high (red), medium (blue) and low (green) constraint streams

The minimum allowable drainage density of 1.29 km/km^2 is recommended in the NOCSS for the North Oakville subwatersheds. This lower limit represents the regional average drainage density minus one standard deviation.

According to the NOCSS, the North Oakville catchments possess sufficient stream lengths to satisfy the imposed drainage density targets based only on the high and medium constraint streams. Despite individual basins having a deficit, there is an overall subwatershed surplus indicating that the replication of low constraint stream lengths is not necessary.

Post-Development Condition

The medium constraint stream 14W-14 and the low constraint stream 14W-13 of the Fourteen Mile Creek West within the development area proposed to be eliminated to accommodate development. The proposed diversions 14W-21 (low constraint stream) along the Highway 407 will intercept flows from the reaches 14W-13 and 14W-14 just downstream of Highway 407 and divert them 10 m upstream the confluence with the 14W-16 via another proposed diversion 14W-22 (medium constraint stream) along the southwest property limits as shown in Figure 6.1. The existing medium constraint tributary 14W-16 will remain in undisturbed condition. Another medium constraint stream 14W-11A will be realigned along Highway 407 and southeast limits of the property limits (14W-23) to accommodate development. The post-development stream reaches through the site is summarized below:

Subcatchment-FM-1001

- 14W-12: High Constraint Stream (573 m)
- 14W-16: High Constraint Stream (421 m)
- 14W-14: Medium Constraint Stream (157 m)
- 14W-13: Low Constraint Stream (94 m)
- 14W-22: Medium Constraint Stream (780 m)
- 14W - 21: Low Constraint Stream (206 m)
- 14W-12A: High Constraint Stream (86 m)

Subcatchment-FM-ll09(Figure3.6)

- 14W -11: High Constraint Stream (196 m)
- 14W-23: Medium Constraint Stream (446 m)

The pre- and post-development stream lengths are compared in Table 2 for high, medium and low constraint streams within the site boundary. Table 2 compares pre- and post-development drainage density for the proposed development area.

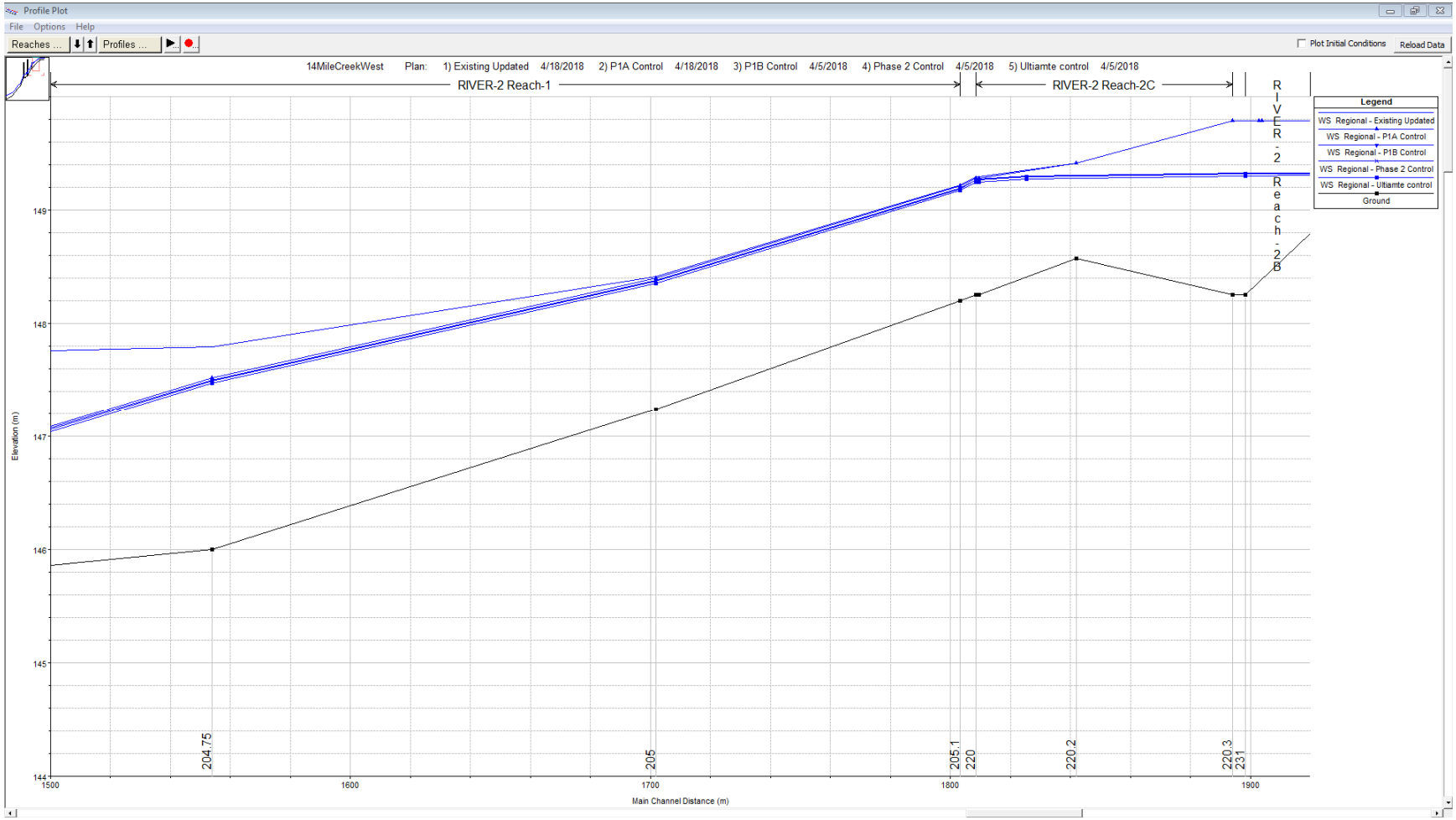
Table 2 Post-Development Densities at Dundas Street Culverts

Subcatchment 1D	Outlet	Drainage Area (km^2)	Stream Length (km)[a]	Drainage Density (km/km^2)	Area Weighted Drainage Density (km/km^2)
FM-1001	FM-D4	4.14	18.11	4.37	4.89
FM-1109	FM-D5	3.51	18.98	5.41	

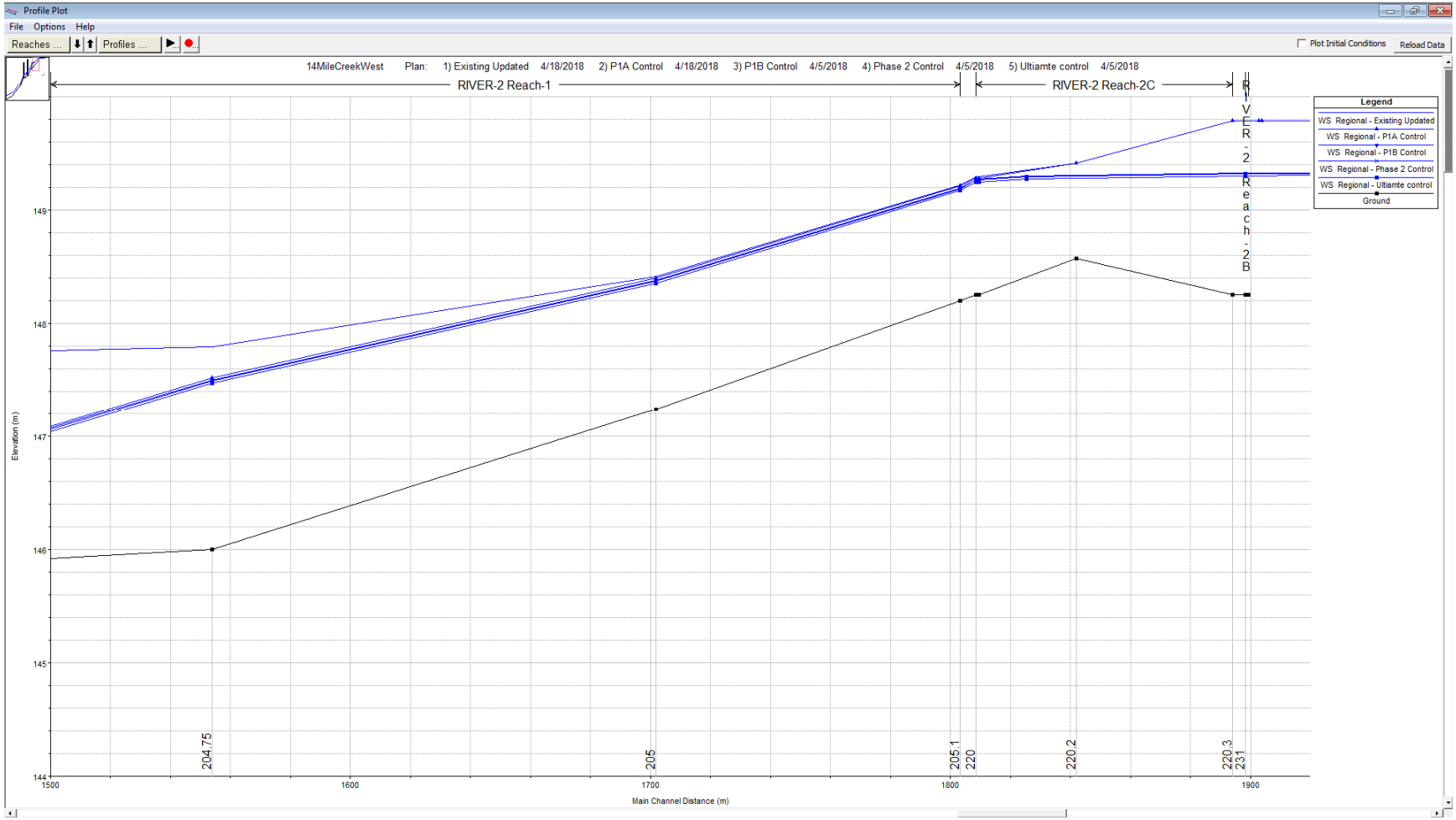
[a] Includes high (red), medium (blue) and low (green) constraint streams

Appendix 6.7 – Water Surface Profiles at Tie in of 14W-22 and 14W-12A

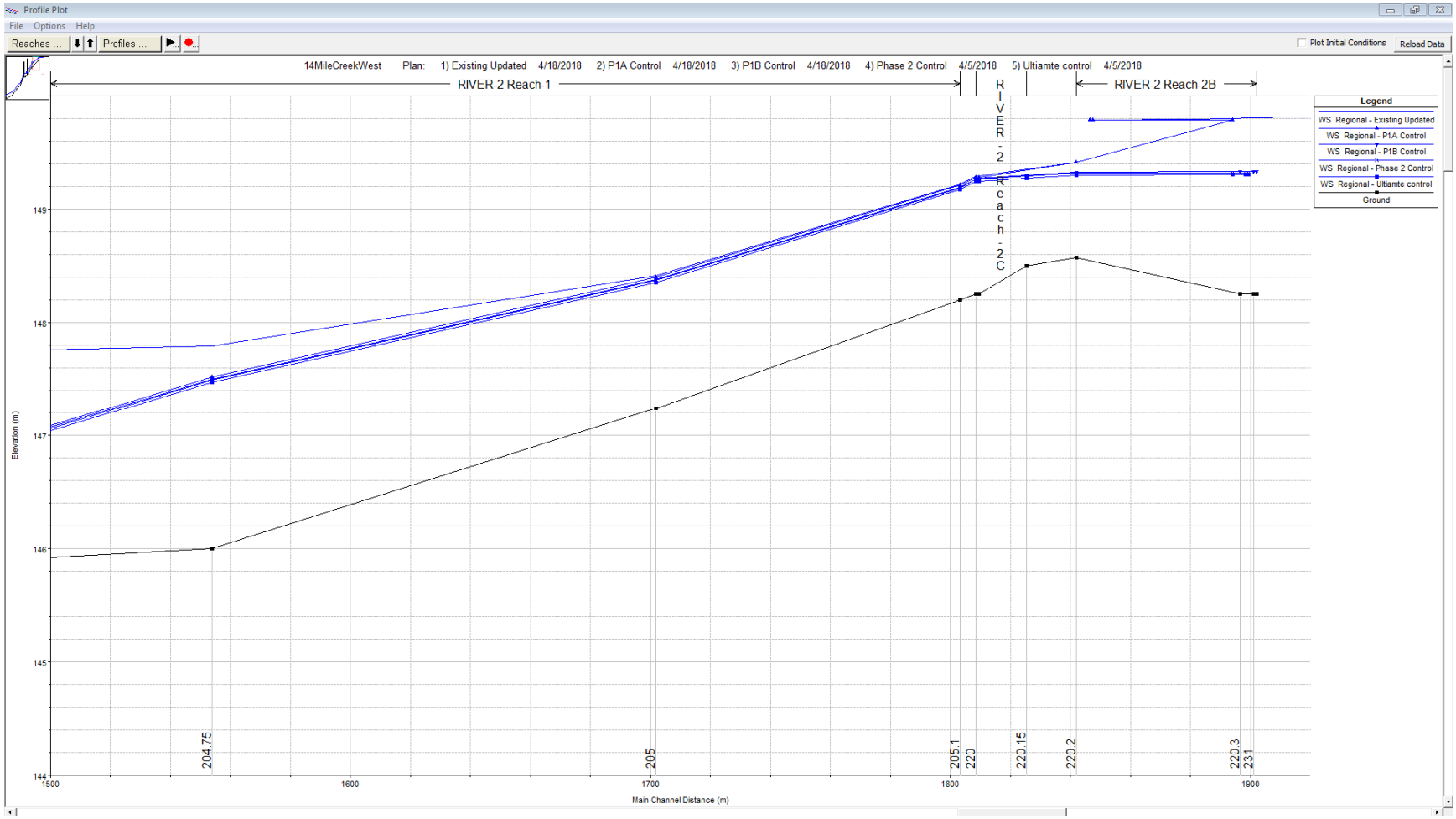
Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.2, 220.3, 231, 231.1 for Existing condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/5/2018 4) Phase 2 Control 4/5/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)

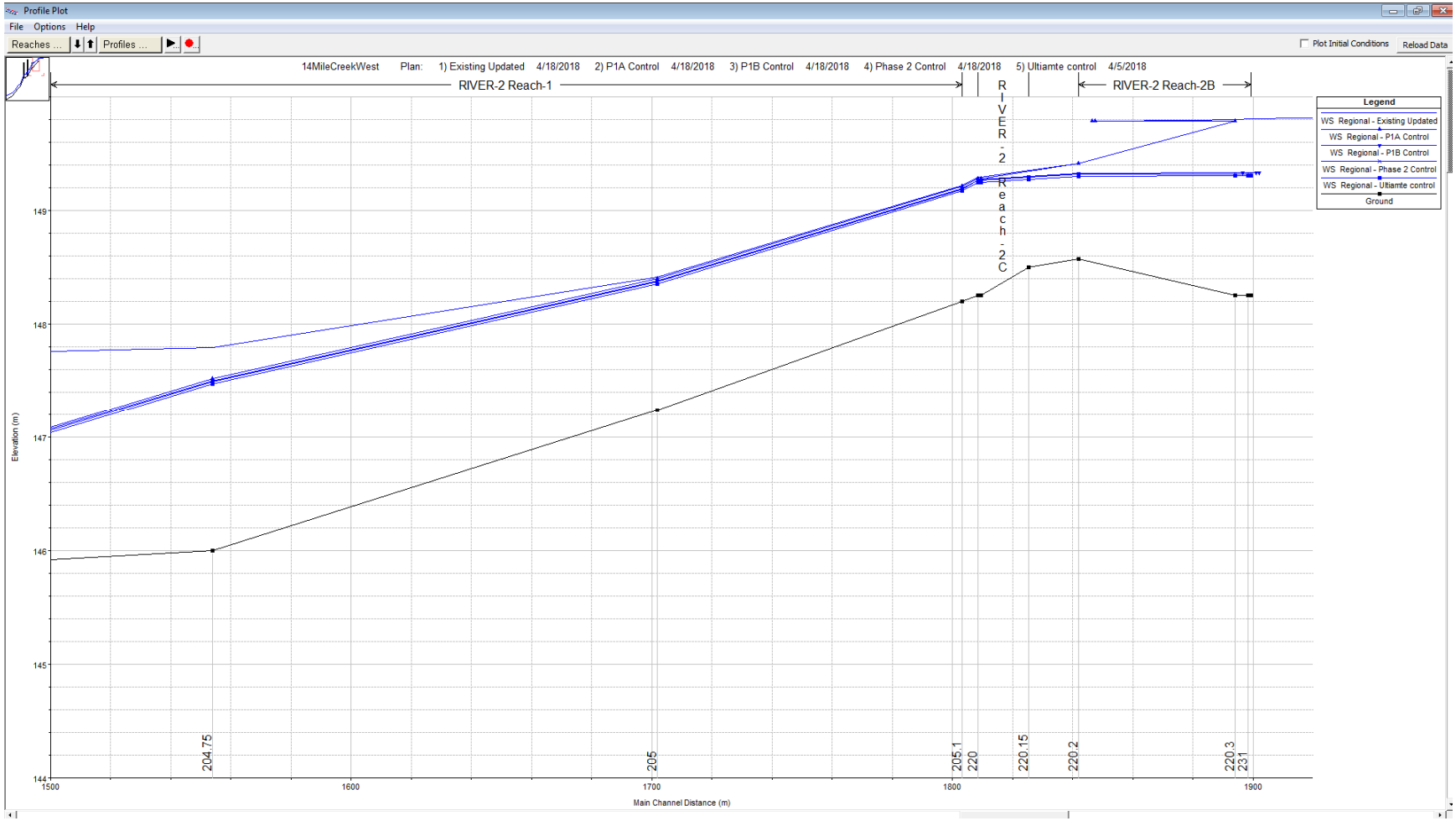
Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.2, 220.3, 231, 231.1 for Phase 1A condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/5/2018 4) Phase 2 Control 4/5/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)

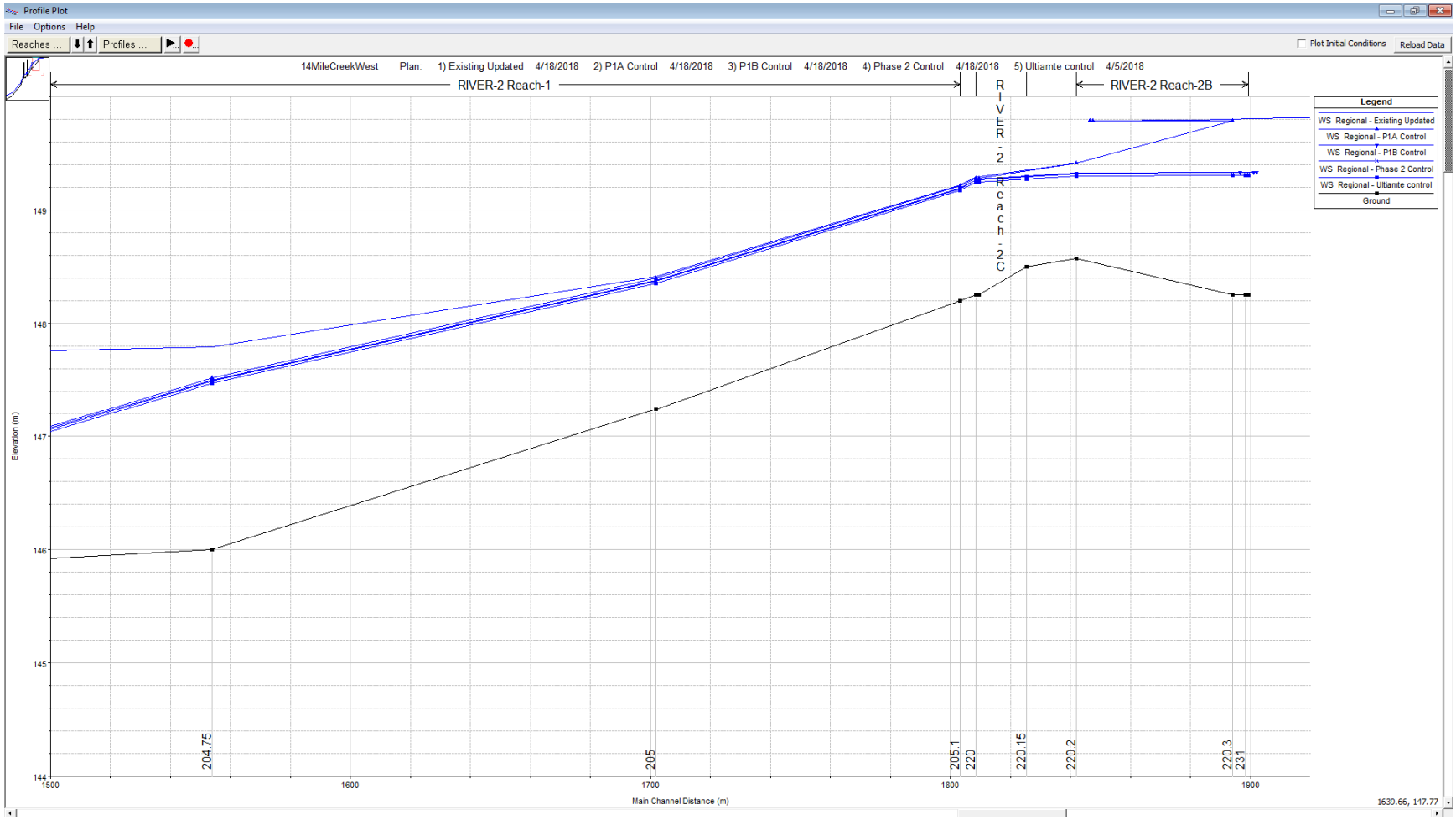
Profile of XS 240.75, 205, 220, 220.1, 220.15, 220.2, 220.3, 231, 231.1 for Phase 1B condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/18/2018 4) Phase 2 Control 4/5/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.15
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)

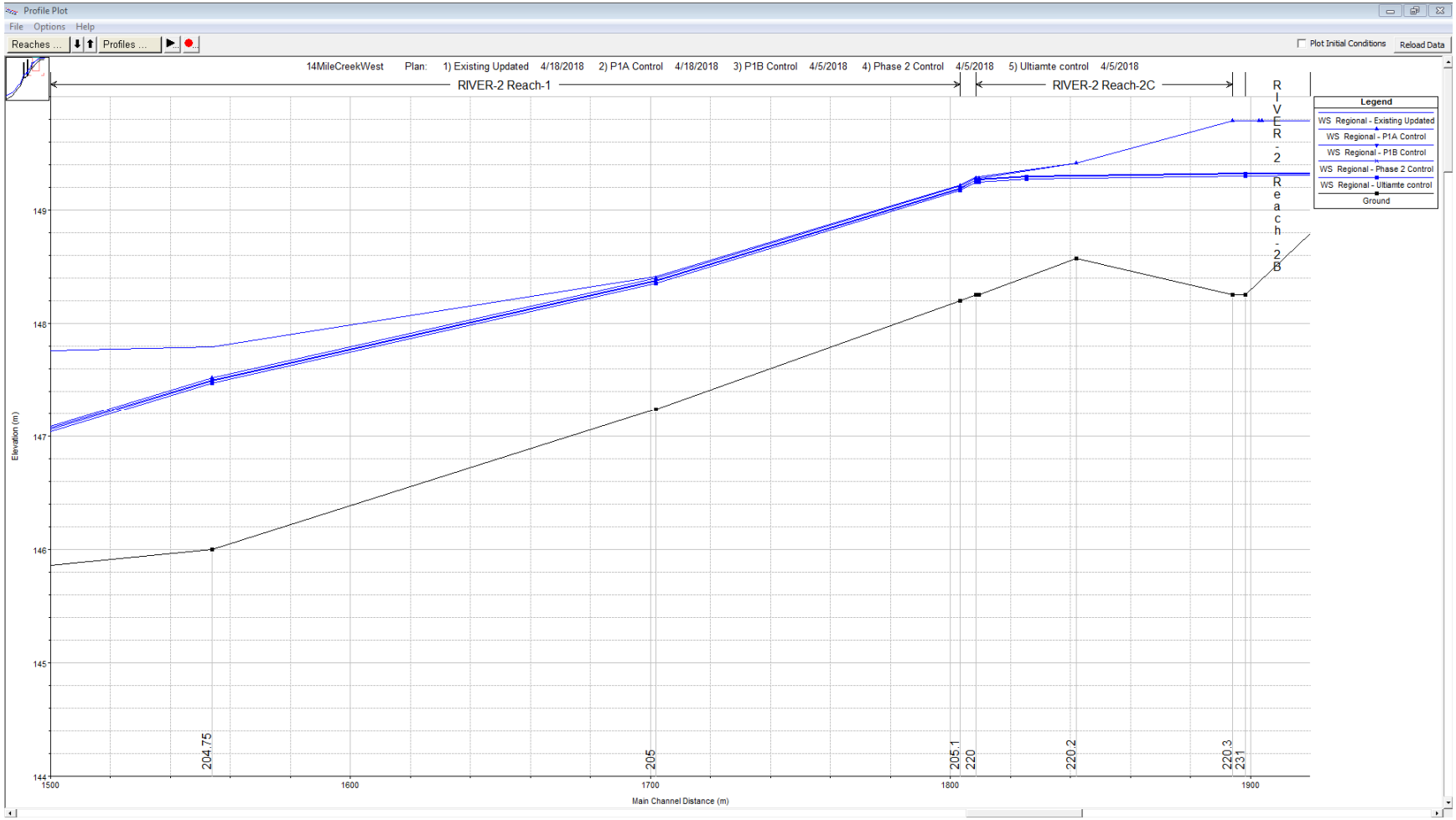
Profile of XS 240.75, 205, 220, 220.1, 220.15, 220.2, 220.3, 231, 231.1 for Phase 2 condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/18/2018 4) Phase 2 Control 4/18/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.15
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)

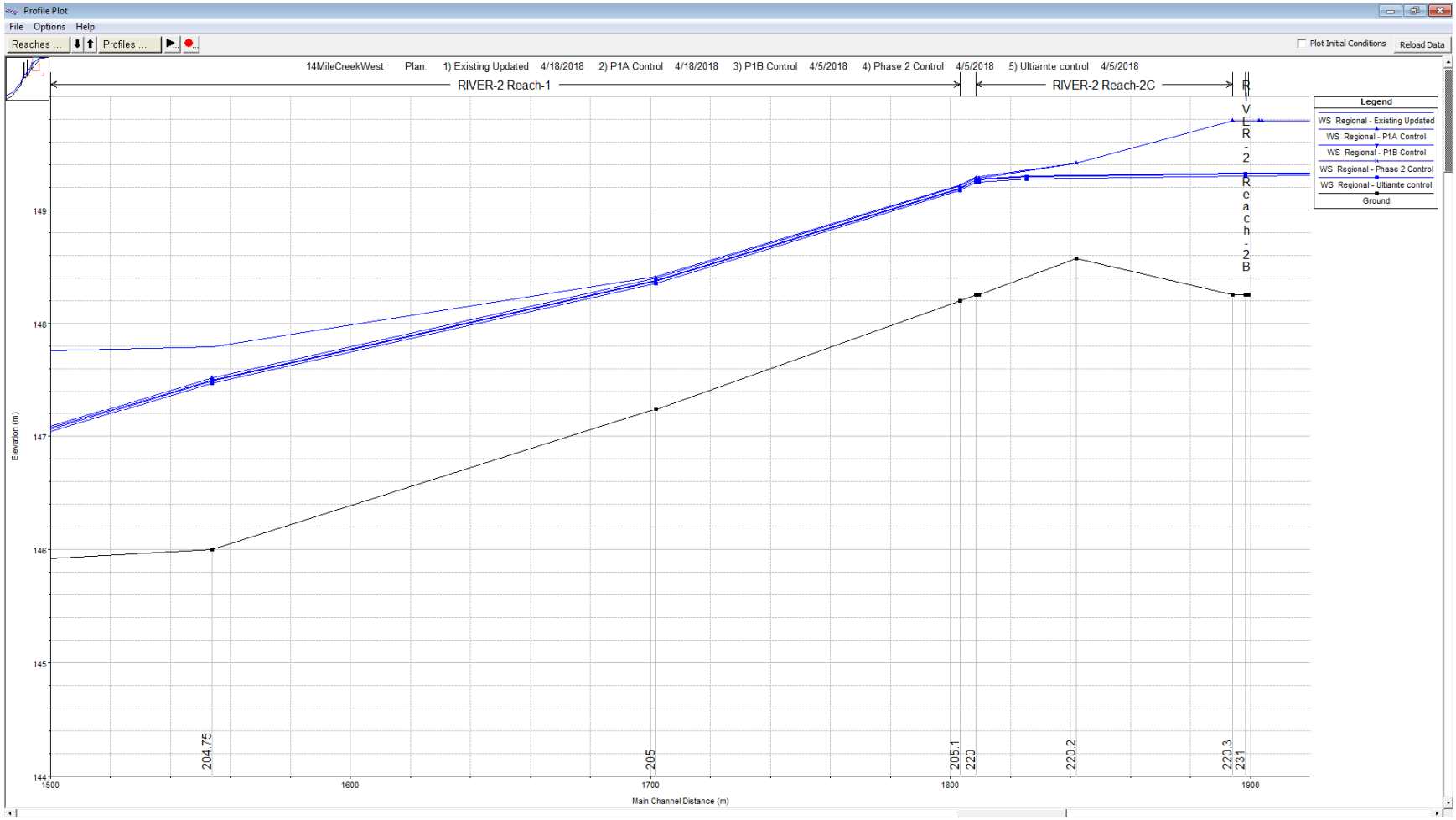
Profile of XS 240.75, 205, 220, 220.1, 220.15, 220.2, 220.3, 231, 231.1 for Ultimate condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/18/2018 4) Phase 2 Control 4/18/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.15
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)
1639.66, 147.77

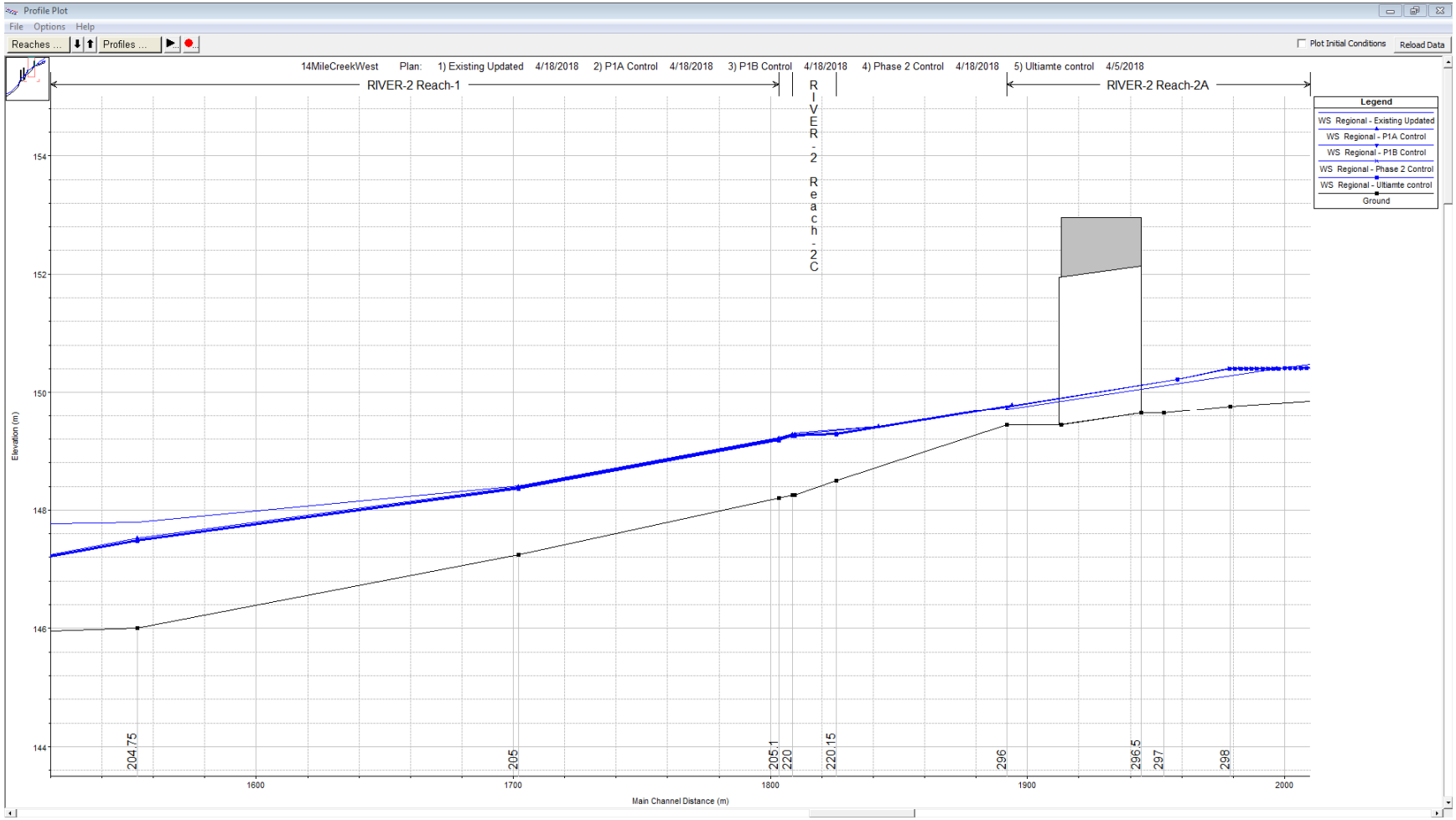
Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.2, 220.3, 221, 222 for Existing condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/5/2018 4) Phase 2 Control 4/5/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)

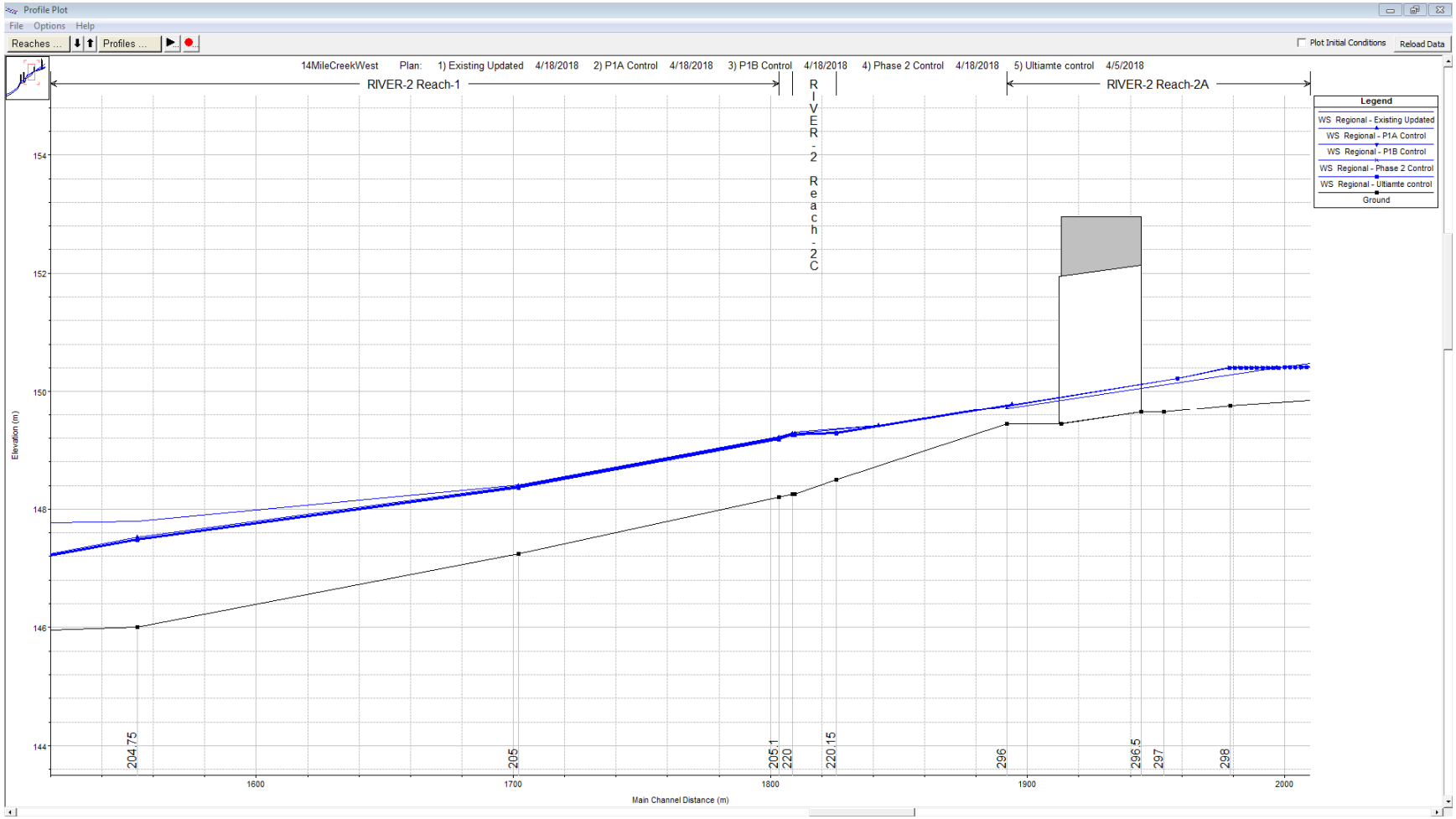
Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.2, 220.3, 221, 222 for Phase 1A condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/5/2018 4) Phase 2 Control 4/5/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2B
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
149
148
147
146
145
144
204.75
205
205.1
220
220.2
220.3
231
1500
1600
1700
1800
1900
Main Channel Distance (m)

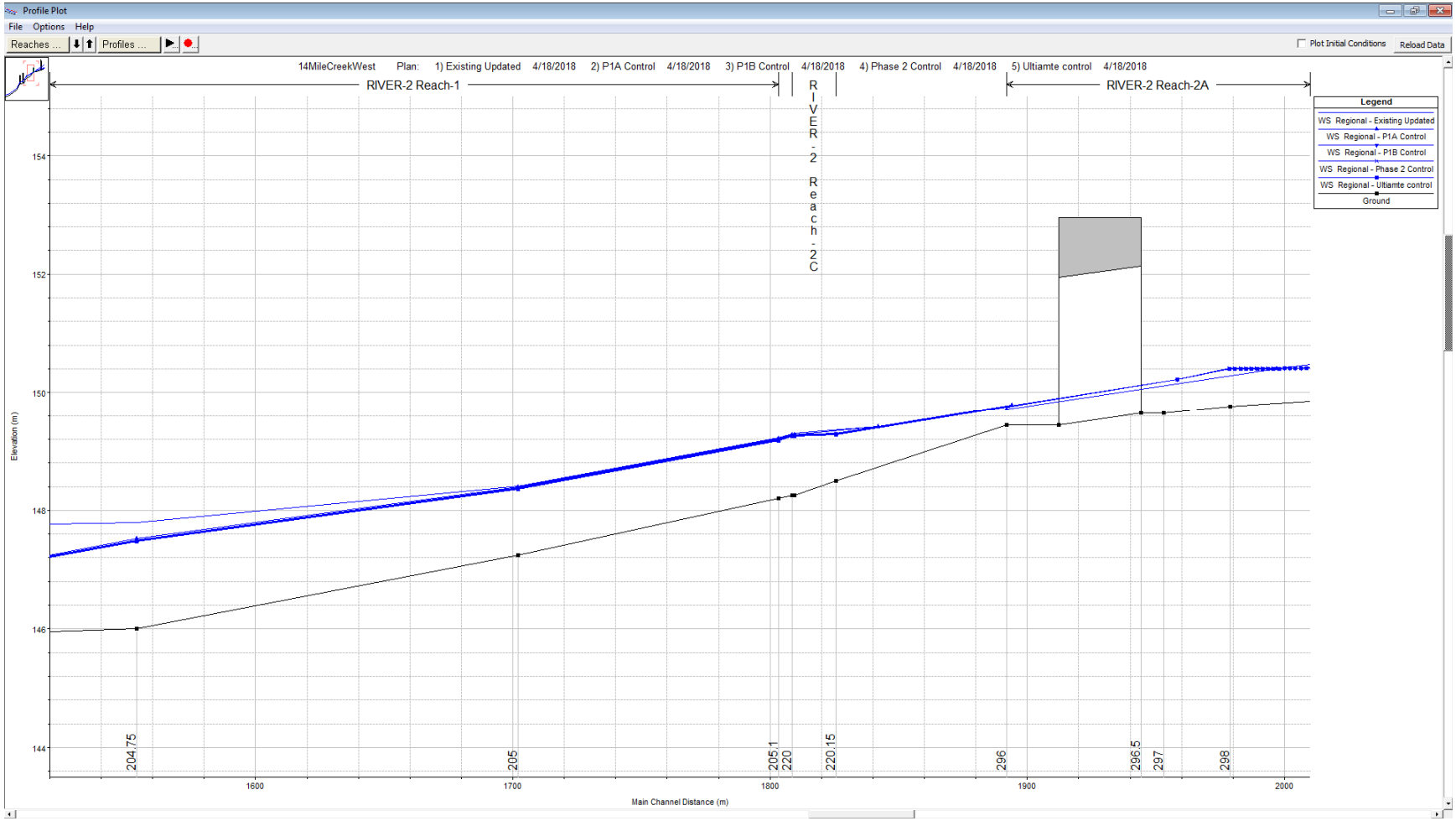
Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.15, 296, 297 and 298 for Phase 1B condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/18/2018 4) Phase 2 Control 4/18/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2A
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
154
152
150
148
146
144
204.75
205
205.1
220
220.15
296
296.5
297
298
1600
1700
1800
1900
2000
Main Channel Distance (m)

Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.15, 296, 297 and 298 for Phase 2 condition

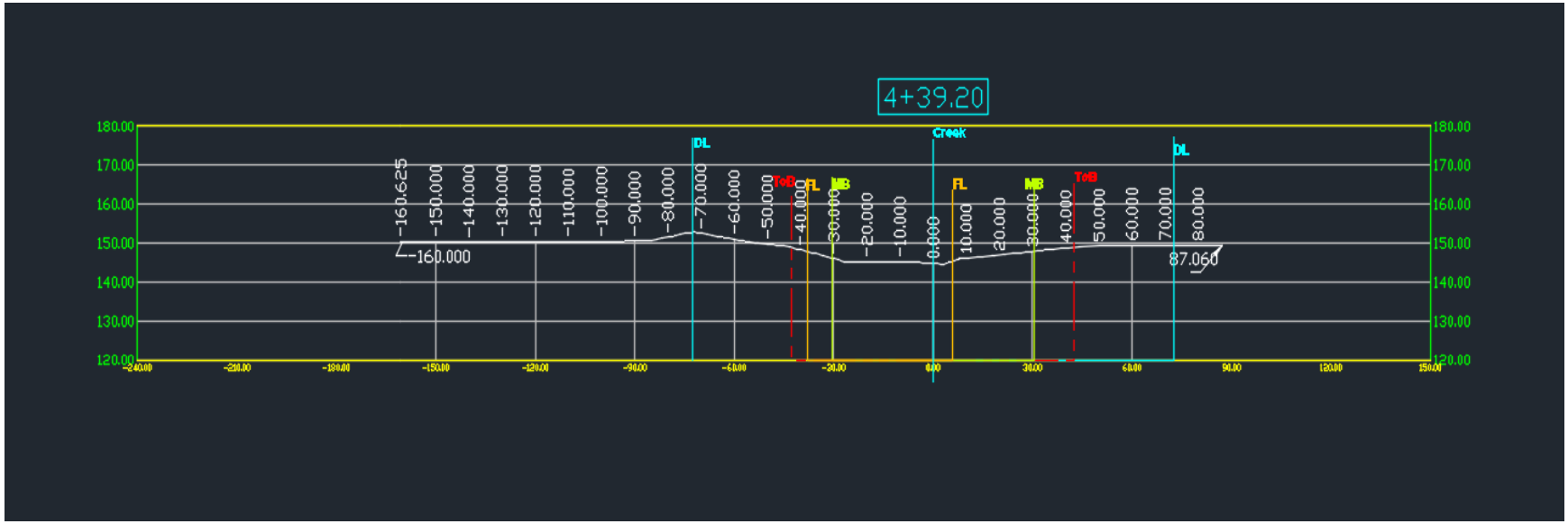

Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/18/2018 4) Phase 2 Control 4/18/2018 5) Ultiamte control 4/5/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2A
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
154
152
150
148
146
144
204.75
205
205.1
220
220.15
296
296.5
297
298
1600
1700
1800
1900
2000
Main Channel Distance (m)

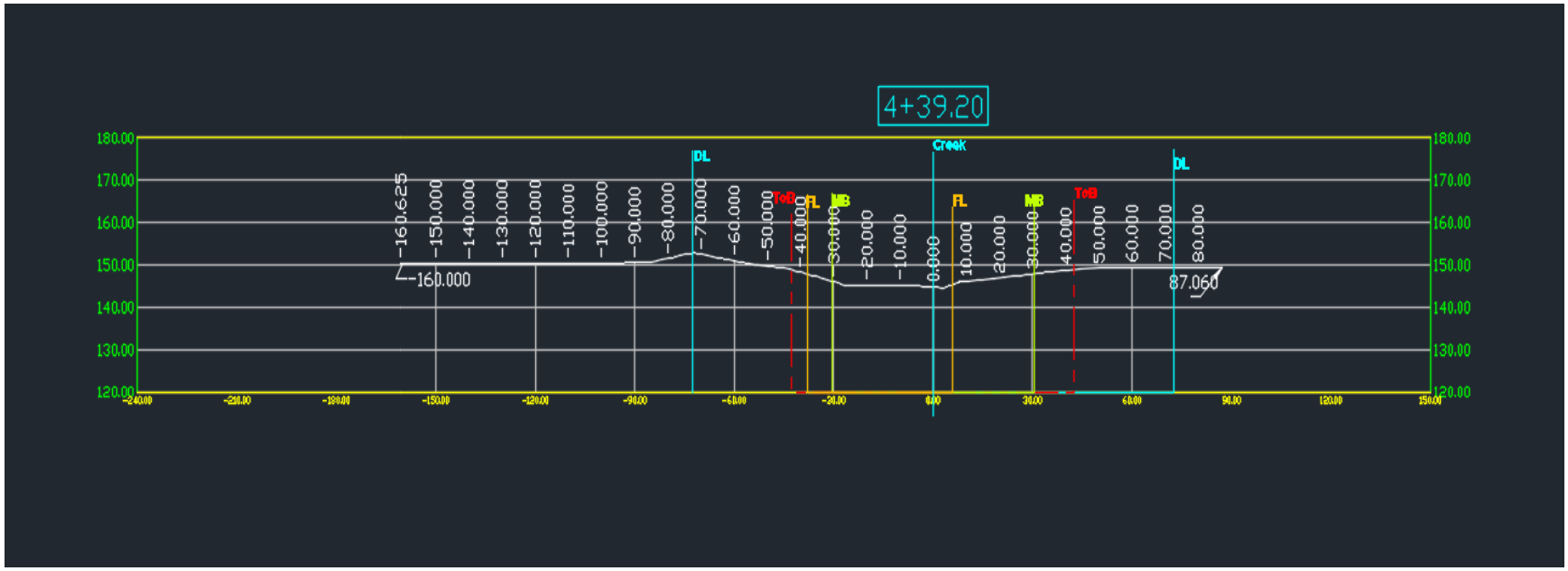
Profile of XS 240.75, 205, 205.1, 220, 220.1, 220.15, 296, 297 and 298 for Ultimate condition


Profile Plot
File Options Help
Reaches ...
Profiles ...
Plot Initial Conditions
Reload Data
14MileCreekWest Plan: 1) Existing Updated 4/18/2018 2) P1A Control 4/18/2018 3) P1B Control 4/18/2018 4) Phase 2 Control 4/18/2018 5) Ultiamte control 4/18/2018
RIVER-2 Reach-1
RIVER-2 Reach-2C
RIVER-2 Reach-2A
Legend
WS Regional - Existing Updated
WS Regional - P1A Control
WS Regional - P1B Control
WS Regional - Phase 2 Control
WS Regional - Ultiamte control
Ground
Elevation (m)
154
152
150
148
146
144
204.75
205
205.1
220
220.15
296
296.5
297
298
1600
1700
1800
1900
2000
Main Channel Distance (m)

Appendix 6.8 – Top of Bank 14W-12A South of Farm Pond




4+39.20
180.00
170.00
160.00
150.00
140.00
130.00
120.00
DL
Creek
DL
ToB
FL
MB
FL
MB
ToB
-160.625
-150.000
-140.000
-130.000
-120.000
-110.000
-100.000
-90.000
-80.000
-70.000
-60.000
-50.000
-40.000
-30.000
-20.000
-10.000
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
-160.000
87.060


4+39.20
DL
Creek
DL
ToB
FL
MB
FL
MB
ToB
-160.625
-150.000
-140.000
-130.000
-120.000
-110.000
-100.000
-90.000
-80.000
-70.000
-60.000
-50.000
-40.000
-30.000
-20.000
-10.000
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
-160.000
87.060
180.00
170.00
160.00
150.00
140.00
130.00
120.00