

Our ref: 044985

15 March 2024

**Mr. Michael Parker**  
Vice-President, Canadian Environmental Compliance  
Clean Harbors Canada Inc.  
4090 Telfer Road  
Rural Route #1  
Corunna, ON N0N 1G0

**April to December 2023 Geotechnical Inspections and Monitoring Summary**  
**Cell 20-1, Clean Harbors Lambton Landfill Site**  
**Corunna**

Dear Mr. Parker

## 1. General

The letter presents a summary of the geotechnical inspection and monitoring program for Cell 20-1 that was carried out in 2023. This monitoring program was developed on behalf of Clean Harbors by GHD Limited (GHD). The purpose of the inspection and monitoring program was to inspect the condition of the Cell 20-1 excavation side slopes on an on-going basis, and to ensure that these side slopes remained in a stable condition during 2023. A previous summary letter was prepared for the 2022 inspections.

Recommendations for the monitoring program were provided in the GHD letter title "Response to Geotechnical Peer Review and Updated Assessment- Cell 20-1 Slope Issue", dated March 2, 2022. These recommendations consisted of the following items:

- Installation of survey pins at the locations as shown on Figure 1. Survey pin coordinates (northing, easting, and elevation) are to be obtained on a weekly basis by Clean Harbors staff.
- Vibrating wire piezometric (VWP) data from the two nested VWPs are collected on a quarterly basis.
- The Geotechnical Engineer visits the site and conducts a visual inspection of the exposed slopes on a quarterly basis, starting in April or May of 2022. These visual inspections will continue until waste placement has reached an elevation where the exposed slopes are no longer a stability concern (slope stability factor of safety greater than 1.5, estimated based on the modelling presented in the March 2, 2022 letter, approximately when the waste level has reached the upper bench of 190 m asl), confirmed by visual and survey pin monitoring.
- The results of the inspection and data collection will be summarized in Clean Harbor's annual report.
- The VWPs will be decommissioned when the exposed slopes are no longer a stability concern. Decommissioning will consist of removing the data loggers, as these VWPs were installed in fully grouted boreholes.

Monitoring program details were summarized in a letter to Clean Harbors dated April 19, 2022, and the monitoring program commenced in April 2022. The 2022 monitoring and inspection program for Cell 20-1 was carried out in accordance with the recommendations provided in the April 19, 2022 GHD letter.

Based on detailed slope stability modelling completed and summary reports produced by GHD, and peer review comments of these reports from Thurber Engineering Ltd., GHD and Thurber agreed that a minimum factor of safety (FS) of 1.3 should be targeted and maintained for the exposed north, east, and south slopes of the cell. The following remedial measures were to be implemented in 2022 to achieve the targeted FS:

- The North and South slopes require additional buttressing with either cement kiln dust (CKD) material or clay to achieve an FS of 1.3. The dimensions and elevations of the required buttressing were provided in the March 2, 2022 letter.
- The East slope requires raising the water level (flooding) in the base of Cell 20-1 to improve the FS to 1.3. The target water level is 185.3 m asl.

The water level in Cell 20-1 was not raised in 2022, as it was not practical to do this before the north and south buttresses were constructed.

## 2. Geotechnical Slope Inspection Summary

A senior Geotechnical Engineer inspected Cell 20-1 side slopes on April 19, June 21, September 14, and December 19, 2023. Photographic logs from the inspection dates are attached. A brief summary of our observations is provided below.

### April 19, 2023

- Dry site conditions.
- All side slopes were visually stable.
- The shallow groundwater seepage zone in the southeast corner of the cell was dry.

### June 21, 2023

- Dry site conditions.
- All side slopes were visually stable.
- The shallow groundwater seepage zone in the southeast corner of the cell was dry.

### September 14, 2023

- Dry site conditions.
- All side slopes were visually stable.
- The southeast corner shows some sloughing from the top surface, but remains stable.

### December 19, 2023

- Dry site conditions, with some surficial snow
- All side slopes were visually stable.
- Some evidence of groundwater seepage from the shallow seepage zone in the southeast corner of the cell.
- Minor shallow cracks running along the top of the east side wall, likely due to surficial sloughing and weathering of the exposed slope.

### 3. Survey Pin Monitoring

GHD recommended specific locations for surface movement monitoring around the perimeter of the cell, in our March 2, 2022 letter. Eighteen locations (SP-1 to SP-18) were recommended as shown on Figure 1. Survey pin locations SP-11, SP-15, SP-16, SP-17, and SP-18 were removed from the surveying program in 2023, as SP-11, SP, SP-15, SP-16, and SP-17 were located in the now filled western half of Cell 20-1, and SP-18 is not accessible due to waste placement.

A baseline survey reading was established for pins SP-7 to SP-18 on May 16, 2022. However, pins SP-1 to SP-5 became inaccessible at that time as waste filling commenced in early 2022 in the western portion of Cell 20-1. Subsequent survey readings for survey pins SP-6 to SP-18 were compared to the May 2022 baseline readings to determine the magnitude of the pin movements over time.

Survey pin readings were obtained by Clean Harbors staff on a generally weekly basis. The survey pin monitoring frequency was changed to once per month, beginning in March 2023, after the construction of the lower north and south side slope buttresses, as discussed in the March 14, 2022 letter regarding monitoring frequencies. Survey pin readings in 2023 continue to show stable conditions at the top of the side wall slopes. The 2023 readings are summarized in Table 1.

### 4. Piezometric Readings

VWP boreholes VWP-01 and VWP-02 were instrumented with vibrating wire piezometers (VWPs) and data loggers. These piezometers were installed to targeted depths based on the results of the geotechnical investigations completed in December 2021. The VWPs were installed in fully grouted boreholes using a cement bentonite slurry. Each piezometer has a thin wire cable that extends from the piezometer tip up to the ground surface, and each cable is connected to a data logger. The piezometers record the piezometric head at the piezometer tip depth. Data is recorded on a daily basis. The piezometers were installed at the following depths:

- VWP-01: 14.0 m, 21.6 m, and 41.5 m bgs; and
- VWP-02: 14.0 m, 29.0 m, and 41.5 m bgs.

Data plots of the piezometric surface collected to date are shown on Figures 2 and 3. The piezometric head pressures show a gradually increasing trend, due to waste placement and gradual stabilizing conditions. VWP-01 readings have shown a gradual steady increase due to the waste filling in the western half of Cell 20-1, with current piezometric reading just above elevation 199.0 m asl. The surface data logger storage box was hit by a pickup truck in the fall of 2023, causing the data loggers to become disconnected from the VWPs. GHD reconnected the data loggers in December 2023. Piezometric head readings for VWP-01 are shown on Figure 2.

VWP-02 is located on the east wall of the eastern half of Cell 20-1, which is currently being filled with waste. The lower piezometer is functioning well at VWP-02, and shows a slowly rising piezometric head of around 198.5 m asl. The upper two piezometers have shown less stable readings, but are reading slightly lower piezometric pressures than the deeper piezometer. Piezometric head for VWP-02 are shown on Figure 3.

Additional data from the piezometers will be collected on a quarterly basis in 2024, until waste placement in the eastern portion of Cell 20-1 is at about elevation 190 m amsl, in accordance with the recommendations provided in the April 19, 2022 letter.

## 5. East Side Wall Ramp Removal

Clean Harbors may want to remove the existing ramp on the east side wall of Cell 20-1 to increase the capacity of the cell during waste filling. Based on the stable side wall conditions observed during 2022 and 2023, and the modelling work completed as presented in the geotechnical reports, and the March 2, 2022 recommendations, the removal of this ramp will not impact the slope stability of the east side wall. To maintain a factor of safety of 1.3, a lower buttress should be kept in place, similar to the one constructed on the north side wall. The lower buttress should have a top elevation of 188.3 m, and should be a minimum width of 15 m across the top of the buttress.

## 6. 2023 Monitoring and Inspection Conclusions and Recommendations

The 2022 and 2023 monitoring and inspection program for Cell 20-1 has been carried out in accordance with the recommendations provided in the April 19, 2022 GHD letter. The remedial buttresses recommended in the March 2, 2022 GHD letter, for the north and south slopes, have been constructed. Landfilling commenced in the eastern half of Cell 20-1 in June 2023.

The monitoring and inspection program will be continued in 2024. The elements of the program will be:

- The Geotechnical Engineer will visit the site and conduct a visual inspection of the exposed slopes on a quarterly basis. These visual inspections will be continued until waste placement has reached an elevation where the exposed slopes are no longer a stability concern (FS greater than 1.5, estimated based on the modelling presented in this letter, approximately when the waste level has reached the upper bench of 190 m asl), confirmed by visual and survey pin monitoring.
- The survey pin monitoring frequency was changed to once per month, beginning in March 2023. Survey pin readings have shown stable conditions at the top of the side wall slopes. Survey pin locations SP-11, SP-15, SP-16, SP-17, and SP-18 have been removed from the surveying program in 2023.
- The vibrating wire piezometric data will continue to be collected on a quarterly basis.
- The results of the inspection and data collection will be summarized in Clean Harbor's annual report.
- The VWPs will be decommissioned when the exposed slopes are no longer a stability concern. Decommissioning will consist of removing the data loggers, as these VWPs were installed in fully grouted boreholes.
- GHD has advised Clean Harbors to restrict heavy construction equipment from using the east and south perimeter gravel road, due to the ongoing sloughing of the upper side wall slopes in this area, and the narrow perimeter road in the southeast corner.

Regards



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- Encl. Geotechnical Inspection Photo Log for 2023 Inspections
  - Figure 1 - Survey Pin Locations
  - Figure 2 and 3 - Vibrating Wire Piezometric Readings
  - Table 1 - 2023 Survey Pin Measurements



Photo 1- Cell 20-1 looking south, April 19, 2023.



Photo 2- East side wall of Cell 20-1, April 19, 2023.

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**





Photo 3- Cell 20-1 Southeast corner, April 19, 2023.



Photo 4- North side wall, April 19, 2023.

**Site Photographs  
Cell 20-1 2023 Geotechnical Inspections  
Clean Harbors Lambton Facility Landfill,  
Corunna**





Photo 5- South side wall, April 19, 2023.



Photo 6- Cell 20-1, East side wall, April 19, 2023.

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**







Photo 7- Cell 20-1, South side wall, June 21, 2023.



Photo 8- North side wall, start of waste placement, June 21, 2023.

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**





Photo 9- Cell 20-1, East side wall, looking north, June 21, 2023.



Photo 10- Cell 20-1, East and North side wall, looking east, June 21, 2023.

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
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**Corunna**





Photo 11- Cell 20-1, looking south. September 14, 2023.



Photo 12- Cell 20-1, looking north, September 14, 2023..

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**





Photo 13- Cell 20-1, southeast corner, September 14, 2023.



Photo 14- South side wall, looking west. Side wall sloughing, but stable, September 14, 2023.



**Site Photographs  
Cell 20-1 2023 Geotechnical Inspections  
Clean Harbors Lambton Facility Landfill,  
Corunna**



Photo 15- Cell 20-1, North side wall, looking west, December 19, 2023.

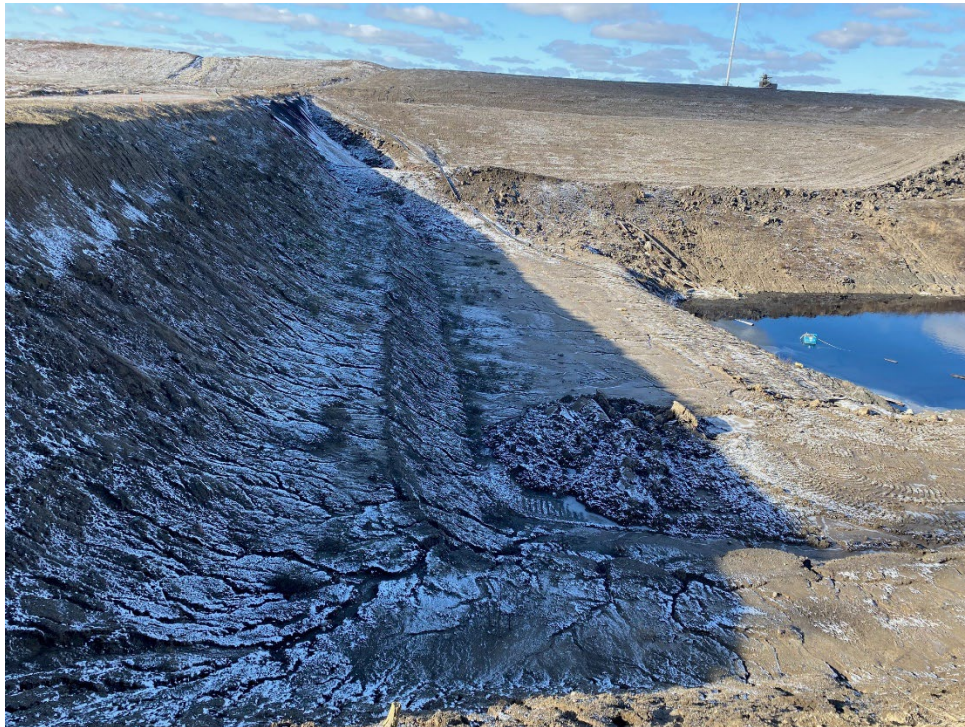


Photo 16- Cell 20-1 Southeast corner south side wall, looking west. Some sloughing and seepage from the southeast corner, December 19, 2023

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**





Photo 17- Cell 20-1 East side wall, December 19, 2023.



Photo 18- Cell 20-1, East side wall, December 19, 2023.

**Site Photographs  
Cell 20-1 2023 Geotechnical Inspections  
Clean Harbors Lambton Facility Landfill,  
Corunna**





Photo 19- Cell 20-1, looking north, December 19, 2023.

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**





Photo 20- Cell 20-1 East side wall, looking south. Note minor cracking along the top of the slope, due to surficial sloughing, December 19, 2023

**Site Photographs**  
**Cell 20-1 2023 Geotechnical Inspections**  
**Clean Harbors Lambton Facility Landfill,**  
**Corunna**





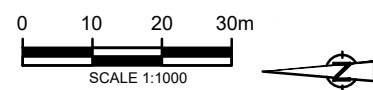


**LEGEND**

- VWP-01 VWP - VIBRATING WIRE PIEZOMETER
  - × SP1 SP - SURVEY PIN
  - SP6 WEEKLY MONITORING LOCATION
- SP6, SP7, SP8, SP9, SP10, SP12, SP13, SP14, SP18

**SOURCE**

AERIAL DRONE PHOTO COMPLETED BY GHD AUGUST 17, 2022

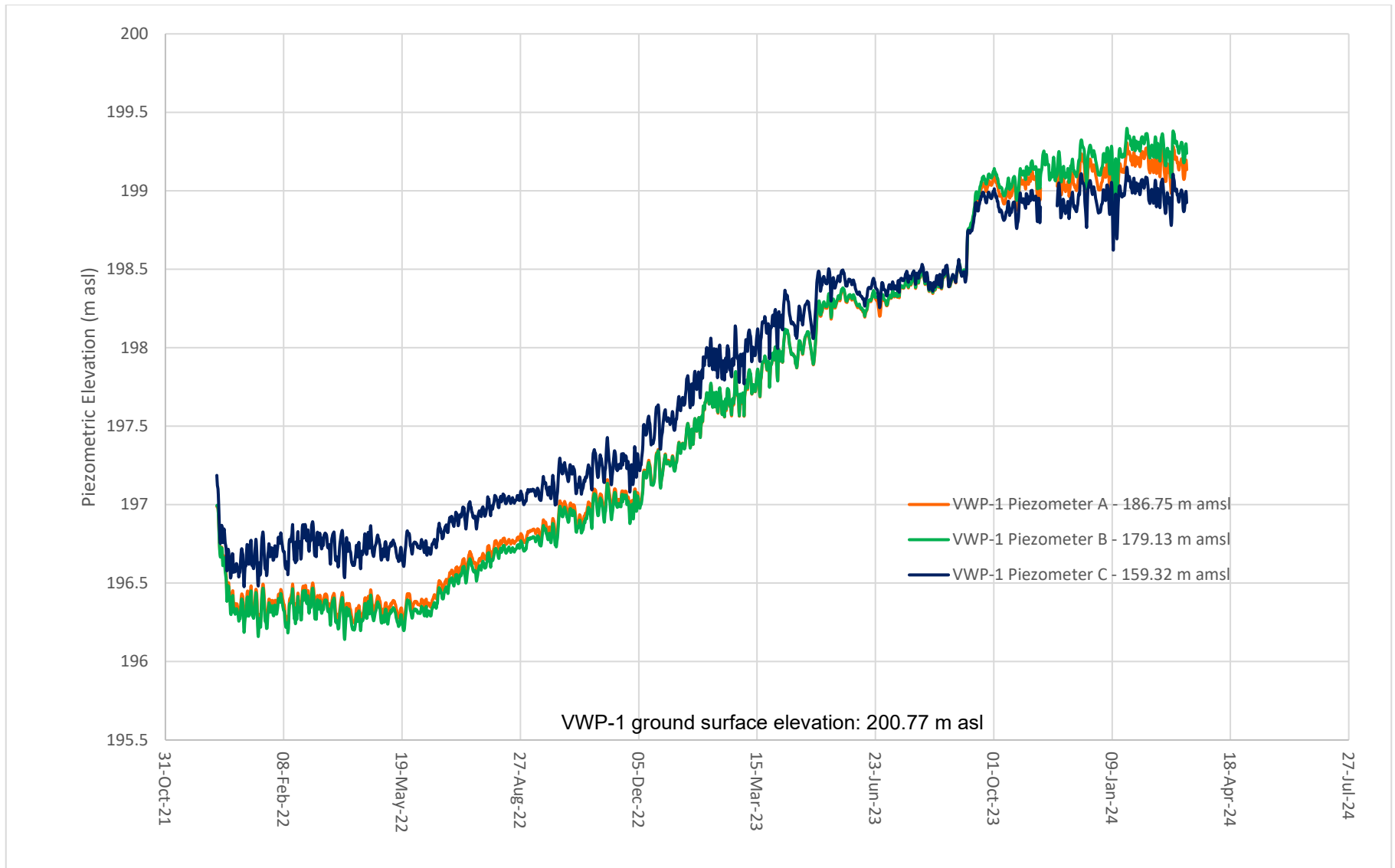


CLEAN HARBORS CANADA, INC.  
LAMBTON COUNTY, ONTARIO

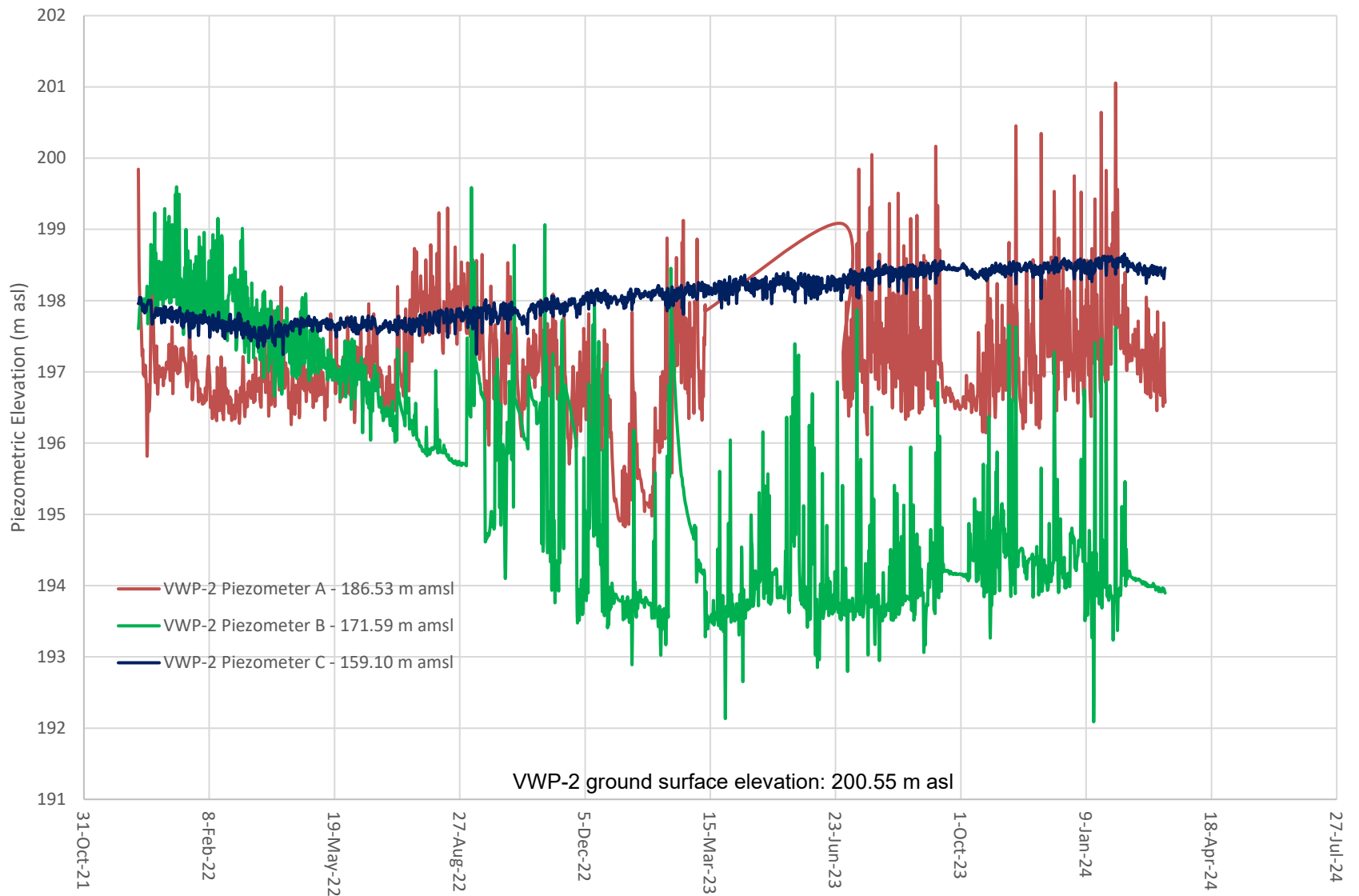
Project No. 44985  
Date Jan 26, 2023

**SURVEY PIN LOCATIONS**

**Figure 1**



**Figure 2 – VWP-1 Piezometric Elevation Readings Cell 20-1**



**Figure 3 – VWP-2 Piezometric Elevation Readings Cell 20-1**





Table 1  
2023 Survey Pin Measurements  
Cell 20-1  
Clean Harbors Lambton Facility  
Corunna, Ontario

Survey Pin	October 25, 2023						November 30, 2023						December 19, 2023						January 29, 2024					
	Changes from Baseline Readings						Changes from Baseline Readings						Changes from Baseline Readings						Changes from Baseline Readings					
	Northing	Easting	Top of Stake (mas)	Northing Net Change (m)	Easting Net Change (m)	Elevation Net Change (m)	Northing	Easting	Top of Stake (mas)	Northing Net Change (m)	Easting Net Change (m)	Elevation Net Change (m)	Northing	Easting	Top of Stake (mas)	Northing Net Change (m)	Easting Net Change (m)	Elevation Net Change (m)	Northing	Easting	Top of Stake (mas)	Northing Net Change (m)	Easting Net Change (m)	Elevation Net Change (m)
SP-6	4747712.798	394291.045	200.637	0.078	-0.057	-0.010	4747712.694	394290.998	200.652	-0.026	-0.104	0.005	4747712.725	394290.911	200.634	0.005	-0.191	-0.013	4747712.636	394290.896	200.644	-0.084	-0.206	-0.003
SP-7	State Damaged						State Damaged						4747914.692	394277.033	201.534				4747914.665	394276.987	201.542	-0.027	-0.046	0.008
SP-8	4747824.772	394338.764	200.870	0.048	-0.040	0.004	4747824.723	394339.017	200.858	-0.001	0.213	-0.008	4747824.756	394338.758	200.885	0.032	-0.046	0.019	4747824.739	394338.838	200.896	0.015	0.034	0.030
SP-9	4747905.047	394341.011	200.754	0.009	-0.018	-0.005	4747905.055	394341.004	200.752	0.017	-0.025	-0.007	4747905.044	394341.011	200.729	0.006	-0.018	-0.030	4747905.031	394341.026	200.755	-0.007	-0.063	-0.004
SP-10	4747725.903	394335.975	200.539	-0.021	-0.127	0.016	4747725.896	394336.022	200.527	-0.028	-0.080	0.004	4747725.935	394335.989	200.555	0.011	-0.153	0.032	4747725.914	394335.946	200.539	-0.010	-0.156	0.016
SP-11	Removed from Survey Program						Removed from Survey Program						Removed from Survey Program						Removed from Survey Program					
SP-12	4747863.597	394340.857	201.144	0.008	-0.084	0.026	4747863.536	394340.901	201.14	-0.053	-0.040	0.022	4747863.644	394340.936	201.143	0.055	-0.005	0.025	4747863.635	394340.928	201.142	0.046	-0.013	0.024
SP-13	4747764.464	394337.153	200.644	0.003	-0.045	0.021	4747764.488	394337.194	200.646	0.027	-0.004	0.023	4747764.438	394337.156	200.642	-0.023	-0.042	0.019	4747764.438	394337.111	200.643	-0.023	-0.087	0.020
SP-14	4747712.930	394273.663	200.308	-0.070	-0.097	0.002	4747712.896	394273.618	200.311	-0.104	-0.142	0.005	4747712.951	394273.611	200.298	-0.049	-0.149	-0.008	4747712.944	394273.688	200.306	-0.056	-0.072	0.000
SP-15	Removed from Survey Program						Removed from Survey Program						Removed from Survey Program						Removed from Survey Program					
SP-16	Removed from Survey Program						Removed from Survey Program						Removed from Survey Program						Removed from Survey Program					
SP-17	Removed from Survey Program						Removed from Survey Program						Removed from Survey Program						Removed from Survey Program					
SP-18	Not Accessible						Not Accessible						Not Accessible						Not Accessible					

Survey Pin	February 15, 2024					
	Changes from Baseline Readings					
	Northing	Easting	Top of Stake (mas)	Northing Net Change (m)	Easting Net Change (m)	Elevation Net Change (m)
SP-6	4747712.693	394290.873	200.630	-0.027	-0.229	-0.017
SP-7	4747914.797	394277.149	201.545	0.105	0.116	0.011
SP-8	4747824.758	394338.828	200.917	0.034	0.024	0.051
SP-9	4747904.954	394340.988	200.756	-0.084	-0.041	-0.003
SP-10	4747725.937	394335.979	200.552	0.013	-0.123	0.029
SP-11	Removed from Survey Program					
SP-12	4747863.565	394340.871	201.149	-0.024	-0.070	0.031
SP-13	4747764.439	394337.141	200.621	-0.022	-0.057	-0.002
SP-14	4747712.941	394273.626	200.302	-0.059	-0.134	-0.004
SP-15	Removed from Survey Program					
SP-16	Removed from Survey Program					
SP-17	Removed from Survey Program					
SP-18	Not Accessible					