
From: Raymond Lam <Raymond@allterraconstruction.ca>
Sent: January 29, 2020 5:51 PM
To: Lachance, Luc ENV:EX
Subject: 2020-01-29 NP to ENV CHH Mine - MW 19-02 Sample Results
Attachments: CHH-JAN 2020 GW DATA.pdf; 0011492 FINAL SxAnalytePivot 27 Jan 20 1408.xlsx; GW Flow Divide_2019 Closure Plan.pdf

Hi Luc,

Here are the results from the recent sampling of MW 19-02.

Thanks,
Ray

Table 1: Analytical Results for Nutrients

Sample Location	CSR Standards ⁽¹⁾		MW19-01	MW19-01X	RPD	MW19-02	MW19-01	MW19-02	MW19-X	RPD
	As-built Well Depths to Bottom		7.05m	7.05m		8.90m	7.05m	8.90m	8.90m	
Sample ID			9121887-01	9121887-02		9121887-03	0011492-01	0011492-02	0011492-03	
Date Sampled	Aquatic Life	Drinking Water	MW19-01	MW19-01X		MW19-02	MW19-01	MW19-02	MW19-X	
			2019-12-19	2019-12-19		2019-12-19	2020-01-21	2020-01-21	2020-01-21	
Physical Tests										
Colour, True (TCU)	-	-	<5.0	<5.0	*	<5.0	-	-	-	-
Conductivity (uS/cm)	-	-	241	248	3%	854	426	453	451	0%
Hardness (as CaCO3) mg/L	-	-	54.7	55.2	1%	321	70.7	189	188	1%
pH (pH Units)	-	-	7.63	7.68	1%	7.74	7.96	7.69	7.7	0%
Total Dissolved Solids mg/L	-	-	162	155	4%	593	274	286	281	2%
Turbidity (NTU)	-	-	393	407	4%	57.8	128	1.05	1.12	6%
Anions and Nutrients mg/L										
Alkalinity, Total (as CaCO3)	-	-	83.3	82.8		161				
Alkalinity, Bicarbonate (as CaCO3)			83.3	82.8	1%	161	154	109	107	2%
Alkalinity, Carbonate (as CaCO3)			<1.0	<1.0	*	<1.0	<1.0	<1.0	<1.0	*
Chloride (Cl)	1500	250	4.57	4.57	0%	25.5	9.97	5.68	5.75	1%
Fluoride (F)	2 (H < 50)	1.5								
	3 (H ≥ 50)		<0.10	<0.10	*	0.13	0.22	0.13	0.12	8%
Nitrate (as N)	400	10	0.196	0.188	4%	0.611	0.086	0.406	0.411	1%
Nitrite (as N) ⁽²⁾ Cl <2 mg/L	0.2						<0.010	<0.010	<0.010	*
Cl 2 - <4 mg/L	0.4									
Cl 4 - <6 mg/L	0.6	3.2	<0.010	<0.010	*					
Cl 6 - <8 mg/L	0.8									
Cl 8 - <10 mg/L	1									
Cl ≥ 10 mg/L	2					<0.010				
Sulfate (SO4)	1000	500	38.9	38.6	1%	263	53.8	109	109	0%

Notes: Refer to Table Endnotes (attached)

Table 3: Analytical Results for Dissolved Metals

Sample Location	CSR Standards ⁽¹⁾		MW19-01	MW19-01X	RPD	MW19-02	MW19-01	MW19-02	MW19-X	RPD
	As-built Well Depths		7.05m	7.05m		8.90m	7.05m	8.90m	8.90m	
Sample ID			9121887-01	9121887-02		9121887-03	0011492-01	0011492-02	0011492-03	
Date Sampled	Aquatic Life	Drinking Water	MW19-01	MW19-01X		MW19-02	MW19-01	MW19-02	MW19-X	
			2019-12-19	2019-12-19		2019-12-19	2020-01-21	2020-01-21	2020-01-21	
Physical Tests mg/L										
Hardness (as CaCO3)	-	-	54.7	55.2	1%	321	70.7	189	188	1%
Dissolved Metals mg/L										
Aluminum (Al)-Dissolved	-	9.5	0.0129	0.0078	*	0.0061	<0.0050	<0.0050	<0.0050	*
Antimony (Sb)-Dissolved	0.2	0.006	<0.00020	<0.00020	*	<0.00020	0.0004	<0.00020	<0.00020	*
Arsenic (As)-Dissolved	0.05	0.01	0.00078	0.00077	*	<0.00050	0.00286	<0.00050	<0.00050	*
Barium (Ba)-Dissolved	10	1	0.0078	0.0086	*	0.0375	0.0121	0.0142	0.0141	*
Beryllium (Be)-Dissolved	0.053	-	<0.00010	<0.00010	*	<0.00010	<0.00010	<0.00010	<0.00010	*
Bismuth (Bi)-Dissolved	-	-	<0.00010	<0.00010	*	<0.00010	<0.00010	<0.00010	<0.00010	*
Boron (B)-Dissolved	50	5	0.0184	0.0189	*	0.0255	0.0689	0.0461	0.0378	20%
Cadmium (Cd)-Dissolved	0.0001 (H<30)	0.005	<0.000010	<0.000010	*		<0.000010			
	0.0003 (H=30-<90)									
	0.0005 (H=90-<150)									
	0.0006 (H=150-<210)					0.000026		0.00001	<0.000010	*
Calcium (Ca)-Dissolved	-	-	18.2	18.4	1%	108	23.1	63.7	63.3	1%
Chromium (Cr)-Dissolved	0.01	0.05	<0.00050	<0.00050	*	<0.00050	<0.00050	<0.00050	<0.00050	*
Colbalt (Co)-Dissolved	0.04	-	<0.00010	<0.00010	*	0.00088	0.00014	0.00018	0.00017	*
Copper (Cu)-Dissolved	0.02 (H<50)	1	<0.00040	<0.00040	*		0.00061			
	0.03 (H=50-<75)									
	0.04 (H=75-<100)									
	0.05 (H=100-<125)									
	0.06 (H=125-<150)									
	0.07 (H=150-<175)									
	0.08 (H=175-<200)								0.00063	0.00061
0.09 (H>200)					0.00067					
Iron (Fe)-Dissolved	-	6.5	<0.010	<0.010	*	0.011	<0.010	<0.010	<0.010	*
Lead (Pb)-Dissolved	0.04 (H<50)	0.01	<0.00020	<0.00020	*		<0.00020			
	0.05 (H=50-<100)						<0.00020	<0.00020	<0.00020	*
	0.06 (H=100-<200)									
	0.11 (H=200-<300)									
0.16 (H>300)					<0.00020					
Lithium (Li)-Dissolved	-	-	0.00296	0.00297	*	0.0017	0.00577	0.00021	0.00021	*
Magnesium (Mg)-Dissolved	-	100	2.26	2.27	0%	12.8	3.15	7.31	7.29	0%
Manganese (Mn)-Dissolved	-	0.55	0.0337	0.038	12%	0.274	0.121	0.0297	0.0293	1%
Mercury (Hg)-Dissolved	0.001	0.001	-	-	-	-	-	-	-	-
Molybdenum (Mo)-Dissolved	10	0.25	0.00534	0.00575	7%	0.00395	0.0202	0.00142	0.00138	*
Nickel (Ni)-Dissolved	0.25 (H<60)	-	0.00046	0.00048	*		0.00105			
	0.65 (H=60-<120)									
	1.1 (H=120-<180)									
	1.5 (H>=180)					0.0012		<0.00040	<0.00040	*
Phosphorus(P)-Dissolved	-	-	<0.050	<0.050	*	<0.050	<0.050	<0.050	<0.050	*
Potassium (K)-Dissolved	-	-	0.82	0.86	5%	1.52	1.58	0.72	0.72	0%
Selenium (Se)-Dissolved	0.01	0.01	<0.00050	<0.00050	*	0.00063	<0.00050	<0.00050	<0.00050	*
Silicon (Si)-Dissolved	-	-	3.3	3.3	*	4.9	5.4	4.7	4.7	*
Silver (Ag)-Dissolved	0.0005 (H<=100)	-	<0.000050	<0.000050	*		<0.000050			
	0.015 (H>100)					<0.000050		<0.000050	<0.000050	*
Sodium (Na)-Dissolved	-	200	31.8	32.7	3%	54.9	60.2	10.6	10.6	0%
Strontium (Sr)-Dissolved	-	-	0.0998	0.102	2%	0.42	0.115	0.205	0.203	1%
Sulfur (S)-Dissolved	-	-	14.8	13		92.2	17.6	38.5	38.2	1%
Tellurium (Te)-Dissolved	-	-	<0.00050	<0.00050	*	<0.00050	<0.00050	<0.00050	<0.00050	*
Thallium (Tl)-Dissolved	0.003	-	<0.000020	<0.000020	*	0.000028	<0.000020	<0.000020	<0.000020	*
Thorium (Th)-Dissolved	-	-	<0.00010	<0.00010	*	<0.00010	<0.00010	<0.00010	<0.00010	*
Tin (Sn)-Dissolved	-	-	<0.00020	<0.00020	*	0.00029	<0.00020	<0.00020	<0.00020	*
Titanium (Ti)-Dissolved	1	-	<0.0050	<0.0050	*	<0.0050	<0.0050	<0.0050	<0.0050	*
Tungsten (W)-Dissolved	-	-	0.0348	0.0362	4%	0.0274	0.128	0.046	0.0457	1%
Uranium (U)-Dissolved	3	0.02	0.00127	0.00128	1%	0.00798	0.00347	0.0013	0.00132	2%
Vanadium (V)-Dissolved	-	-	<0.0010	<0.0010	*	0.0015	<0.0010	0.001	0.001	*
Zinc (Zn)-Dissolved	0.075 (H<90)	5	<0.0040	<0.0040	*		<0.0040			
	0.150 (H=90-<100)									
	0.900 (H=100-<200)							<0.0040	<0.0040	*
	1.650 (H=200-<300)									
2.4 (H=300-<400)					<0.0040					
Zirconium (Zr)-Dissolved	-	-	<0.00010	<0.00010	*	<0.00010	<0.00010	<0.00010	<0.00010	*

Notes: Refer to Table Endnotes (attached)

CARO Analytical Services
 FINAL Analytical Testing Report
 Work Order: 0011492
 Report Date: 2020-01-27 14:08:26

Client Allterra Construction
 Attention Rahim Gaidhar
 Project P17-932
 Project Info [none]

Note: This is not the original data. Please refer to PDF / Hardcopy report

LAB ID				0011492-01	0011492-02	0011492-03
CLIENT ID				MW19-01	MW19-02	MW19-X
DATE SAMPLED				2020-01-21	2020-01-21	2020-01-21
DATE RECEIVED				2020-01-23	2020-01-23	2020-01-23
MATRIX				Water	Water	Water
General Method	Analyte	Units	RL			
Anions	Chloride	mg/L	0.1	9.97	5.68	5.75
Anions	Fluoride	mg/L	0.1	0.22	0.13	0.12
Anions	Nitrate (as N)	mg/L	0.01	0.086	0.406	0.411
Anions	Nitrite (as N)	mg/L	0.01	<0.010	<0.010	<0.010
Anions	Sulfate	mg/L	1	53.8	109	109
Calculated Parameters	Hardness, Total (as CaCO3)	mg/L	0.5	70.7	189	188
General Parameters	Alkalinity, Total (as CaCO3)	mg/L	1	154	109	107
General Parameters	Alkalinity, Phenolphthalein (as Ca mg/L	mg/L	1	<1.0	<1.0	<1.0
General Parameters	Alkalinity, Bicarbonate (as CaCO3	mg/L	1	154	109	107
General Parameters	Alkalinity, Carbonate (as CaCO3)	mg/L	1	<1.0	<1.0	<1.0
General Parameters	Alkalinity, Hydroxide (as CaCO3)	mg/L	1	<1.0	<1.0	<1.0
General Parameters	Solids, Total Dissolved	mg/L	15	274	286	281
General Parameters	Turbidity	NTU	0.1	128	1.05	1.12
General Parameters	pH	pH units	0.1	7.96	7.69	7.7
General Parameters	Conductivity (EC)	uS/cm	2	426	453	451
Dissolved Metals	Aluminum, dissolved	mg/L	0.005	<0.0050	<0.0050	<0.0050
Dissolved Metals	Antimony, dissolved	mg/L	0.0002	0.0004	<0.00020	<0.00020
Dissolved Metals	Arsenic, dissolved	mg/L	0.0005	0.00286	<0.00050	<0.00050
Dissolved Metals	Barium, dissolved	mg/L	0.005	0.0121	0.0142	0.0141
Dissolved Metals	Beryllium, dissolved	mg/L	0.0001	<0.00010	<0.00010	<0.00010
Dissolved Metals	Bismuth, dissolved	mg/L	0.0001	<0.00010	<0.00010	<0.00010
Dissolved Metals	Boron, dissolved	mg/L	0.005	0.0689	0.0461	0.0378
Dissolved Metals	Cadmium, dissolved	mg/L	1E-05	<0.000010	0.00001	<0.000010
Dissolved Metals	Calcium, dissolved	mg/L	0.2	23.1	63.7	63.3
Dissolved Metals	Chromium, dissolved	mg/L	0.0005	<0.00050	<0.00050	<0.00050
Dissolved Metals	Cobalt, dissolved	mg/L	0.0001	0.00014	0.00018	0.00017
Dissolved Metals	Copper, dissolved	mg/L	0.0004	0.00061	0.00063	0.00061
Dissolved Metals	Iron, dissolved	mg/L	0.01	<0.010	<0.010	<0.010
Dissolved Metals	Lead, dissolved	mg/L	0.0002	<0.00020	<0.00020	<0.00020
Dissolved Metals	Lithium, dissolved	mg/L	0.0001	0.00577	0.00021	0.00021
Dissolved Metals	Magnesium, dissolved	mg/L	0.01	3.15	7.31	7.29
Dissolved Metals	Manganese, dissolved	mg/L	0.0002	0.121	0.0297	0.0293
Dissolved Metals	Molybdenum, dissolved	mg/L	0.0001	0.0202	0.00142	0.00138
Dissolved Metals	Nickel, dissolved	mg/L	0.0004	0.00105	<0.00040	<0.00040
Dissolved Metals	Phosphorus, dissolved	mg/L	0.05	<0.050	<0.050	<0.050
Dissolved Metals	Potassium, dissolved	mg/L	0.1	1.58	0.72	0.72
Dissolved Metals	Selenium, dissolved	mg/L	0.0005	<0.00050	<0.00050	<0.00050
Dissolved Metals	Silicon, dissolved	mg/L	1	5.4	4.7	4.7
Dissolved Metals	Silver, dissolved	mg/L	5E-05	<0.000050	<0.000050	<0.000050
Dissolved Metals	Sodium, dissolved	mg/L	0.1	60.2	10.6	10.6
Dissolved Metals	Strontium, dissolved	mg/L	0.001	0.115	0.205	0.203
Dissolved Metals	Sulfur, dissolved	mg/L	3	17.6	38.5	38.2
Dissolved Metals	Tellurium, dissolved	mg/L	0.0005	<0.00050	<0.00050	<0.00050
Dissolved Metals	Thallium, dissolved	mg/L	2E-05	<0.000020	<0.000020	<0.000020
Dissolved Metals	Thorium, dissolved	mg/L	0.0001	<0.00010	<0.00010	<0.00010
Dissolved Metals	Tin, dissolved	mg/L	0.0002	<0.00020	<0.00020	<0.00020
Dissolved Metals	Titanium, dissolved	mg/L	0.005	<0.0050	<0.0050	<0.0050
Dissolved Metals	Tungsten, dissolved	mg/L	0.001	0.128	0.046	0.0457
Dissolved Metals	Uranium, dissolved	mg/L	2E-05	0.00347	0.0013	0.00132
Dissolved Metals	Vanadium, dissolved	mg/L	0.001	<0.0010	0.001	0.001
Dissolved Metals	Zinc, dissolved	mg/L	0.004	<0.0040	<0.0040	<0.0040
Dissolved Metals	Zirconium, dissolved	mg/L	0.0001	<0.00010	<0.00010	<0.00010



**Sperling
Hansen
Associates**

Landfill Services Group

- Remediation
- Design & Operations Plans
- Landfill Closure
- Environmental Monitoring

North Vancouver, B.C. V7J 1J3
Phone: (604) 986-7223
Fax: (604) 986-7754

LEGEND:

- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPERTY LINES
- CREEK
- LANDFILL EXTENTS
- MONITORING WELLS
- WATER WELL
- SURFACE WATER STATION
- AIR SAMPLING STATION
- GROUNDFLOW CONVERGENCE / DIVIDE
- GROUNDFLOW CONTOUR

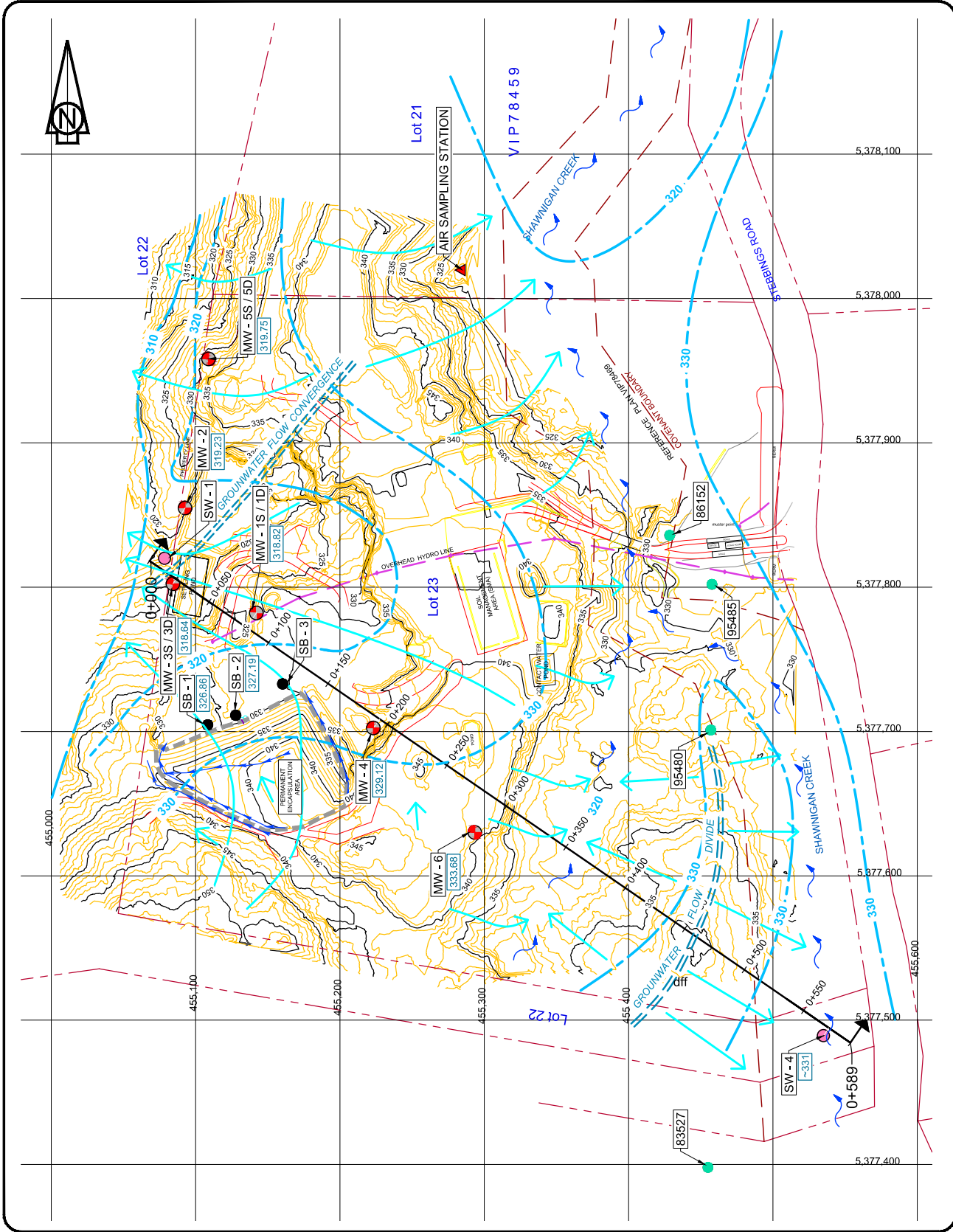
CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
**COBBLE HILL LANDFILL
UPDATED FINAL CLOSURE PLAN
2019**

TITLE:
GROUNDFLOW MAP

SCALE:	DATE:	PROJECT NO.:
1:2,500	2019/01/29	PRJ 18074
DESIGNED:	DRAWING NO.:	
DRAWN:	BRAID	
CHECKED:	JH	

FIGURE 6-4



HYDRO 1:250 MONIT WELL LOCATIONS & HYDRO-LOGIC CROSS-SEC R1.DWG 1/31/2019 4:24 PM