

Pinellas Environmental Restoration Project

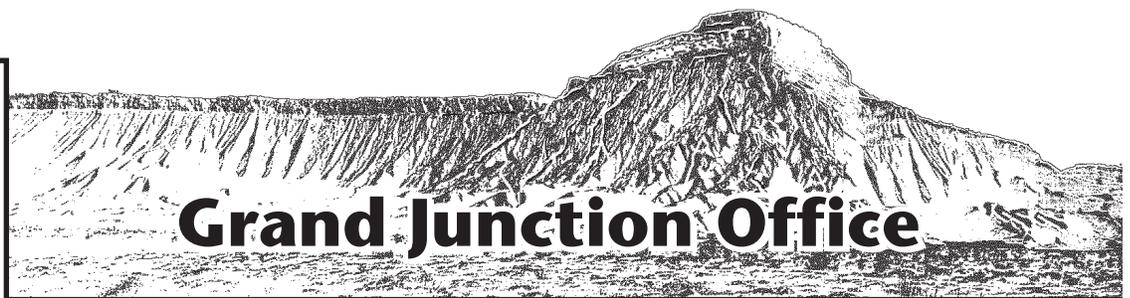
Northeast Site Non-Aqueous Phase Liquids Interim Measures Progress Report

January through March 2003

April 2003



U.S. Department
of Energy



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Interim Measures Progress Report**

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Prepared by
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

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Acronyms and Abbreviations

BTU	British Thermal Units
µg/L	micrograms per liter
NAPL	non-aqueous phase liquid
PID	photoionization detector
TCE	trichloroethene
VOC	volatile organic compound

1.0 Introduction

This report is the third quarterly report for the in-situ thermal remediation at the Northeast Site. [Figure 1](#) shows a site plan for the remediation components. The previous reports covered the periods from May 2002 through September 2002 and from October 2002 through December 2002. They provided background information for the site, a description of the remediation process, an overview of construction activities, and a description of operation activities for the Area A non-aqueous phase liquid (NAPL) remediation system.

This report describes the NAPL remediation activities at Area A that occurred from January 2003 through March 2003. Activities during this period included completion of operations for the in-situ thermal remediation system, the start of demobilization, and the start of confirmatory soil sampling.

2.0 Summary of Activities

Operation of the remediation system that began on September 28, 2002 continued during this reporting period. Operations continued to be directed and overseen by the Operations Oversight Team, described in previous reports. Prior to the start of this reporting period, January 1, 2003, the entire subsurface had reached a minimum temperature of 84° Celsius. Significantly higher temperatures, up to 115° Celsius, had been reached in the Hawthorn Group (Hawthorn) soils and in the lower portion of the remediation area. The pressure cycling that began in November 2002 was continued until active heating stopped. For the majority of the remediation area, active heating stopped on January 31, 2003. There was a small area, less than one fourth of the remediation area in which pressure cycling and heating continued until February 17, 2003. Throughout operations, heating the subsurface involved a combination of steam injection and electrical resistive heating. The name of the electrical resistive heating process is Electro-Thermal Dynamic Stripping Process.

Pressure cycling involved creating a pressure change in the formation by varying the steam injection pressure, the electrical heating rate, and the vacuum applied to the subsurface. This was done to increase the amount of contaminants that is removed from the subsurface. A typical pressure cycle lasted approximately 1 week but some cycles were longer and some were shorter. Pressure cycling involved injecting steam at a relatively high pressure for a few days and then reducing the steam pressure and increasing the vapor extraction rate. When the steam pressure was reduced, the contaminant concentrations in the vapor extracted from the subsurface would increase. The first pressure cycles conducted in November and December 2002 resulted in a significant mass of contaminants being captured by the vapor extraction system. Subsequent pressure cycles in December resulted in less dramatic contaminant removal rates, as shown on [Figures 2 and 3](#).

In January 2003, the pressure cycles focused on the most contaminated areas and on the upper portion of the subsurface in the remediation area. These pressure cycles resulted in significant additional mass removal. Also, air was injected into the subsurface to assist with oxidation of contaminants and to help further reduce subsurface contaminant concentrations. Active heating of the subsurface in all areas was scheduled to stop on January 31, 2003. However, in mid January soil sampling of selected locations was conducted to determine the level of cleanup that had been achieved. Results of the soil sampling showed that there were still high levels of

contamination in the area of Vertical Electrode Array-19 (V-19). The areas of high concentration in the soil coincided with the location of a resin layer. The resin layer was approximately 1 foot thick and located 6 feet below the surface. The problems associated with the resin are discussed in Section 4.0. The high soil concentrations were located below the resin layer. Because of the high soil concentrations, additional heating and vapor extraction was conducted in this area for approximately 2 more weeks. Active heating of this area stopped on February 17, 2003.

When active heating stopped, volatile organic compound (VOC) levels in the extracted vapor from the well field, as measured by a photoionization detector (PID), were less than 20 parts per million by volume. Ground water concentrations also had been reduced significantly. Concentrations in the most contaminated well, EE-17, had been over 30,000 micrograms per liter ($\mu\text{g/L}$) for trichloroethene (TCE) at the start of remediation. The TCE concentration in EE-17 at the end of January 2003 was 19 $\mu\text{g/L}$. The concentrations in other wells were even lower than those in EE-17.

Cooling the subsurface was the next phase of operations. This primarily involved continuing to extract vapor and liquid from the extraction wells. Extraction of vapor and liquid for cooling activities stopped on February 28, 2003. At this time it was anticipated that the subsurface would continue cooling at a rate that would allow all areas to be below 100° Celsius when confirmatory sampling started on March 24, 2003. However, subsurface temperatures around the resin area, i.e., V-19, did not cool fast enough and, therefore, additional active cooling measures were initiated on March 17, 2003. Clean water from the cooling tower was injected in the subsurface at approximately 30 feet below land surface and vapor and liquid were extracted from the extraction wells. This activity continued until March 24, 2003 at which time the subsurface had cooled sufficiently to allow confirmatory sampling to proceed safely.

The initial confirmatory sampling event started on March 24, 2003. The initial sampling event will take soil samples from the alluvium at 20 different locations and ground water samples from 16 new wells and 8 perimeter wells. Four of the soil and eight of the ground water sampling locations are located outside the remediation area. These will be used to determine whether or not contamination has been spread beyond the remediation area. The soil and ground water samples within the remediation area will be used to determine whether or not cleanup goals were met. The locations of the soil and ground water confirmatory samples are shown on [Figure 4](#).

Another round of ground water samples will be collected in mid May 2003. This sampling round is called the 12-week confirmatory sampling event. At that time, soil samples from the Hawthorn will be collected to determine whether or not cleanup levels were met in the Hawthorn. No other soil samples will be collected during the 12-week sampling event. Collection of soil samples from the Hawthorn is being delayed until the well field can be removed from the vapor cap. This will allow a sonic drilling rig, which is required to obtain samples from the Hawthorn, to maneuver on the vapor cap. The final sampling round, called the 24-week confirmatory sampling event, will occur in late July 2003. During this sampling event, only ground water samples will be collected. Results from all the confirmatory sampling events will be included in the Final Report.

In late March 2003, the water in the separation tank was removed and treated and the NAPLs were placed in drums. Approximately 50 gallons of NAPL and 150 gallons of NAPL saturated water were separated into drums. Previously, approximately 100 gallons of NAPL had been separated into drums. The density of the NAPL is approximately 10 pounds per gallon, giving a

recovered mass of NAPL captured in drums of 1,500 pounds plus the NAPL saturated water. In addition, approximately 1,500 pounds of contaminants have been captured in the carbon used in the water treatment. Much of the methylene chloride was probably destroyed in-situ by hydrolysis. Of the NAPL recovered, approximately 250 pounds was methylene chloride. It is possible that up to 1,000 pounds of methylene chloride was destroyed in-situ by hydrolysis. This gives a preliminary total mass recovered of approximately 3,000 to 4,500 pounds. This estimate compares with an estimate of 9,000 pounds of contaminants removed that was calculated based on readings from a PID. This mass estimate is shown on Figure 3. The PID estimate is much less accurate than the estimate using the NAPL waste and the mass captured by the carbon. However, both estimates are considered preliminary. A final estimate of the mass removed will be presented in the Final Report. The final estimate will consider all the analytical data from the vapor extracted, the water extracted and discharged, the carbon used for treatment, and the NAPL waste collected.

Demobilization activities started in early March 2003. The equipment used for the Electro-Thermal Dynamic Stripping Process, i.e., the resistive heating equipment, was removed from the site in mid March 2003. Additional demobilization activities are scheduled for early May 2003.

Throughout operations, subsurface temperatures were monitored with thermocouples. These temperatures could be monitored real time via a website and were used to “fine tune” the operations. The temperature data were used to determine where additional energy was needed and where less energy was needed. The temperature of the extracted vapor and ground water was also monitored to evaluate the subsurface temperature.

During the remediation, the total energy input into the ground was approximately 10 billion British Thermal Units (BTUs). Approximately 5.5 billion BTUs were from injected steam and 4.5 billion BTUs were from resistive heating. Figure 5 shows the energy balance over time. The net water extracted during operations, i.e., the difference between the total water extracted and the water injected for steam and electrodes, was approximately 1,750,000 gallons, as shown on Figure 6. The figure also shows that the total liquid extracted during the project was approximately 4,000,000 gallons, the total water used for steam injection was 750,000 gallons, and the total water injected at the electrodes was 1,500,000 gallons.

3.0 Deviations

There were no deviations from the general concept of the remediation. All modifications to the original system that were described in the previous report continued to be used during this reporting period, i.e., changes to the treatment system, changes to the extraction wells, and replacement of some steam injection screens. The most significant deviation to the operations during this reporting period was due to the presence of a resin layer in the area of V-19. The existence of the resin layer at this location was not known before remediation started and this created a change in conditions that required additional treatment in this area. Additional details are provided in Section 4.0, Problems.

4.0 Problems

There were operational problems during this reporting period. As described above, the major problem was due to a layer of resin in the area of V-19. The resin was likely a form of the chemical Adiprene. Records indicate the compound was used during operations at the plant and may have been disposed at the Northeast Site. The resin formed a lens in the subsurface estimated to be 6 to 8 feet below the surface, 12 to 18 inches thick, and up to 20 feet wide. The exact location and dimensions of the resin lens was not determined. However, the presence of the lens significantly affected the vapor and steam flow in the vicinity. This resulted in high levels of contaminants remaining under the resin lens. To address the high contaminant levels that still remained in the subsurface, additional steam injection and extraction wells were installed in the resin area. Five new extraction wells and four new steam injection wells were installed in the area around V-19 and the remediation was extended for an additional 2 weeks in this area.

As previously reported, the electrical resistive tomography did not work as expected and was not used for operations. Temperature monitoring was done completely with the thermocouples. The thermocouples were placed close enough to provide an excellent subsurface temperature profile and not having the electrical resistive tomography data did not hinder operations.

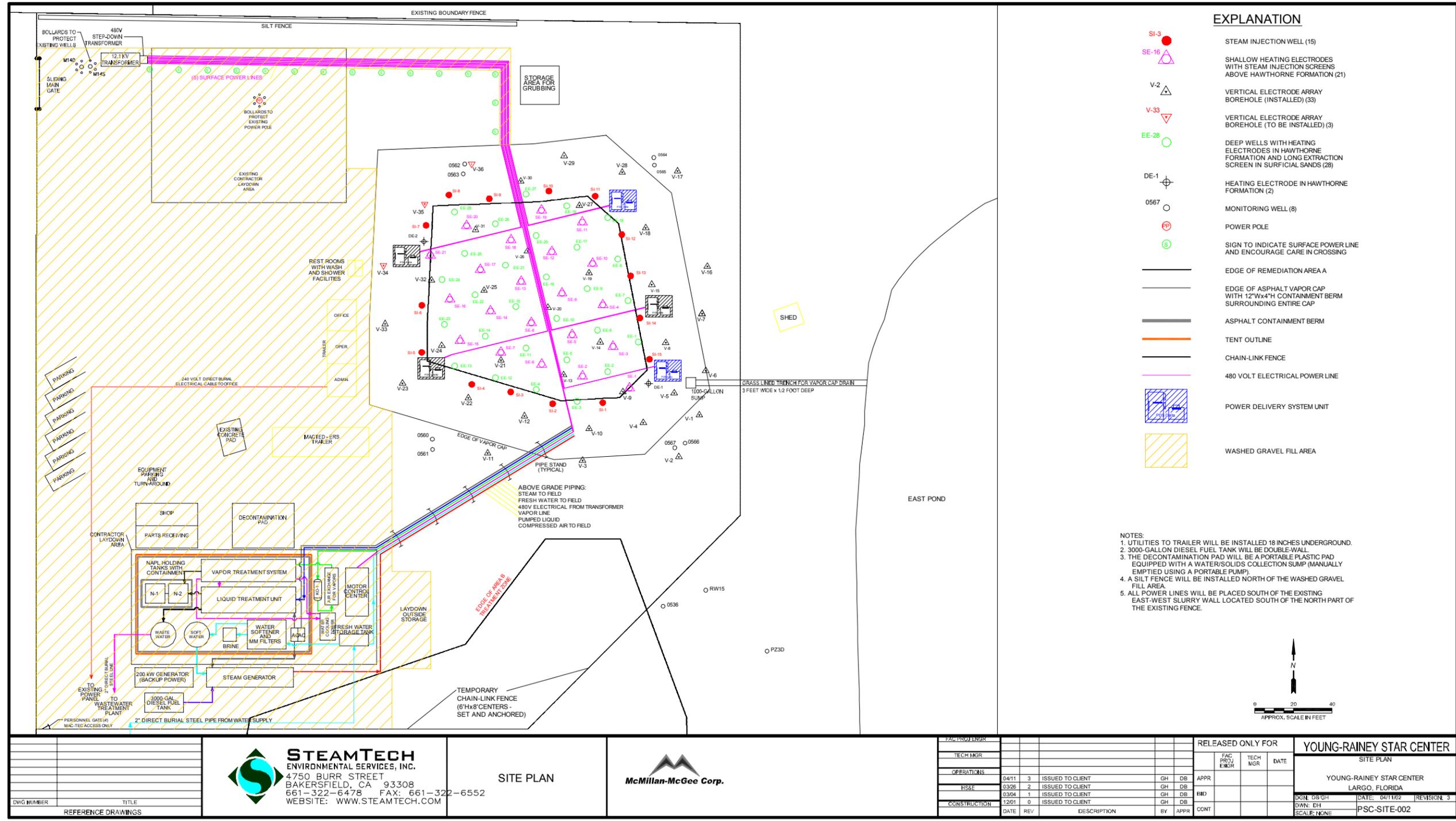
5.0 Upcoming Activities

The NAPL waste generated in March 2003 will be disposed as hazardous waste in April 2003. Confirmatory sampling that began on March 24, 2003 will be completed by mid April 2003. This will include installing monitoring wells and collecting soil samples from the alluvium. The analytical results from the first sampling event will be available in May 2003.

One soil sample will be collected from five different intervals at each location with one of the samples obtained from the Hawthorn. Because the well field was still in place during the initial sampling event, drilling rigs large enough to get a sample of the Hawthorn could not get into the area. Therefore, the Hawthorn will be sampled when the well field piping has been removed, currently scheduled for mid May 2003. Also, a second round of ground water samples will be obtained at this time. The final confirmatory sampling event, the 24-week event, will occur in late July 2003.

The Final Report is the last activity for Area A. Results from the confirmatory sampling, sampling conducted during operations, and a summary of the remediation activities will be included in the Final Report. The Final Report will be completed by the end of September 2003.

The initial activities for remediation of Area B will start in Summer 2003. These will involve evaluation of the permitting, environmental compliance requirements, and baseline sampling to verify the remediation area for Area B.



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SITE PLAN



FAV PROJ ENGR		RELEASED ONLY FOR		YOUNG-RAINEY STAR CENTER	
TECH MGR		FAC PROJ ENGR	TECH MGR	DATE	SITE PLAN
OPERATIONS	04/11 3 ISSUED TO CLIENT	APPR			YOUNG-RAINEY STAR CENTER
HSSE	03/26 2 ISSUED TO CLIENT				LARGO, FLORIDA
	03/04 1 ISSUED TO CLIENT	BID			DGN: DB/SH DATE: 04/11/02 REVISION: 3
CONSTRUCTION	12/01 0 ISSUED TO CLIENT				DWN: DH SCALE: NONE PSC-SITE-002
DATE	REV	DESCRIPTION	BY	APPR	CONT

Figure 1. Site Plan

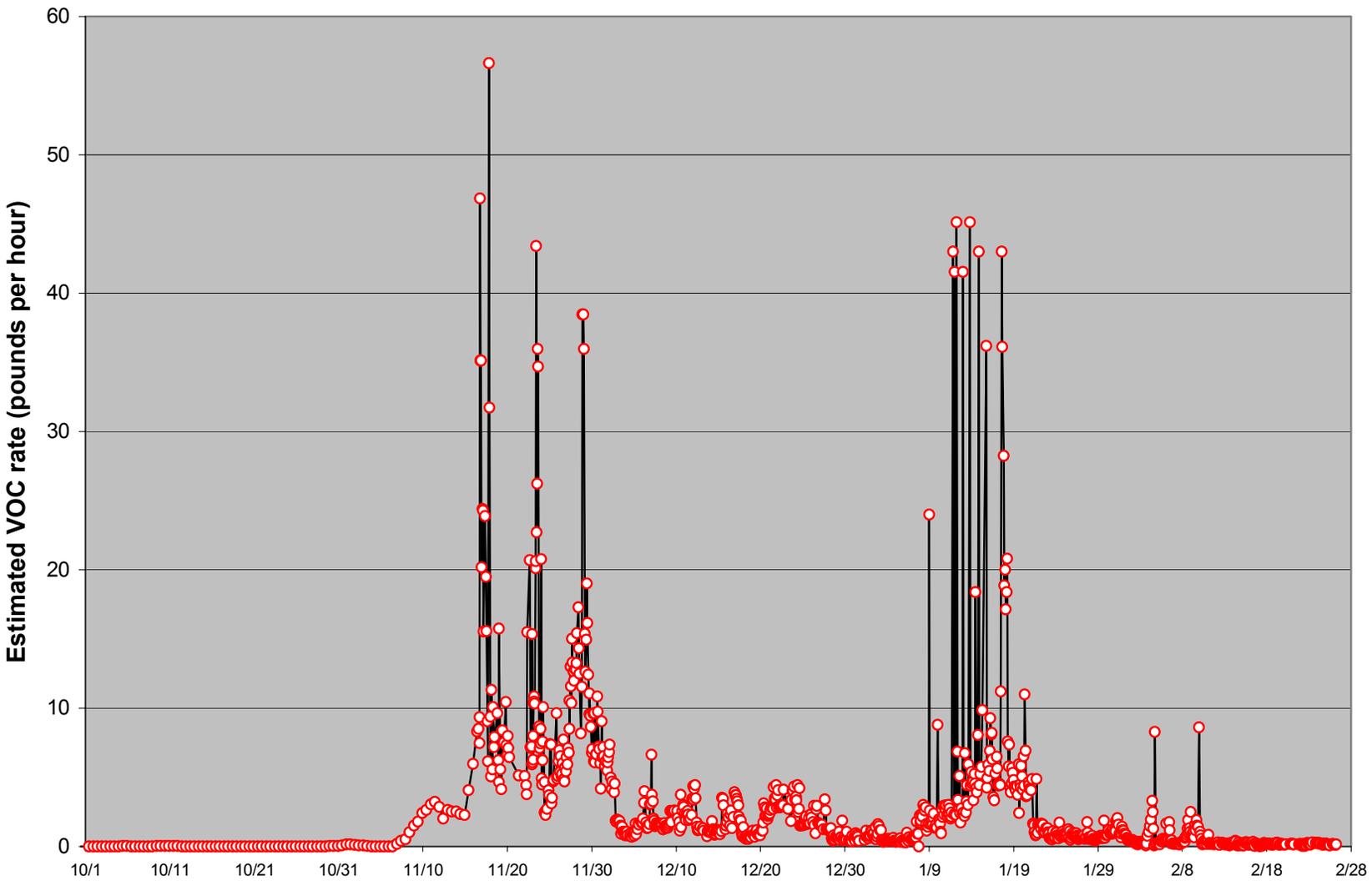


Figure 2. Estimated VOC Removal Rate Based on PID Readings at Sample Port V-1 (untreated vapor)

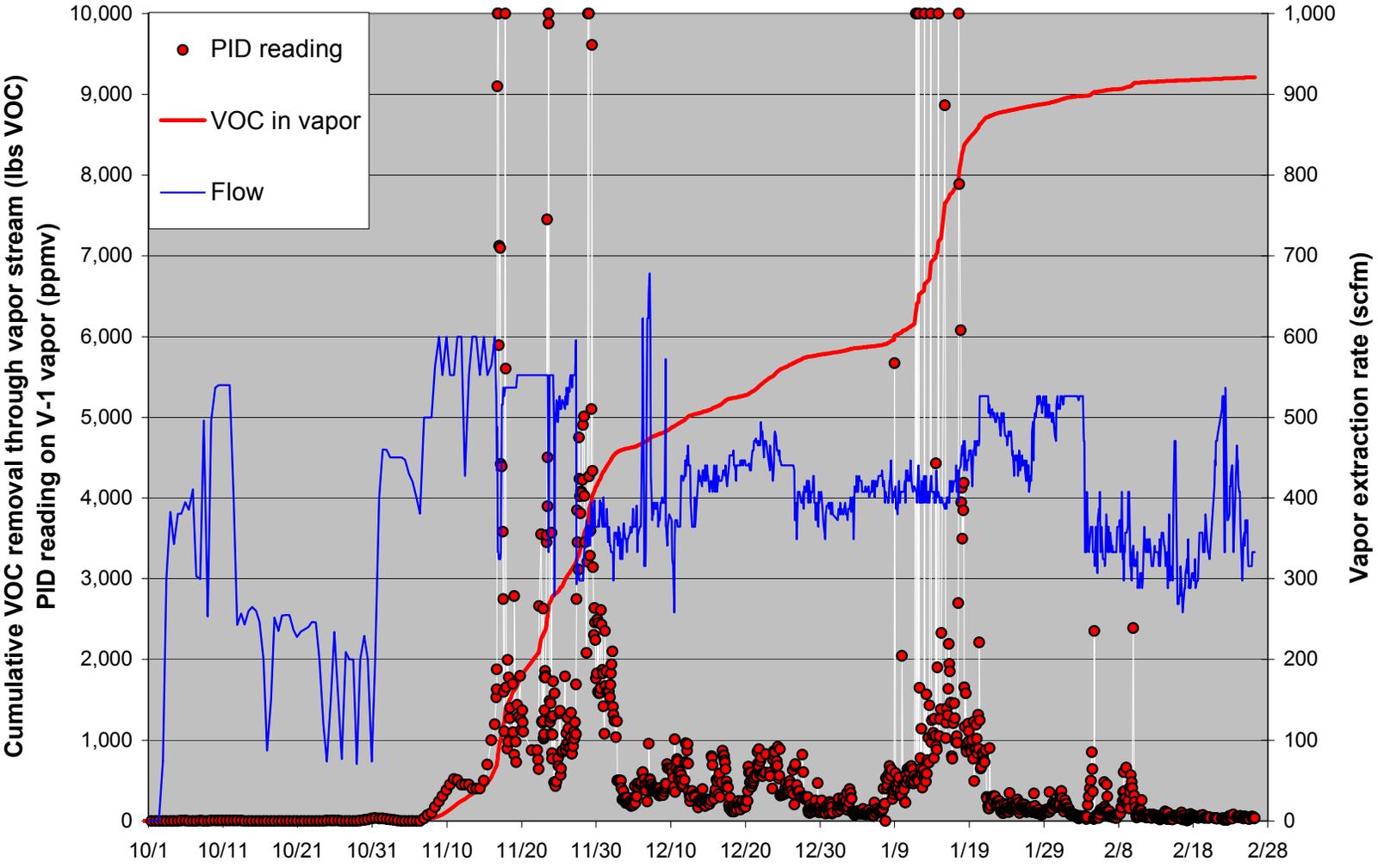


Figure 3. Estimated VOC Removal in Vapor Phase Based on PID Reading on V-1

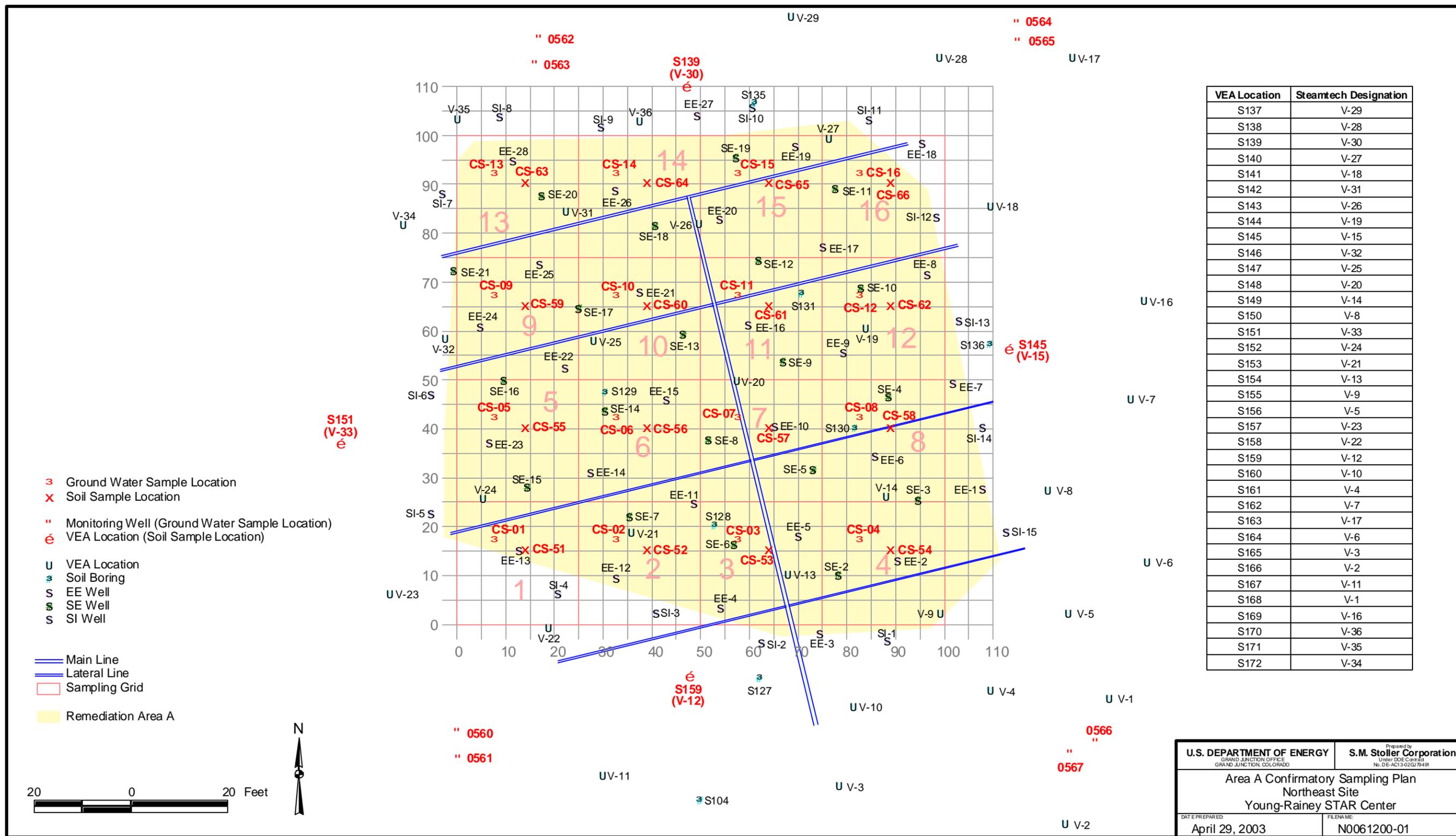


Figure 4. Soil and Ground Water Sampling Locations

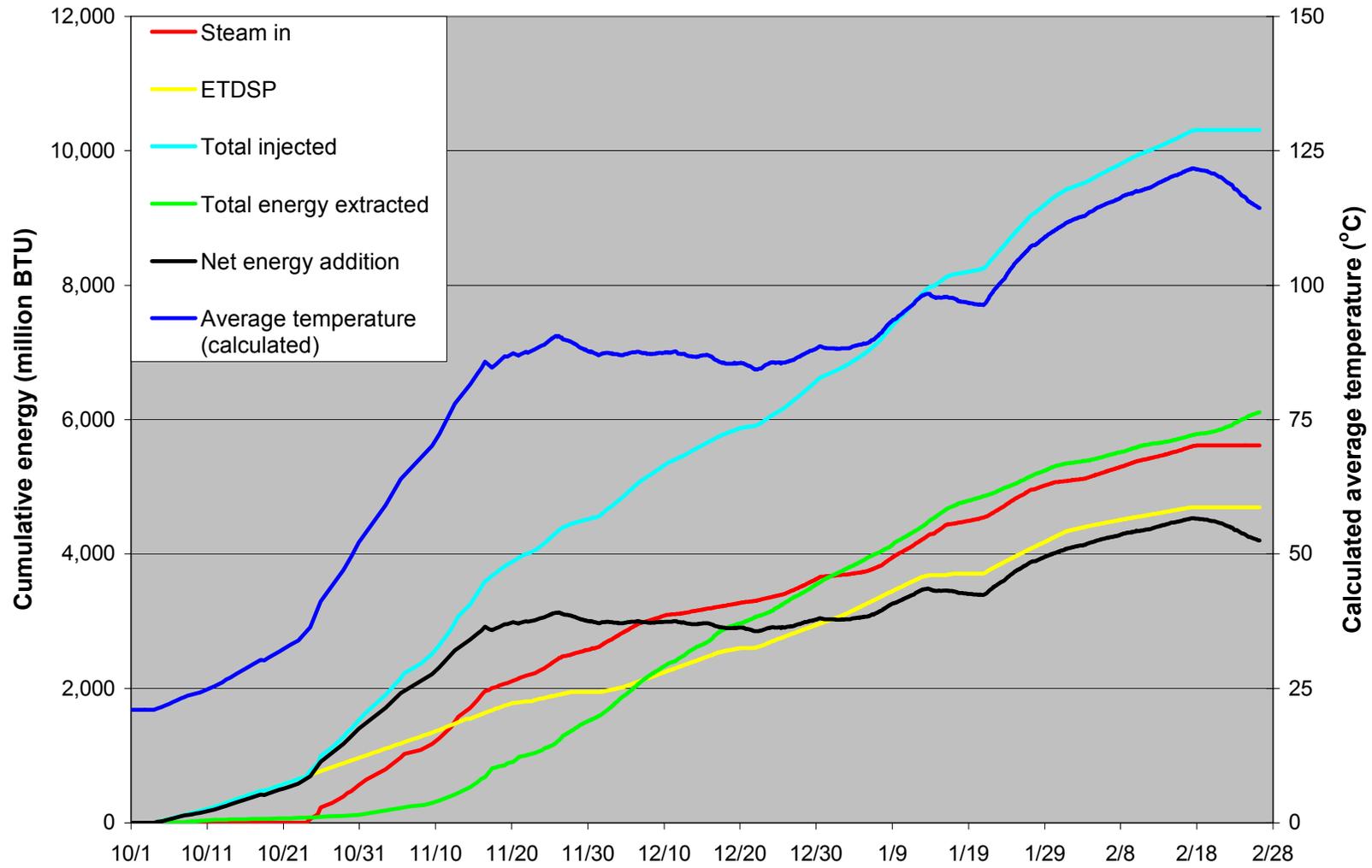


Figure 5. Energy Balance

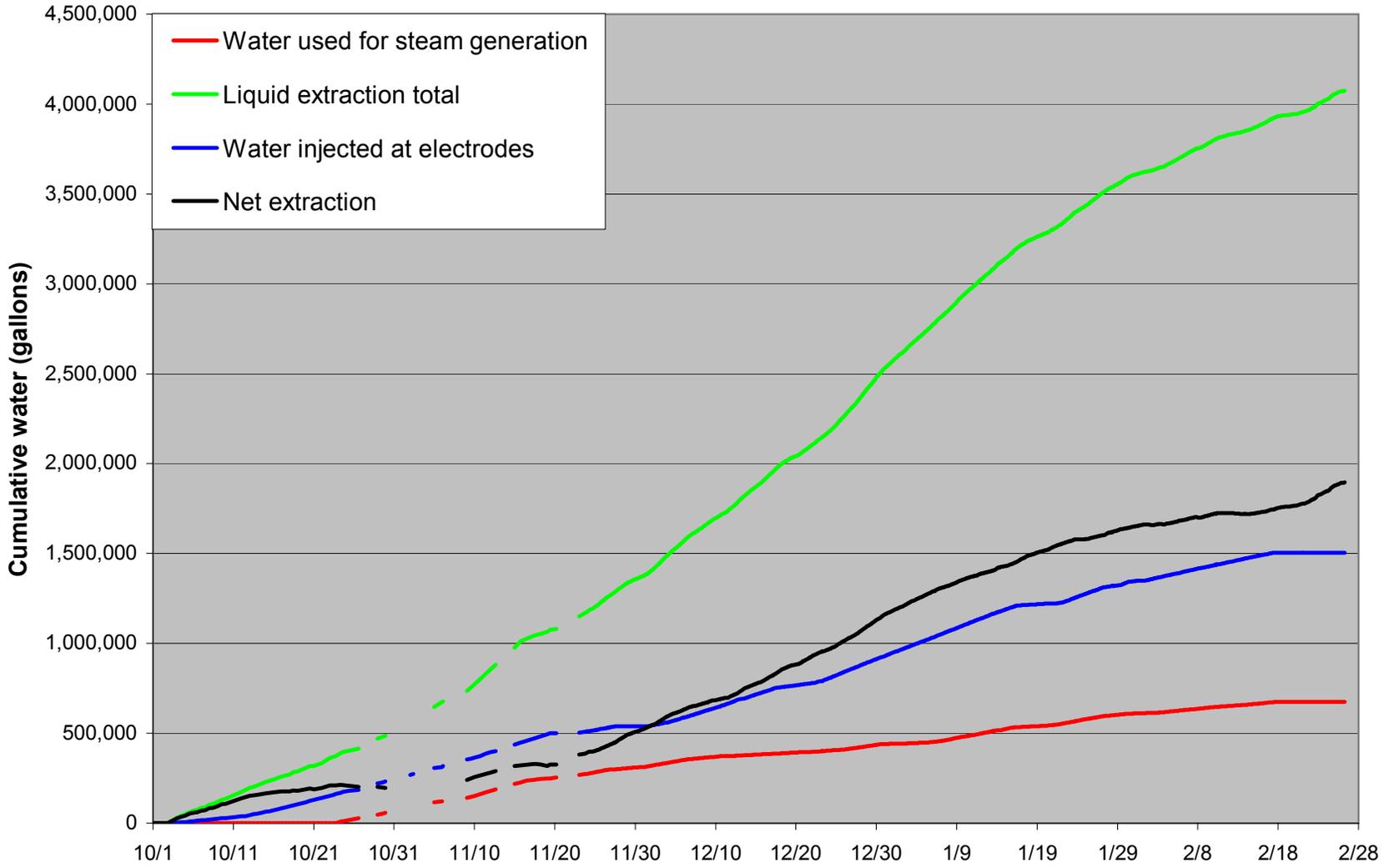


Figure 6. Water Balance for Area A