



OVAM Mortsel: Bi-weekly report

Soil remediation by Electric Resistance Heating

February 16 – March 1, 2024

Former Electra Site, Statielei 111 Mortsel

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1 Introduction

This letter report contains a brief description of the Electrical Resistance Heating (ERH) remediation system operations performed at the former Electra Site at Statielei 105 – 113 in Mortsel. The time period addressed in this report is from February 16 to March 1, 2024. **Figure 1** contains a site map displaying the locations of the thermal treatment area, electrodes, temperature monitoring points (TMPs) and other pertinent Site features.

2 System Operation Activities

The weeks of the reporting period involve week 8 and 9 of 2024. During this period the site was visited 9 times in light of the soil sampling activities.

In the reporting period the following works were performed:

- Prepared site for drillers
- Assisted drillers for soil sampling
 - Cooling in basement SL113
 - Cleaning site / drill cuttings
 - Location of soil sample bore holes were measured, documented and sent to TEC
- Assisted TEC with grouting drill holes before re-starting ERH.
- Fixed settings of drip flowmeter in CARS (the 20 mA value did not correspond to the meter)
 - Checked all FQITs (sensor settings) in CARS.
- Fixed ProWirl meter FQIT01-SC01
 - a piece of debris got stuck inside the meter housing.
- Removed pallets and paper for Veerle
- Tightened V-belt of cooling tower
 - Installed a sound proof liner for the V-belt to reduce the cracking noise
- Vapor flow tests to see if shallow temperatures would increase (lower VR flow)
- VITO installed 4 PFAS sensors: 2 outside and inside 109 and 111
- PFAS measurements were carried out at the effluent of the blowers
- General checks and equipment maintenance
 - General data collection and inspections
 - Amp surveys
 - Stept & Touch
 - PID measurements
 - Relative humidity measurements
 - Temperature measurements
 - Drained the condensate in the VGAC vessels, influent hose blowers
 - Drained cooling water from SC

3 ERH Application Summary

The ERH system operational parameters from the current reporting period are presented in **Table 1** below.

Table 1. ERH System Parameters

ERH System Parameters	Estimated	Up to March 1st	Percentage of total
Operation Time (days)	137 ¹	101 ³	74%
Cumulative Energy Applied (MWh)	3.800 ²	2.210	58%

Total energy for ERH and auxiliary Equipment was ca. 2.210 MWh. Energy applied for ERH up to March 1st was ca. 2.139 MWh.

¹ Extra days for higher concentrations in soil not included.

² Extra energy for higher concentrations in soil not included.

³ This is with regard to the days that ERH was not active. Including those days would give an operation time of 140 days.



4 Temperature Monitoring

During the reporting period of February 16 to March 1, 2024 the site average subsurface temperature increased from 94,1 degrees Celsius (°C) to 96,9 °C, an increase of 2,7 °C this period. This represents an average temperature increase of approximately 0,19 °C/day. The daily rise of the average site temperature has decreased significantly, which is logical as the upper limits are approached (asymptote). The temperature in all RTD's has reached the boiling temperature.

As mentioned in the last report, because of a broken solenoid we had a short circuit flow from drip water to TMP K10. The cold drip water decreased the temperature in TMP K10 significantly. The solenoid has been repaired and temperatures increased significantly.

The highest individual temperature measurement within the treatment volume is 104,6 °C at TMP D12 at 7,5 meters below ground surface (bgs). Subsurface temperatures at different depths per TMP location and over time are presented in **Figure 2**. The site average peaked at 96,9 °C on the 1st of March. Shallow temperatures increased as a result of the lower vapor flow.

In total 4 shallow RTD's are installed near utilities (Statielei 109 front and Statielei 113 back) to measure the temperature close to the utilities. The average temperature at the utility RTDs is 46 °C, the maximum temperature is 55 °C in RTD T4 (SL 113 back).

5 Vapor Recovery

During the reporting period the vacuum applied to the vapor recovery piping system (as measured at the condenser inlet) was maintained between 40 - 130 mbar. The difference is caused by the vapor recovery tests. All pipe and field piezometer pressure measurements show negative values, indicating the system is working sufficiently to maintain negative pressure. The vapor flow rate, as measured after the vapor recovery blower, averaged circa 1.190 m³/hour. We tested the system at low (700 m³/hr) and high (1.400 m³/hr) vapor flows. The lower vapor flow had a positive effect on the shallow soil temperature. Total mass removal did not increase significantly: the lower flow and higher concentrations resulted in global equal contaminant mass removal.

Vapor monitoring

During every site visit HMVT performs PID vapor measurements of the ambient air and the extracted soil vapor. The most recent PID measurement for chlorinated volatile organic compounds (CVOC), collected on March 1, was 8,0 ppm. The PID measurements of the extracted soil vapor are still stable on a level of 5 - 10 ppm. During the reporting period, the highest recorded PID measurement in the soil vapor was 8,0 ppm at March 1.

6 Vapor treatment

The extracted soil vapors are treated with granular activated carbon (GAC). The emission limit, as defined in the tender document, for PCE and TCE is 100 mg/m³ if total mass is higher than 2.000 g/hr. The client wants to limit the emissions to zero.

The spare Mach4X vessel, containing 10 m³ of GAC, is currently connected and functioning as the second VGAC. HMVT performs PID vapor measurements of the vapor treatment on a regular base. During the reporting period, the PID reading of the effluent of the first GAC filter was 0,0-0,1 ppm. The PID reading of the effluent of the second GAC filter was 0,0 ppm. TEC will periodically take vapor samples from the influent and effluent of each vessel.

The activated carbon has a relatively low adsorption rate. A lot of attention was spent to prevent condensation in the VGAC vessels. Measures were taken to decrease the humidity level of the vapor stream (extra cooling in the steam condenser and insulation of tubing). Measurements showed that relative humidity complies to the requirement. Relative humidity in the vapor was < 50% (at a temperature of ca. 28 - 36 °C). HMVT also made a memo about relative humidity in the soil vapor. Condensation will probably take place on the cold vessel wall,



but not in the middle of the filter. During this reporting period the activated carbon filters were drained frequently. The amount of condensate was low.

7 Condensate and water treatment

During the reporting period 252 m³ of water was recovered via condensed water by the vapor recovery system. A total of 1.753 m³ of condensate has been produced since the start-up of the ERH system.

The condensate produced from the steam condensers is collected and treated in 2 liquid granular activated carbon vessels, before being discharged to the sewer. The discharge limit for PCE and TCE is 10 µg/l. TEC will periodically take samples from the water treatment system. From the samples of the 16th of January, no contaminants were detected in the effluent.

8 Mass removal (by PID)

The mass removal calculation is based on the PID measurements in the influent of GAC1. We use a 10,6 eV bulb, so the correction factor for PCE is 0,57. During the reporting period, the total mass removed from the subsurface was approximately 9 kg (based on PCE), 6 kg less than the previous reporting period. The total mass recovered from the subsurface since the start of the project is circa 364 kg (**Figure 3.**).

9 Health & Safety

During the reporting period, there were no mentionable affairs regarding health and safety.

Step & Touch

The highest measured voltage (step and touch) during the reporting period was negligible at <100 mV.

Ambient air monitoring

During the reporting period, no presence of CVOC in daily ambient air monitoring was measured (PID). TEC will provide the measurement data from the VaporSafe.

10 Settlement measurements

The settlement measurements are being monitored on a weekly basis by buro Teugels. The results of the measurements can be found in table 2, displayed in meters. Settlement is expressed in mm. The measuring points can be found in the map below.

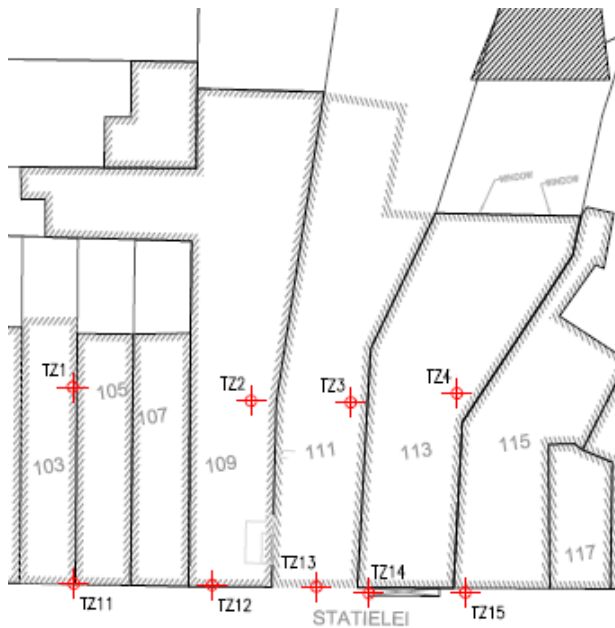


Table 2. Results settlement measurements

	dossier nr.: #
	werf: Wegroan - Mortsel Statielei
	datum: #
	Operator: K.J. - S.B.

ZETTINGSMETING

Nr. pt	19/04/23	Δ	TOT Δ	11/01/24	Δ	TOT Δ	16/01/24	Δ	TOT Δ	30/01/24	Δ	TOT Δ	06/02/24	Δ	TOT Δ	20/02/24	Δ	TOT Δ	27/02/24	Δ	TOT Δ
TZ1	5,705			5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2	5,703	0	-2
TZ2	8,780			8,778	0	-2	8,778	0	-2	8,777	-1	-3	8,776	-1	-4	8,776	0	-4	8,777	1	-3
TZ3	12,178			12,178	0	-2	12,178	0	-2	12,176	0	-2	12,175	-1	-3	12,175	0	-3	12,176	1	-2
TZ4	9,266			9,266	0	0	9,266	0	0	9,255	-1	-1	9,255	0	-1	9,254	-1	-2	9,255	1	-1
TZ11	5,211			5,209	0	-2	5,209	0	-2	5,209	0	-2	5,209	0	-2	5,209	0	-2	5,210	1	-1
TZ12	8,150			8,147	0	-3	8,147	0	-3	8,146	-1	-4	8,145	-1	-5	8,145	0	-5	8,146	1	-4
TZ13	11,095			11,095	0	0	11,095	0	0	11,095	0	0	11,095	0	0	11,095	0	0	11,096	1	1
TZ14	8,922			8,922	0	0	8,923	1	1	8,923	0	1	8,923	0	1	8,923	0	1	8,924	1	2
TZ15	3,971			3,970	0	-1	3,971	1	0	3,970	-1	-1	3,970	0	-1	3,970	0	-1	3,971	1	0

OPMERKINGEN
 Ref.meting: 19/04/23
 Δ : verschil t.o.v. vorige meting
 TOT Δ : verschil t.o.v. ref.meting

Limited settlements (2 – 4 mm) have been measured in buildings Statielei 103, 109 and 111. Settlement in front of and the back of Statielei 109 appear to retreat. According to stability engineer Herman Peiffer, settlements over 6 mm can pose a potential problem. We notified him of these ongoing settlements, and he will visit the site to check the settlements and buildings.

11 Further remarks

During the reporting period, soil samples were taken by TEC. For soil results we refer to ‘ORTEC1700613 Statielei 111 ORTEC1700613’ – Analyserapport 1378050, 1377389, 1376456, 1375049, 1374491, 1375049’. All values were below remediation targets.

12 Planned Activities

- Planned activities for the following two weeks (10 and 11) involve:
- Regular monitoring and maintenance activities
 - Steam sampling per electrode using Dräger tubes, PID and Vaporsafe
 - Hot soil (and groundwater) sampling (End of week 11)



Figures

1. Site plan
2. Average Temperature vs. Time (by TMP)
3. Cumulative Mass Removed vs Time



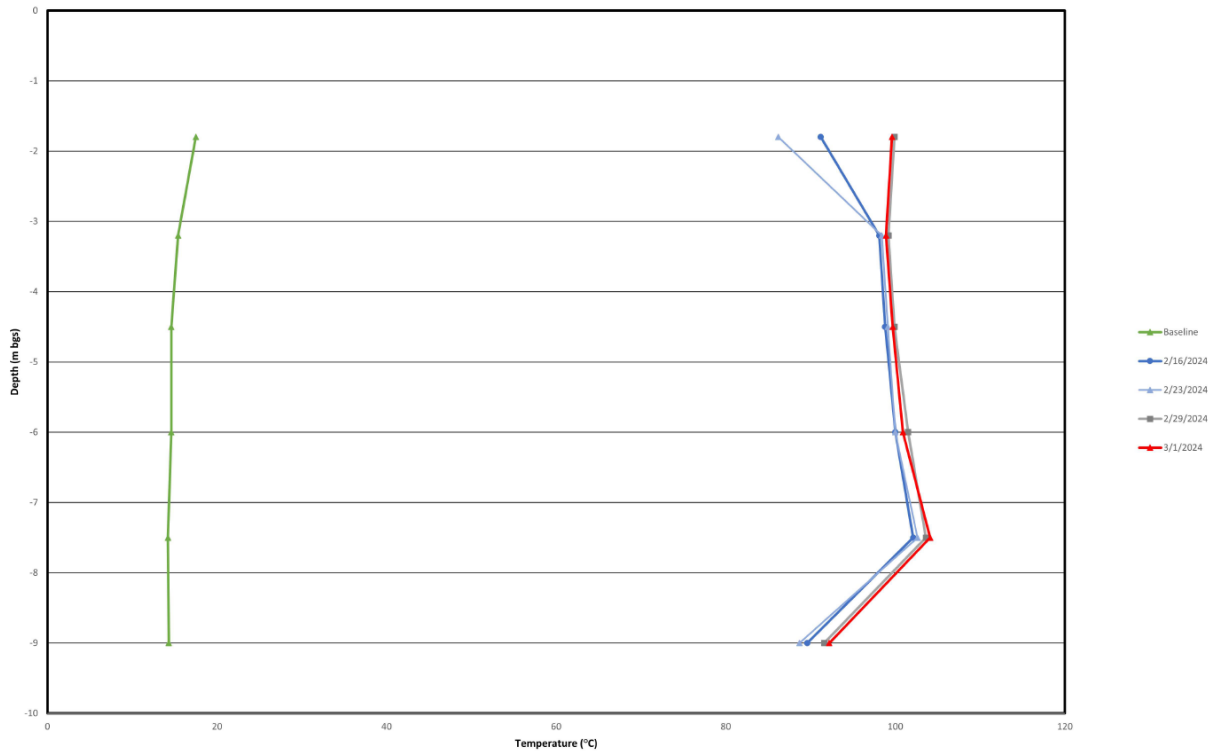
Figure 1: Site plan

The as built site plan is attached separately

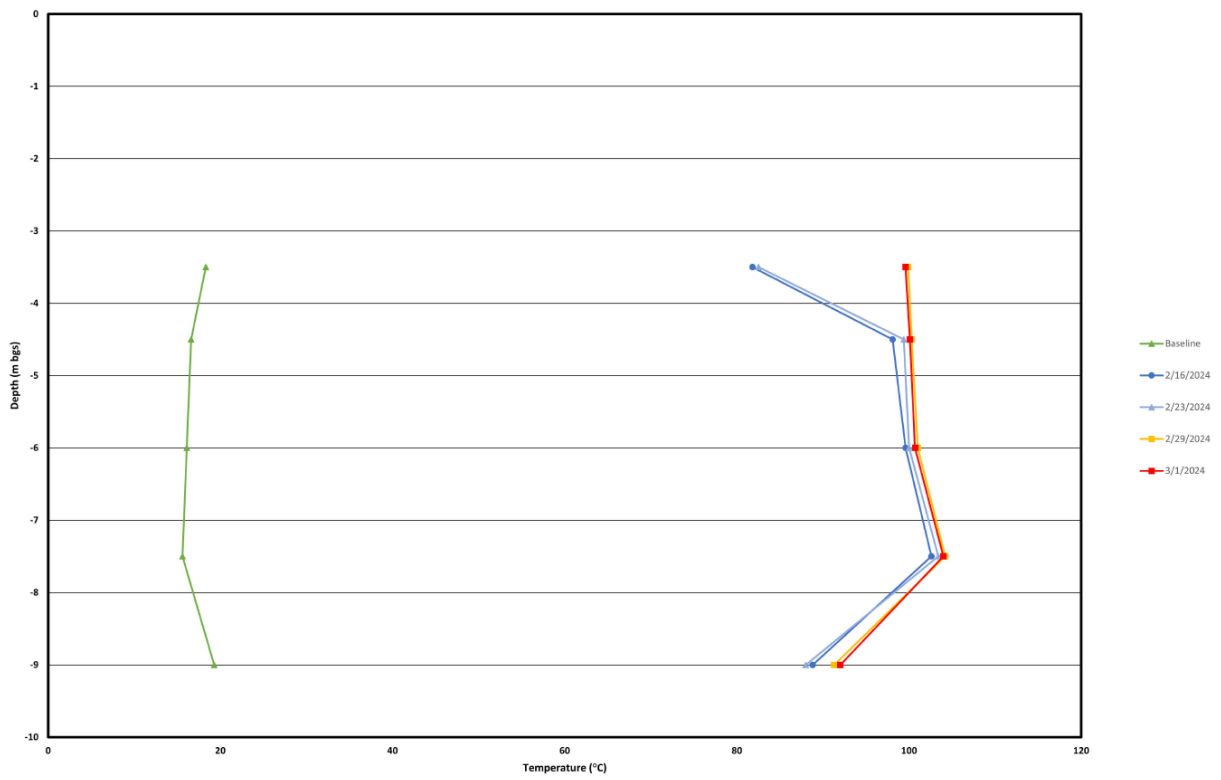


Figure 2. Average Temperature vs. Time (By TMP)

TMP C10 - Mortsel

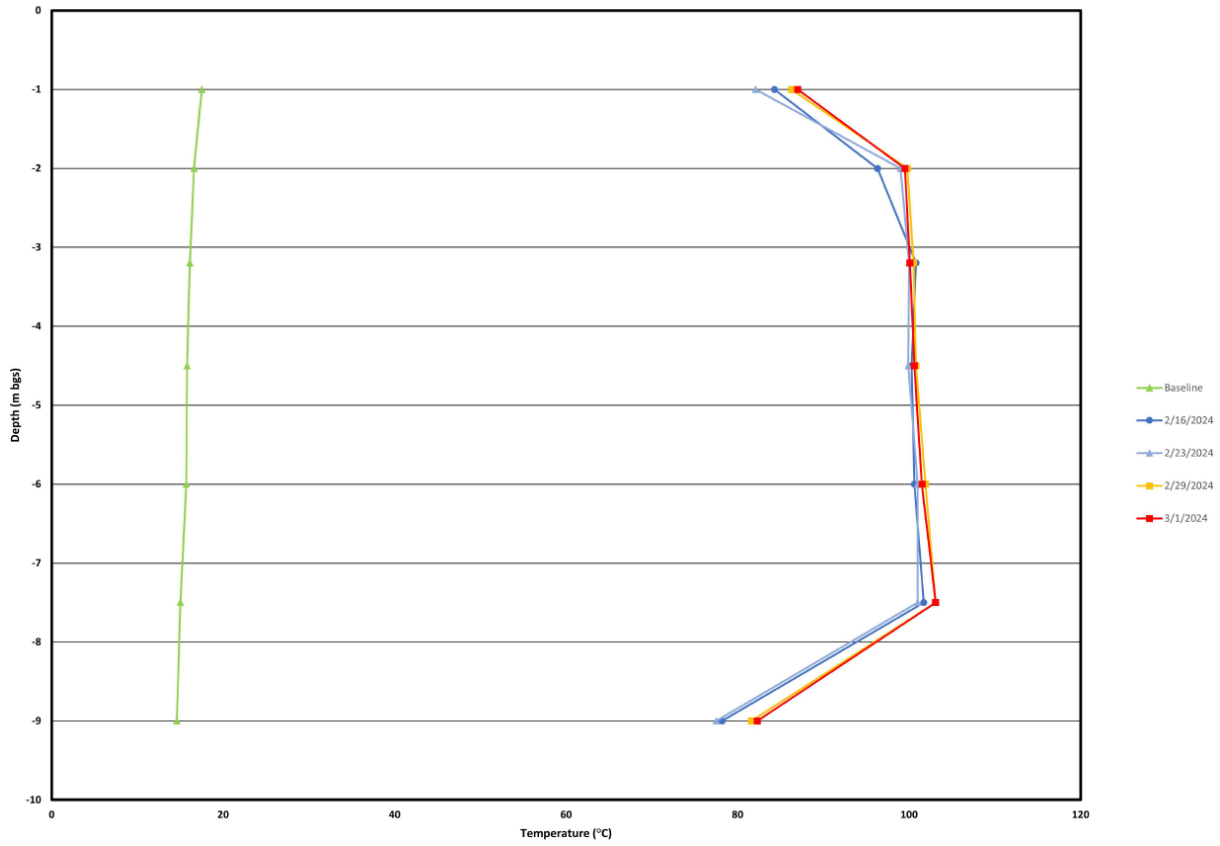


TMP-D12 - Mortsel

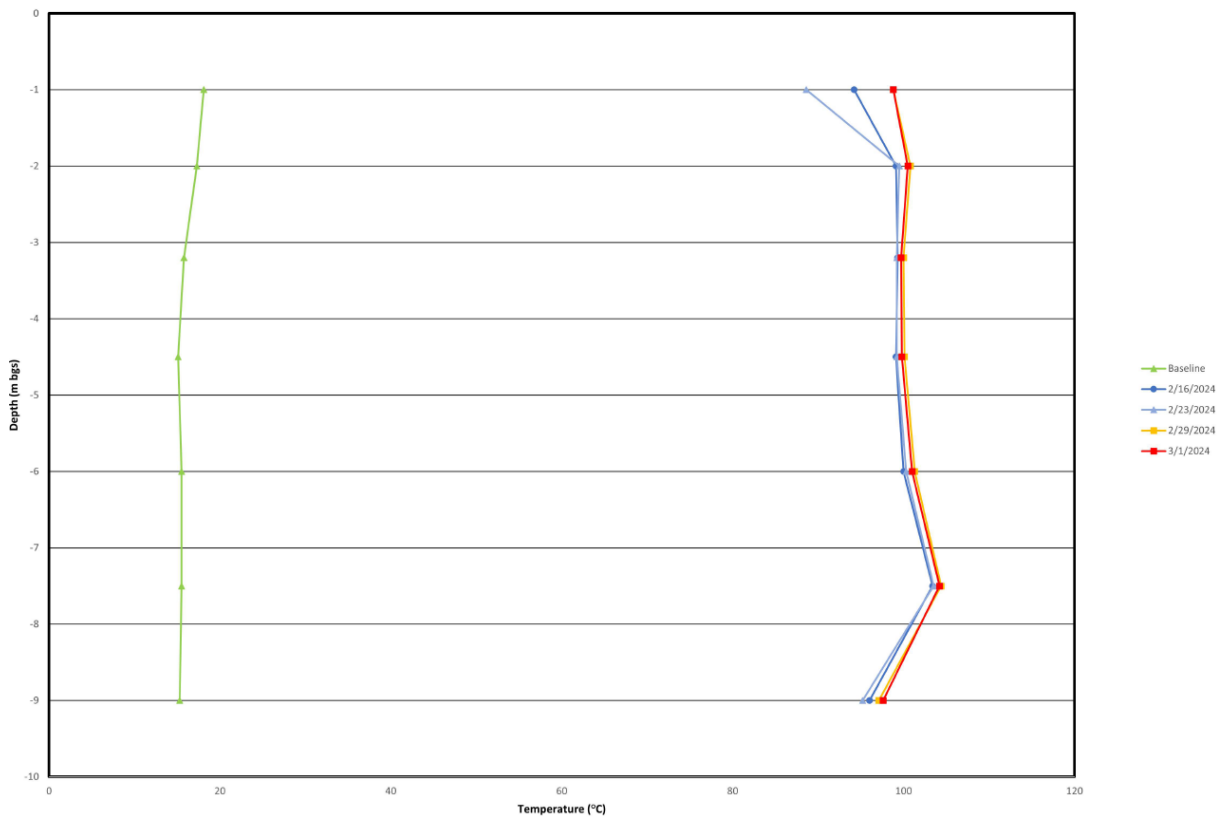




TMP-E05 - Mortsel

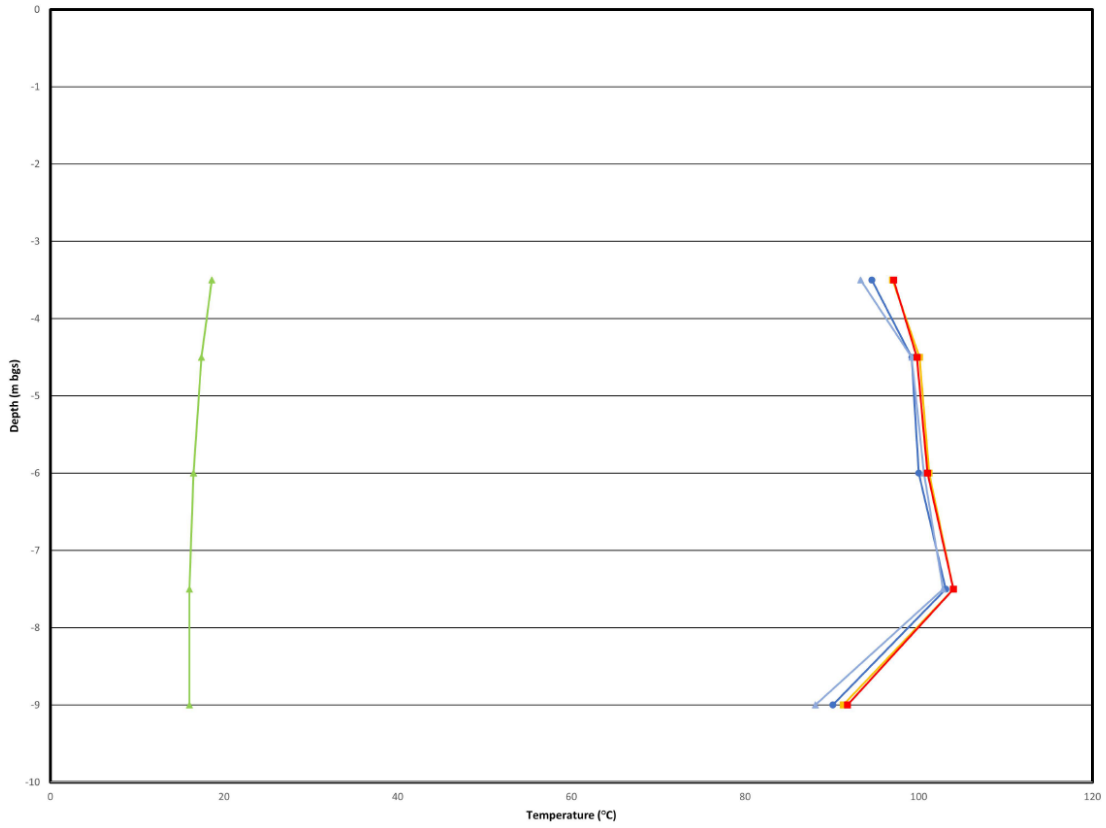


TMP F08 - Mortsel

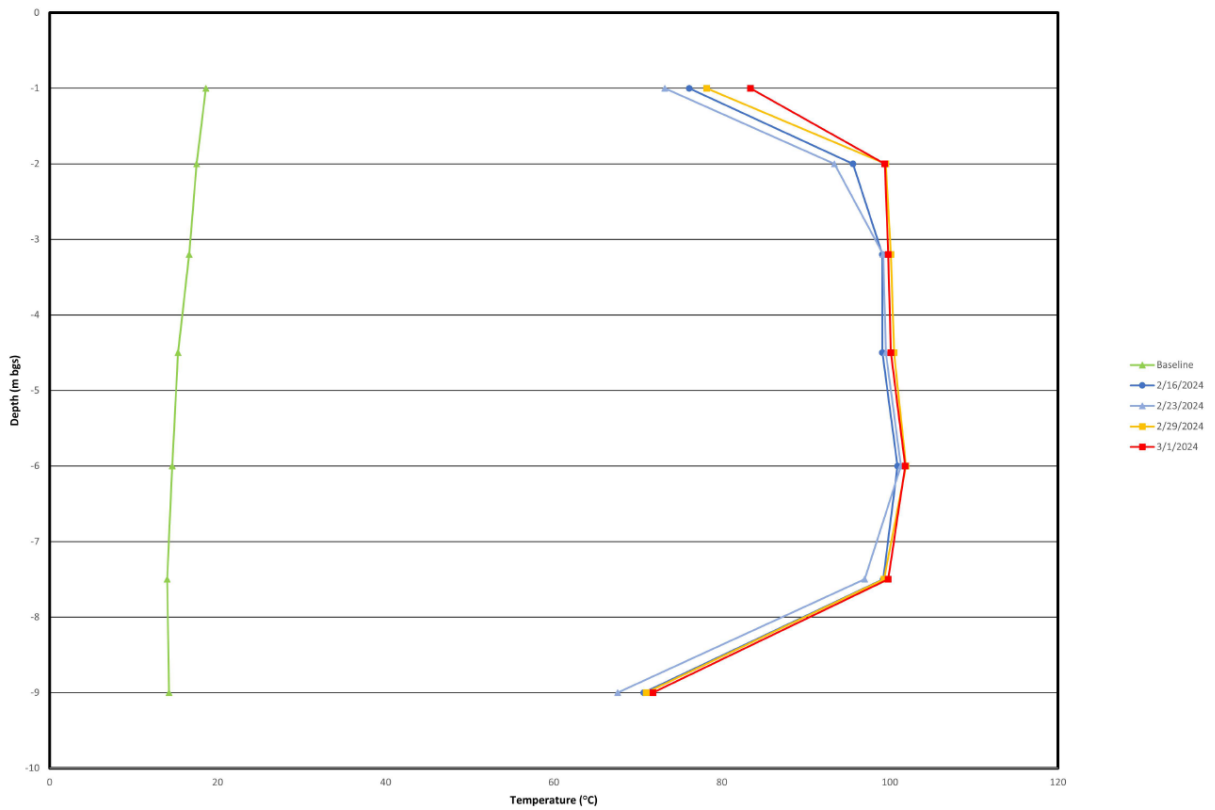




TMP H10 - Mortsel

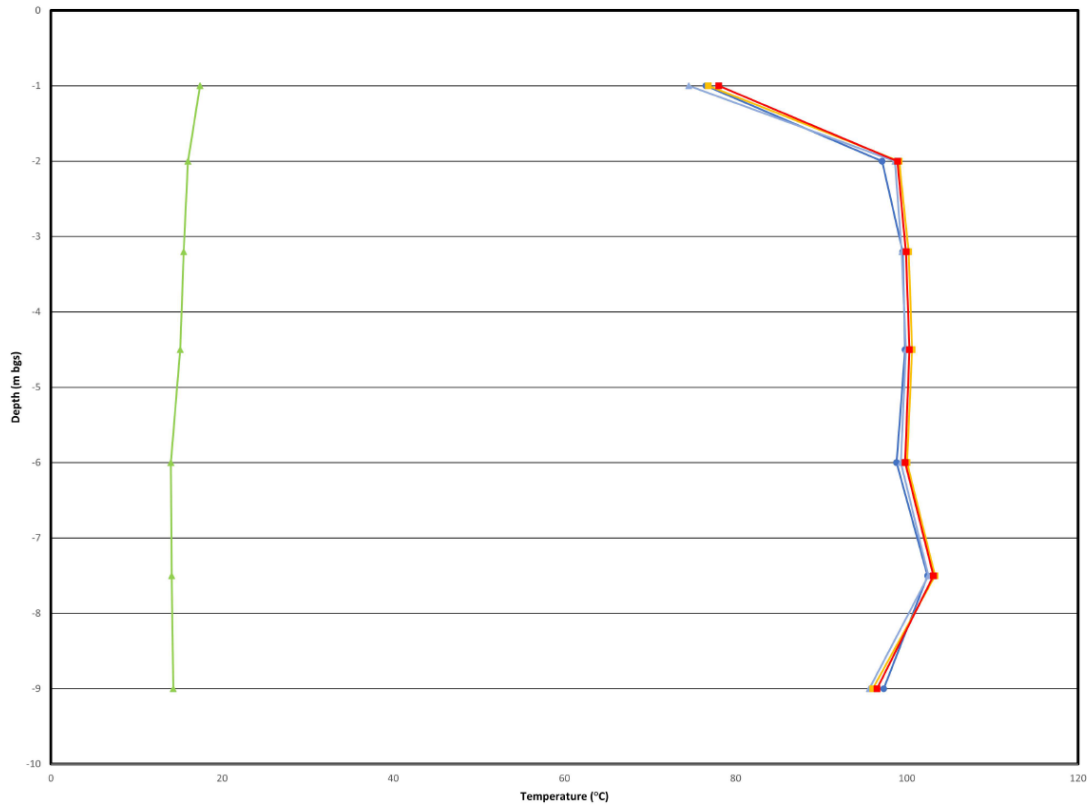


TMP J03 - Mortsel

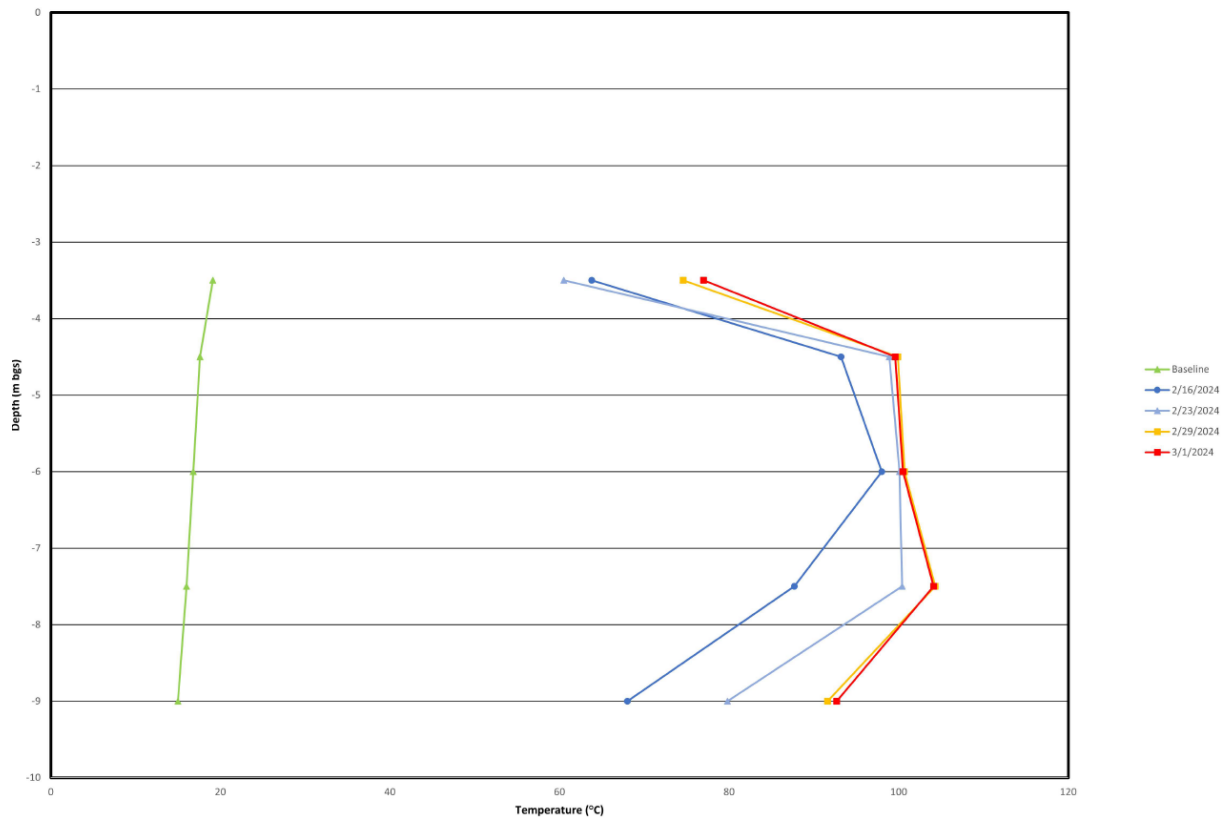




TMP K06 - Mortsel

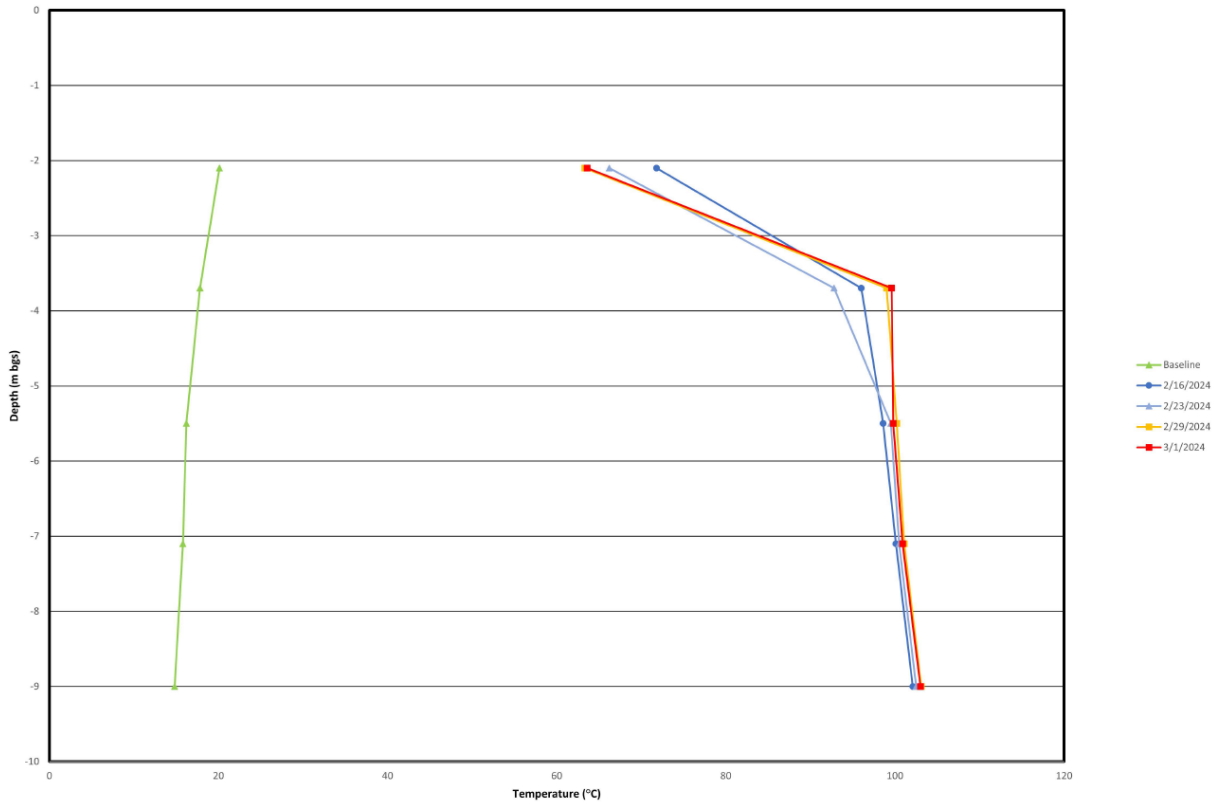


TMP K10 - Mortsel





TMP N04 - Mortsel



Mortsel TMP Average Temperature over Time

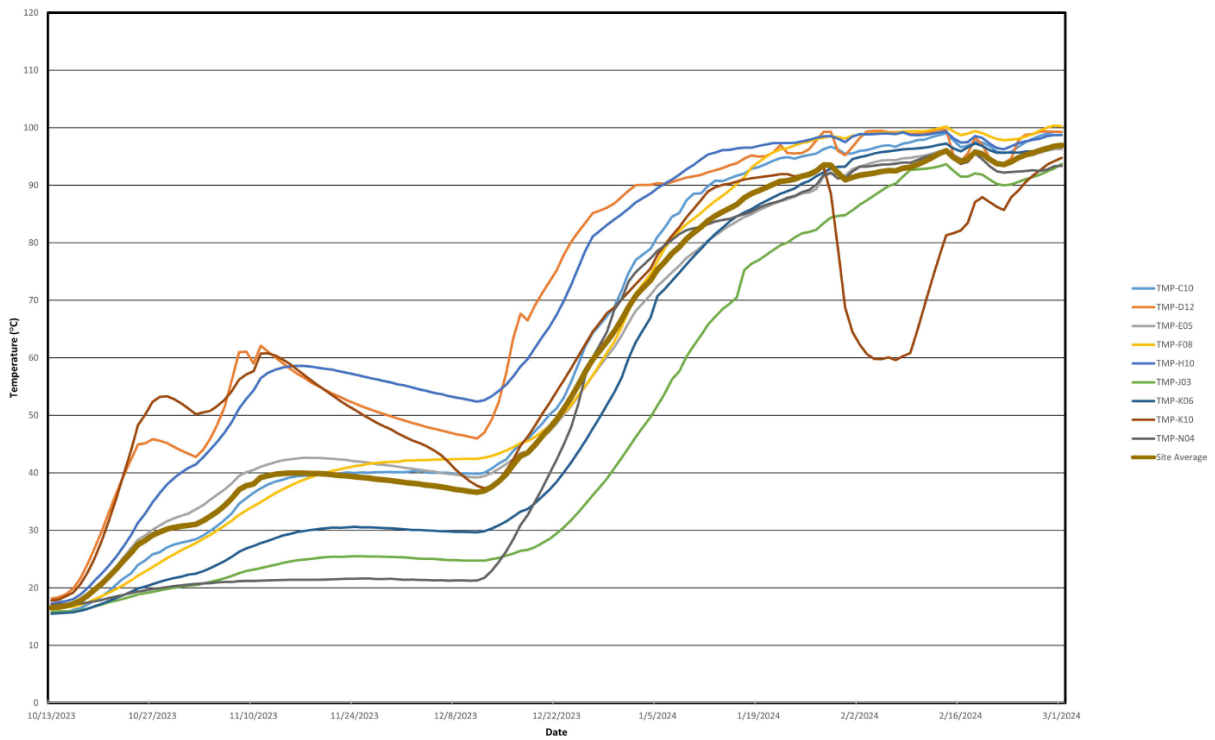




Figure 3. Cumulative Mass Removed vs. Time

