411000 412000 413000 414000 415000 416000 417000 418000 419000

4990000 4989000 4988000 4987000 4986000 4985000 4984000 4983000

Kennetcook River

Avon River

St. Croix River

Belmont Road

Belmont Road

Miller's Creek Extension
Project Area

Non-Mineral Registration: No. 002

Ferry Road

Miller's Creek Mine
(Existing Operation)

Avondale Road

Avondale Road

Non-Mineral
Registration:
No. 001

LEGEND:

- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area
- Non Mineral Registration

SOURCE:

Basemap - Nova Scotia Topographic Database, SNS&MR
Mineral Registration - NS Natural Resources.
DPME 51 Feb 2009
Project Data - CGC Inc. & CRA

0 250 500 1,000 1,500
Metres

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:30,000	August 20, 2009	820677K

820677K (10) GIS-DA021_Site Location.mxd

figure 2.1
SITE LOCATION
Miller's Creek Extension Project
CGC INC. - WINDSOR PLANT
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

412000 413000 414000 415000 416000 417000 418000 419000

4989000 4988000 4987000 4986000 4985000 4984000 4983000

Avon River

Kennetcook River

Non Mineral Registraion 002

Belmont Road

Pole Road

Miller's Creek Mine Extension
Project Area

Ferry Road
Crossing

Miller's Creek Mine
(Existing Operation)

Non Mineral Registraion 002

Non Mineral Registraion 002

Ferry Road

Pole Road

St. Croix River

LEGEND:

- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area

SOURCE:

Airphoto Hauts-Monts Inc 14 May 2006 (AS06106-6, & -8)
Basemap - Nova Scotia Topographic Database, SNS&MR
Mineral Registration - NS Natural Resources.
DPME 51 Feb 2009
Project Data - CGC Inc. & CRA

0 250 500 1,000 1,500
Metres

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:25,000	August 20, 2009	820677K

820677K (10) GIS-DA022 Site layout photo.mxd

figure 2.2
SITE LAYOUT - PHOTO MAP
Miller's Creek Extension Project
CGC INC - WINDSOR PLANT
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

412000 413000 414000 415000 416000

4988000 4987000 4986000 4985000

Non Mineral Registraion 002

Miller's Creek Mine Extension
Project Area

Belmont Road

Ferry Road
Crossing

Ferry Road

Avondale Road

Avondale Road

Non Mineral Registraion 002

LEGEND:

- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area

SOURCE:

Airphoto Hauts-Monts Inc 14 May 2006 (AS06106-6, & -8)
Basemap - Nova Scotia Topographic Database, SNS&MR
Mineral Registration - NS Natural Resources.
DPME 51 Feb 2009
Project Data - CGC Inc. & CRA

0 50100 200 300 400 500
Metres

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:15,000	August 20, 2009	820677K

820677K (10) GIS-DA022a_Site layout photo.mxd

figure 2.2a
SITE LAYOUT - PHOTO MAP
PROPOSED PROJECT SITE
Miller's Creek Extension Project
CGC INC - WINDSOR PLANT
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

LEGEND:

- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area

SOURCE:

Airphoto Hauts-Monts Inc 14 May 2006 (AS06106-6, & -8)
Basemap - Nova Scotia Topographic Database, SNS&MR
Mineral Registration - NS Natural Resources.
DPME 51 Feb 2009
Project Data - CGC Inc. & CRA

0 50100 200 300 400
Metres

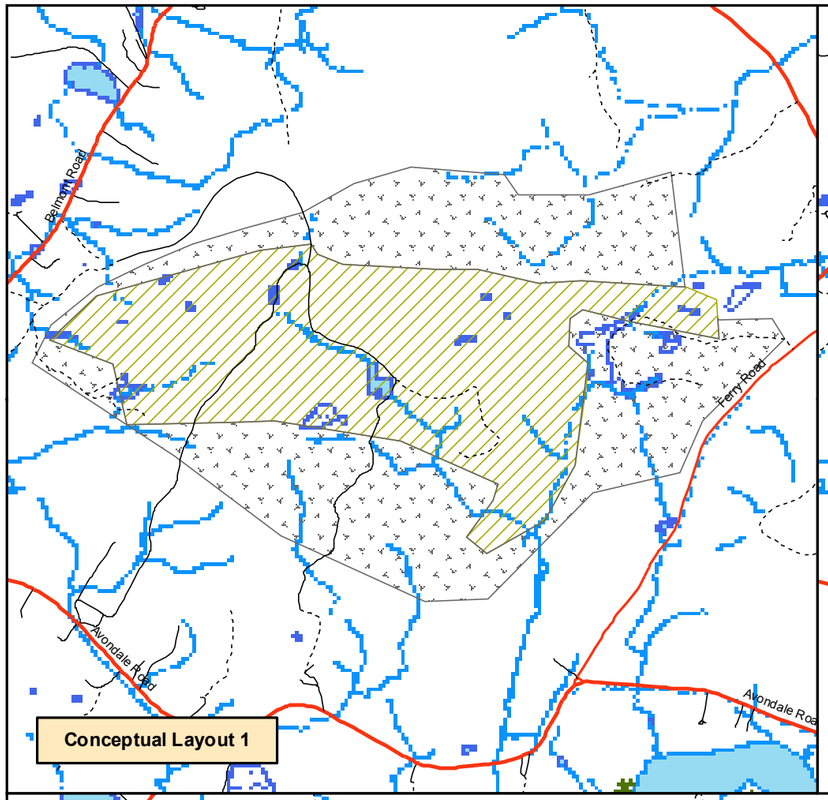
N

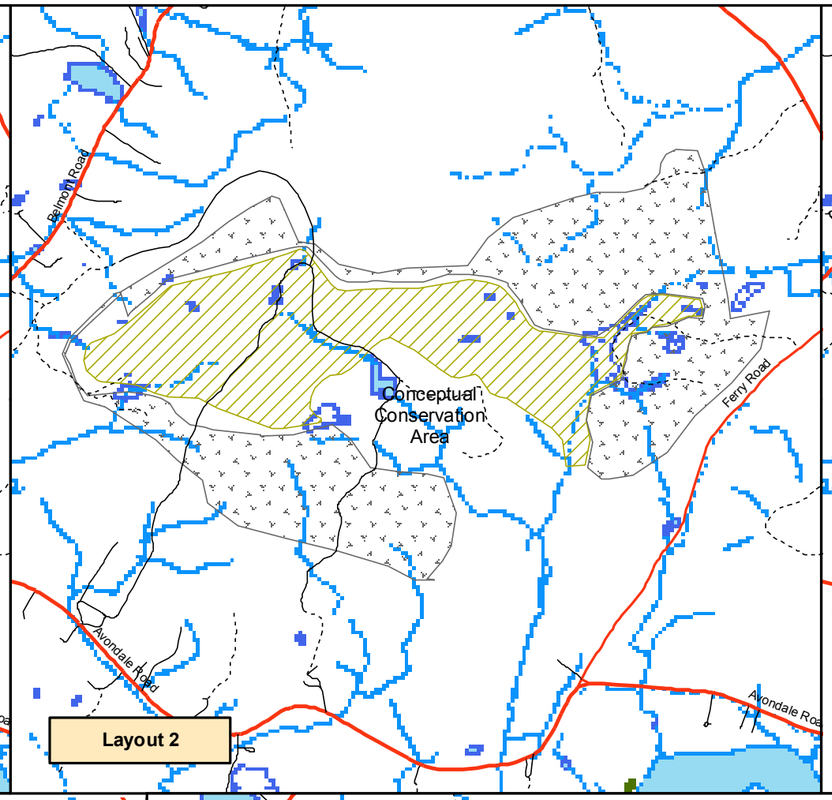
PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:15,000	August 20, 2009	820677K

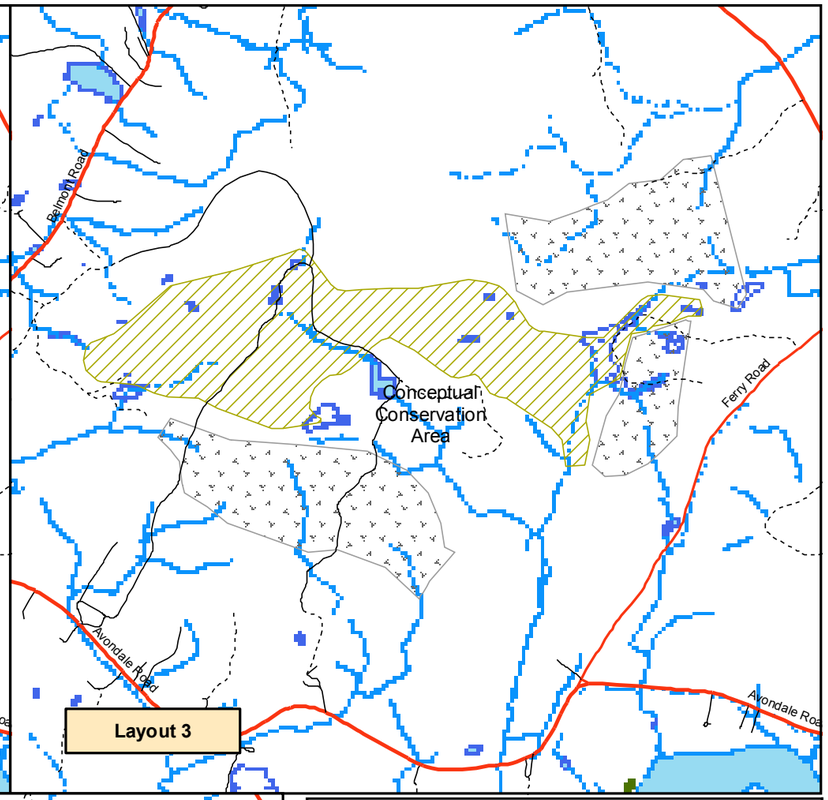
820677K (10) GIS-DA022b_Site layout photo.mxd

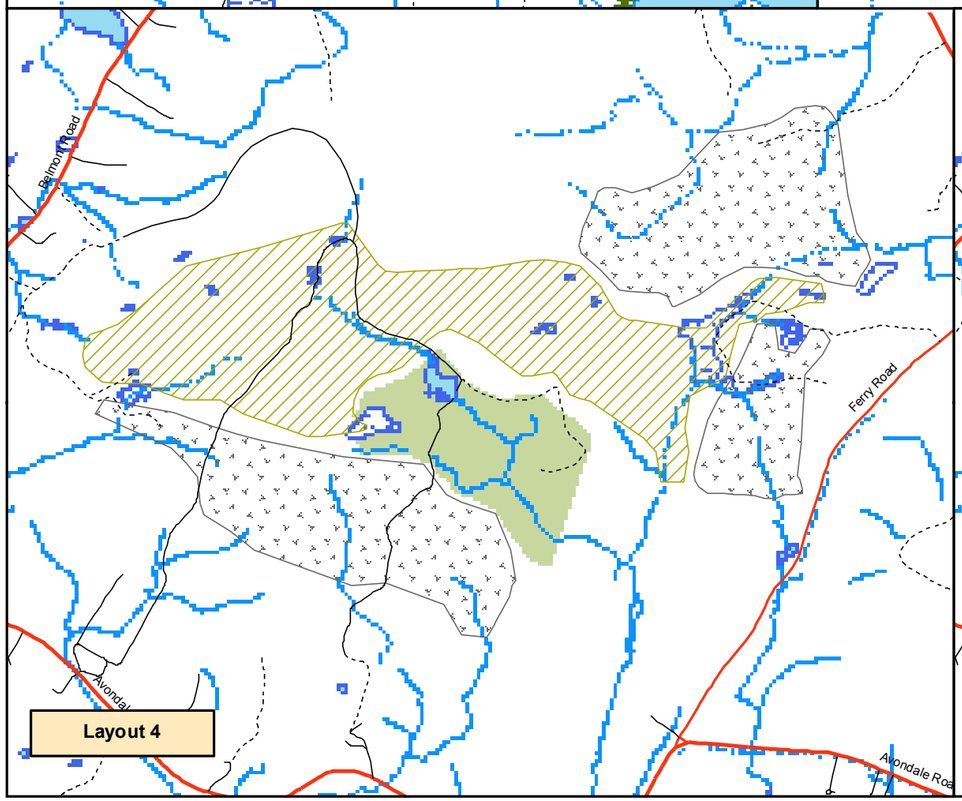
figure 2.2b
SITE LAYOUT - PHOTO MAP
EXISTING MINE
Miller's Creek Extension Project
CGC INC - WINDSOR PLANT
Hants County, Nova Scotia

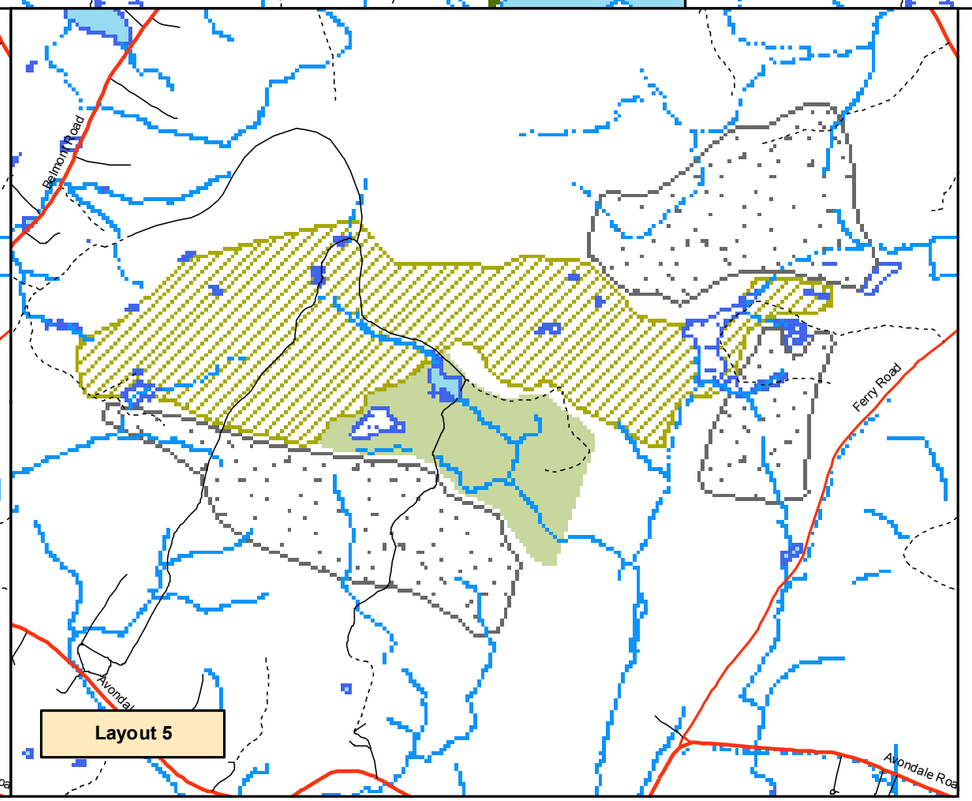
CONESTOGA-ROVERS & ASSOCIATES











LEGEND:

- Extraction Area
- Stockpile Areas
- Conservation Area

SOURCE:

Base Map : SNS&MR
Concepts: CGC Inc.

NOTE:

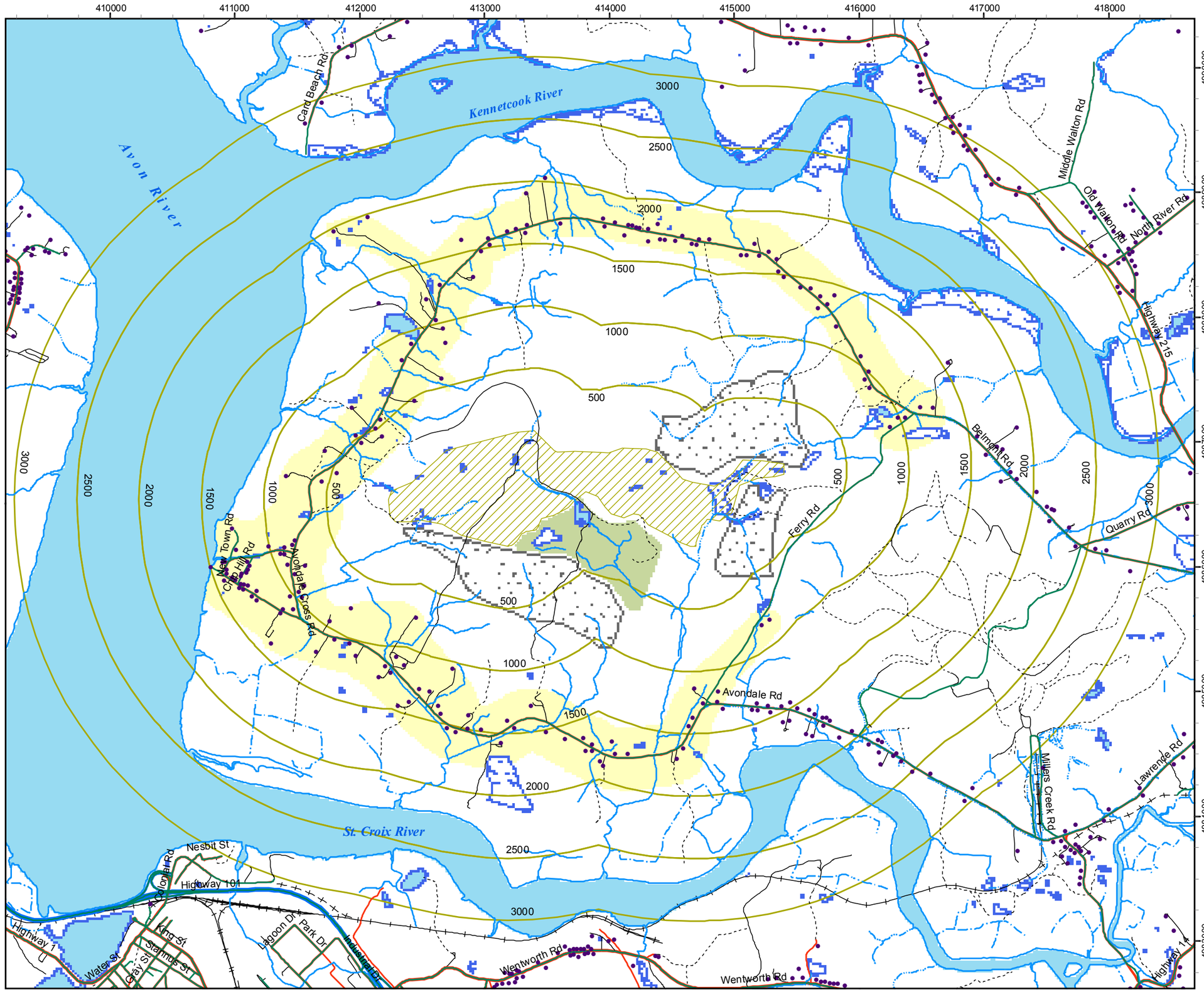
For the Current Proposal
(Layout 5)
See Figures 2.1 & 2.2

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:30,000 / 1:25,000	August 24, 2009	820677K

820677K(10) GIS-DA031_Alternates.mxd

figure 3.1
CHRONOLOGY OF ALTERNATE MINE LAYOUTS
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES



LEGEND:

- Domestic Water Well Locations
- Distance from Edge of Pit (m)
- Proposed Extraction Area
- Proposed Stockpiles
- Wetlands
- Conservation_Area
- Extent of Domestic Well Surveys

Distance from Pit	No. of Potential Wells
500 m	- 4
1000 m	- 32
1500 m	- 85
2000 m	- 75
2500 m	- 16
3000 m	- 20 (6 on Peninsula)

SOURCE:

Nova Scotia Topographic Database
SNS&MR - NS Geomatics Centre
Water Wells approximated based on Civic Location (NSCAF)
and the limits of Municipal Water Systems

0 100 200 400 600 800 1,000
Metres

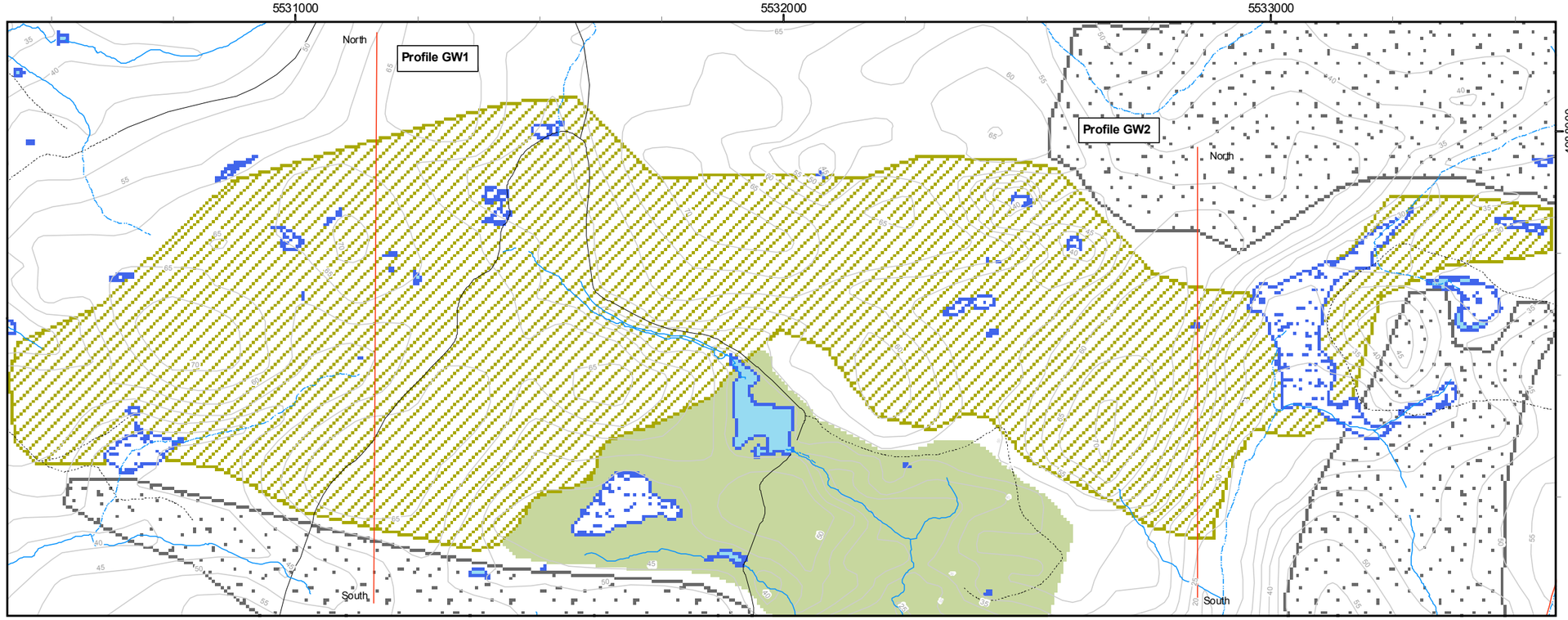
N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:30,000	August 28, 2009	820677K

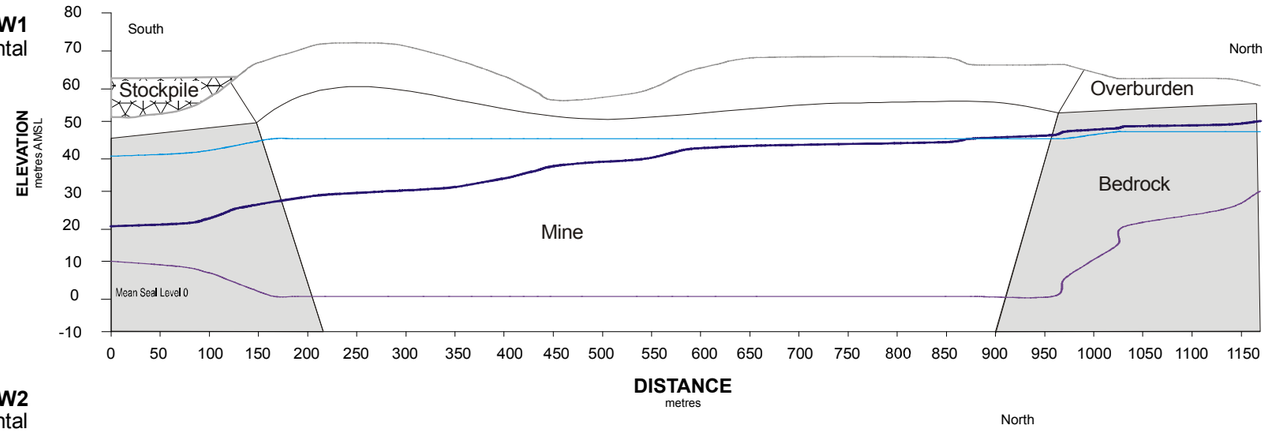
820677K(10)GIS_DA411_Domestic Wells.mxd

Figure 4.1-1
DOMESTIC WELL LOCATIONS - DISTANCES FROM EXTRACTION AREA
Miller's Creek Extension Project
CGC Inc., Windsor Plant
Hants County, Nova Scotia

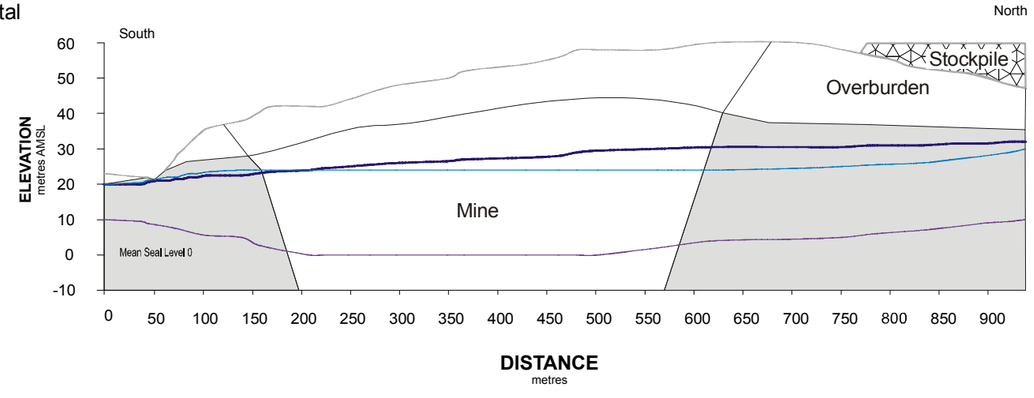
CONESTOGA-ROVERS & ASSOCIATES



Profile GW1
Vertical 4X Horizontal



Profile GW2
Vertical 4X Horizontal



Groundwater Elevations
- Existing
- Full Mine Life
- Post Reclamation

LEGEND:
- Cross Section
- Contours
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area

SOURCE:
Base Map : SNS&MR
Field Studies: CGC, CRA

0 50 100 200 300 400
Metres

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / PO	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:10,000	Sept 9, 2009	820677K

820677K(09)GIS-DA412_GWElev.mxd

figure 4.1-2
GROUNDWATER ELEVATIONS
Miller's Creek Extension Project
CGC INC. - WINDSOR PLANT
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

411000 412000 413000 414000 415000 416000 417000

4989000 4988000 4987000 4986000 4985000 4984000

AVON RIVER

Highfield Pond

Belmont Road

KENNETCOOK RIVER

Fish Brook

Allison Pond

Avondale

Newport Landing

Avondale Road

Shaw Brook

Ferry Road

Poplar Grove

Miller Creek

ST CROIX RIVER

LEGEND:

- CGC catchments
- CRA subcatchments
- River / Stream
- River / Stream indefinite
- Ditch
- Wetlands
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area
- Waterbodies

SOURCE:

Nova Scotia Topographic Database (SNS&MR - NS Geomatics Centre)
Field Surveys: CRA Ltd.

0 100 200 400 600 800 1,000
Metres

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / SB	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:20,000	August 24, 2009	820677K

820677K(10)GIS_DA422_SW_Sample.mxd

figure 4.2-1
CRA & CGC SUBCATCHMENT DELINEATION COMPARISON
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

LEGEND:

Surface Water Sampling

Exisitng Locations

- Flow / Water Level Monitoring
- Water Quality Monitoring

Proposed Locations

- Flow / Water Level Monitoring
- Rain Gauge
- CGC catchments
- Wetlands
- River / Stream
- River / Stream indefinite
- Ditch
- CGC Property
- Property
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area
- Waterbodies

SOURCE:

Nova Scotia Topographic Database (SNS&MR - NS Geomatics Centre)
Field Surveys: CRA Ltd.

0 100200 400 600 800 1,000
Metres

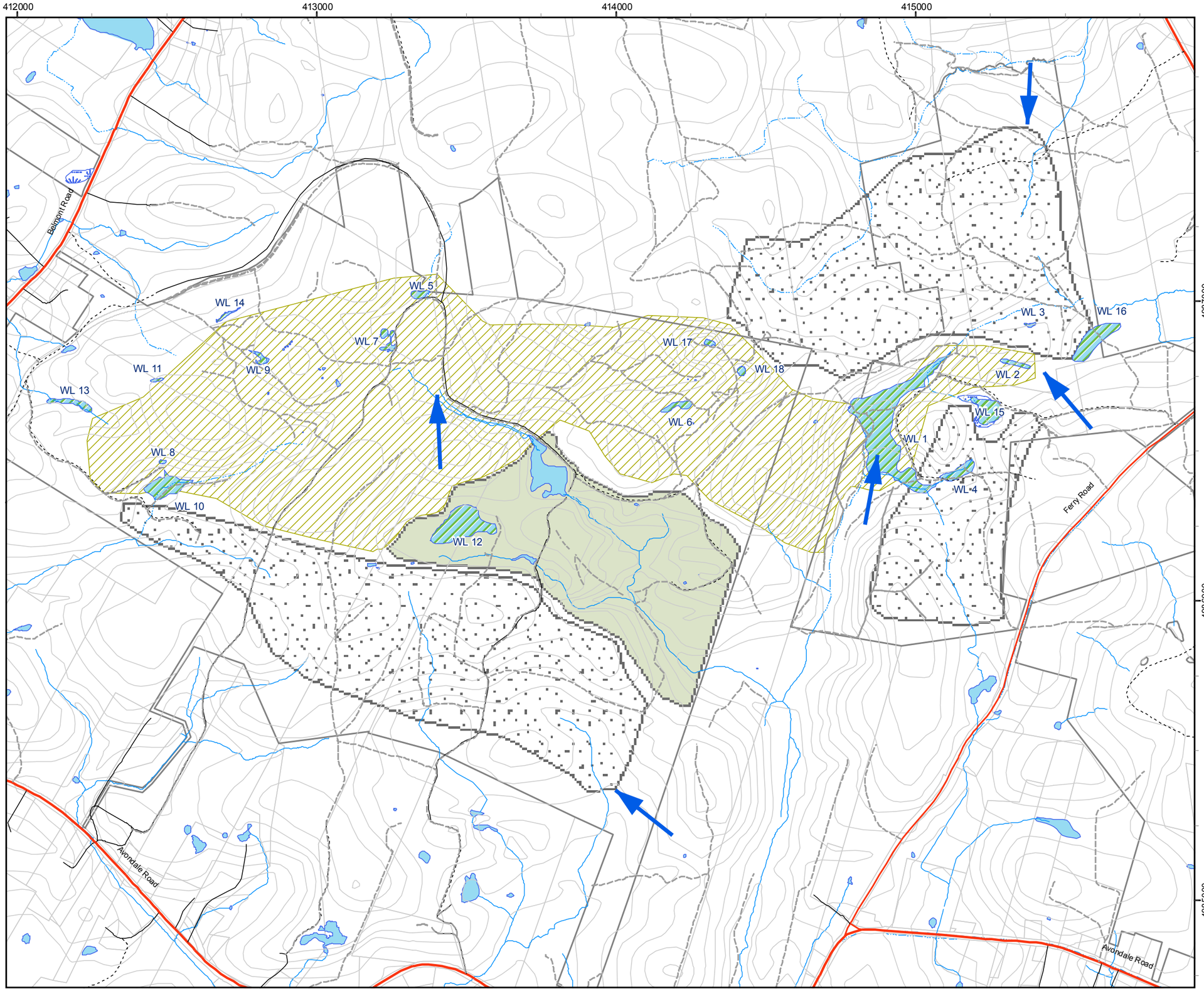
N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / SB	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:25,000	August 24, 2009	820677K

820677K(10)GIS_DA422_SW_Monitor.mxd

figure 4.2-2
EXISTING & PROPOSED MONITORING STATIONS
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES



LEGEND:

- Site Wetlands
- CGC Property
- Property
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area
- Conceptual Settling Pond Location

SOURCE:

Basemap - Nova Scotia Topographic Database, SNS&MR
Project Data - CGC Inc. & CRA

0 50 100 200 300 400 500
Metres

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:12,500	August 24, 2009	820677K

820677K (09) GIS-DA423_SettlePond.mxd

figure 4.2.3
CONCEPTUAL SETTLING POND LOCATIONS
Miller's Creek Extension Project
CGC INC. - WINDSOR PLANT
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

412000 413000 414000 415000

4987000 4986000 4985000

Belmont Road

Ferry Road

Avondale Road

Avondale Road

WL 1 WL 2 WL 3 WL 4 WL 5 WL 6 WL 7 WL 8 WL 9 WL 10 WL 11 WL 12 WL 13 WL 14 WL 15 WL 16 WL 17 WL 18

LEGEND:

Red Listed

- Round-leaved Hepatica
- Ram's-head Lady's-Slipper
- Eastern Leatherwood

Yellow Listed

- Canada Buffalo-Berry
- Small Yellow Lady's-Slipper
- Wood Anemone
- Black Ash

Lichens

- Collema cristatum
- Leptogium lichenoides
- Leptogium teretiusculum
- Peltigera lepidophora
- Solorina saccatta
- Site Wetlands
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area

SOURCE:

Basemap - Nova Scotia Topographic Database, SNS&MR
Mineral Registration - NS Natural Resources.
DPME 51 Feb 2009
Project Data - CGC Inc. & CRA

0 50 100 200 300 400 500
Metres

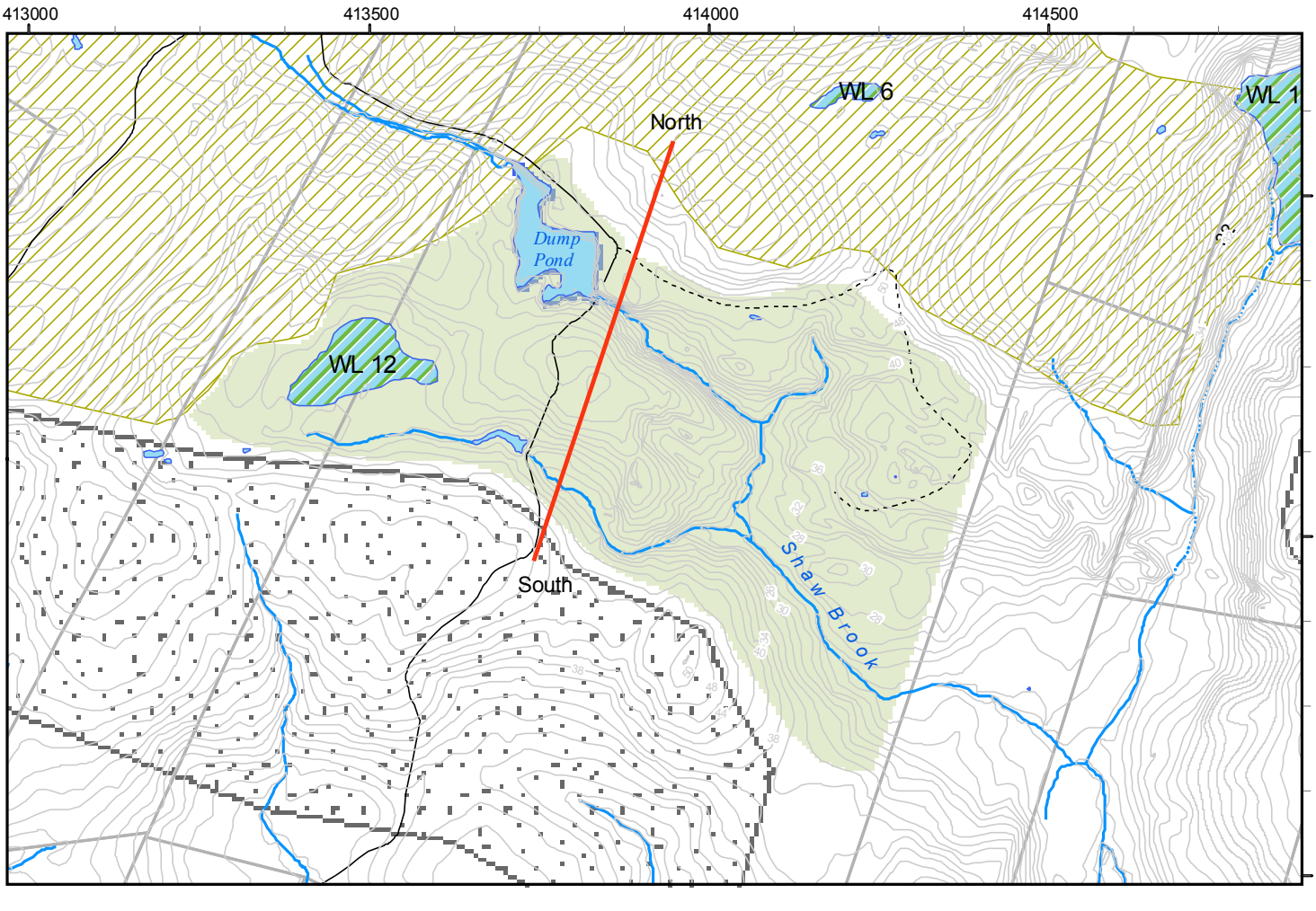
N

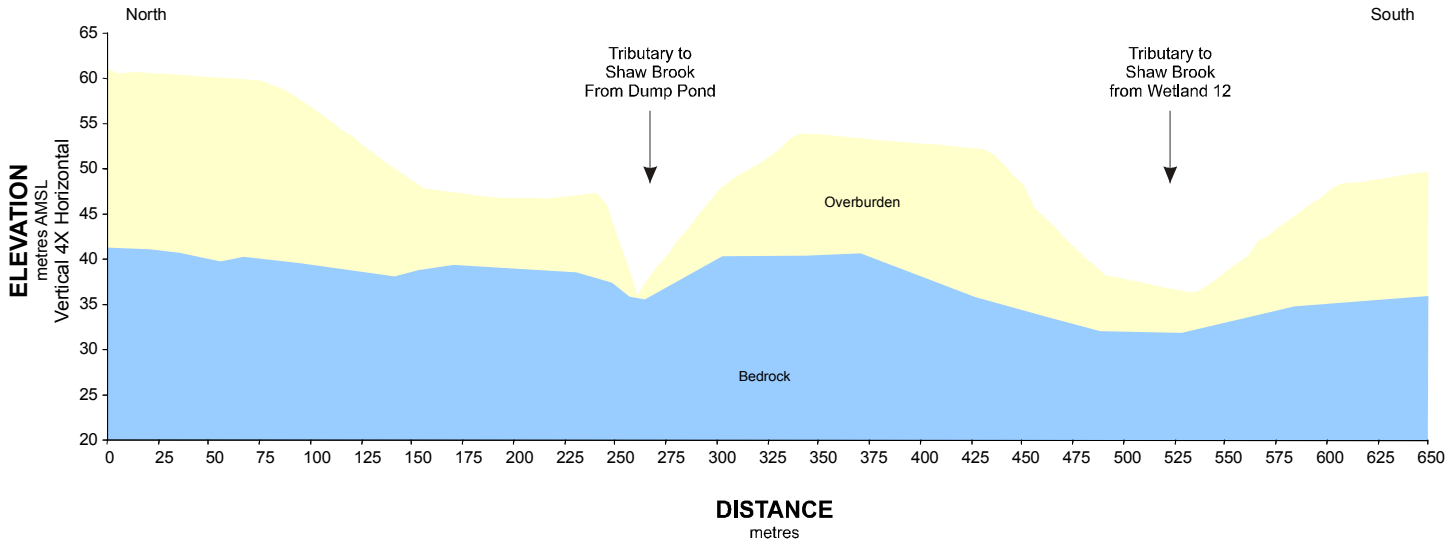
PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP /	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:12,500	August 24, 2009	820677K

820677K (10) GIS-DA431_SpeciesAR.mxd

figure 4.3-1
SPECIES AT RISK, WETLANDS, WATERCOURSES AND PROPOSED CONSERVATION AREA RELATIVE TO THE MINE FOOTPRINT
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES





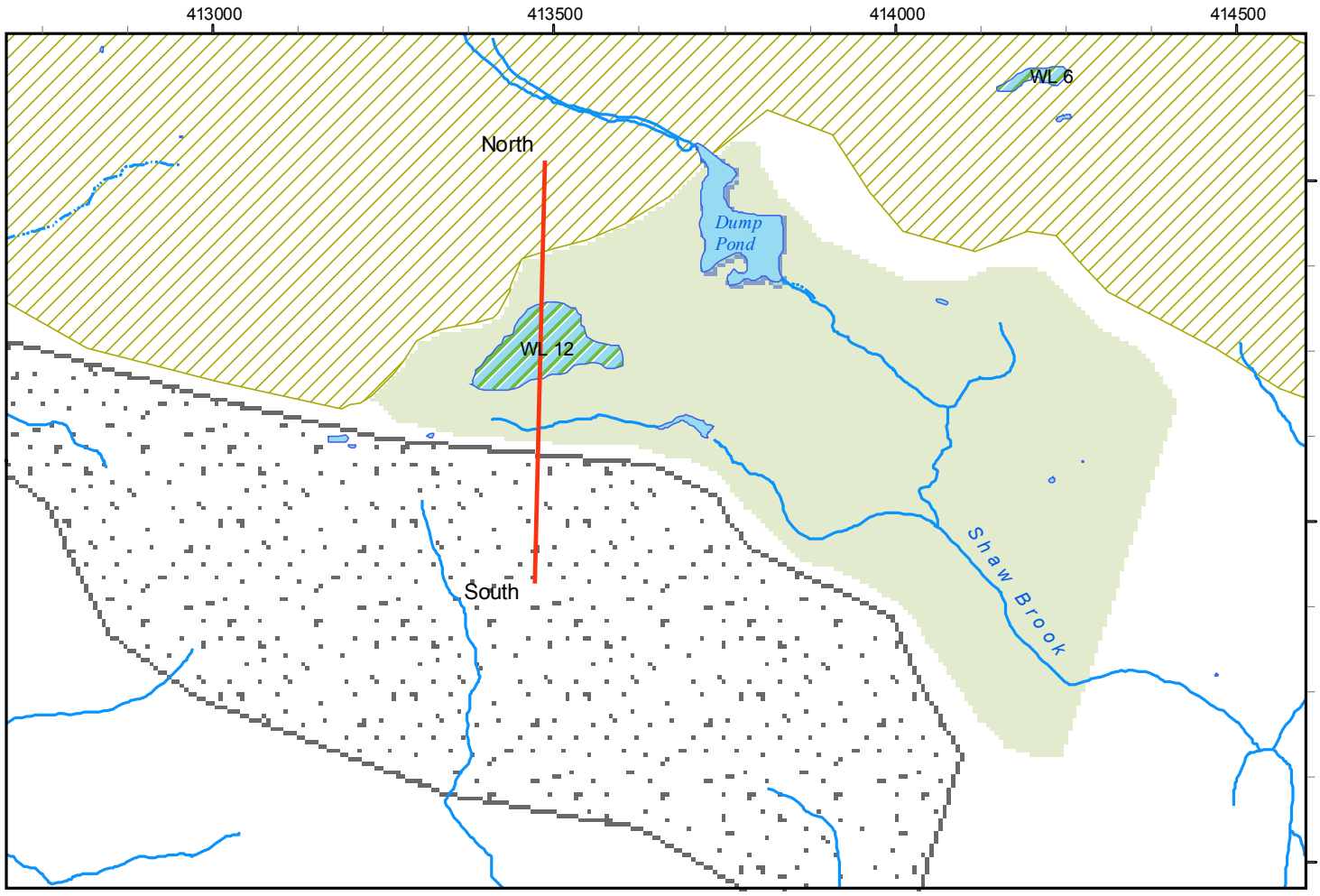
- Cross Section
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area
- Clay
- * Miller Creek Formation gypsum, minor siltstone, limestone, dolostone

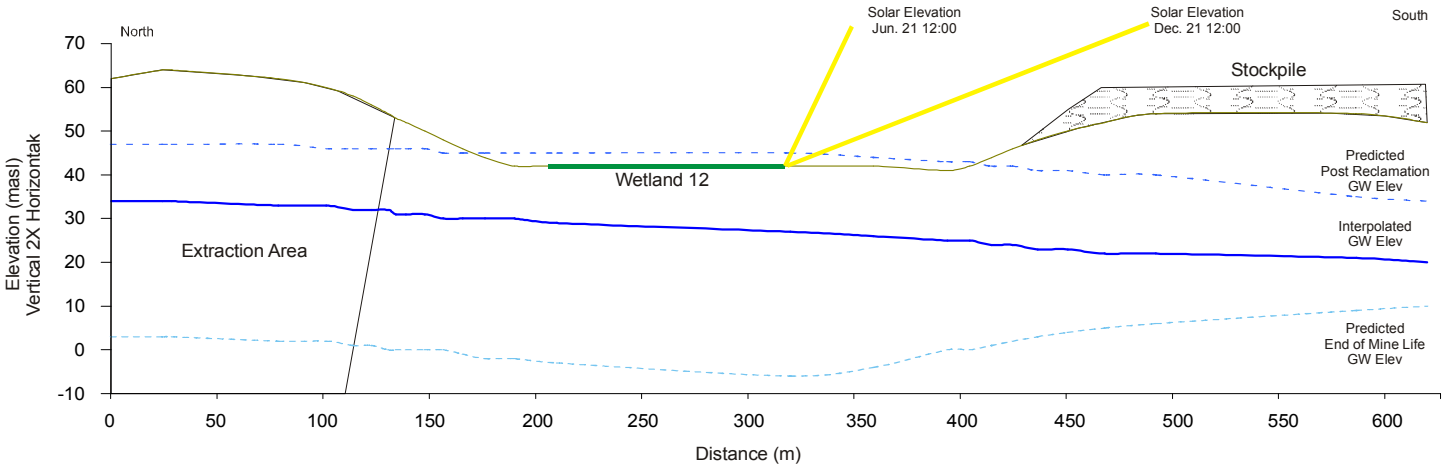
* Conceptualized based on overburden thickness and bedrock surface elvations

figure 4.3-2
CONSERVATION AREA CROSS-SECTION
Miller's Creek Extension Project
CGC Inc. - WINDSOR PLANT
Hants County, Nova Scotia

Metres
0 100 200
1:10,000
UTM z20 NAD83

820677K (10) GIS-DA432_ConservationXS.mxd August 31, 2009



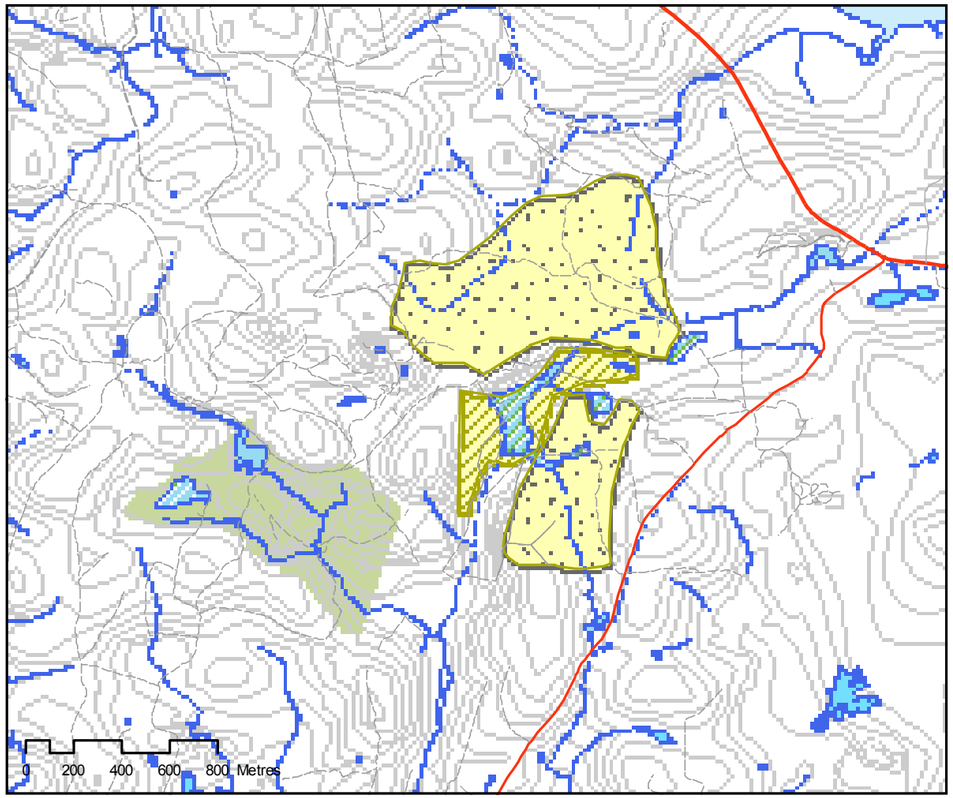


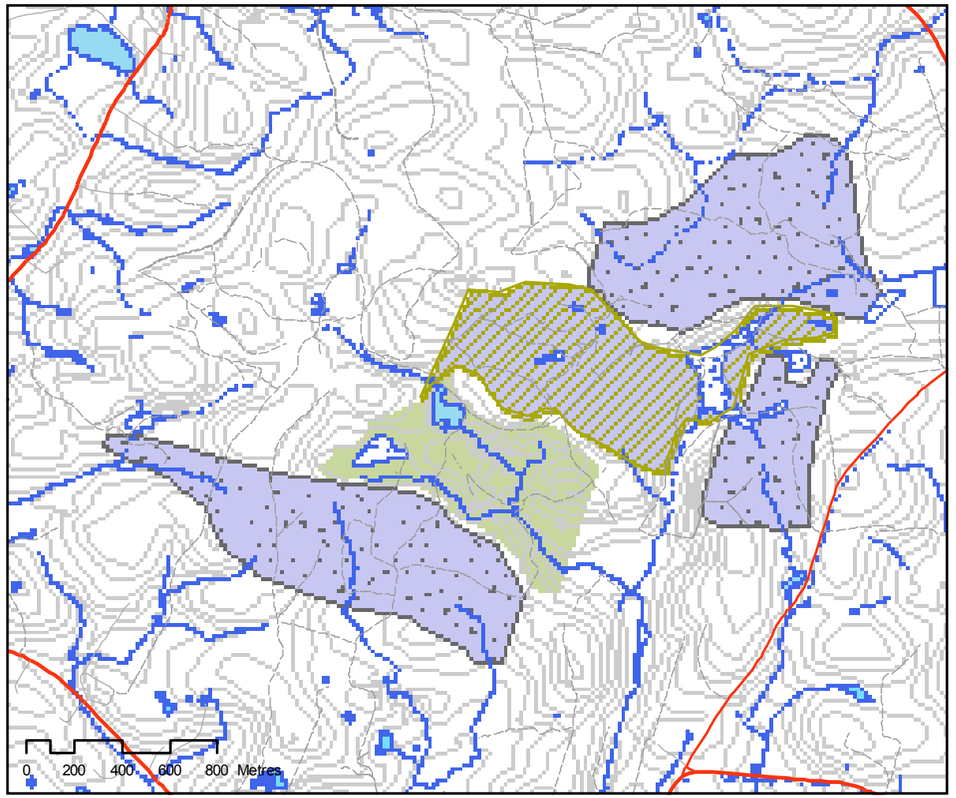
Cross Section
Proposed Extraction Area
Proposed Stockpiles
Proposed Conservation Area

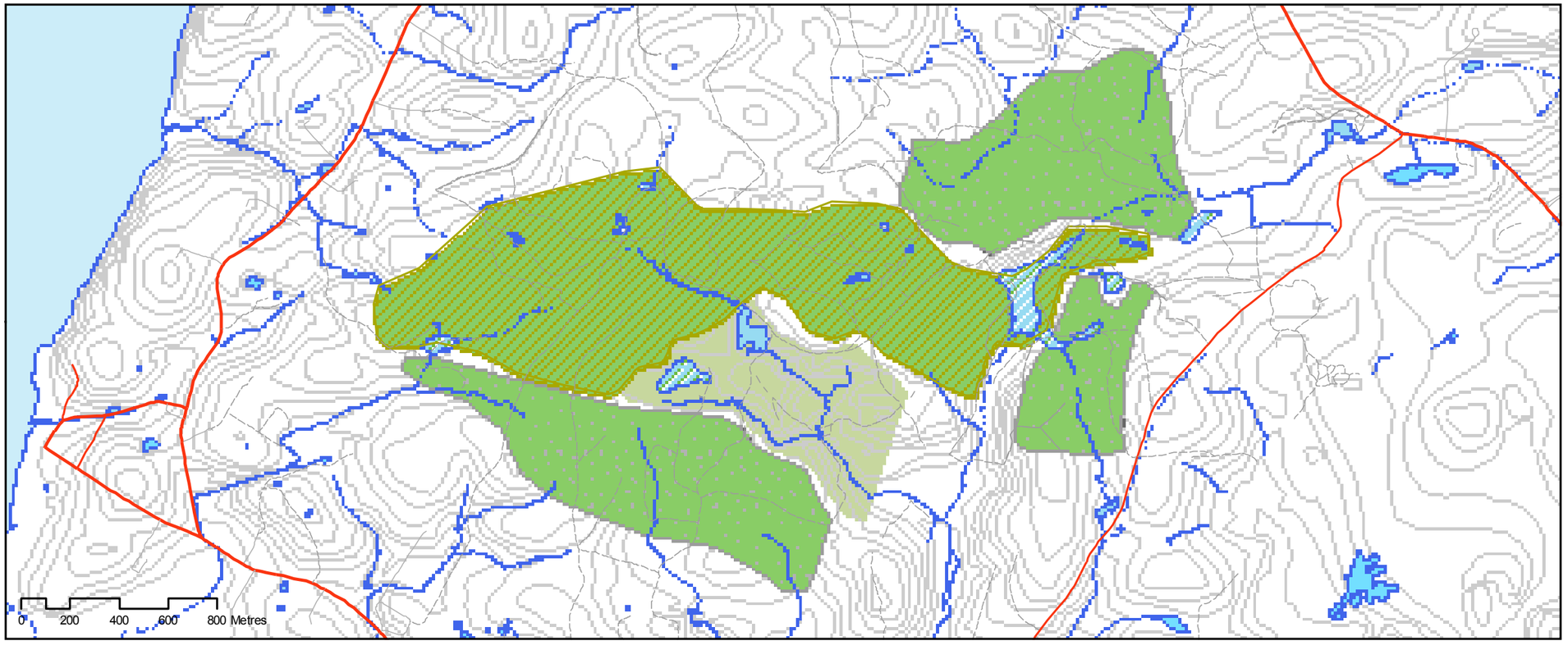
figure 4.3-3
WETLAND 12 CROSS-SECTION
Miller's Creek Extension Project
CGC Inc. - WINDSOR PLANT
Hants County, Nova Scotia

Metres
0 100 200
1:10,000
UTM z20 NAD83

820677K (09) GIS-DA413_Wetland 12XS.mxd October 7, 2009







LEGEND:

20 Yr Mine Extent
- Extraction Area - 20 yr
- Stockpiles - 20 yr

40 Yr Mine Extent
- Extraction Area - 40 yr
- Stockpiles - 40 yr

Mine Extent - Full Mine Life
- Extraction Area
- Stockpiles
- Proposed Conservation Area
- Contours (topo)

SOURCE:

Nova Scotia Topographic Database (SNS&MR - NS Geomatics Centre)
Field Surveys: CRA Ltd.
Mine Layout: CGC Inc.

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / PO	0° North
SCALE: 1:25,000 1:20,000	**DATE:** October 6, 2009	**PROJECT NO:** 820677K

820677K (00) GIS_DA434_Project Phase.mxd

figure 4.3-4
CONCEPTUAL PLANNED EXTENT OF PROJECT 20, 40 YEARS & FULL MINE LIFE
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

412000 413000 414000 415000 416000

4988000 4987000 4986000 4985000

WL 5 WL 14 WL 7 WL 17 WL 2 WL 16 WL 11 WL 9 WL 18 WL 15 WL 13 WL 6 WL 1 WL 8 WL 4 WL 10 WL 12

LEGEND:

- Site Wetlands
- River / Stream
- River / Stream indefinite
- Ditch
- Waterbodies
- Proposed Extraction Area
- Proposed Stockpiles
- Proposed Conservation Area

SOURCE:

Nova Scotia Topographic Database (SNS&MR - NS Geomatics Centre)
Field Surveys: CRA Ltd.
Mine Layout: CGC Inc.

0 100 200 400 600 800
Metres

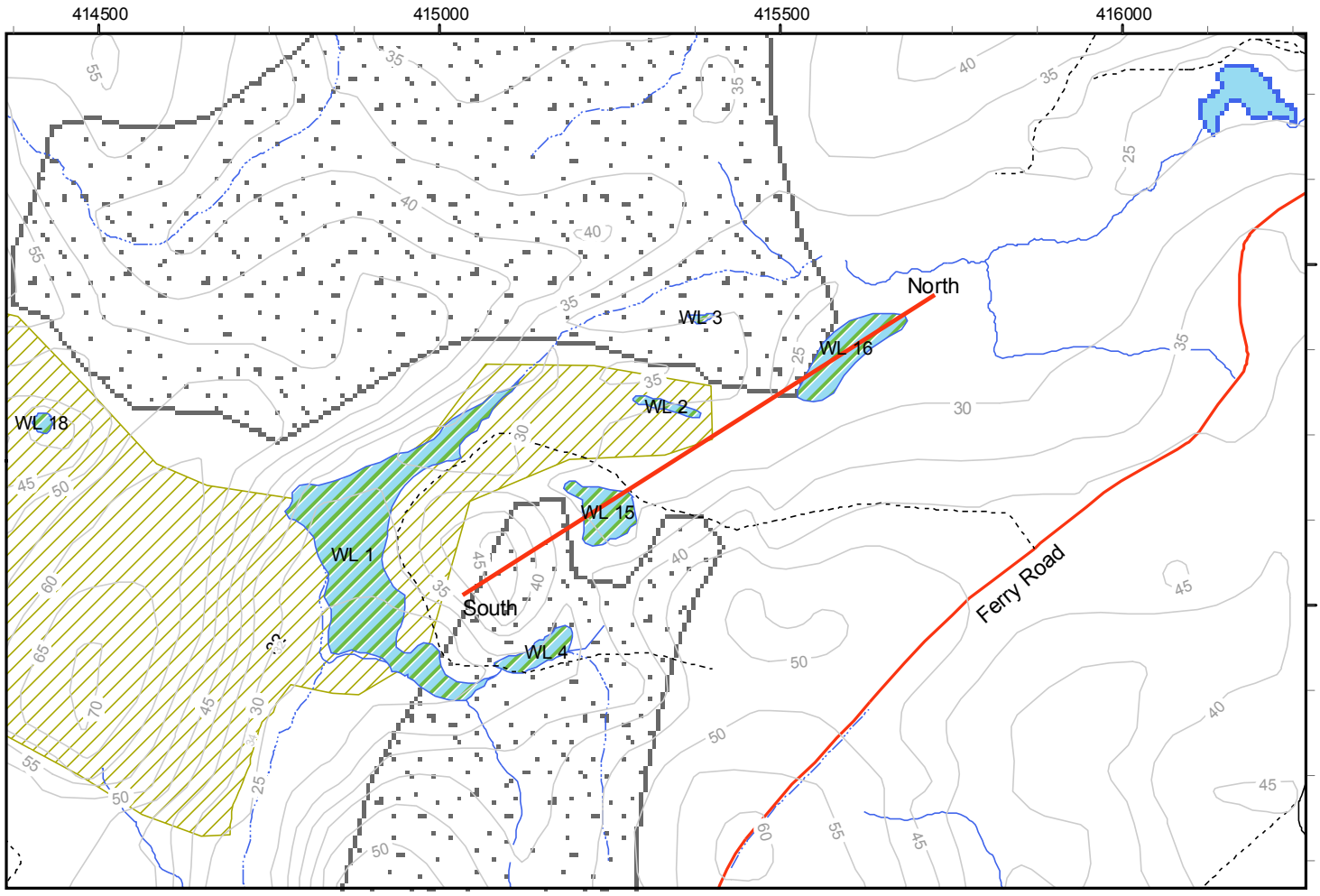
N

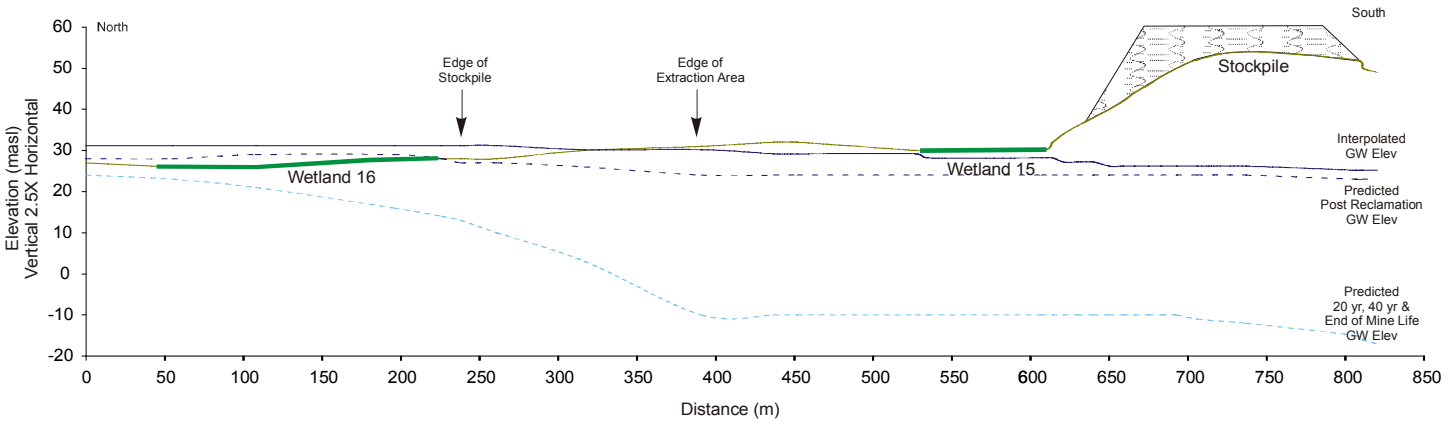
PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / SB	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:15,000	August 20, 2009	820677K

820677K (09) GIS_DA441_wetlands.mxd

figure 4.4-1
WETLANDS
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES





Cross Section

Contours

Proposed Extraction Area

Proposed Stockpiles

figure 4.4-2

WETLAND 15 CROSS-SECTION

Miller's Creek Extension Project

CGC Inc. - WINDSOR PLANT

Hants County, Nova Scotia

Metres

0 100 200

1:10,000

UTM z20 NAD83

820677K (09) GIS-DA442_Wetland 15XS.mxd October 7, 2009

411000 412000 413000 414000 415000 416000 417000

4989000 4988000 4987000 4986000 4985000 4984000

AVON RIVER

Belmont Road

KENNETCOOK RIVER

Fish Brook

E

B

Avondale

Newport Landing

C

D

A

Shaw Brook

Ferry Road

Poplar Grove

Miller Creek

Avondale Road

ST CROIX RIVER

LEGEND:

- **A** Map Reference
- Mapped Streams
- River / Stream
- River / Stream indefinite
- Ditch
- Proposed Extraction Area
- Proposed Stockpiles
- Waterbodies

SOURCE:

Nova Scotia Topographic Database (SNS&MR - NS Geomatics Centre)
CGC Inc. - Windsor Plant
Field Surveys: CRA

0 100 200 400 600 800 1,000
Metres

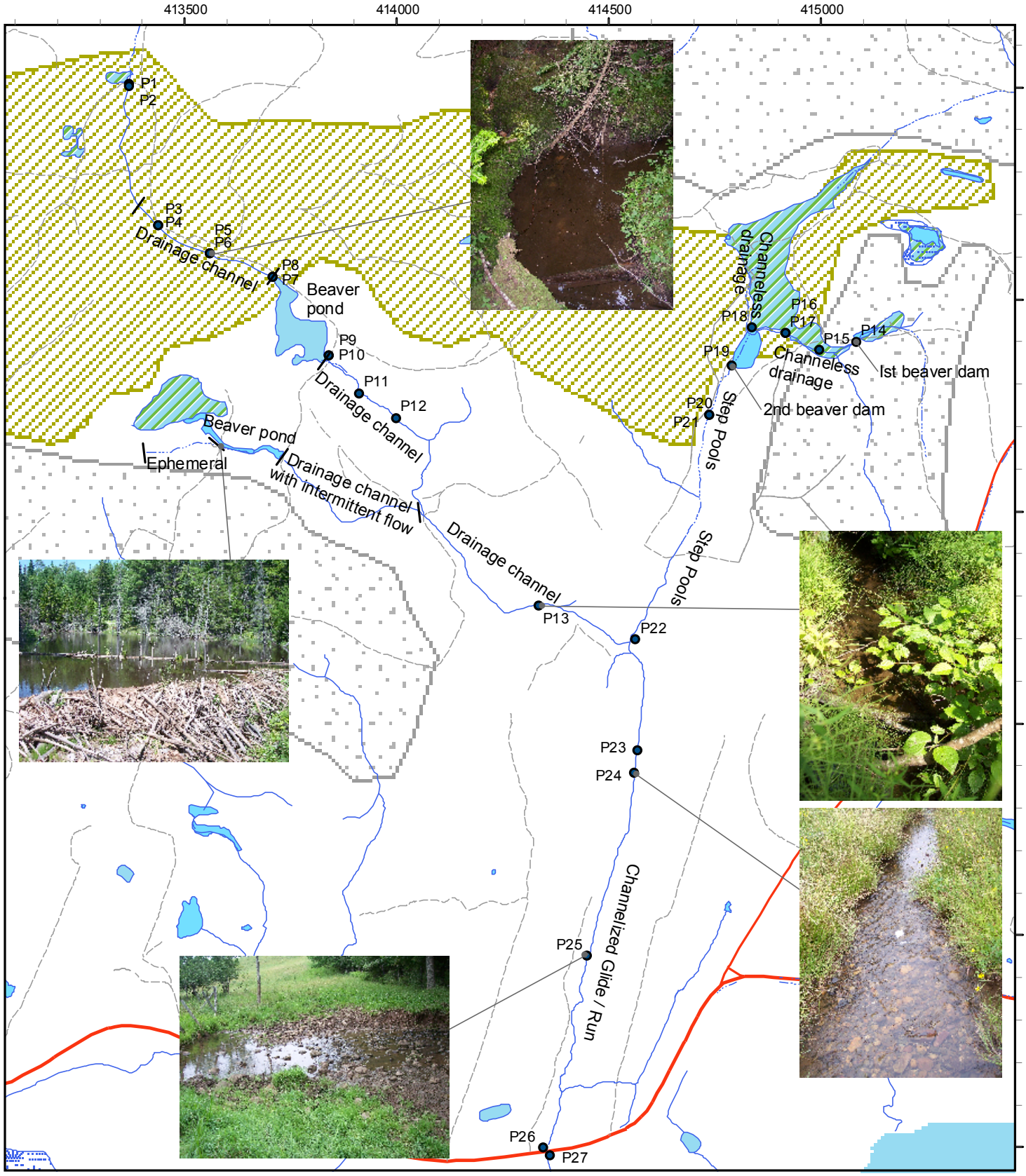
N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / SB	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:20,000	August 24, 2009	820677K

820677K (09) GIS-DA451_Stream_Survey.mxd

figure 4.5-1
STREAM HABITAT OVERVIEW
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES



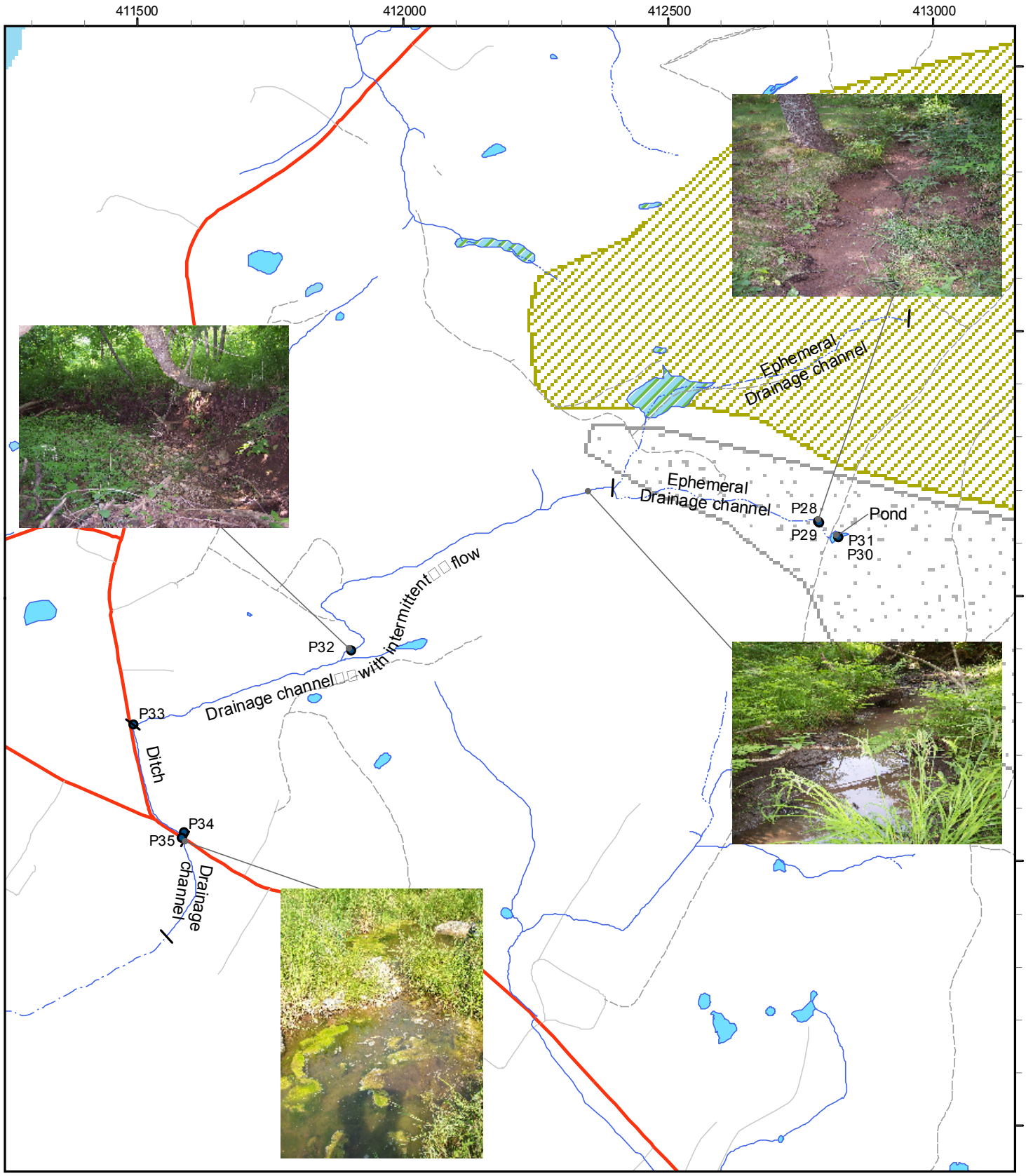
Legend

- Stream
- Stream indefinite
- Ditch
- Photos (P#)
- Pond
- Wetland Area
- Proposed Extraction Area
- Proposed Stockpiles

figure 4.5-2
HABITAT SURVEY - SHAW BROOK
Miller's Creek Extension Project
CGC Inc - Windsor Plant
Avondale, Nova Scotia

0 100 200 400
Metres
1:12,500 UTM z20 NAD83

820677K (09) GIS-DA452_Habitat_Survey.mxd August 24, 2009



Legend

- Stream
- Stream indefinite
- Ditch
- Photos (P#)
- Pond
- Wetland Area
- Proposed Extraction Area
- Proposed Stockpiles

figure 4.5-3

HABITAT SURVEY - UNNAMED TRIBUTARY TO AVON RIVER

Miller's Creek Extension Project

CGC Inc - Windsor Plant

Avondale, Nova Scotia

0 100 200 400

Metres

1:10,000 UTM z20 NAD83

820677K (09) GIS-DA453_Habitat_Survey.mxd August 24, 2009

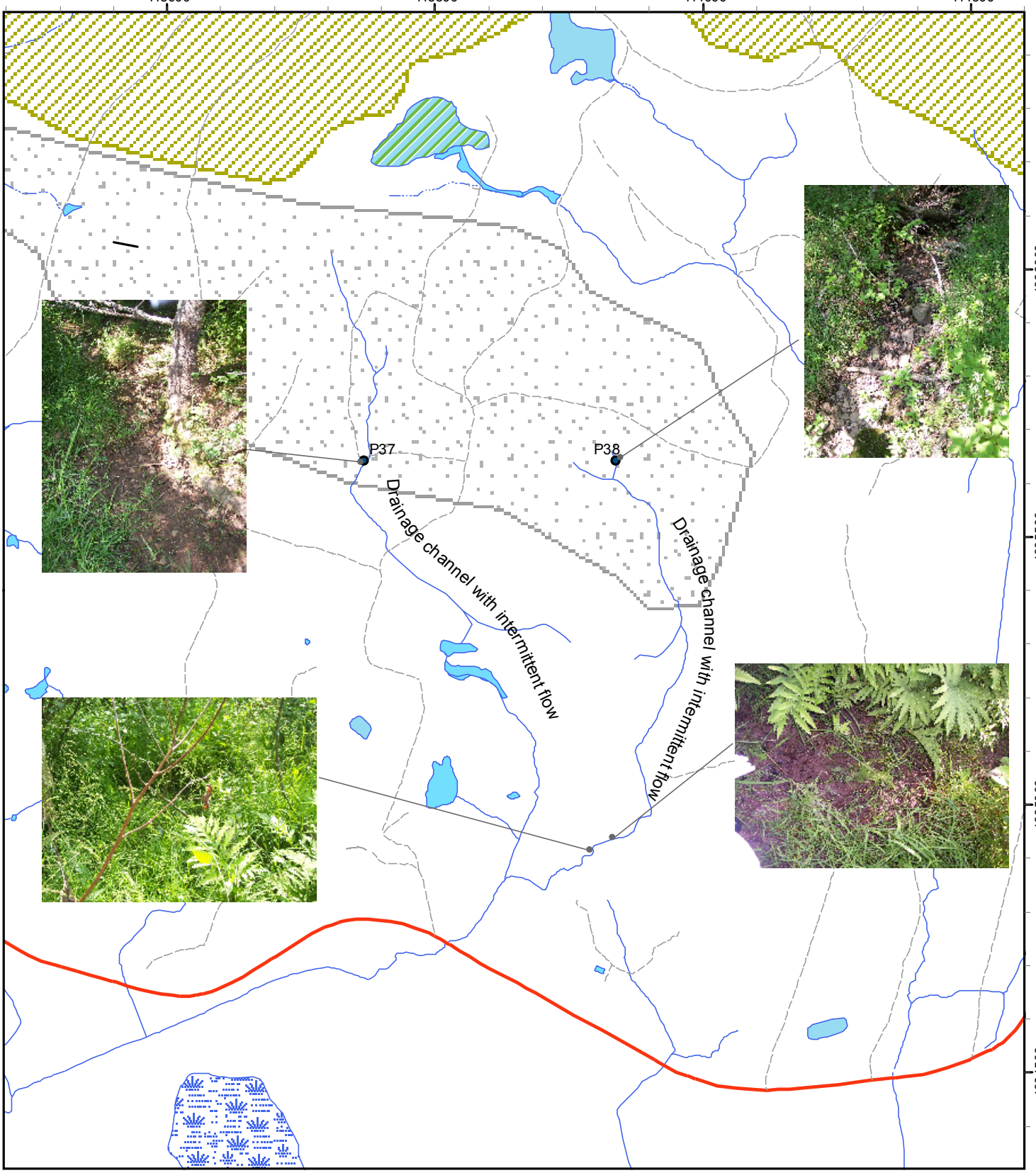
Legend

- Stream
- Stream indefinite
- Ditch
- Photos (P#)
- Pond
- Wetland Area
- Proposed Extraction Area
- Proposed Stockpiles

figure 4.5-4
HABITAT SURVEY - UNNAMED TRIBUTARY TO ST. CROIX RIVER
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Avondale, Nova Scotia

0 100 200 400
Metres
1:10,000 UTM z20 NAD83

820677K (09) GIS-DA454_Habitat_Survey.mxd August 24, 2009



Legend

- Photos (P#)
- Stream
- stream indefinite
- Ditch
- Pond
- Wetland Area
- Proposed Extraction Area
- Proposed Stockpiles

figure 4.5-5

HABITAT SURVEY - UNNAMED TRIBUTARY TO ST. CROIX RIVER

Miller's Creek Extension Project

CGC Inc. - Windsor Plant

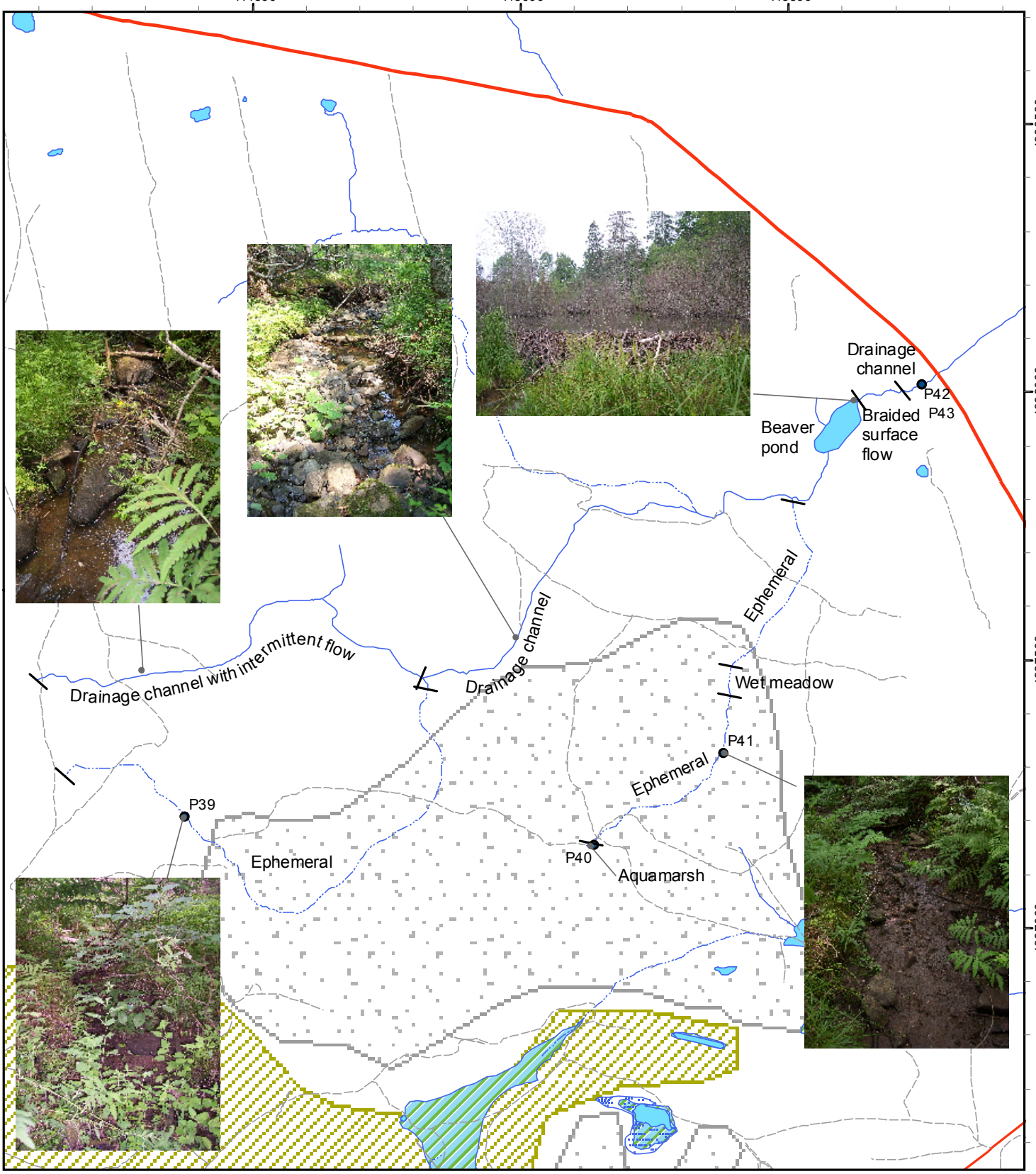
Avondale, Nova Scotia

0 100 200 400

Metres

1:10,000 UTM z20 NAD83

820677K (09) GIS-DA455_Habitat_Survey.mxd August 24, 2009



Legend

- Photos (P#)
- Stream
- Stream indefinite
- Ditch
- Pond
- Wetland Area
- Proposed Extraction Area
- Proposed Stockpiles

figure 4.5-6

HABITAT SURVEY - FISH BROOK

Miller's Creek Extension Project

CGC Inc. - Windsor Plant

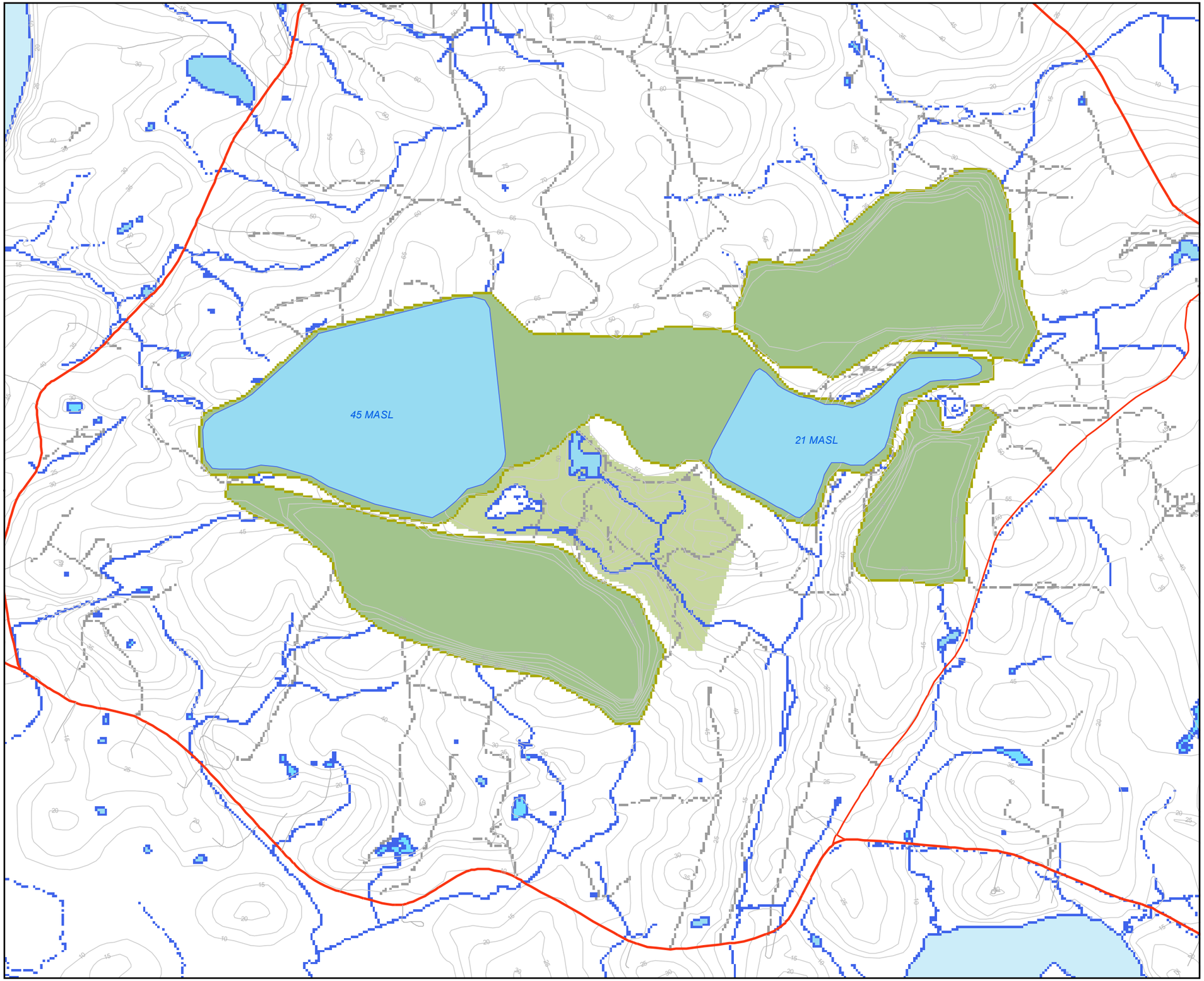
Belmont, Nova Scotia

0 100 200 400

Metres

1:10,000 UTM z20 NAD83

820677K (09) GIS-DA456_Habitat_Survey.mxd August 24, 2009



LEGEND:

- Reclaimed Areas
- Post Reclamation Lakes
- Contours (Approx)
- Conservation Area

SOURCE:

Nova Scotia Topographic Database (SNS&MR - NS Geomatics Centre)
Field Surveys: CRA Ltd.
Mine Layout: CGC Inc.

0 200 400 600 800 Metres

N

PROJECTION:	DRAWN / CHECKED BY:	MAP ANGLE:
UTM z20 NAD83	JJP / PO	0° North
SCALE:	**DATE:**	**PROJECT NO:**
1:15,000	October 6, 2009	820677K

820677K (00) GIS_DA433_Project Phase.mxd

figure 4.6-1
CONCEPTUAL RECLAMATION PLAN
Miller's Creek Extension Project
CGC Inc. - Windsor Plant
Hants County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

TABLE 4.2-1

CATCHMENT IMPACT SUMMARY - 20-YEAR DEVELOPMENT
MILLER'S CREEK MINE EXTENSION PROJECT
CGC INC. - WINDSOR PLANT
HANTS COUNTY, NOVA SCOTIA

Watershed #	CGC Catchment #	CRA Subcatchment #	Flow Monitoring Location	Outlet #	Groundwater Model Results	Hydrologic Model Results	Conclusions and Suggested Mitigation Options
1	N/A	11	-	1-1	No effect	No effect	No predicted effects.
		12	-				
		13	-				
		14	-				
		15	-				
		16	-				
		17	-	1-2			
2	N/A	21	-	2-1	No effect	No effect	No predicted effects.
		22	-				
		23	-	2-2			
		24	-	2-3			
		25	-				
		26	-				
		27	-				
	28	28	-	2-4	No effect	No effect	No predicted effects.
3	31	31	-	3-1	Baseflow reduction at SW-18 from 0.63 L/s (existing) to 0.36 L/s, i.e -43%	Surface water runoff volume reduction of 9%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		32	SW-18				
		33	-				
	35	34	SW-17	3-2	Baseflow reduction at SW-17 from 3.03 L/s (existing) to 2.36 L/s, i.e. -22%.	Surface water runoff volume reduction of 14%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		35	-				
		36	-				
		37	-				
4	41	41	SW-15, SW-16	4-1	No effect	No effect	No predicted effects.
		48	SW-14				
		47	-	4-2			
	45	42	SW-13	4-3	Negligible baseflow reduction at SW-11 from 0.30 L/s (existing) to 0.30 L/s, i.e. -0.8%.	No effect	Negligible baseflow changes predicted.
		43	SW-11				
		44	SW-10, SW-12				
		45	-				
		46	-				
5	51	51	SW-08, SW-09	5-1	No effect	No effect	No predicted effects.
	52	52	SW-07	5-2	No effect	No effect	No predicted effects.
	53	53	SW-06	5-3	No effect	No effect	No predicted effects.
6	64	63	SW-02, SW-03	6-1	No effect	No effect	No predicted effects.
		64	-				
		67	-				
		68	SW-04, SW-05				
	66	61	-	6-2	Baseflow reduction at SW-01 from 2.21 L/s (existing) to 0.58 L/s, i.e. -74%.	Surface water runoff volume reduction of 10%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		62	SW-01				
		65	-				
		66	-				

Notes:
N/A - CGC catchments not defined since no aerial disturbance will occur in these subcatchments
Refer to Figure C.4 in Appendix C.1 for CRA/CGC subcatchment delineation
Refer to Figure C.5 in Appendix C.1 for 20-year subcatchment delineation

TABLE 4.2-2

CATCHMENT IMPACT SUMMARY - 40-YEAR DEVELOPMENT
MILLER'S CREEK MINE EXTENSION PROJECT
CGC INC. - WINDSOR PLANT
HANTS COUNTY, NOVA SCOTIA

Watershed #	CGC Catchment #	CRA Subcatchment #	Flow Monitoring Location	Outlet #	Groundwater Model Results	Hydrologic Model Results	Conclusions and Suggested Mitigation Options
1	N/A	11	-	1-1	No effect	No effect	No predicted effects.
		12	-				
		13	-				
		14	-				
		15	-				
		16	-				
		17	-	1-2			
2	N/A	21	-	2-1	No effect	No effect	No predicted effects.
		22	-				
		23	-	2-2			
		24	-	2-3			
		25	-				
		26	-				
		27	-				
	28	28	-	2-4	No effect	No effect	No predicted effects.
3	31	31	-	3-1	Baseflow reduction at SW-18 from 0.63 L/s (existing) to 0.36 L/s, i.e. -43%	Surface water runoff volume reduction of 9%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		32	SW-18				
		33	-				
	35	34	SW-17	3-2	Baseflow reduction at SW-17 from 3.03 L/s (existing) to 1.78 L/s, i.e. -41%.	Surface water runoff volume reduction of 15%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		35	-				
		36	-				
		37	-				
4	41	41	SW-15, SW-16	4-1	No effect	No effect	No predicted effects.
		48	SW-14				
		47	-	4-2			
	45	42	SW-13	4-3	Negligible baseflow reduction at SW-11 from 0.30 L/s (existing) to 0.29 L/s, i.e. -4%.	No effect	Negligible baseflow changes predicted.
		43	SW-11				
		44	SW-10, SW-12				
		45	-				
		46	-				
5	51	51	SW-08, SW-09	5-1	No effect	No effect	No predicted effects.
	52	52	SW-07	5-2	No effect	No effect	No predicted effects.
	53	53	SW-06	5-3	No effect	Surface water runoff volume reduction of 8%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
6	64	63	SW-02, SW-03	6-1	No effect	Surface water runoff volume reduction of 13%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		64	-				
		67	-				
		68	SW-04, SW-05				
	66	61	-	6-2	Baseflow reduction at SW-01 from 2.21 L/s (existing) to 0 L/s, i.e. -100%.	Surface water runoff volume reduction of 26%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		62	SW-01				
		65	-				
		66	-				

Notes:

N/A - CGC catchments not defined since no aerial disturbance will occur in these subcatchments
Refer to Figure C.4 in Appendix C.1 for CRA/CGC subcatchment delineation
Refer to Figure C.6 in Appendix C.1 for 40-year subcatchment delineation

TABLE 4.2-3

CATCHMENT IMPACT SUMMARY - END OF MINE LIFE (70 YEARS)
MILLER'S CREEK MINE EXTENSION PROJECT
CGC INC. - WINDSOR PLANT
HANTS COUNTY, NOVA SCOTIA

Watershed #	CGC Catchment #	CRA Subcatchment #	Flow Monitoring Location	Outlet #	Groundwater Model Results	Hydrologic Model Results	Conclusions and Suggested Mitigation Options
1	N/A	11	-	1-1	No effect	No effect	No predicted effects.
		12	-				
		13	-				
		14	-				
		15	-				
		16	-				
		17	-	1-2			
2	N/A	21	-	2-1	No effect	No effect	No predicted effects.
		22	-				
		23	-	2-2			
		24	-	2-3			
		25	-				
		26	-				
		27	-				
	28	28	-	2-4	No effect	No effect	No predicted effects.
3	31	31	-	3-1	Baseflow reduction at SW-18 from 0.63 L/s (existing) to 0.36 L/s, i.e -43%	Surface water runoff volume reduction of 9%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		32	SW-18				
		33	-				
	35	34	SW-17	3-2	Baseflow reduction at SW-17 from 3.03 L/s (existing) to 1.70 L/s, i.e. -44%.	Surface water runoff volume reduction of 15%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		35	-				
		36	-				
		37	-				
4	41	41	SW-15, SW-16	4-1	No effect	No effect	No predicted effects.
		48	SW-14				
		47	-	4-2			
	45	42	SW-13	4-3	Negligible baseflow reduction at SW-11 from 0.30 L/s (existing) to 0.23 L/s, i.e. -23%.	No effect	Monitor water level in Highfield Pond, just d/s of SW-11, to ensure that it is not affected by mine development.
		43	SW-11				
		44	SW-10, SW-12				
		45	-				
		46	-				
5	51	51	SW-08, SW-09	5-1	No effect	Surface water runoff volume reduction of 8%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
	52	52	SW-07	5-2	No effect	Surface water runoff volume reduction of 6%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
	53	53	SW-06	5-3	No effect	Surface water runoff volume reduction of 25%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
6	64	63	SW-02, SW-03	6-1	No effect	Surface water runoff volume reduction of 13%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		64	-				
		67	-				
		68	SW-04, SW-05				
	66	61	-	6-2	Baseflow reduction at SW-01 from 2.21 L/s (existing) to 0 L/s, i.e. -100%.	Surface water runoff volume reduction of 45%.	Continue to monitor flow. Controlled release of surface water from settling ponds to maintain pre-development flows.
		62	SW-01				
		65	-				
		66	-				

Notes:
N/A - CGC catchments not defined since no aerial disturbance will occur in these subcatchments
Refer to Figure C.4 in Appendix C.1 for CRA/CGC subcatchment delineation
Refer to Figure C.7 in Appendix C.1 for end of mine life (70-year) subcatchment delineation

TABLE 4.3-1
SUMMARY OF EXTRACTION SCHEDULE
AS IT RELATES TO
SPECIES-AT-RISK LOCATIONS

Species	Current Total Number of specimens[1] known on Project site	Years 0- 20		Years 20-40		Year 40-70	
		# to be removed[2]	Location of Specimens	# to be removed[2]	Location of Specimens	# to be removed[2]	Location of Specimens
Yellow lady's-slipper	7936	1877	Wetland 1m northeastern southeastern edges of proposed Pit	1571	Centre of Project site, near historically mined areas	300	Along Shaw Brook, above Dump Pond
Black ash	37	19	Wetlands 1 and 2	0	N/A	5	Wetlands 8 and 10
Canada buffalo-berry	447	0	N/A	195	Centre of Project site, near historically mined areas	0	N/A
Solorina saccata	303	53	West of Wetland 1	0	N/A	0	N/A
Collema cristatum var. cristatum	3 locations (each <9m^2)	1 location (<9m^2)	West of Wetland 1	0	N/A	0	N/A

[1] Number of stems for yellow lady's-slipper

[2] Numbers of each species within extraction area may fluctuate naturally over time, numbers provided are based on most recent counts (2008)

N/A = Not applicable

TABLE 4.4-1: EXISTING WETLANDS IN THE MILLER'S CREEK EXTENSION AREA

Wetland ID	Wetland Area (ha)	Wetland Classification[1]	Wetland Description	Wetland Functions (Hydrological, Biogeochemical, Habitat)[2]	Relative Importance of Wetland Functions to Ecosystem[3]	Wetland Hydrology (Water Budget)
1	4.22	Treed basin swamp and marsh complex	Treed swamp; mineral soils, some peat accumulation; semi-disturbed through deforestation, logging and disturbance from skidder trails; beaver dam present	Storm water moderation; Water quality treatment; Nutrient and organic export; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Moderate **Biogeochemical:** Moderate **Habitat:** Moderate	**Input**: groundwater (springs); precipitation run-off; Wetland 4 **Output**: tributary of Shaw Brook; evaporation
2	0.12	Treed basin swamp	Mineral soils, some peat accumulation; sinkhole; long, narrow and shallow hummocky pool situated in a small valley between two small ridges	Storm water moderation; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Low	**Input** - precipitation run-off **Output** - evaporation
3	0.03	Isolated basin marsh	Situated in closed shallow basin, sinkhole; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Negligible	**Input** - precipitation run-off **Output** - evaporation
4	0.34	Treed basin swamp and marsh complex	Mostly basin marsh; mineral soils, some peat accumulation; semi-disturbed through deforestation, logging and disturbance from skidder trails; beaver evidence	Storm water moderation; Water quality treatment; Nutrient and organic export; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Low **Biogeochemical:** Low **Habitat:** Moderate	**Input** - intermittent streams; precipitation run-off **Output** - Wetland 1; evaporation
5	0.12	Isolated basin marsh	Situated in closed shallow basin; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Negligible	**Input** - precipitation run-off **Output** - evaporation
6	0.19	Isolated basin marsh	Situated in closed shallow basin; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Low **Habitat:** Low	**Input** - precipitation run-off **Output** - evaporation
7	0.17	Isolated basin marsh	Situated in closed shallow basin; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Low **Habitat:** Moderate	**Input** - precipitation run-off **Output** - evaporation
8	0.02	Isolated basin marsh	Situated in closed shallow basin, sinkhole; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Negligible	**Input** - precipitation run-off **Output** - evaporation
9	0.09	Isolated basin marsh	Situated in closed shallow basin; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Low	**Input** - precipitation run-off **Output** - evaporation
10	0.72	Treed basin swamp	Mineral soils, some peat accumulation; semi-disturbed through deforestation, logging and disturbance from skidder trails	Storm water moderation; Water quality treatment; Nutrient and organic export; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Low **Biogeochemical:** Low **Habitat:** Moderate	**Input** - groundwater (seepage); two intermittent surface water inflows; precipitation run-off **Output** - intermittent stream; evaporation
11	0.04	Isolated basin marsh	Situated in closed shallow basin, sinkhole; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Negligible	**Input** - precipitation run-off **Output** - evaporation
12	1.53	Treed basin swamp	Mineral soils, some peat accumulation; semi-disturbed through deforestation, logging and disturbance from skidder trails; beaver dam present	Storm water moderation; Water quality treatment; Nutrient and organic export; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Moderate **Biogeochemical:** Moderate **Habitat:** High	**Input** - precipitation run-off **Output** – small intermittent tributary of Shaw Brook; evaporation
13	0.26	Isolated basin marsh	Situated in closed shallow basin; some emergent vegetation around well-defined edge	Storm water moderation; Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Low **Biogeochemical:** Low **Habitat:** Low	**Input** - precipitation run-off; intermittent stream **Output** - intermittent stream; evaporation
14	0.05	Isolated basin marsh	Situated in closed shallow basin; some emergent vegetation around well-defined edge	Water quality treatment; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Negligible **Biogeochemical:** Negligible **Habitat:** Negligible	**Input** - precipitation run-off **Output** – evaporation
15	0.60	Shallow water wetland	Emergent vegetation around well-defined edge; semi-disturbed through deforestation, logging and disturbance from skidder trails; dammed by road and beaver	Storm water moderation; Possible ground water recharge; Water quality treatment; Nutrient and organic export; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Moderate **Biogeochemical:** Moderate **Habitat:** Moderate	**Input** - groundwater; precipitation run-off **Output** – seepage to Wetland 16; evaporation
16	0.86	Treed basin swamp	Mineral soils, some peat accumulation; semi-disturbed through deforestation, logging and disturbance from skidder trails; dammed by road and beaver	Storm water moderation; Possible ground water recharge; Water quality treatment; Nutrient and organic export; Carbon sequestration and storage; Biological productivity and biodiversity	**Hydrological:** Moderate **Biogeochemical:** Moderate **Habitat:** Moderate	**Input** – groundwater; seepage from Wetland 15; precipitation run-off **Output** - stream to wetland off-site; evaporation
17	0.06	Unclassified	Old mine pit; very little soil accumulation, mostly rocky sides and bottom; depth >2m; low primary productivity (clear water)	Storm water moderation; Water quality treatment; Biological productivity and biodiversity	**Hydrological:** Low **Biogeochemical:** Low **Habitat:** Negligible	**Input** – possible groundwater; precipitation run-off **Output** – possible groundwater recharge; evaporation
18	0.06	Unclassified	Old mine pit; very little soil accumulation, mostly rocky sides and bottom; depth >2m; very little organics; low primary productivity	Storm water moderation; Water quality treatment; Biological productivity and biodiversity	**Hydrological:** Low **Biogeochemical:** Low **Habitat:** Negligible	**Input** – possible groundwater; precipitation run-off **Output** – possible groundwater recharge; evaporation

[1] Based on Canadian Wetland Classification System (National Wetlands Working Group, 1997)

[2] Based on Wetland Ecological Functions Assessment: An Overview of Approaches (Atlantic Region; Environment Canada, 2008)

[3] **High**: Important at landscape/watershed level; **Moderate**: Important at sub-watershed level; **Low**: Important to immediate surroundings of wetland (< 30 m); **Negligible**: Little importance beyond wetland boundary

TABLE 4.4-2: SUMMARY OF MITIGATION OPTIONS TO MINIMIZE PROJECT-RELATED IMPACTS TO AVOIDED WETLANDS

Wetland ID	Wetland Classification[1]	Wetland Area (ha)	Mitigative Options to Maintain Annual and Interannual Hydroperiods for Streams and Wetlands[2]	Mitigative Options to Reduce Sediment Discharge from Mining Activities
12	Mixed-Wood Treed Basin Swamp	1.53	• Install data loggers to monitor soil moisture levels • Control release of surface water from settling ponds to maintain pre-development soil moisture levels and hydrological input	• Maintain 30 m buffer area around Wetland • Partially buried, water-permeable silt fencing around buffer area • Annual spring maintenance of silt fencing
13	Isolated Basin Marsh	0.26	• Install water level meters to measure and maintain pre-development water levels • Control release of surface water from settling ponds to maintain pre-development water levels and hydrological input	• Maintain 30 m buffer area around Wetland • Partially buried, water-permeable silt fencing around buffer area • Annual spring maintenance of silt fencing
14	Isolated Basin Marsh	0.05	• Install water level meters to measure and maintain pre-development water levels • Control release of surface water from settling ponds to maintain pre-development water levels and hydrological input	• Maintain 30 m buffer area around Wetland • Partially buried, water-permeable silt fencing around buffer area • Annual spring maintenance of silt fencing
15	Shallow Water Wetland	0.60	• Install water level meters piezometres to measure and maintain pre-development water levels • Control release of surface water/groundwater from settling ponds as required to maintain pre-development water levels and hydrological input • Installation of temporary cofferdam to shore-up the old-logging/mining road • Placement of culvert to control water flow to Wetland 16	• Maintain 30 m buffer area around wetland, where possible • Silt fencing in water along northeast edge of wetland • Partially buried, water-permeable silt fencing around buffer area • Annual spring maintenance of silt fencing
16	Mixed-Wood Treed Basin Swamp	0.86	• Install data loggers and piezometres to monitor soil moisture and groundwater inputs • Control release of surface water/groundwater from settling ponds to maintain pre-development soil moisture levels and hydrological input • Control water flow from Wetland 16	• Maintain 30 m buffer area around Wetland • Partially buried, water-permeable silt fencing around buffer area • Annual spring maintenance of silt fencing