



April 28, 2011

ANNUAL TREND ANALYSIS - 2011

Prepared by Constellation Power Source Generation, Inc. for the BBSS Site

Paragraph 51 of the Consent Decree effective October 31, 2007, between the Maryland Department of the Environment (MDE), Constellation Power Source Generation, Inc. (CPSG), and BBSS, Inc. requires that the April 30th quarterly report for each year shall include a long term trend analysis. This report addresses that requirement of Paragraph 51 with a narrative trend analysis followed by selected long term trend graphs supporting the described observations. The trend graphs include data collected through the first quarter of 2011.

The data developed since the trends summary report prepared last year show a continuing improvement in the groundwater quality in wells downgradient to the Waugh Chapel and Turner Pits for nearly all analyzed parameters, including the absence of any exceedances of the Consent Decree Appendix A remedial goals in the established compliance wells. This improvement corresponds to the continued efforts to eliminate potential sources of surface water infiltration into the ash. Furthermore, the successful operation of the groundwater extraction and treatment system has created a capture zone at the downgradient end of the WCP-TP hydrogeological system, reducing the potential for offsite migration of ash constituents.

The monitoring wells and graphs are grouped and discussed as follows:

- Compliance Wells – these wells have been established in the *Second Revised Plan for Characterization of Water Impact* as compliance wells where the groundwater is monitored to determine achievement of the remedial goals contained in the Consent Decree (Appendix A).
- Upgradient Wells – these wells are located upgradient to the fill areas of the Waugh Chapel Pit and Turner Pit, and reflect the quality of the groundwater entering or unaffected by the fill areas.
- Waugh Chapel Pit Wells and Turner Pit Wells – these wells are located generally downgradient from the respective fill areas.

These trend graphs focus on parameters for which a remedial goal was established under the Consent Decree, Appendix A. Therefore, parameters that are not included in Appendix A are not graphed, but the required monitoring data has been reported to MDE. Additionally, as discussed below, several Appendix A parameters have remained below detection limits or are significantly below the drinking water standards in all site monitoring wells for 2010, and consequently are not graphed for trend analysis.

A discussion of the monitoring wells and key individual analytical parameters, with respect to long term groundwater quality follows.

DESCRIPTION OF WELLS

Compliance Wells – The Compliance Wells include MW-9, MW-10, MW-11, MW-26, MW-27, MW-28, MW-29 and MW-30. These wells are located at the downgradient end of Turner Pit, along Evergreen Road and in the Route 3 median (wells MW-27, MW-28 and MW-34). The three median wells were installed in September 2010, and therefore there is not sufficient data to exhibit a trend. It should be noted that none of the compliance wells have exhibited an exceedance of the established Appendix A remedial goals since 2008, and in general, decreasing concentrations have been observed for most analytes since 2007 or earlier.

Upgradient Wells – The Upgradient Wells include monitoring wells MW-1, MW-12 and MW-15 as upgradient to Turner Pit, and MW-17, MW-18 and MW-25 as upgradient to the Waugh Chapel Pit. It is noted that MW-1 and MW-15 can also be considered downgradient from the Waugh Chapel Pit. None of the Upgradient Wells currently exhibit any exceedances of the Appendix A parameters, except for a recent anomalous nitrate increase in well MW-18 at a concentration 54 milligrams per liter (mg/l). Otherwise, most of the analytes reflect a decreasing trend over the 2007 to 2011 time period.

Waugh Chapel Pit (WCP) Wells - The WCP ash fill area is monitored by downgradient wells MW-2, MW-3, MW-19, MW-20, MW-21, and MW-22. Well MW-19 is located at the northeastern corner of the fill and based on groundwater contouring, appears to be located in a cross-gradient direction. Well MW-21B, completed deeper in the surficial aquifer than the other monitoring wells, has not been sampled since early 2008, and is not included with this trend summary.

Well MW-24 is completed within bottom of the ash fill in the WC pit, and is used to monitor the characteristics of the leachate. This well generally shows the highest concentrations of sulfate, chloride, total dissolved solids, as well as various metals, including arsenic, boron, lithium, calcium, magnesium, potassium and sodium. Because it does not reach the lower elevation of the groundwater and does not reflect groundwater conditions moving away from the WCP, leachate well MW-24 is not included in this trends analysis.

The WCP area is hydrogeologically upgradient of the Turner Pit (TP) area.

Turner Pit (TP) – The Turner Pit monitoring wells include downgradient wells MW-7, MW-13, MW-16 and MW-8. Well MW-16 is located at the northeastern edge of the TP ash fill and is in a somewhat crossgradient position. It is directly downgradient of the mined section of North Turner Pit which was not reclaimed with ash. However, a significant quantity of black soil was encountered directly upgradient of this well during mining, and it is possible that this well may be affected by leachate from the black soil.

Laboratory testing of the black soil indicated that it can generate acidic leachate high in sulfate and other metals when exposed.

Recovery Wells - The existing groundwater recovery wells are located at the downgradient edge of TP, generally in a line parallel to Route 3. They include wells RW-1, RW-2, RW-3, RW-4, and RW-5. These wells extract groundwater at the downgradient end of TP for treatment prior to discharge in accordance with the requirements of an MDE issued discharge permit. Using submersible pumps that run continuously, these wells draw impacted groundwater to that area for extraction and treatment. They are not considered to be perimeter compliance wells. Recovery Well RW-6 was installed in August, 2010, and will be equipped with a pump for groundwater extraction when the entire system is reconfigured for site development. Recovery Well RW-11 is located near MW-21 on the downgradient edge of WCP. It was installed for a pumping test to determine aquifer properties and was built to be capable of eventual functioning as a groundwater recovery if needed. Concentration graphs are not provided for the recovery wells.

DISCUSSION OF GROUNDWATER QUALITY TRENDS

As stated above, none of the compliance wells have exhibited an exceedance of the established remedial goals (Consent Decree, Appendix A) since 2008, and in general, decreasing concentrations have been observed for most analytes since 2007 or earlier.

The following Appendix A parameters have remained below detection limits or are significantly below the drinking water standard in all site monitoring wells, and consequently graphs of the data are not included in this trend analysis: antimony (Sb), barium (Ba), chromium (Cr), mercury (Hg), selenium (Se) cyanide, fluoride, and nitrite (NO₂). Minor exceedances were observed in 2010 for cadmium (Cd) and beryllium (Be) in TP well MW-13 and WCP leachate well MW-24, and are also not included in this trend analysis. For those instances where the analytical results were found to be below the detection limit (non-detects) for the analyte, a concentration equal to the negative value of the reporting limit is shown on the graphs. This was done so that the non-detects and their detection limits could be readily discerned on the graph.

Beginning in July, 2009, collected groundwater samples were analyzed for total metals rather than dissolved metals as had been done previously. Very little, if any, differences in the observed concentrations were noted. For this reason, the following graphs for arsenic, beryllium, cadmium and thallium include both the dissolved and total concentrations on the same plot.

Summary of Trends for Appendix A Parameters

- **Arsenic (As)** has exhibited generally decreasing trends in both WCP and TP downgradient monitoring wells, and except for a recent increase in well MW-13, has been within the primary drinking water standard of 0.01 mg/l since March and June 2007, respectively.

- **Thallium (Tl)** concentrations have also been decreasing since early 2008, with only wells MW-21 and MW-22 at WCP, and MW-7 and MW-13 at TP exhibiting exceedances of the Appendix A goal of 0.002 mg/l (a primary drinking water standard) in 2010. The graphs depict generally improving Tl concentrations since 2008.
- **Sulfate** concentrations have shown a general decrease since early 2008 with the exception of a slight increase observed in several wells in early and mid 2009. Sulfate remains elevated above the 250 mg/l Appendix A remedial goal (a secondary drinking water standard) in WCP downgradient wells MW-3, MW-20, MW-21, and MW-22; and in TP downgradient well MW-13. Sulfate concentrations for samples collected from wells MW-3, MW-20 MW- 21, MW-22 (WCP) and MW-13 (TP) in late August 2008 were anomalously high, and have been excluded from the graphs because subsequent duplicate samples submitted to a third party laboratory confirmed that the original results stemmed from procedural difficulties experienced by the outside laboratory that was used at the time.
- **Nitrate (NO₃)** concentrations in the WCP and TP monitoring wells have been within the Appendix A remedial goal of 10 mg/l (a primary drinking water standard) since March of 2008 with the exception of an early 2010 exceedance in well MW-7, and a for a recent anomalous nitrate increase in well MW-18 at a concentration 54 mg/l. This increase is believed to reflect an issue unrelated to the ash.

Summary of Trends Observed for Boron (B), Chloride (Cl), Lithium (Li)

Chloride, boron and lithium are not used for compliance determinations, pursuant to the Consent Decree but are discussed below because they are useful ash constituents. Of these three parameters, only chloride has an established groundwater quality standard at 250 mg/l as a secondary drinking water standard. Thus no graphs are provided for these parameters, but a narrative summary of data provided to MDE follows:

- **Chloride** exceeds the secondary water quality standard in WCP downgradient wells MW-21, TP downgradient well MW-13, compliance wells MW-9, MW-28 and MW-34, and upgradient well MW-1. As several of these wells are located in close proximity to roadways, this may reflect applications of road salt as a de-icing agent.
- **Boron:** The concentrations for boron observed in wells MW-21 and MW-22 (WCP) and MW-13 (TP) have generally been decreasing since first analyzed for in early 2007, as shown in the attached graphs. Recent one-time increases of boron were observed in WCP well MW-19 and compliance well MW-9. Future monitoring will determine whether these are indicative of trends or anomalies.
- **Lithium** concentrations have been decreasing in all site monitoring wells since 2007. A recent increase was observed in compliance well MW-9. Future monitoring will determine whether this is indicative of a trend or an anomaly.

Status of Treatment Systems

The trend analyses continue to indicate the success of the current treatment systems and remedial measures, and indicate the progress to date toward achieving the remediation goals of the Consent Decree. The *Quarterly Assessment of the Turner Pit Pump and Treat System Hydraulic Control – 1st Quarter 2011* shows that capture is being maintained downgradient of the Turner Pit in the vicinity of the five recovery wells as demonstrated by the observed potentiometric surface. This has been confirmed by a recent review by a third-party groundwater expert. The groundwater extraction and treatment system continues to operate with few problems. A thorough discussion of how CPSG proposes to fulfill the remedial goals was included in the *Alternatives Analysis and Proposed Remediation Report* submitted in May, 2008, and the subsequent *Alternatives Analysis Supplemental Report* submitted in September 2010.

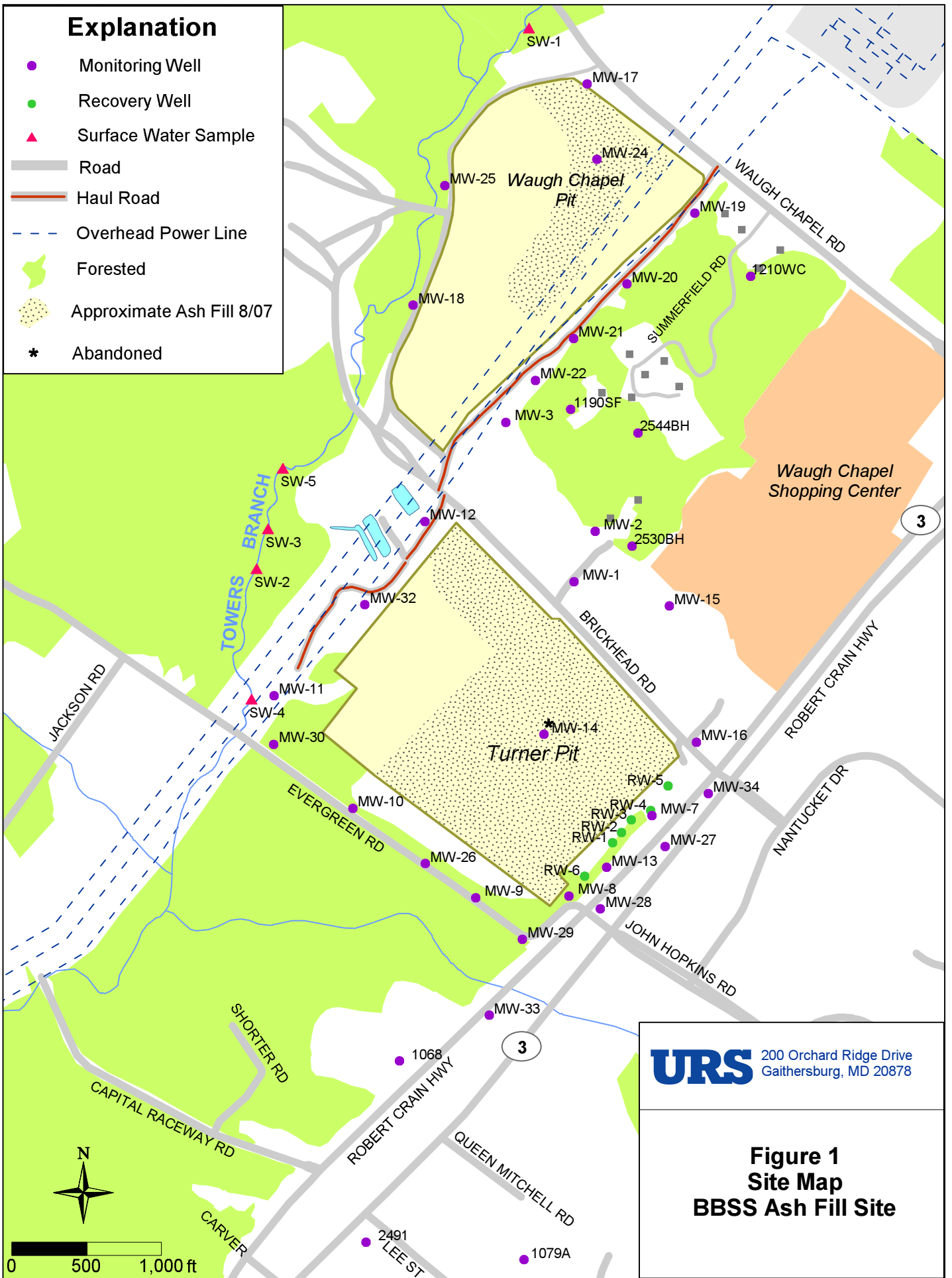
In support of the development of Turner Pit currently underway, the groundwater extraction system, including the pump control house and recovery wells RW-1, RW-2, RW-3 and RW-5, will be reconfigured during the summer of 2011. This has been discussed with and approved by the MDE.

Summary

The data developed since the trends summary report prepared last year show a continuing improvement in the groundwater quality in wells downgradient to the Waugh Chapel and Turner Pits for nearly all analyzed parameters, including the absence of any exceedances of the Consent Decree Appendix A parameters in the established compliance wells. This improvement corresponds to the continued efforts to eliminate potential sources of surface water infiltration into the ash. Furthermore, the successful operation of the groundwater extraction and treatment system has created a capture zone at the downgradient end of the WCP-TP hydrogeological system, reducing the potential for offsite migration of ash constituents.

Explanation

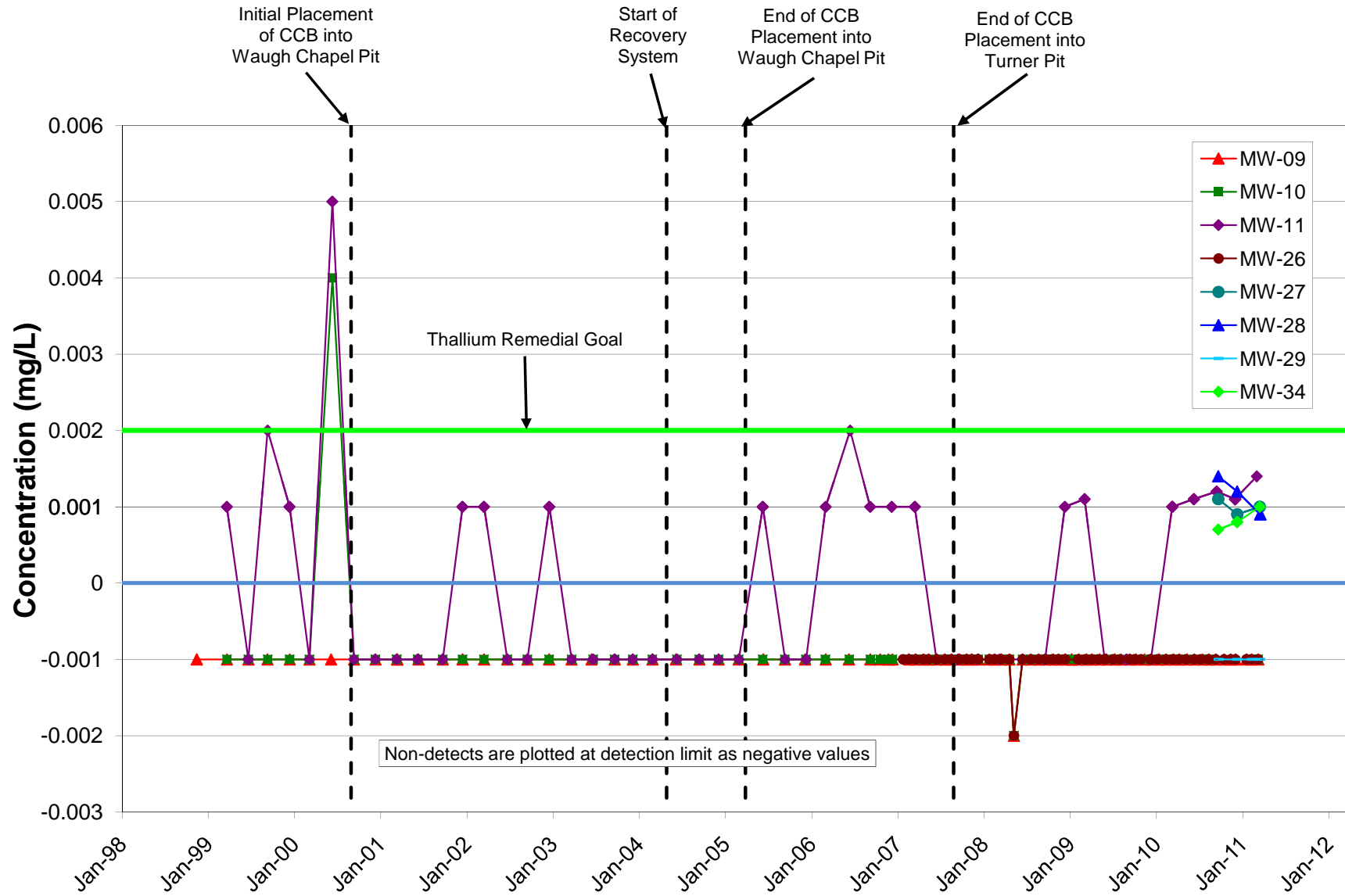
- Monitoring Well
- Recovery Well
- ▲ Surface Water Sample
- Road
- Haul Road
- Overhead Power Line
- Forested
- Approximate Ash Fill 8/07
- * Abandoned



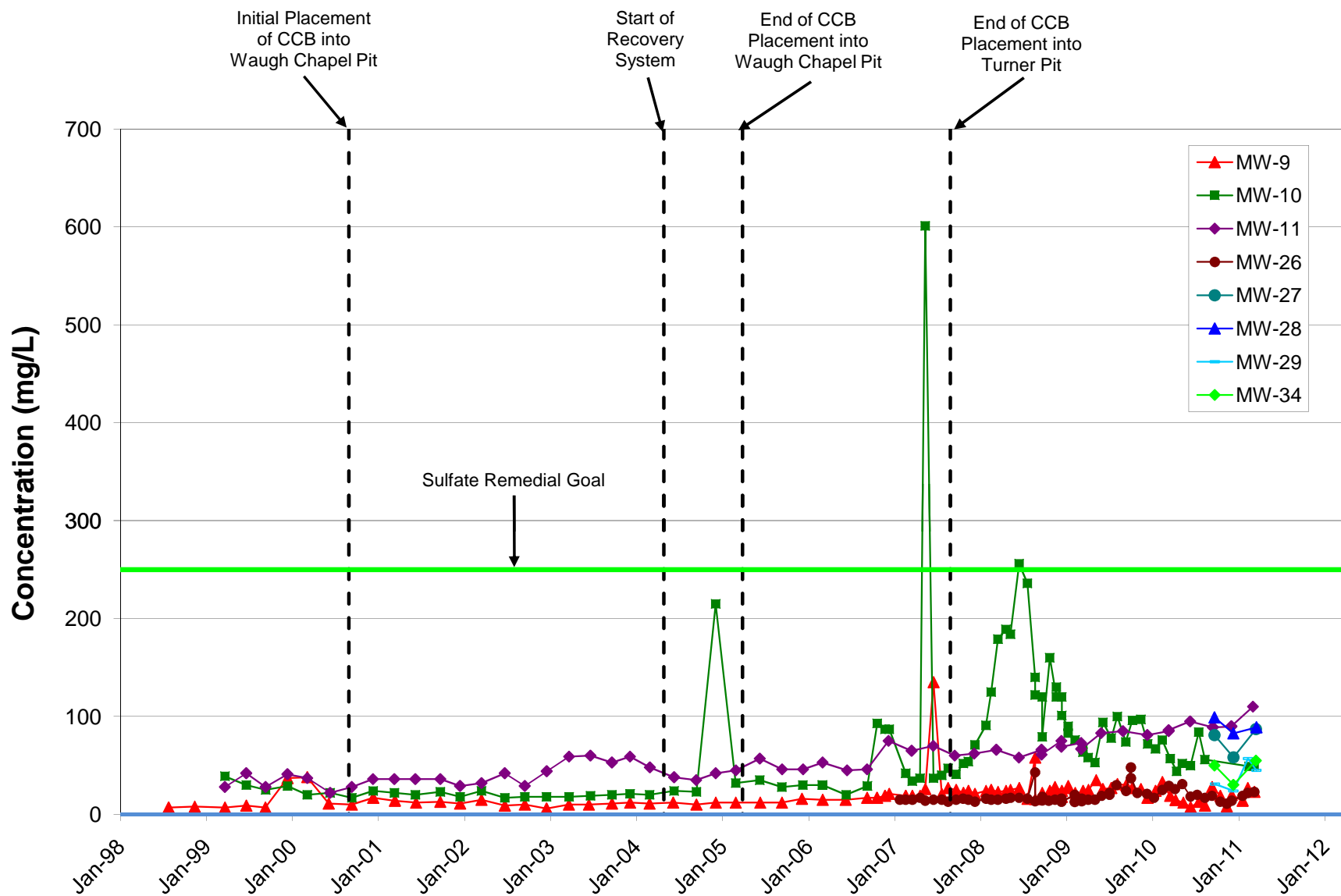
URS 200 Orchard Ridge Drive
Gaithersburg, MD 20878

Figure 1
Site Map
BBSS Ash Fill Site

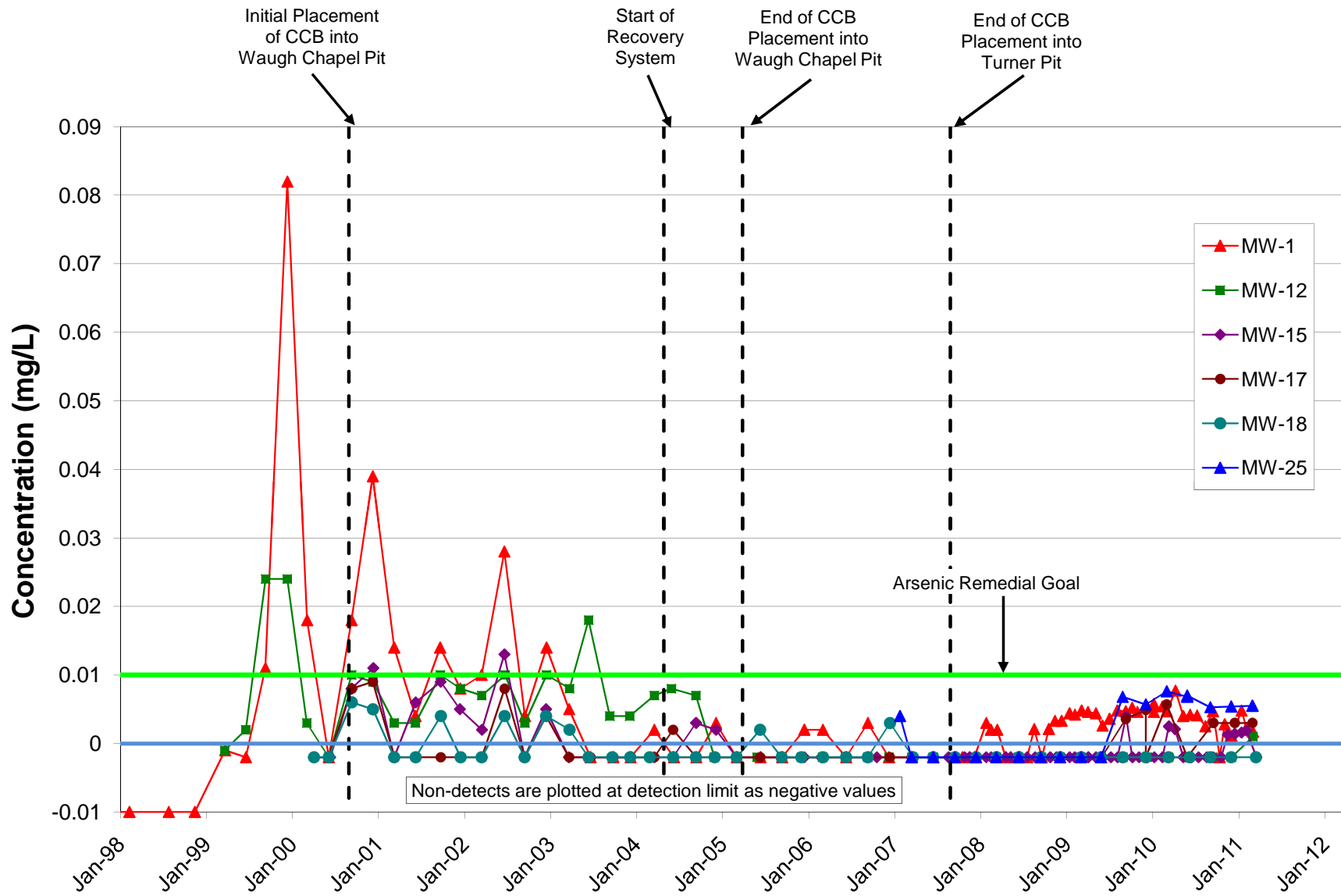
Thallium - Compliance Wells



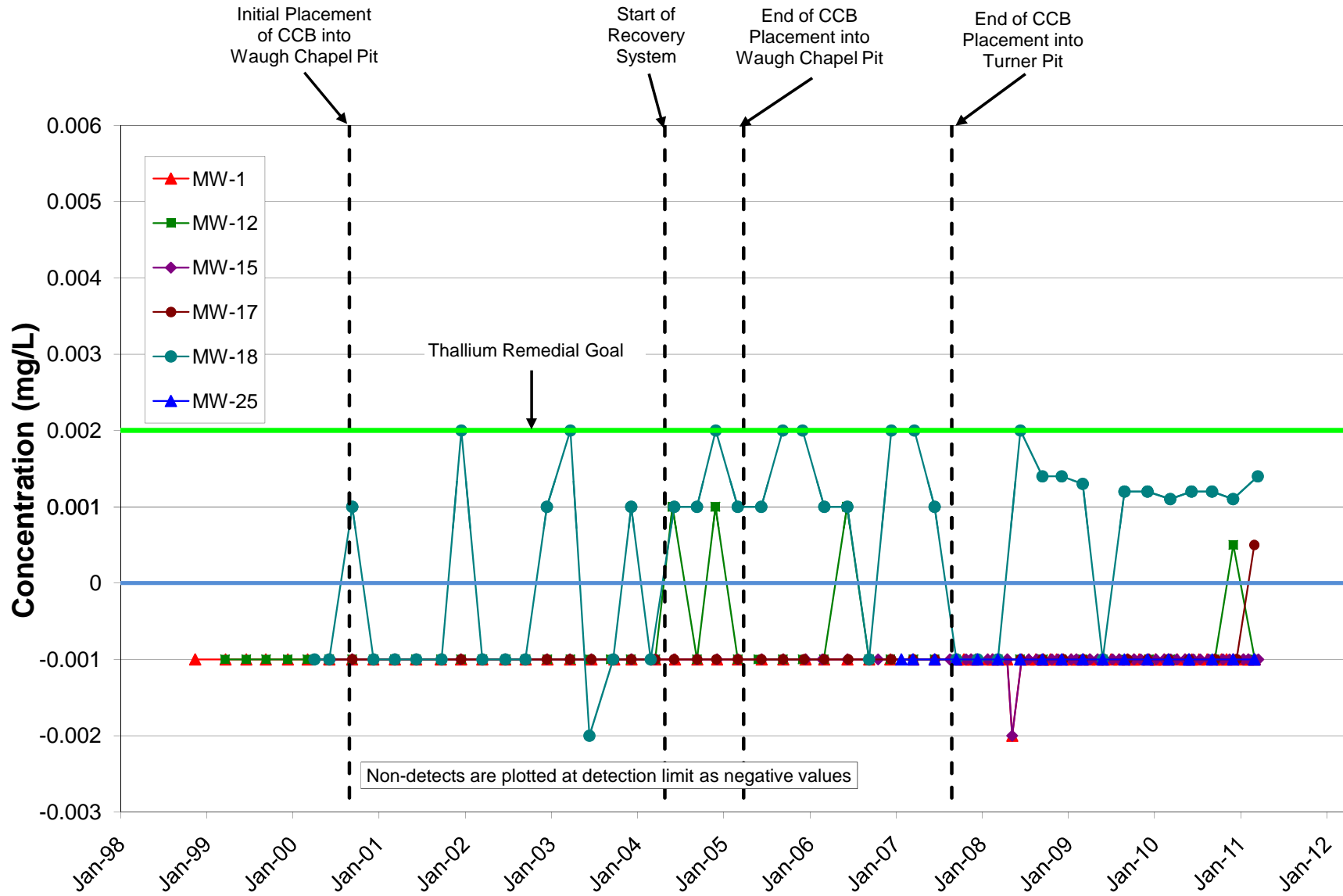
Sulfate - Compliance Wells



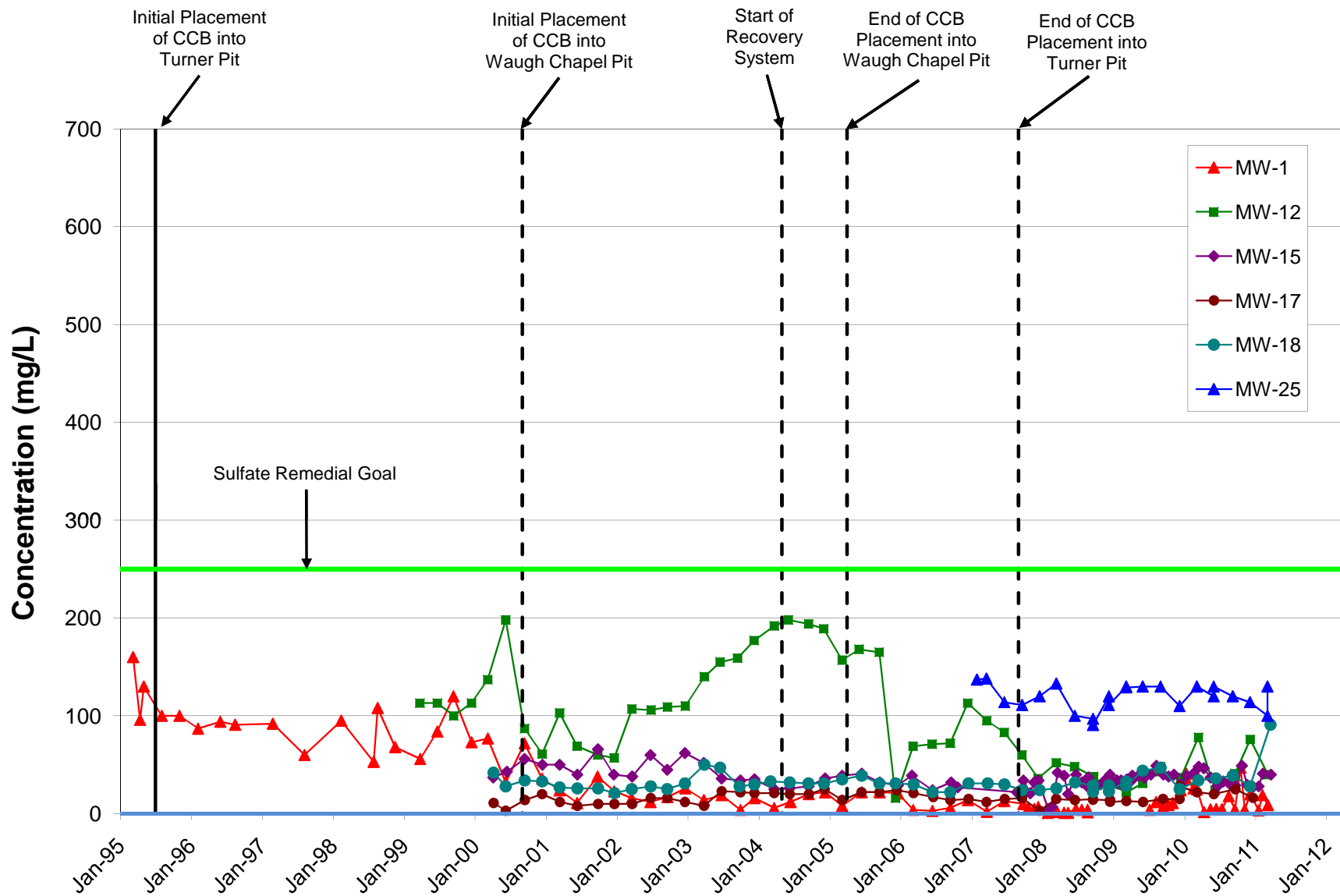
Arsenic - Upgradient Wells



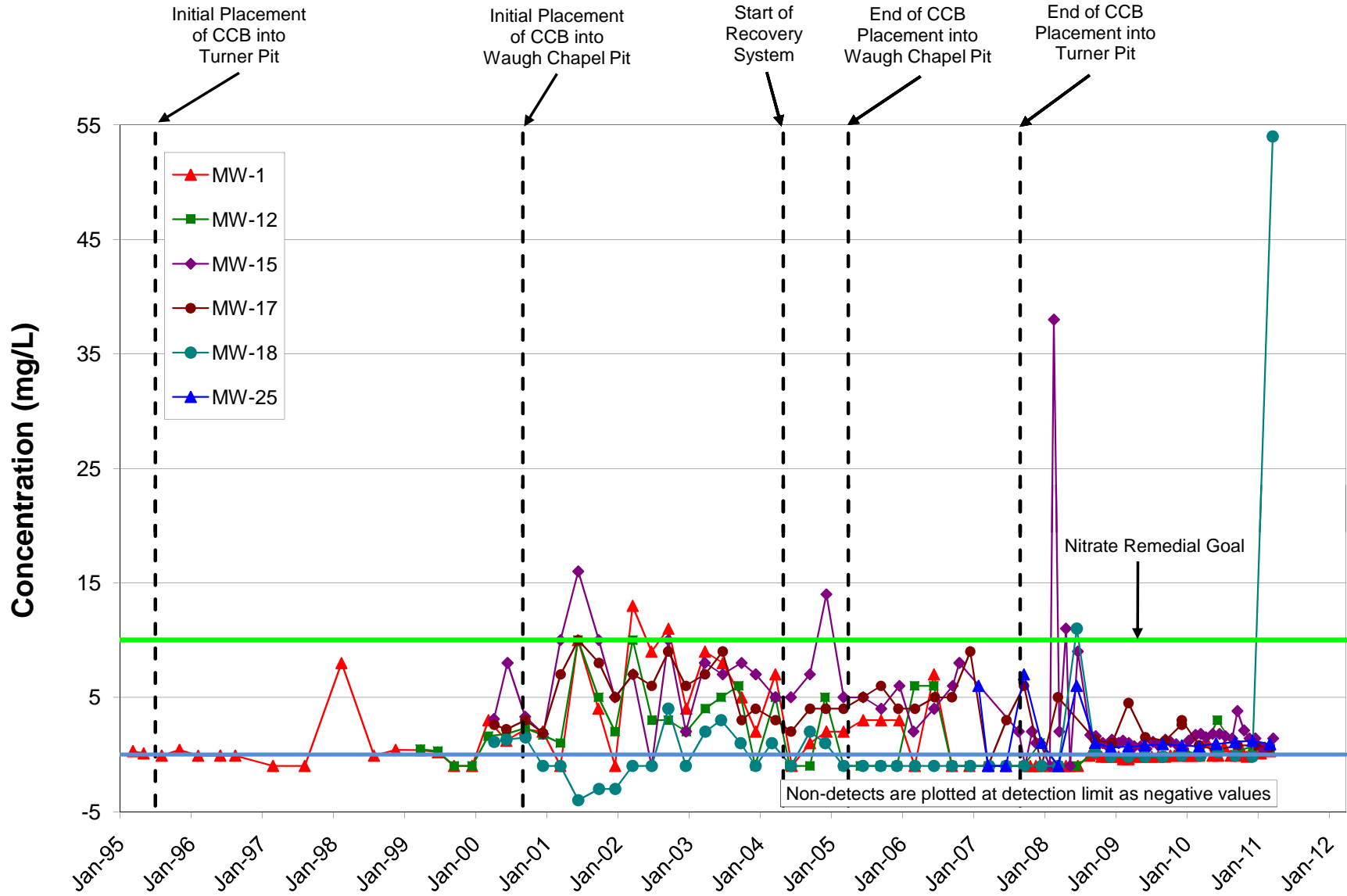
Thallium - Upgradient Wells



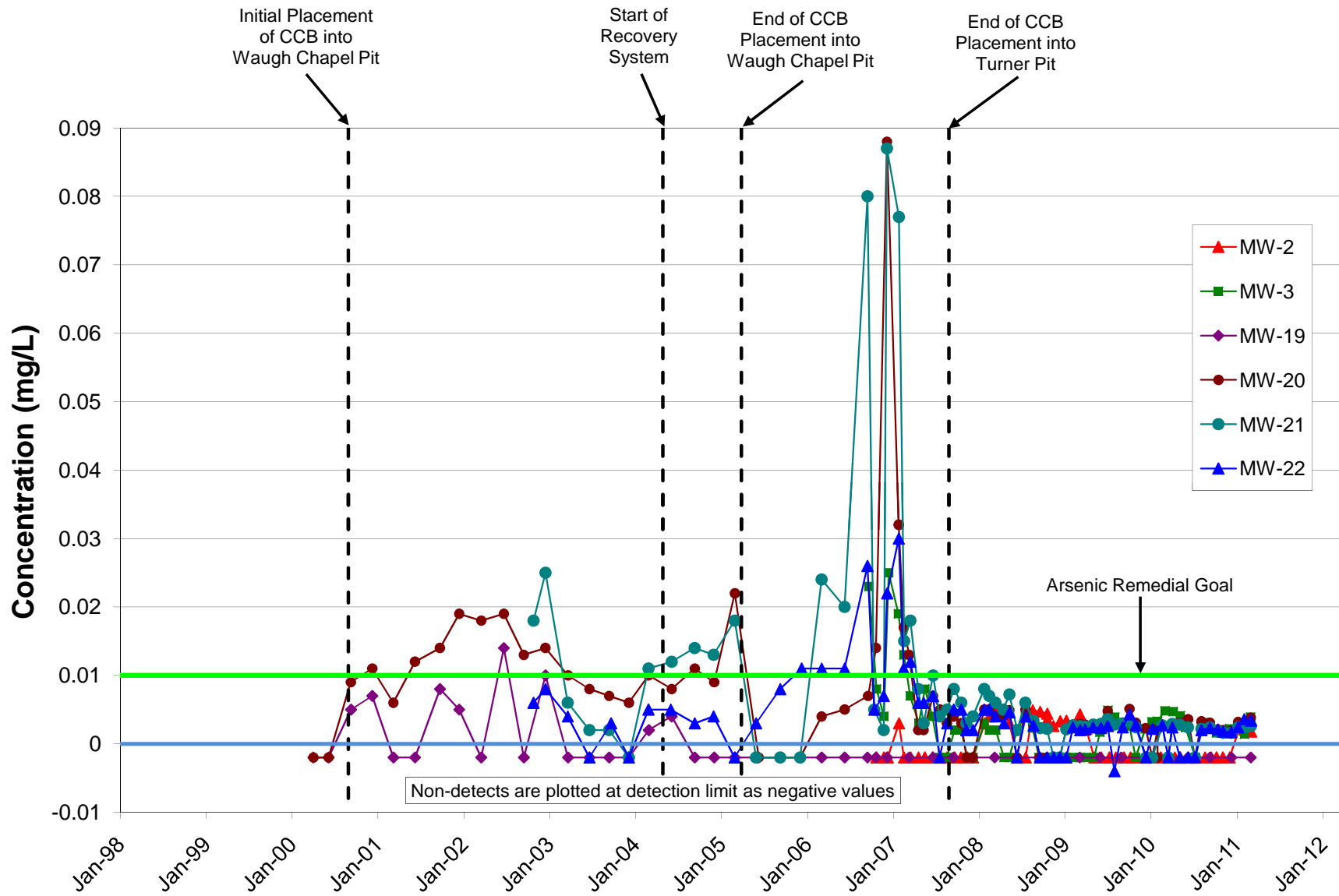
Sulfate - Upgradient Wells



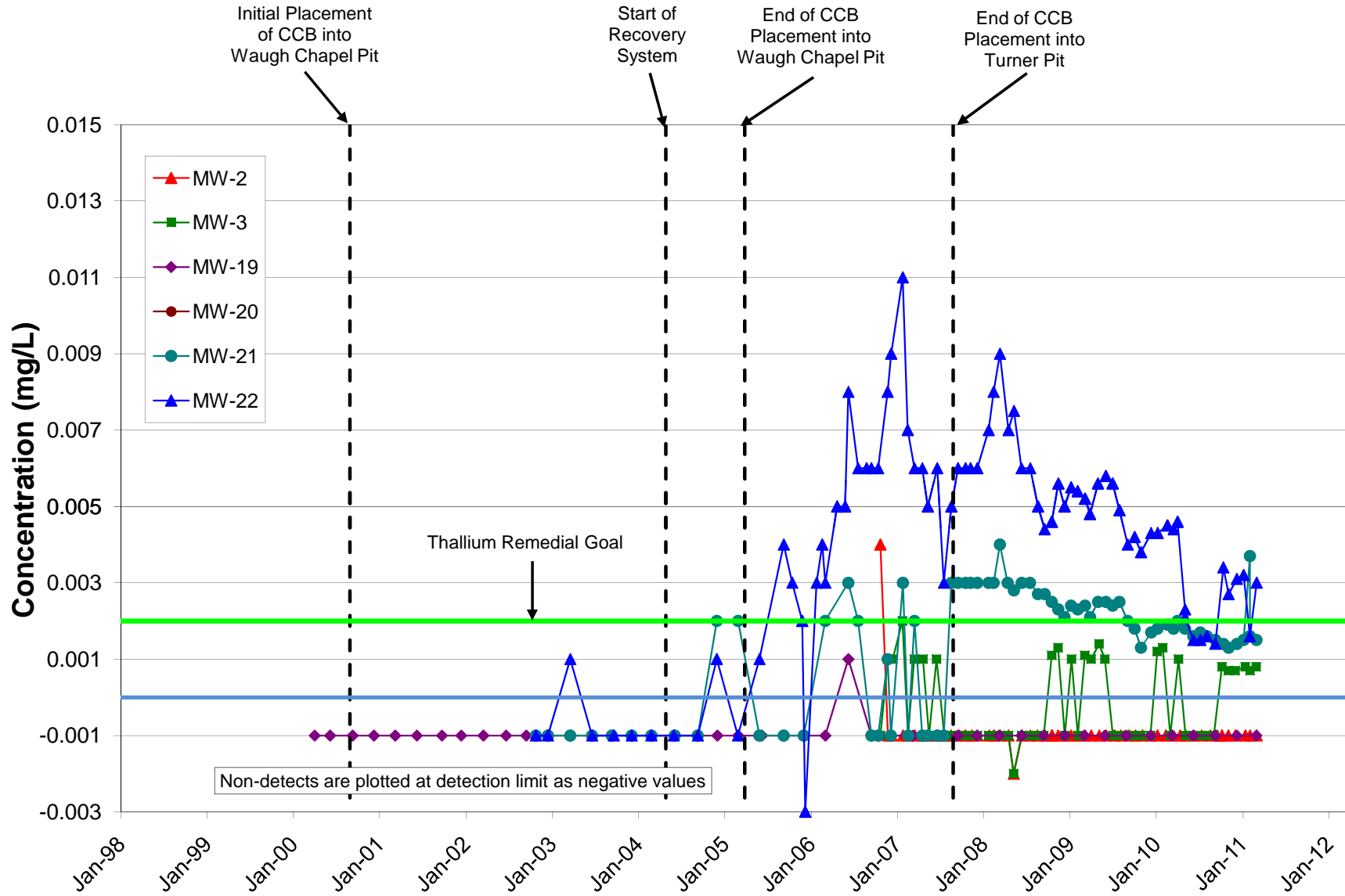
Nitrate - Upgradient Wells



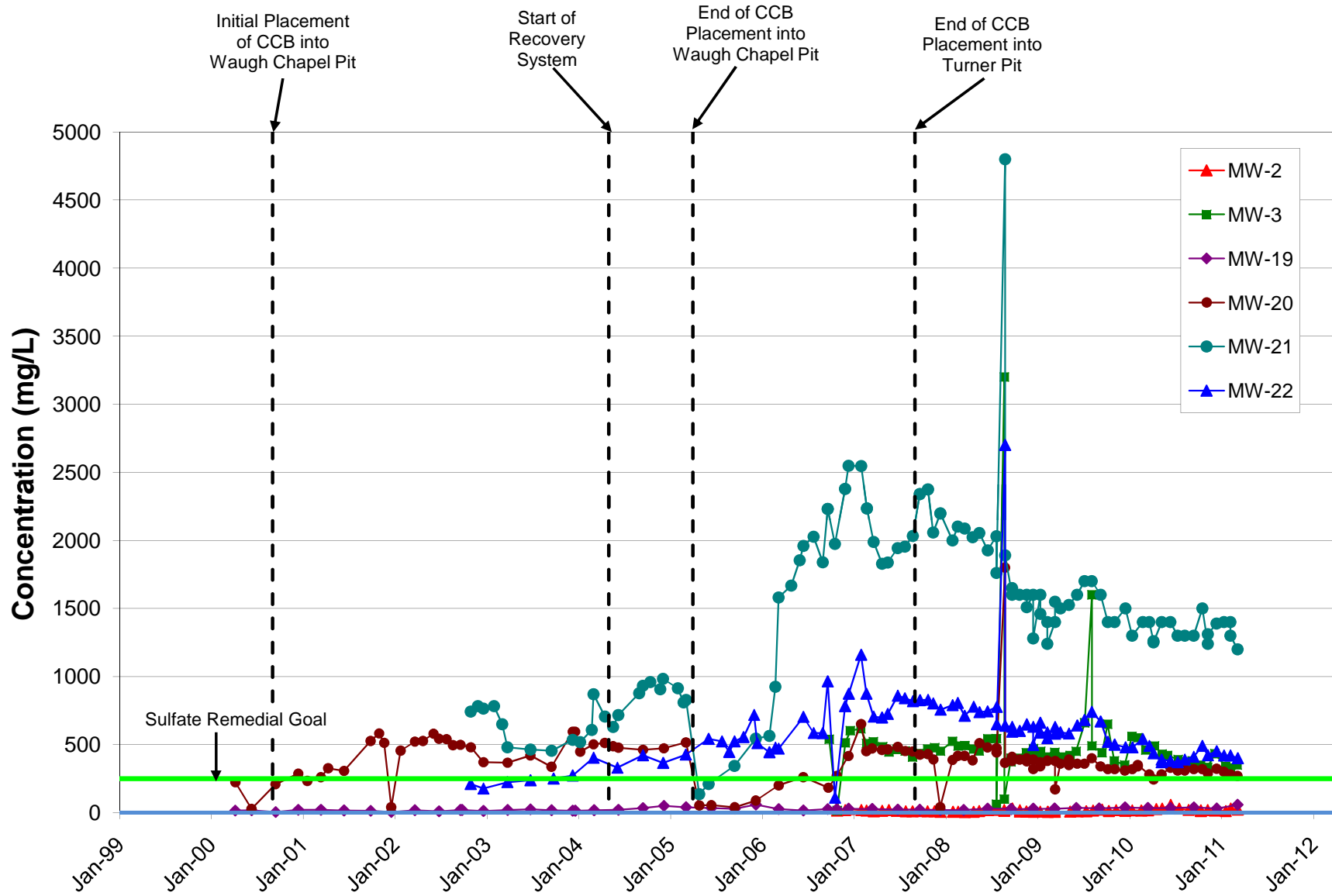
Arsenic - Waugh Chapel Pit (WCP) Wells



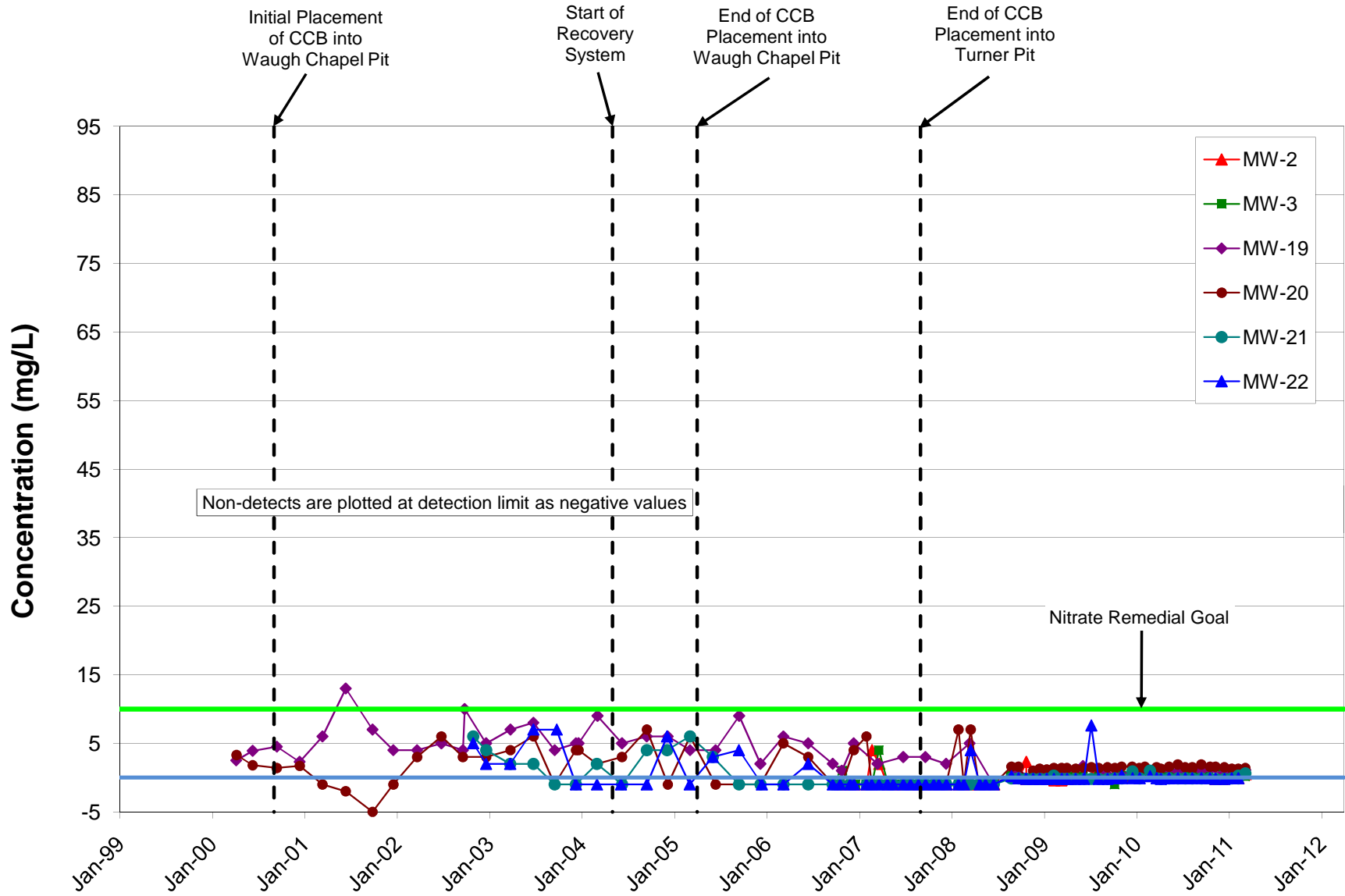
Thallium - Waugh Chapel Pit (WCP) Wells



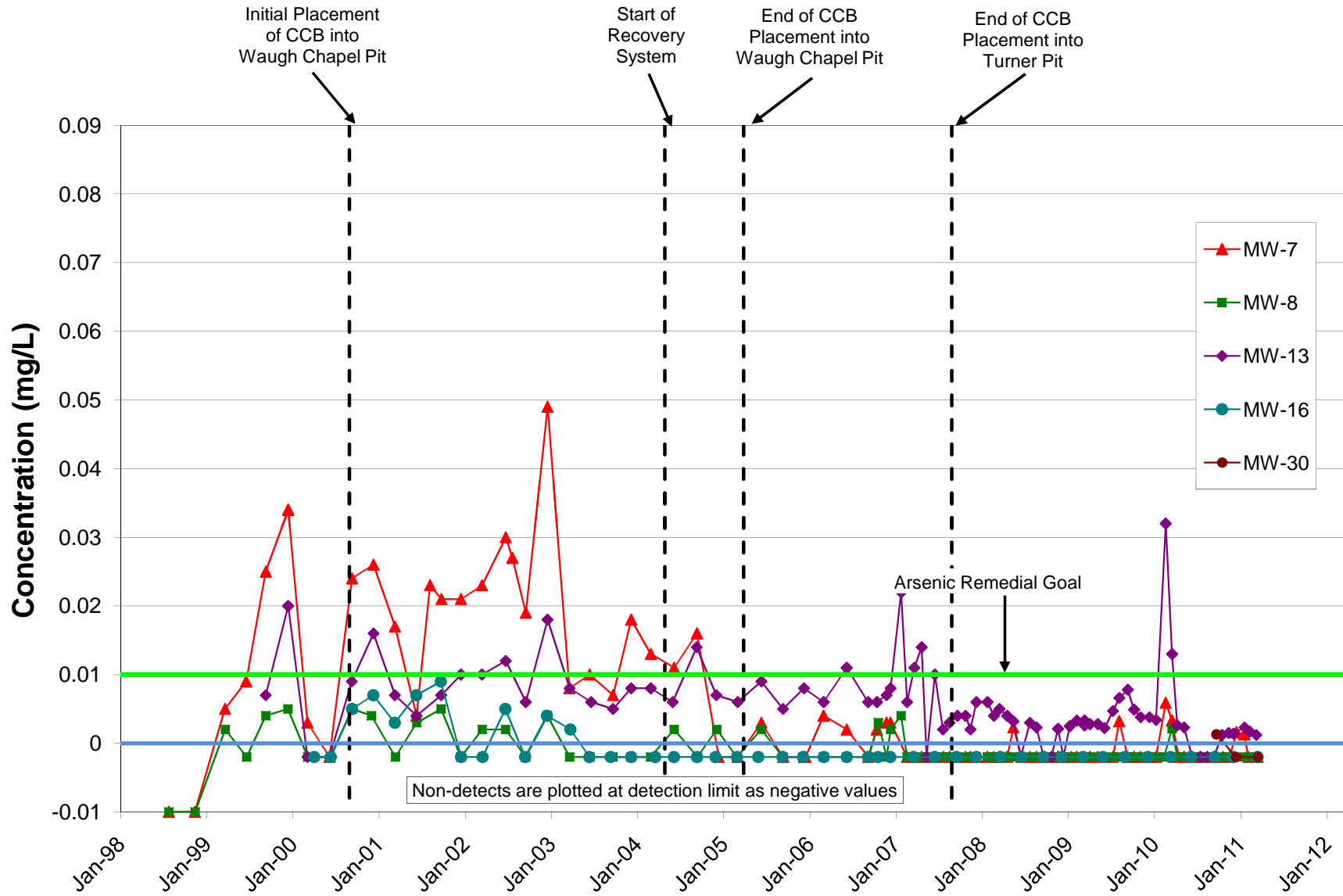
Sulfate - Waugh Chapel Pit (WCP) Wells



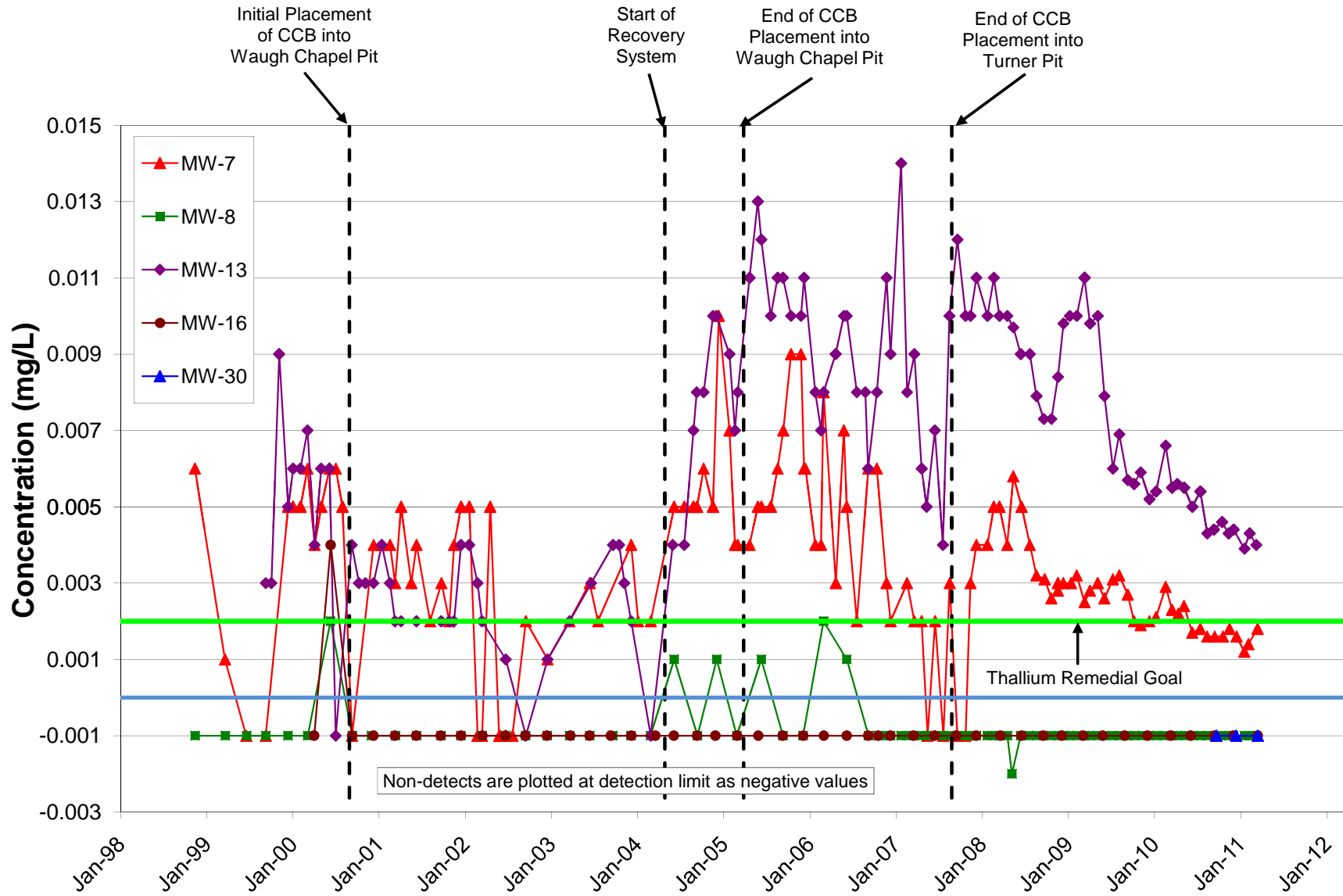
Nitrate - Waugh Chapel Pit (WCP) Wells



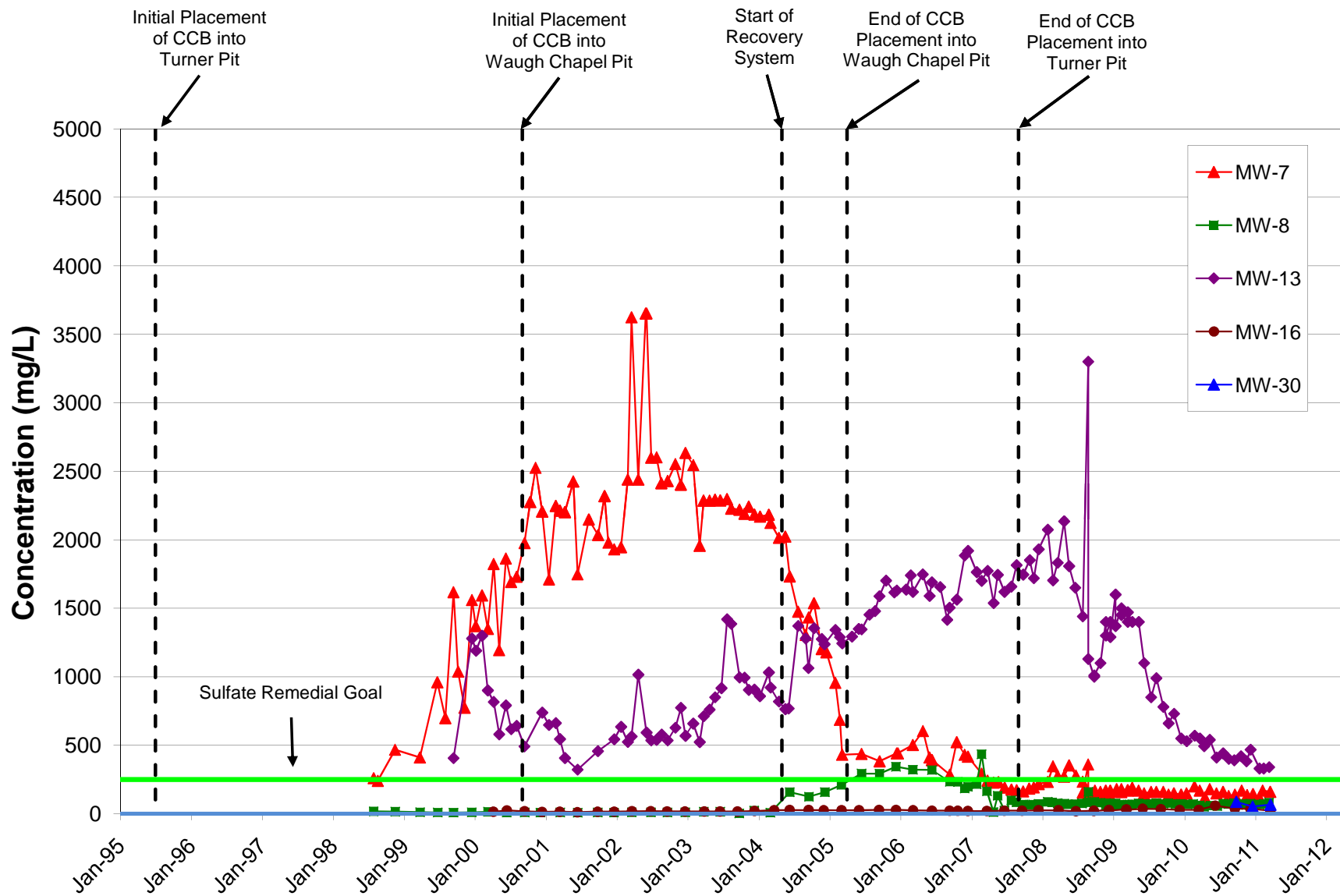
Arsenic - Turner Pit (TP) Wells



Thallium - Turner Pit (TP) Wells



Sulfate - Turner Pit (TP) Wells



Nitrate - Turner Pit (TP) Wells

