Clifton Associates Ltd.
engineering science technology

31 October 2012
File R4790

City of Regina
P.O. Box 1790
2476 Victoria Avenue
Regina, Saskatchewan
S4P 3C8

Attention: Mr. Geoff Brown, P.Eng.

Dear Sir:

Subject: Remedial Cost Estimate
Regina Multi-Use Facility Site Impact Study
Regina, Saskatchewan

The City of Regina is considering purchasing the Regina Canadian Pacific Railway Company (CP) Intermodal lands and using the site for residential and commercial use. Clifton Associates Ltd. (Clifton) was tasked with evaluating the site to determine the level of environmental remediation required on the site. This letter provides an estimate of potential remedial costs for the site.

Investigations on the site compared soil and groundwater criteria to Saskatchewan Ministry of Environment (MOE) Risk Based Corrective Actions for Petroleum Hydrocarbon Impacted Sites (RBCA) Tier IIB criteria. Based on the RBCA, it would be appropriate to eliminate potable water and surface water as pathways. Bore Hole locations and associated soil analysis are included in Drawing Nos. R4914-2, R4914-3 and R4914-4.

No hydrocarbon concentrations exceeding the applicable criteria were identified in the bore holes drilled on the Intermodal Yard by Clifton. Historical drilling (1997) on the west side of the property indicated hydrocarbon concentrations in excess of allowable criteria in the top 1.5 m. The hydrocarbons were identified in a sand fill layer. These hydrocarbon impacts were investigated and although they were not encountered in the latest drilling, may still exist. Reasons for not identifying these impacts are that exact same location of them has not been investigated or they may have degraded in the 15 years between investigations. No impacts were observed in locations surrounding the historical impacted area. If the hydrocarbon impacts are still present they are likely limited in extent. There has been an allowance of 750 m^3 of impacted soil included in the estimate to account for tank bed backfill and other soil which is likely still in place and has the potential to be impacted. Bore hole locations are shown in the attached drawings, chemical analysis of the soil is included in Table 1.

Although testing indicated hydrocarbon concentrations below criteria in BH208, elevated headspace vapours were observed. This could be a result of being in close proximity to a potential spill or of hydrocarbon vapours migrating through coarse grained fill near the surface. Further shallow drilling was conducted in the vicinity of BH208 to assess conditions; no hydrocarbon concentrations above applicable criteria were encountered.

Due to the proximity to potential impacts, it is recommended that an HDPE liner be placed along the property boundary in the area of BH114 and BH116 to reduce the risk of hydrocarbons migrating onto the site and to mitigate potential vapour intrusion onto the site. An allowance of 750 m^3 of impacted soil has been included in the estimate to deal with

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impacted soil potentially encountered while installing a liner. The limits of the vapour impacts are estimated to be 200 m long extending approximately 5 m deep.

It is apparent that hydrocarbon odours might be present in areas where soil impacts are below allowable criteria. Development plans should consider this eventuality.

Based on the results of the Phase II ESA completed by Clifton on the site, there is a moderate risk for hydrocarbon impairment on site. If impacts are identified on the site, they will likely be limited in their extent. It would be prudent to allocate some funding for limited remediation work and for the placement of liners along certain portions of the property boundary. Costs for placement of liners and excavating a limited quantity of hydrocarbon impacted soil are included in the estimate.

Rail and ties are present on the site. This estimate takes into account handling the track and ties but not the disposal of the ties. It is understood that disposal of the ties will be provided by CP at no charge to the City. This estimate takes into account removal of the asphalt surface.

Estimated costs are attached in Table 2. The estimated potential remedial estimate is $575,500.

Closure

I hope that the information provided in this letter is adequate for your current needs. Should you have any questions regarding this matter, please contact me at this office.

Yours truly,

Clifton Associates Ltd.

Greg M. Kuntz, P.Eng.
Environmental Engineer
GMK/hd

Attachments:
Table 1 – Summary of Soil Laboratory Analyses – Hydrocarbons
Table 2 – Estimated Cost – Intermodal Yard Cleanup and Placing Barriers
Drawing No. R4914.2 – Bore Hole Location Plan
Drawing No. R4914.3 – Soil Analytical Results mg/kg (100's)
Drawing No. R4914.4 – Soil Analytical Results mg/kg (200's)

Table 1
Summary of Soil Laboratory Analyses - Hydrocarbons

Sample Location	Sample Date	Sample Number	Sample Depth (m)	Sample Container Headspace Vapour Concentration* (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethylbenzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Fraction 1 C_6 - C_{10} mg/kg** (ppm)	Fraction 2 C_{10} - C_{16} mg/kg (ppm)	Fraction 3 C_{16} - C_{34} mg/kg (ppm)	Fraction 4 C_{34} - C_{50+} mg/kg (ppm)	Lead mg/kg
BH114	17-Nov-09	AL96	3.05	25	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	<5.0
BH116	17-Nov-09	AL75	3.81	25	0.0161	<0.050	0.02	<0.1	<10	92	194	52	<5.0
BH116	17-Nov-09	AL78	6.1	75	0.612	<0.050	0.245	<0.1	21	<30	55	<50	13.6
BH117	17-Nov-09	AL102	1.52	45	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	<5.0
BH118	17-Nov-09	AL129	3.81	20	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	<5.0
BH119	17-Nov-09	AL112	3.05	40	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	<5.0
BH120	17-Nov-09	AL87	3.81	20	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH121	17-Nov-09	AL121	3.81	30	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	<5.0
BH201	26-Mar-12	RC4	2.3 - 3.0	100	<0.0050	<0.050	<0.010	<0.1	<10	<30	70	<50	NA
BH201	26-Mar-12	RC7	4.6 - 5.3	80	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH202	26-Mar-12	RC18	0.8 - 1.5	215	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH202	26-Mar-12	RC20	2.3 - 3.0	190	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH202	26-Mar-12	RC23	4.6 - 5.3	170	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH203	26-Mar-12	RC10	0.8 - 1.5	160	<0.0050	<0.050	<0.010	<0.1	<10	<30	101	67	NA
BH203	26-Mar-12	RC11	1.5 - 2.3	85	<0.0050	<0.050	<0.010	<0.1	<10	<30	50	<50	NA
BH203	26-Mar-12	RC16	5.3 - 6.1	120	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH204	26-Mar-12	RC28	2.3 - 3.0	160	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH204	26-Mar-12	RC32	5.3 - 6.1	195	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
Saskatchewan Ministry of Environment - Risk Based Corrective Actions for Petroleum Hydrocarbon Impacted Sites - March 2009.													
Tier 2B - Fine-grained Soils - Commercial - Vapour Inhalation					2.8	-	-	-	-	-	-	-	
Tier 2B - Fine-grained Soils - Commercial - Ecological Soil Contact					-	330	430	230	320	260	2,500	6,500	

Notes:

* Soil sample container headspace vapour concentration measured with an RKI Eagle II vapour analyzer, calibrated to hexane with methane exclusion. 1% LEL = 110 ppm.

** F1 less BTEX.

Bold and **underline** indicate exceedance of referenced criteria.

Testing was conducted by ALS Laboratory Group.

Table 1 - Cont'd
Summary of Soil Laboratory Analyses - Hydrocarbons

Sample Location	Sample Date	Sample Number	Sample Depth (m)	Sample Container Headspace Vapour Concentration* (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethylbenzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Fraction 1 C_6 - C_{10} mg/kg** (ppm)	Fraction 2 C_{10} - C_{16} mg/kg (ppm)	Fraction 3 C_{16} - C_{34} mg/kg (ppm)	Fraction 4 C_{34} - C_{50+} mg/kg (ppm)	Lead mg/kg
BH205	26-Mar-12	RC37	3.0 - 3.7	250	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH205	26-Mar-12	RC38	3.7 - 4.3	220	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH205	26-Mar-12	RC40	5.3 - 6.1	180	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH206	26-Mar-12	RC42	0.8 - 1.5	210	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH206	26-Mar-12	RC45	3.0 - 3.7	220	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH206	26-Mar-12	RC48	5.3 - 6.1	150	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH207	26-Mar-12	RC50	0.8 - 1.5	420	<0.0050	<0.050	<0.010	<0.1	<10	<30	71	<50	NA
BH207	26-Mar-12	RC53	3.0 - 3.7	240	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH207	26-Mar-12	RC55	4.6 - 5.3	110	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH208	26-Mar-12	RC58	0.8 - 1.5	600	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH208	26-Mar-12	RC61	3.0 - 3.7	250	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH208	26-Mar-12	RC64	5.3 - 6.1	140	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH209	26-Mar-12	RC73	0.3 - 0.8	250	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH209	26-Mar-12	RC75	1.5 - 2.3	200	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH209	26-Mar-12	RC80	5.3 - 6.1	120	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH210	26-Mar-12	RC67	1.5 - 2.3	170	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH210	26-Mar-12	RC70	3.8 - 4.6	240	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH210	26-Mar-12	RC72	5.3 - 6.1	200	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
Saskatchewan Ministry of Environment - Risk Based Corrective Actions for Petroleum Hydrocarbon Impacted Sites - March 2009.													
Tier 2B - Fine-grained Soils - Commercial - Vapour Inhalation					2.8	-	-	-	-	-	-	-	
Tier 2B - Fine-grained Soils - Commercial - Ecological Soil Contact					-	330	430	230	320	260	2,500	6,500	

Notes:

* Soil sample container headspace vapour concentration measured with an RKI Eagle II vapour analyzer, calibrated to hexane with methane exclusion. 1% LEL = 110 ppm.

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Bold and **underline** indicate exceedance of referenced criteria.

Testing was conducted by ALS Laboratory Group.

Table 1 - Cont'd
Summary of Soil Laboratory Analyses - Hydrocarbons

Sample Location	Sample Date	Sample Number	Sample Depth (m)	Sample Container Headspace Vapour Concentration* (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethylbenzene mg/kg (ppm)	Xylenes mg/kg (ppm)	Fraction 1 C_6 - C_{10} mg/kg** (ppm)	Fraction 2 C_{10} - C_{16} mg/kg (ppm)	Fraction 3 C_{16} - C_{34} mg/kg (ppm)	Fraction 4 C_{34} - C_{50+} mg/kg (ppm)	Lead mg/kg
BH301	11-Jun-12	RC304	2.3 - 3.0	150	<0.0050	<0.050	<0.010	<0.1	<10	<30	213	132	NA
BH301	11-Jun-12	RC305	3.0 - 3.8	340	<0.0050	<0.050	<0.010	<0.1	<10	<30	<50	<50	NA
BH302	11-Jun-12	RC309	0.3 - 0.8	600	0.0099	<0.050	<0.010	<0.1	<10	<30	116	<50	NA
BH303	11-Jun-12	RC311	0.3 - 0.8	790	0.0165	0.071	0.014	0.12	<10	<30	234	93	NA
BH304	11-Jun-12	RC313	0.3 - 0.8	740	0.0162	0.059	0.021	<0.1	<10	<30	111	<50	NA
BH305	11-Jun-12	RC316	0.8 - 1.5	1,000	<0.050	<0.050	<0.010	<0.1	<10	<30	101	67	NA
BH306	11-Jun-12	RC318	0.8 - 1.5	350	0.0064	<0.050	<0.010	<0.1	<10	<30	50	<50	NA
Saskatchewan Ministry of Environment - Risk Based Corrective Actions for Petroleum Hydrocarbon Impacted Sites - March 2009.													
Tier 2B - Fine-grained Soils - Commercial - Vapour Inhalation					2.8	-	-	-	-	-	-	-	
Tier 2B - Fine-grained Soils - Commercial - Ecological Soil Contact					-	330	430	230	320	260	2,500	6,500	

Notes:

* Soil sample container headspace vapour concentration measured with an RKI Eagle II vapour analyzer, calibrated to hexane with methane exclusion. 1% LEL = 110 ppm.

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Bold and **underline** indicate exceedance of referenced criteria.

Testing was conducted by ALS Laboratory Group.

Table 2
Estimated Cost - Intermodal Yard Cleanup and Placing Barriers

Item	Units	Unit Cost ($)	Amount	Extension
Excavate & Load Diesel and Gasoline Impacted Soil	m^3	$10.00	1,500	$15,000.00
Haul & Dispose of Diesel and Gasoline Impacted Soil	tonnes	$35.00	2,700	$94,500.00
Backfill Excavated Gasoline Impacted Area	m^3	$10.00	1,500	$15,000.00
Install liner (5 m Deep)	m	$200.00	200	$40,000.00
Asphalt Removal	m^3	$22.00	6,000	$132,000.00
Excavate and Stockpile Pipe and Track	Lump	$100,000.00	1	$100,000.00
Sub Total				$396,500.00
Contingency	%		30	$119,000.00
Engineering	%		15	$60,000.00
Total				$575,500.00

LEGEND:

RAILWAY LAND

INTERMODAL YARD

BORE HOLE

MONITORING WELL

VAPOUR WELL

NOTES:

1. ISC 2009 AIR PHOTO.

DRAWING REVISIONS			
NO.	DD/MM/YY	DESCRIPTION	BY

Clifton Associates Ltd.
engineering science technology

CLIENT
CITY OF REGINA

PROJECT TITLE
PHASE II ESA
CP INTERMODAL YARD
REGINA, SASKATCHEWAN

DRAWING TITLE
BORE HOLE
LOCATION PLAN

PROJECT NO. R4914		FILE NO. R4914
DATE 15/03/12	SCALE 1:2500	DWG. NO. R4914-2
DRAWN JCS/TAK	CHECKED TT	

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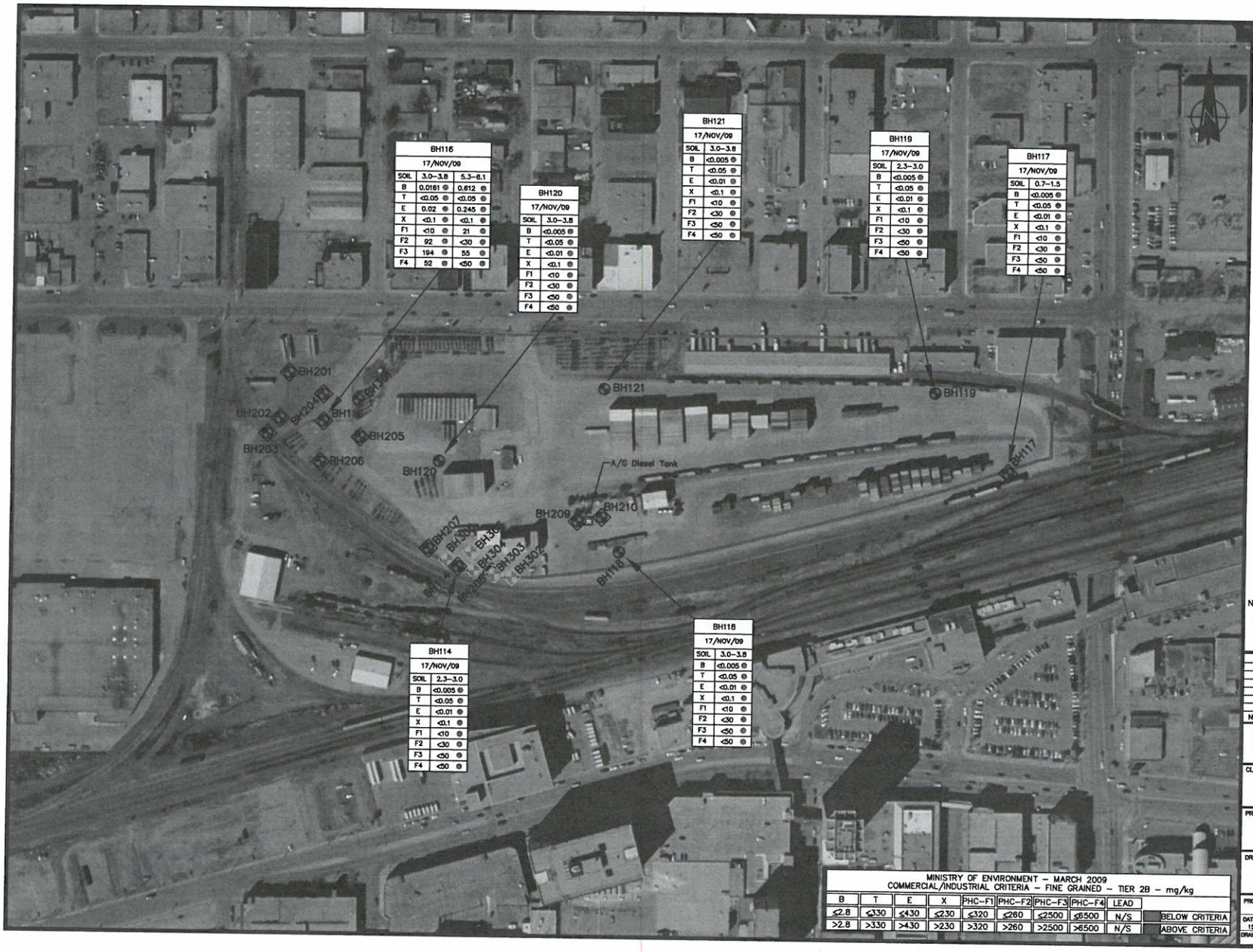

MINISTRY OF ENVIRONMENT – MARCH 2009 COMMERCIAL/INDUSTRIAL CRITERIA – FINE GRAINED – TIER 2B – mg/kg									
B	T	E	X	PHC–F1	PHC–F2	PHC–F3	PHC–F4	LEAD	
≤2.8	≤330	≤430	≤230	≤320	≤260	≤2500	≤6500	N/S	BELOW CRITERIA
>2.8	>330	>430	>230	>320	>260	>2500	>6500	N/S	ABOVE CRITERIA

LEGEND:

INTERMODAL YARD

BORE HOLE

MONITORING WELL

VAPOUR WELL

EXCEEDANCES IN TIER 2B CRITERIA

BTEX

F_1 TO F_4 and/or LEAD

NOTES:

1. ISC 2009 AIR PHOTO.

DRAWING REVISIONS			
NO.	DD/MM/YY	DESCRIPTION	BY

Clifton Associates Ltd.
engineering science technology

CLIENT
CITY OF REGINA

PROJECT TITLE
PHASE II ESA
CP INTERMODAL YARD
REGINA, SASKATCHEWAN

DRAWING TITLE
SOIL ANALYTICAL
RESULTS mg/kg (100's)

PROJECT NO. R4914		FILE NO. R4914
DATE 15/03/12	SCALE 1:2500	DWG. NO. R4914–3
DRAWN TAK	CHECKED RMC	

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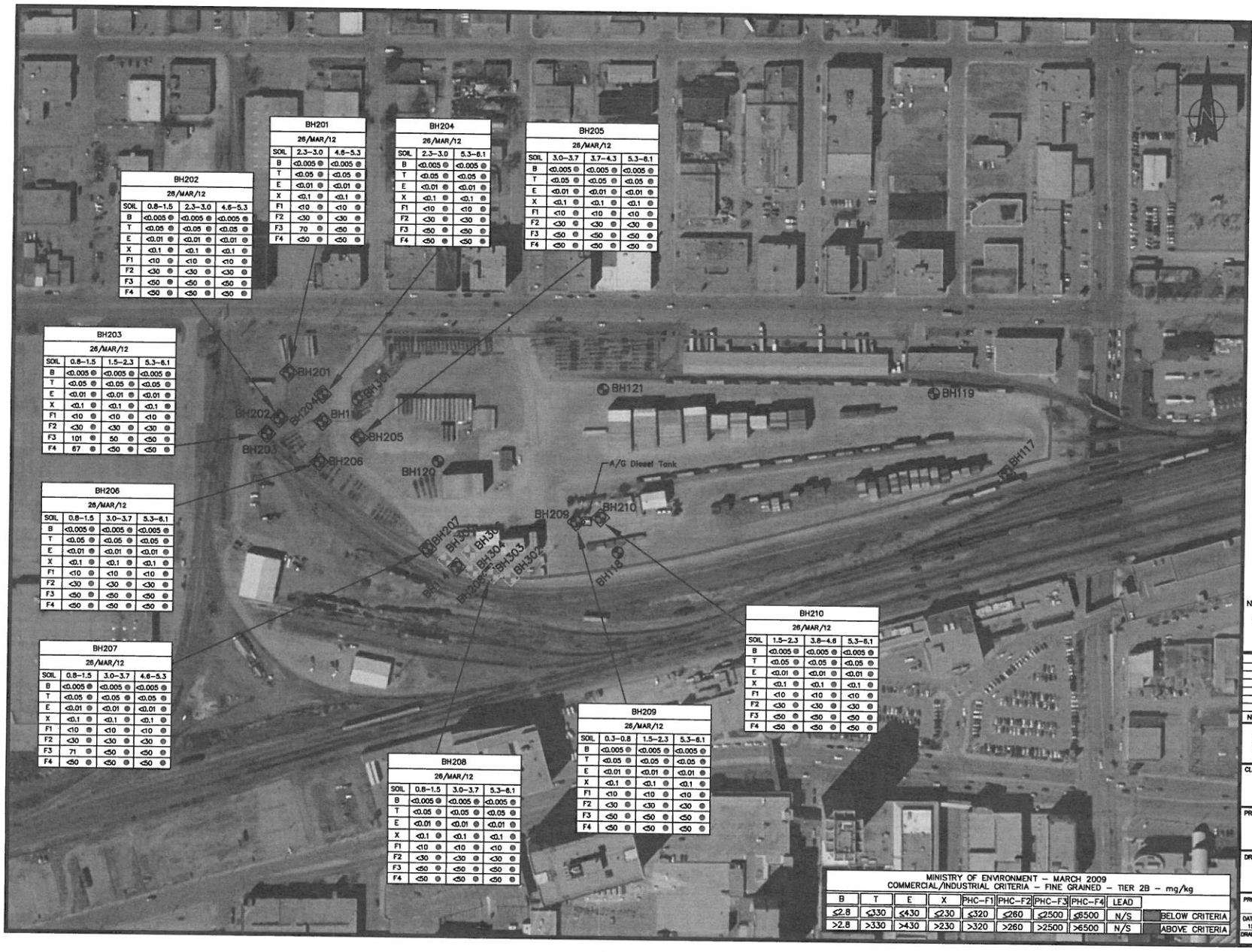

BH201 — 26/MAR/12

SOIL	2.3–3.0	4.6–5.3
B	<0.005	<0.005
T	<0.05	<0.05
E	<0.01	<0.01
X	<0.1	<0.1
F1	<10	<10
F2	<30	<30
F3	70	<50
F4	<50	<50

BH202 — 26/MAR/12

SOIL	0.8–1.5	2.3–3.0	4.6–5.3
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	<50	<50	<50
F4	<50	<50	<50

BH204 — 26/MAR/12

SOIL	2.3–3.0	5.3–6.1
B	<0.005	<0.005
T	<0.05	<0.05
E	<0.01	<0.01
X	<0.1	<0.1
F1	<10	<10
F2	<30	<30
F3	<50	<50
F4	<50	<50

BH205 — 26/MAR/12

SOIL	3.0–3.7	3.7–4.3	5.3–6.1
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	<50	<50	<50
F4	<50	<50	<50

BH203 — 26/MAR/12

SOIL	0.8–1.5	1.5–2.3	5.3–6.1
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	101	50	<50
F4	67	<50	<50

BH206 — 26/MAR/12

SOIL	0.8–1.5	3.0–3.7	5.3–6.1
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	<50	<50	<50
F4	<50	<50	<50

BH207 — 26/MAR/12

SOIL	0.8–1.5	3.0–3.7	4.6–5.3
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	71	<50	<50
F4	<50	<50	<50

BH208 — 26/MAR/12

SOIL	0.8–1.5	3.0–3.7	5.3–6.1
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	<50	<50	<50
F4	<50	<50	<50

BH209 — 26/MAR/12

SOIL	0.3–0.8	1.5–2.3	5.3–6.1
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	<50	<50	<50
F4	<50	<50	<50

BH210 — 26/MAR/12

SOIL	1.5–2.3	3.8–4.6	5.3–6.1
B	<0.005	<0.005	<0.005
T	<0.05	<0.05	<0.05
E	<0.01	<0.01	<0.01
X	<0.1	<0.1	<0.1
F1	<10	<10	<10
F2	<30	<30	<30
F3	<50	<50	<50
F4	<50	<50	<50

MINISTRY OF ENVIRONMENT – MARCH 2009
COMMERCIAL/INDUSTRIAL CRITERIA – FINE GRAINED – TIER 2B – mg/kg

B	T	E	X	PHC–F1	PHC–F2	PHC–F3	PHC–F4	LEAD	
≤2.8	≤330	≤430	≤230	≤320	≤260	≤2500	≤6500	N/S	BELOW CRITERIA
>2.8	>330	>430	>230	>320	>260	>2500	>6500	N/S	ABOVE CRITERIA

LEGEND:

INTERMODAL YARD

BORE HOLE

MONITORING WELL

VAPOUR WELL

EXCEEDANCES IN TIER 1 CRITERIA

BTEX

F_1 TO F_4 and/or LEAD

NOTES:

1. ISC 2009 AIR PHOTO.

DRAWING REVISIONS

NO.	DD/MM/YY	DESCRIPTION	BY

Clifton Associates Ltd.
engineering science technology

CLIENT
CITY OF REGINA

PROJECT TITLE
PHASE II ESA
CP INTERMODAL YARD
REGINA, SASKATCHEWAN

DRAWING TITLE
SOIL ANALYTICAL
RESULTS mg/kg (200's)

PROJECT NO. R4914
FILE NO. R4914
DATE 15/03/12
SCALE 1:2500
DRAWN TAK
CHECKED RMC
DWG. NO. R4914-4

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