Technical Memorandum

To: J. Hamrick, J. Cain, Cotter Corporation

From: E. Lawrence, HydroSolutions,
W. Huskie, Nankoweep Environmental Consulting

Date: July 27, 2011

Subject : TCE Soil Gas Survey, Source Area and Extent Investigation, Cañon City Milling Facility

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INTRODUCTION

Trichloroethene (TCE) has been detected in groundwater at levels that exceed the US Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL) at the Cotter Corporation (N.S.L.) (Cotter) Cañon City Milling Facility (CCMF) located in Fremont County, Colorado. The extent of elevated TCE has been substantially delineated by the results of groundwater sampling conducted in February and May of 2011. A source of the TCE contamination has not been identified. The highest TCE concentrations in groundwater are located in the vicinity of monitoring wells 802 and 042 (Figure 1). A phased soil gas investigation is proposed in this area, to identify potential sources of the TCE contamination, and to further delineate the extents of the groundwater plume.

BACKGROUND

TCE in groundwater was identified by Cotter in October 2010 during sampling to determine if trihalomethanes (THMs) were present in groundwater beneath the property located directly north and west of the CCMF. The groundwater sampling was intended to support an investigation into the nature and extent of elevated levels of uranium in the area north and west of the CCMF. Eleven wells were sampled as part of that effort. During analysis of the samples, the laboratory noted interferences associated with quantitation of THMs, due to the presence of TCE in samples collected from monitoring wells 802 and 346.

Re-sampling of monitoring wells 802 and 346 in February 2011, and sampling of three additional monitoring wells, confirmed the presence of TCE in groundwater. TCE was not detected at upgradient monitoring well 024. A full site investigation for TCE was conducted in May 2011. Twenty-eight monitoring well locations were sampled. Results of the sampling are shown in Figure 1. TCE detections at concentrations exceeding the 5 ug/L MCL are completely bounded within the CCMF property, with one exception at well 803 (TCE = 5.6 ug/L). Based on

the results of the May 2011 sampling, the downgradient extent of elevated TCE in groundwater has been well defined. However, the upgradient extent has not been adequately delineated. The intent of the proposed soil gas investigation is to better define the upgradient extent of TCE, and to identify potential TCE source areas.

POTENTIAL SOURCE OF TCE

There are two known uses of TCE at the CCMF. One was for the removal of polychlorinated biphenyls from milling materials in late 1983 into early 1984. Milling solids and adjacent soils in the old mill float plant became contaminated from leakage of polychlorinated biphenyl containing heating oil from a holoflite dryer used in the recovery of source material. TCE was used to strip the polychlorinated biphenyls from the solids. The solids were shipped to a disposal facility and the recovered polychlorinated biphenyls were shipped offsite for thermal destruction. The locations of the TCE use were in the bay of the grind and leach building (pre-mixing of the milling materials with TCE) and in the catalyst plant (TCE washing of the milling materials). The locations of these building are shown in Figures 1 through 4.

Secondly, TCE was used as a Hypalon® cleaning agent when patching of impoundment liners was required. This use is unlikely to have impacted groundwater. There are no known areas where TCE may have been disposed. There are no areas of the site where surface contamination of TCE is observed.

PROPOSED INVESTIGATION

A soil gas investigation is proposed as a method to obtain representative data over a large area that can be used to guide eventual installation of additional monitoring wells to fully delineate the TCE plume.

Soil gas investigations can be generally divided into active and passive investigations. Active methods typically involve some type of direct push Geoprobe tool to make a hole, and a pumping system to evacuate the hole and collect samples. Samples are submitted to an off-site laboratory for analysis, or submitted to an on-site mobile laboratory for real time analysis.

Passive soil gas surveys utilize adsorbent samplers that are placed at shallow subsurface depths. The samplers adsorb VOCs in soil gas without forcing the flow rate of soil gas, yielding a more representative sample than active soil gas methods. Samplers are typically placed in a grid pattern to sample trace levels of compounds in soil gas that originate from contamination in soil or groundwater. By sampling all locations at the same time, the temporal variations in soil gas concentrations that are known to occur daily and even hourly are normalized. In addition, the spatial variability of contamination can be better defined with a passive soil gas survey

because the lower sampling and analytical costs of the method allow for more locations to be sampled within a given budget. Passive soil gas methods have been demonstrated to be more sensitive and reproducible than active soil gas methods (Becaon Environmental Services - http://www.beacon-usa.com/services/passive-soil-gas-surveys).

The analytical results for a passive soil gas survey are presented in units of mass absorbed rather than concentrations. The results of the passive survey can be plotted to identify source areas, lateral extents of contamination, including migration pathways, and to monitor progress of remediation programs. Soil gas concentrations reported from active soil gas sampling methods, using high flow pumps, may not represent the actual concentration in soil gas due to the forced movement of soil gas as a result of active pumping.

Previous experience at the Cotter site has shown that shallow hardpan soils and consolidated sediments have precluded the ability of Geoprobes to penetrate soils to consistent depths. Given the high cost to mobilize a Geoprobe rig to the site, and the likelihood of limited success to obtain quality samples, Cotter has determined that a passive soil gas survey may be the most effective investigation technique.

SOIL GAS SAMPLING METHODOLOGY

Cotter plans to contract the services of Vista GeoSciences (Vista) of Golden, Colorado, to provide the passive samplers, and to analyze the samplers for TCE after collection. Vista's VaporTec™ passive soil gas samplers consist of proprietary hydrophobic, non-polar, highly activated sorbents in sealed 40-milliliter glass vials. Most volatile organic compounds (VOCs) will adsorb to the samplers and can be detected at trace levels, down to a few nanograms. The samplers are analyzed by GC/MS by modified EPA method 8260B which includes standard EPA SW-846 QA/QC protocol. The time-integrated technique concentrates the soil gas signal due to the amount of time the sampling device is exposed, and allows for much lower detection levels of compounds in the soil gas than can be detected using active soil gas methods.

Cotter will install and retrieve the samplers using the general procedures developed by Vista. Cotter proposes to perform the soil gas survey using a phased approach. Phase I will be performed to test the ability of the passive samplers to produce results in the area of the highest known groundwater contamination (around well 802). A single soil gas sampler will be placed directly adjacent to well 802 act as a control point. Additional soil gas samplers will be placed in a concentric pattern around well 802 to provide an indication of the spatial distribution of TCE concentrations around the well. Figure 2 shows the locations for 26 passive soil gas sample points. If results from the Phase 1 investigation indicate that the passive soil gas survey is effective in identifying the presence of TCE in the subsurface, a more comprehensive

Phase 2 investigation will be implemented, as shown in Figure 3. Final location of Phase 2 soil gas samplers will be dependent on the results of the Phase 1 sampling effort. If the Phase 1 results indicate that passive soil gas evaluation is not a useful tool, then Cotter will evaluate other approaches, such as additional well installation, to investigate the nature and extent of the TCE contamination.

The general approach to install the passive soil samplers is to drill a hole with a diameter of 1.5-3 inches to a depth of 12 to 18 inches. Drilling can be performed with battery operated hand tools, small hand augers, punch rods, or with tools powered by a gas generator located at least 50 feet downwind of the drilling location. For the Cotter project, potential contamination associated with operation of a generator is minimized, as TCE (a non-fuel compound) is the only target of the investigation. Once the hole is drilled, the VaporTec™ sampler is lowered into the hole and suspended by a fine wire that is secured at the surface. The hole is plugged with a wad of tin foil (pushed a couple of inches into the hole), and a thin bentonite slurry plug is placed on top of the foil to seal the hole. The location is marked with a labeled pin flag, and GPS notation (if available) for later retrieval. Samplers will be left in the ground for a period to 10 to 14 days.

Upon retrieval, samplers will be labeled with an ink pen (solvent based markers are not to be used with the samplers), and placed back in the boxes they were initially shipped in, for return to the laboratory.

A minimum of one trip blank is supplied with each project. These are kept with the field staff during the trips to the field and are returned with the samplers for analysis. They remain sealed during the entire project. Duplicate samplers, containing two sorbent wires are shipped with every batch of samplers. The duplicate wires are used for field or lab duplicates and for backup runs if needed.

GROUNDWATER SAMPLING

Cotter has identified two monitoring wells (wells 038 and 044) that were not sampled during the comprehensive May 2011 site investigation. These wells will be sampled to provide more information regarding the TCE distribution, and potential source areas. These two wells are shown in Figure 4. Cotter also plans to re-sample well 803, which is the only off-site well to have a TCE concentration greater than the 5 ug/L MCL. These three wells will be sampled during the time frame of the Phase 1 soil gas testing, using the low flow procedures described in the Work Plan submitted to CDPHE in April 2011.

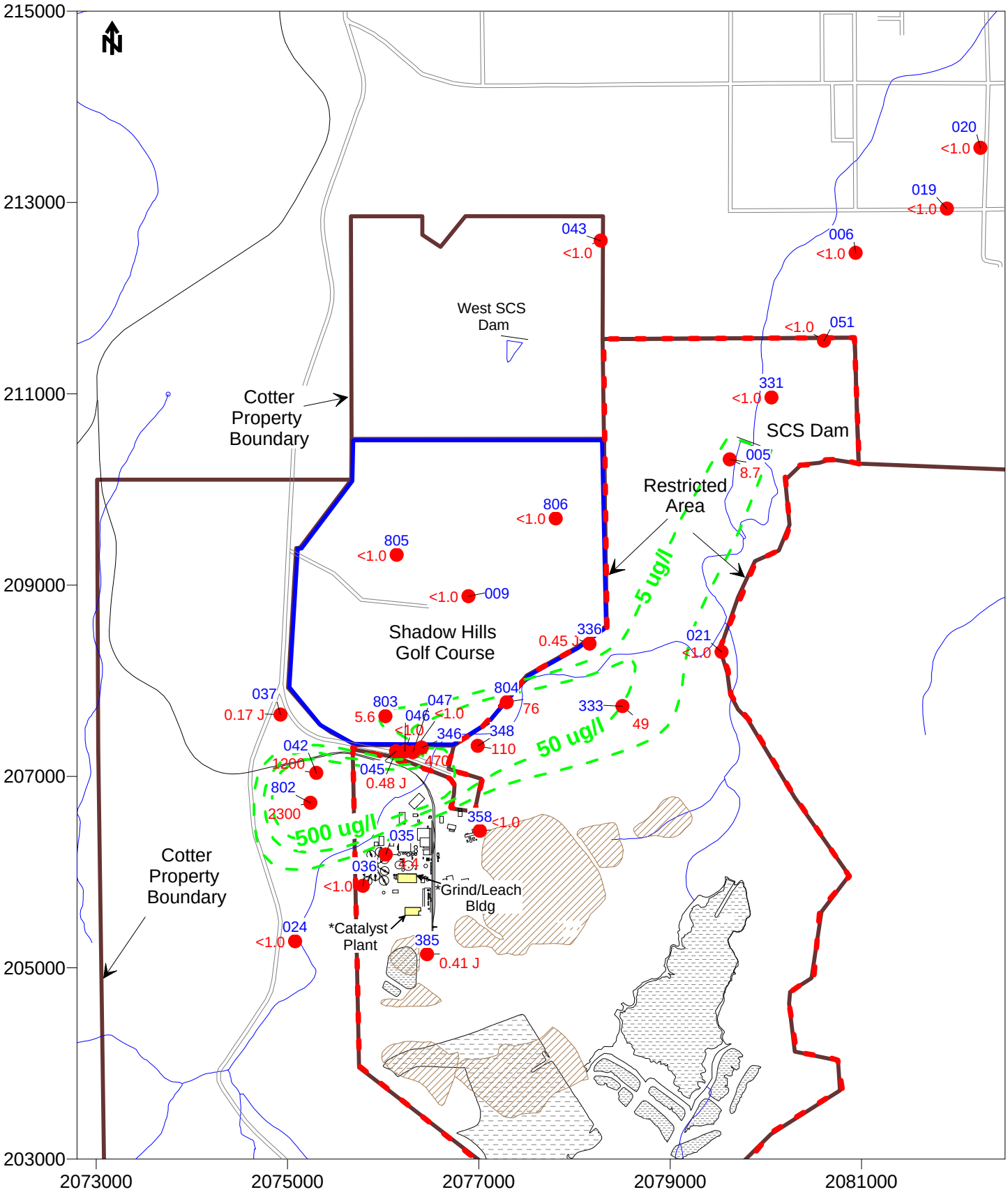
INVESTIGATION RESULTS REPORTING

Results of the Phase 1 passive soil gas sampling investigation will be included in a summary report. The summary report will include all laboratory analytical reports, a tabulation of all analytical results, a map illustrating the distribution of TCE, and recommendations for the Phase 2 sampling as necessary. In the event that the Phase 1 soil gas sampling proves ineffective in identifying TCE in the subsurface in the vicinity of well 802, other methods of investigation (such as additional monitoring well installation) may be proposed. The Phase 1 summary report will be provided within 30 days of receiving all analytical reports for TCE analysis from the laboratory.

SCHEDULE

A tentative schedule for completion of the sampling analyses and reporting is provided below.

- Initiate Phase 1 passive soil gas sampling – August 15, 2011
- Retrieve samplers and submit to laboratory - August 30, 2011
- Receive results of laboratory analyses – September 10, 2011
- Submit Summary Report with Phase 2 Work plan – October 10, 2011
- Initiate Phase 2 work (as warranted) - October-November 2011.



* Buildings where TCE use occurred but have since been demolished

037 Sample Location

86 TCE Concentration (ug/l)

Estimated TCE Isoconcentration Contour (ug/l)

Impoundments

Historic

Current

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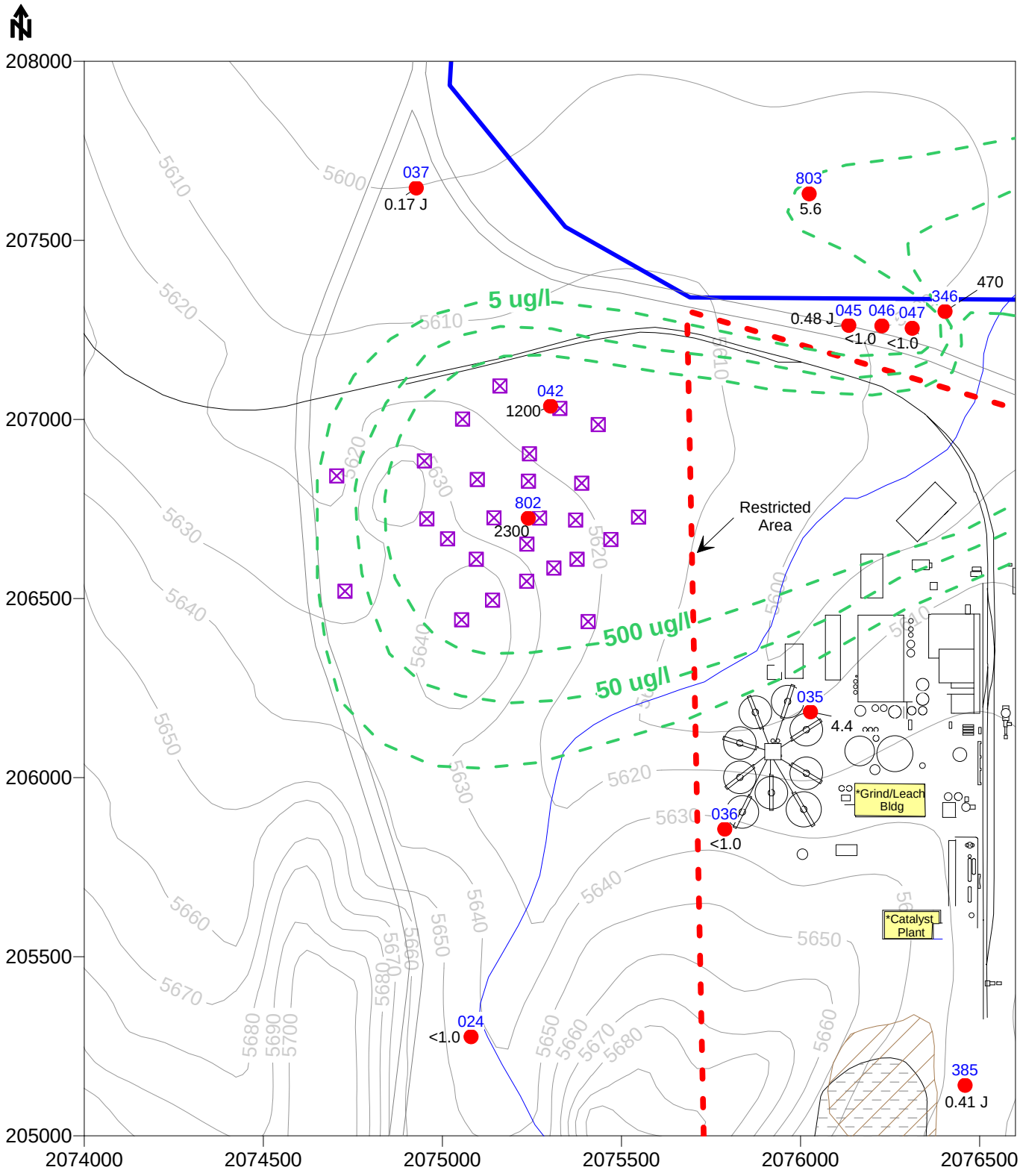
Figure 1.
TCE Concentration, May 2011

By: EPL Checked: JC File ID:fig1VOCInvest.srf Date:7/20/11



Proposed Phase 1 Soil Gas Sample Location

037 Groundwater Sample Location

86 TCE Concentration (ug/l)

Estimated TCE Isoconcentration Contour (ug/l)

Surface Topography Contour (ft amsl)

Impoundments

Historic

Current

* Buildings where TCE use occurred but have since been demolished

Note:Soil Gas Sample Locations are approximate and may be adjusted in the field

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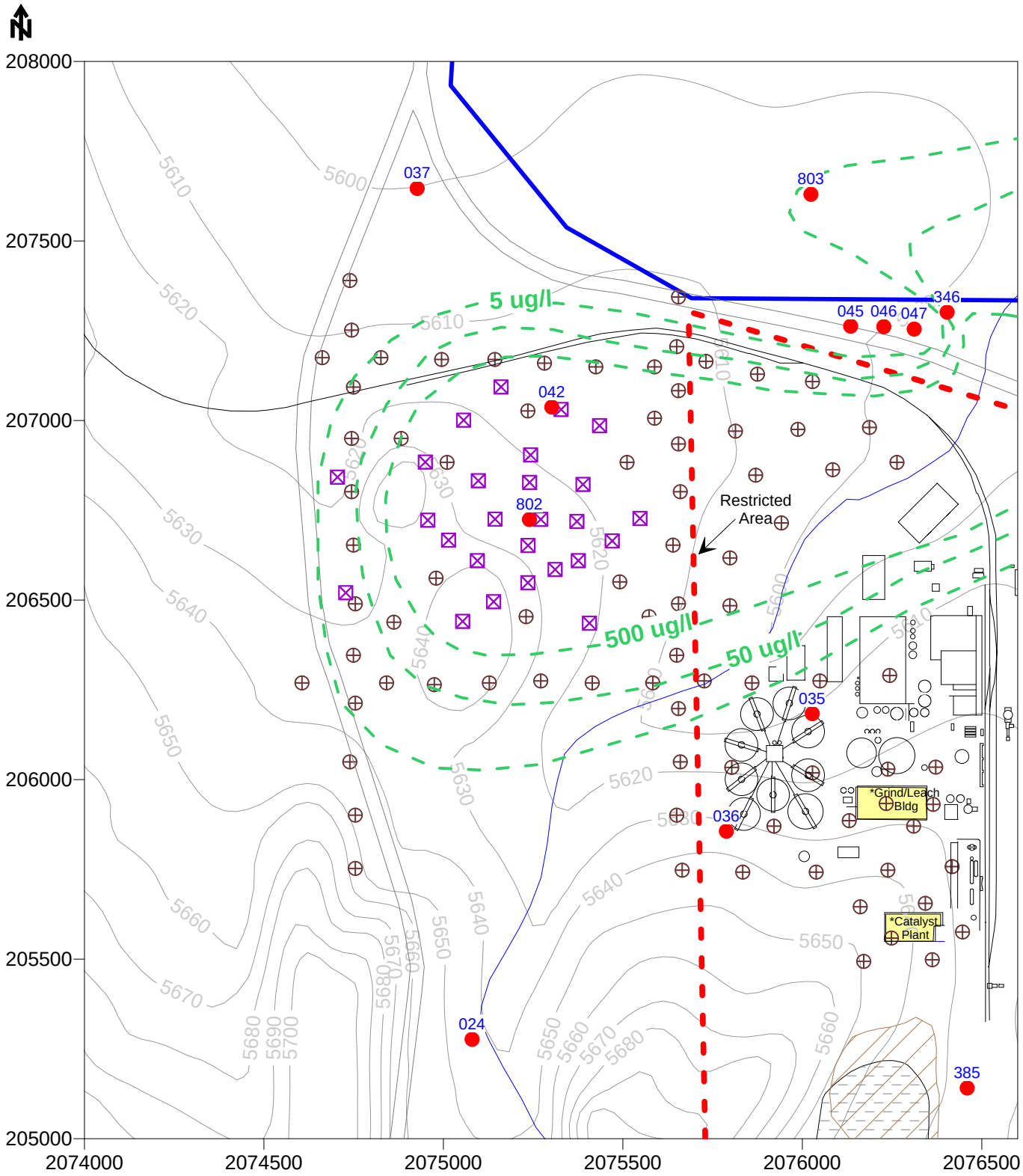
Figure 2.
Proposed Phase 1 Soil Gas Sampling Locations

By: EPL Checked: JC File ID:fig2VOCInvest.srf Date:7/27/11



Proposed Phase 1 Soil Gas Sample Location

Potential Phase 2 Soil Gas Sample Location#

037 Groundwater Sample Location

Estimated TCE Isoconcentration Contour (ug/l)

Surface Topography Contour (ft amsl)

Impoundments

Historic

Current

* Buildings where TCE use occurred but have since been demolished

\# Phase 2 Soil Gas Sample Locations will be based on the results of the Phase 1 Soil Gas Samples and may be more or less densely spaced than depicted in this figure

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Figure 3.
Potential Phase 2 Soil Gas Sampling Locations

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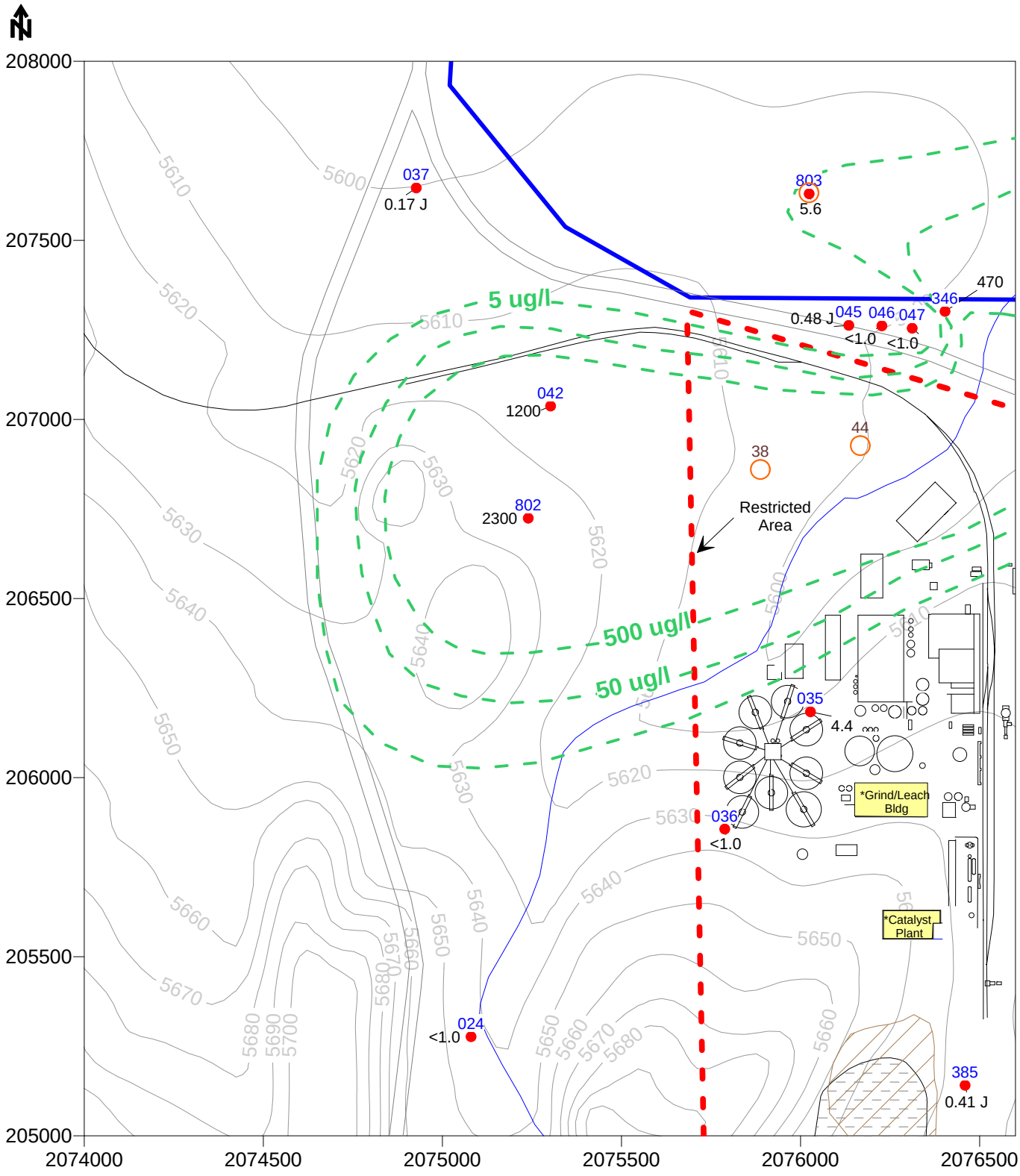

Proposed Monitor Well Sample Location

037 May 2011 Monitor Well Sample Location

86 TCE Concentration-May 2011(ug/l)

Estimated TCE Isoconcentration Contour (ug/l)

Surface Topography Contour (ft amsl)

Impoundments

Historic

Current

* Buildings where TCE use occurred but have since been demolished

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Figure 4.
Proposed Additional Well Sampling Locations

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