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STATEMENT OF BASIS/ PROPOSED FINAL GROUNDWATER REMEDY DECISION SOLID WASTE MANAGEMENT UNIT 55 NAVAL ACTIVITY PUERTO RICO

6/1/2012

CH2MHILL

STATEMENT OF BASIS / PROPOSED FINAL GROUNDWATER REMEDY DECISION	REGION 2 ID# PR2170027203

NAVAL ACTIVITY PUERTO RICO (former Naval Station Roosevelt Roads)

Ceiba, Puerto Rico
(June 2012)

Facility/Unit Type: SWMU 55 (former boat maintenance facility)
Contaminants:
Groundwater: Trichloroethene (TCE)
Proposed Final Remedy:
Small excavation followed by short-term in situ chemical oxidation (ISCO) to aggressively degrade source area TCE mass in groundwater. At conclusion of the ISCO phase, in situ bioremediation (ISB) will be implemented in source area using a bioreactor. ISB will also be implemented mid-plume using injection wells.

FACILITY DESCRIPTION

SWMU 55 is the TCE plume near the Tow Way Fuel Farm and is located south of Forrestal Drive near former Building 2314 (formerly Building 46). Former Building 2314 was reportedly used for the storage and maintenance of small watercraft. The exact maintenance activities completed here and specific materials stored in the building are unknown, and the source of TCE could not be determined based on available records. Former Building 2314 was destroyed by Hurricane Hugo in September 1989 (Baker, 2005). However, the pad remains, and the former location of the building is shown on Figure 1.

PROPOSED REMEDY

The proposed remedy at SWMU 55 includes a phased approach to address high-level TCE concentrations in the source area and in situ bioremediation to enhance the naturally occurring processes to achieve reduction of TCE concentrations in the more dilute, downgradient portion of the TCE plume. The source area approach will include additional characterization of the source area, excavation of some source area soils, in situ chemical oxidation using sodium permanganate, and in situ bioremediation.

Current land use controls (LUCs), including prohibited use of groundwater, will be maintained during the corrective action. When corrective action is complete, LUCs must be maintained including:

- No permanent residences may be installed on the property.
- No groundwater extraction wells may be installed by the deed grantee.
- Potential for vapor intrusion must be considered by the developer and addressed by the developer, as needed.
- The grantee may not interfere with any existing or future groundwater remedial systems.
- The grantee must complete annual inspections of the property to ensure all LUCs are being complied with and provide written certification of the inspection.
- The grantee must comply with the Resource Conservation Recovery Act (RCRA) Administrative Order on Consent for this property (provided to the Puerto Rico Local Redevelopment Authority (LRA) by the U.S. Navy).
- Release of environmental conditions and grantee covenants can be considered only with EPA concurrence.

SUMMARY OF FACILITY RISKS

Historical releases of TCE are assumed to be associated with activities at the former Building 2314 and releases no longer occur at the site. According to the CMS, no soil contamination exists in the TCE area, though a TCE plume was defined during groundwater sampling in 2009 – 2010 (AGVIQ-CH2M HILL, 2012a). However, the lateral extent of the plume was well defined during the 2009 – 2010 sampling and does not migrate outside the SWMU 55 area (Figures 2 and 3).

In addition, the groundwater beneath SWMU 55 was demonstrated to be unusable as a potable water supply because of the brackish/saline nature of the area groundwater, with high levels of total dissolved solids and salinity, as detailed in the Groundwater Usability Assessment, Naval Activity Puerto Rico, Ceiba, Puerto Rico Technical Memorandum (Appendix B of the SWMU 55 Corrective Measures Study Addendum [AGVIQ, CH2M HILL, 2012b]).

Under current land use, no direct exposure to site groundwater is occurring. However, indirect exposure pathway through volatilization of TCE to ambient air and indoor air could occur in the SWMU 55 TCE plume area. Therefore, this indirect exposure pathway was considered complete for deriving the cleanup criteria for the site groundwater.

The cleanup criteria were developed for industrial (indoor) worker and construction worker scenarios as presented in the Revised Corrective Action Objectives for Solid Waste Management Units 7&8, 54, and 55 Technical Memorandum (Appendix A of the SWMU 55 Corrective Measures Study Addendum AGVIQ-CH2M HILL, 2012a).

SCOPE OF CORRECTIVE ACTION

The corrective action for TCE in groundwater at SWMU 55 includes two approaches – one for the source area and one for the more dilute plume downgradient of the source area.

Additional Characterization

To complete the horizontal delineation of the source area and potentially improve the siting of the bioreactor, one shallow well will be installed and sampled in the source area.

Source Area Approach

The proposed remedy in the source area is a combined treatment approach, including excavation, ISCO, and ISB to address the source area, defined as groundwater exceeding 10,000 micrograms per liter (µg/L) TCE. First, some high-level TCE contamination will be removed from the source area through excavation, followed by construction of an infiltration gallery/bioreactor in the excavation. The gravel-filled infiltration gallery will first be used to distribute sodium permanganate in the aquifer to rapidly oxidize residual TCE in the soils and groundwater directly beneath the excavation. This aggressive mass removal should reduce the amount of time required to complete the ISB treatment. When permanganate is no longer detected in site groundwater, the infiltration gallery will be converted into the bioreactor by injecting emulsified vegetable oil (EVO) into the gravel/mulch portion of the bioreactor and recirculating groundwater through the bioreactor.

An infiltration gallery maximizes the amount of sodium permanganate that can be introduced to the source area while minimizing movement of TCE-laden groundwater. This remedial approach will aggressively remove TCE contamination from the source area and lead to TCE concentration reductions in the downgradient plume over time. After the immediate reduction in TCE mass through excavation and oxidation, the bioreactor will be established to address residual TCE contamination in the soil and groundwater of the source area. The bioreactor will provide a longer-term source area treatment system. Groundwater from outside the bioreactor will be recovered and pumped to the top of the bioreactor to extend the treatment zone and further reduce downgradient plume concentrations.

Other than the excavation and initial EVO injection, the bioreactor will operate automatically using a solar-powered pump to recirculate groundwater. After 2 years, the bioreactor treatment area will be expanded to more of the TCE plume area. During this phase, an additional downgradient extraction well may be incorporated into the bioreactor.

After the TCE concentration as been reduced to 500 µg/L or less, deep zone monitoring wells will be considered for installation in the source zone to define the TCE concentrations in groundwater near the bedrock surface.

Downgradient Plume Approach

The remainder of the TCE plume will be treated over an extended timeframe using ISB and monitored natural attenuation (MNA). To reduce the remediation timeframe, the plume downgradient of the bioreactor will be treated using a line of EVO injection wells across the middle of the plume. Because the full extent of this TCE plume was only recently defined, the MNA potential and stability of the distal portion of the plume should be evaluated over time and the need for an MNA study will be determined.

SUMMARY OF ALTERNATIVES

Based on the 2005 data, six clean up alternatives were evaluated in the CMS (Baker, 2005), including:

- Alternative 1 No Action
- Alternative 2 Monitored natural attenuation (MNA), including LUCs
- Alternative 3 Enhanced bioremediation and MNA, including LUCs
- Alternative 4 In situ chemical oxidation and MNA, including LUCs
- Alternatives 5 In situ chemical reduction and MNA, including LUCs
- Alternative 6 Groundwater Extraction with Liquid Phase Carbon Adsorption treatment, reinjection, and long term monitoring

Except for Alternative 1, each alternative addresses TCE in groundwater at SWMU 55. LUCs and MNA are components of each alternative except Alternatives 1 and 6. Alternative 1 was evaluated due to the small probability of groundwater exposure at SWMU 55. Alternative 2 consists solely of LUCs and MNA. This alternative would provide an assessment of naturally occurring degradation processes as the TCE is monitored with time. In addition, LUCs in the form of a deed restriction on groundwater extractions would protect human health. Alternative 3 utilizes enhanced bioremediation with optional bioaugmentation and MNA to reduce contaminant concentrations in groundwater. Enhanced bioremediation options include the addition of a substrate, such as EVO, to the TCE-contaminated groundwater to promote TCE degradation. Alternative 4 includes oxidation of contaminants through the use of an oxidizing agent such as permanganate or hydrogen peroxide. It was not expected that oxidation, alone, would reduce concentrations below clean up criteria. Alternative 5 consists of active TCE plume remediation using a reductive technology such as zero-valent iron. This alternative was also not expected to achieve cleanup standards alone. Alternative 6 includes groundwater extraction, treatment, and re-injection for 5 years at SWMU 55. This alternative was not expected to attain cleanup criteria alone.

EVALUATION OF THE PROPOSED REMEDY AND ALTERNATIVES

To complete the CMS, a technical evaluation of the alternatives was completed and the alternatives were ranked based on technical merits, human health benefits, environmental benefits, and cost. The technical merits evaluated included performance, reliability, implementability, and safety of each alternative. Alternative 2 was ranked highest in most of the evaluation categories, including cost. However, this alternative did not meet the desired time frame to complete the corrective action and Alternatives 4 and 5 were the next highest ranking. The cost associated with Alternative 5 was considered prohibitive for a full-scale installation. Therefore, Alternative 4 was selected for pilot-scale testing.

The ISCO pilot-scale test was conducted between December 3 and 17, 2009 (AGVIQ-CH2MHILL, 2012a). Sodium permanganate was injected into groundwater to determine if TCE concentrations in groundwater could be reduced. Test results showed it was possible to inject the sodium permanganate solution in the groundwater. Initially, significant decreases in TCE concentrations were observed in the test area; however, within 3 months, permanganate concentrations had decreased substantially and then increases in the TCE concentration was observed.

The pilot-scale testing results indicate multiple sodium permanganate injections would be required to attain sufficient reduction in TCE concentrations to achieve the cleanup criteria. Additionally, the possibility exists that the injection of large volumes of permanganate over the entire plume may result in the unintentional discharge of sodium permanganate into Ensenada Honda. Therefore, full-scale ISCO would not be a cost-effective remedy for the SWMU 55 TCE plume and an alternative treatment approach was recommended, including excavation with an ISCO application in the bottom of the excavation to aggressively reduce TCE in source area soils, followed by in situ bioremediation (ISB) to establish longer term treatment in the source zone and to enhance monitored natural attenuation (MNA) of the remaining TCE plume.

PUBLIC PARTICIPATION

Public review and comment on the proposed remedy for SWMU 55 will be implemented as part of the public comment period for the proposed Administrative Order on Consent between the Navy and EPA. A public notice of that public comment period will be published in both Spanish and English in select Puerto Rico newspapers.

NEXT STEPS

Following completion of public review and comment on the proposed remedy, the EPA will advise of any required modifications based on the public comments, or its acceptability.

KEY DOCUMENTS

AGVIQ-CH2M HILL. 2012a. Corrective Measures Study Addendum for SWMU 55, Naval Activity Puerto Rico. June.

AGVIQ-CH2M HILL. 2012b. Corrective Measures Implementation Plan for SWMU 55, Naval Activity Puerto Rico. June.

Baker Environmental, Inc. 2005. Final Corrective Measures Study Final Report for SWMUs 54 and 55.

FURTHER INFORMATION

The key documents may be reviewed at:

U. S. Environmental Protection Agency
Region 2
RCRA File Room
290 Broadway, 15th floor
New York, NY 1007-1866
Attn: Mr. David Abrines
Phone: 212-637-3043

U. S. Environmental Protection Agency
Caribbean Environmental Protection Division
City View Plaza II – Suite 7000
#48 RD. 165 km 1.2
Guaynabo, PR 00968-8069
Attn: Mr. Luis Negron
Phone: 787-977-5870

Puerto Rico Environmental Quality Board
Oficina del Presidente – Piso 5
Ave. Ponce de Leon #1308
Carr Estatal 8838
Sector El Cinco
Rio Piedras, PR 00926
Attn: Ms. Wilmarie Rivera
Phone: 787- 767-8181 ext. 6141

Or at the following internet web page address:
http://nsrr-ir.org/

Monitoring Well Screened Primarily Less than 25 ft bgs
Injection Well Screened Primarily Less than 25 ft bgs
Monitoring Well Screened Primarily Greater than 25 ft bgs
Injection Well Screened Primarily Greater than 25 ft bgs
Monitoring Well
SWMU 55 Boundary

N 0 60 120 Feet
1 inch = 120 feet

FIGURE 1
Site Layout
SWMU 55
Naval Activity Puerto Rico

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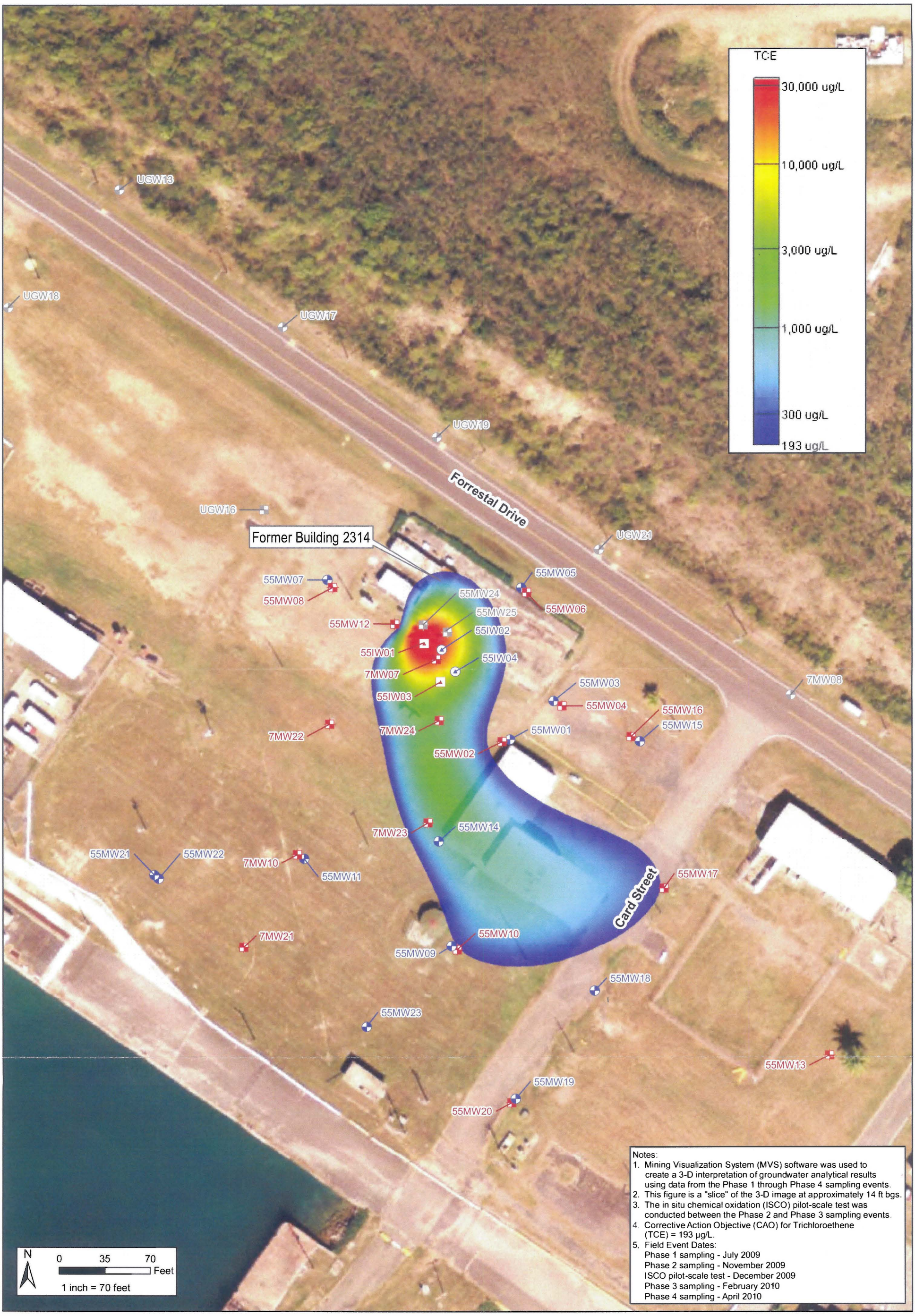

Monitoring Well Screened Primarily Less than 25 ft bgs

Injection Well Screened Primarily Less than 25 ft bgs

Monitoring Well Screened Primarily Greater than 25 ft bgs

Injection Well Screened Primarily Greater than 25 ft bgs

Existing monitoring wells not used to develop 3-D interpretation.

FIGURE 2
Shallow Aquifer Zone TCE Concentrations – Baseline
SWMU 55
Naval Activity Puerto Rico

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DVR \\MNUSTRICTGFS01\PROJECTS\USNAVYPUERTORICO20000317\MAPFILES\SWMU55_SOB\FIG_2_BASELINE_SHALLOW.MXD JCARR 6/14/2012 8:55:31 AM

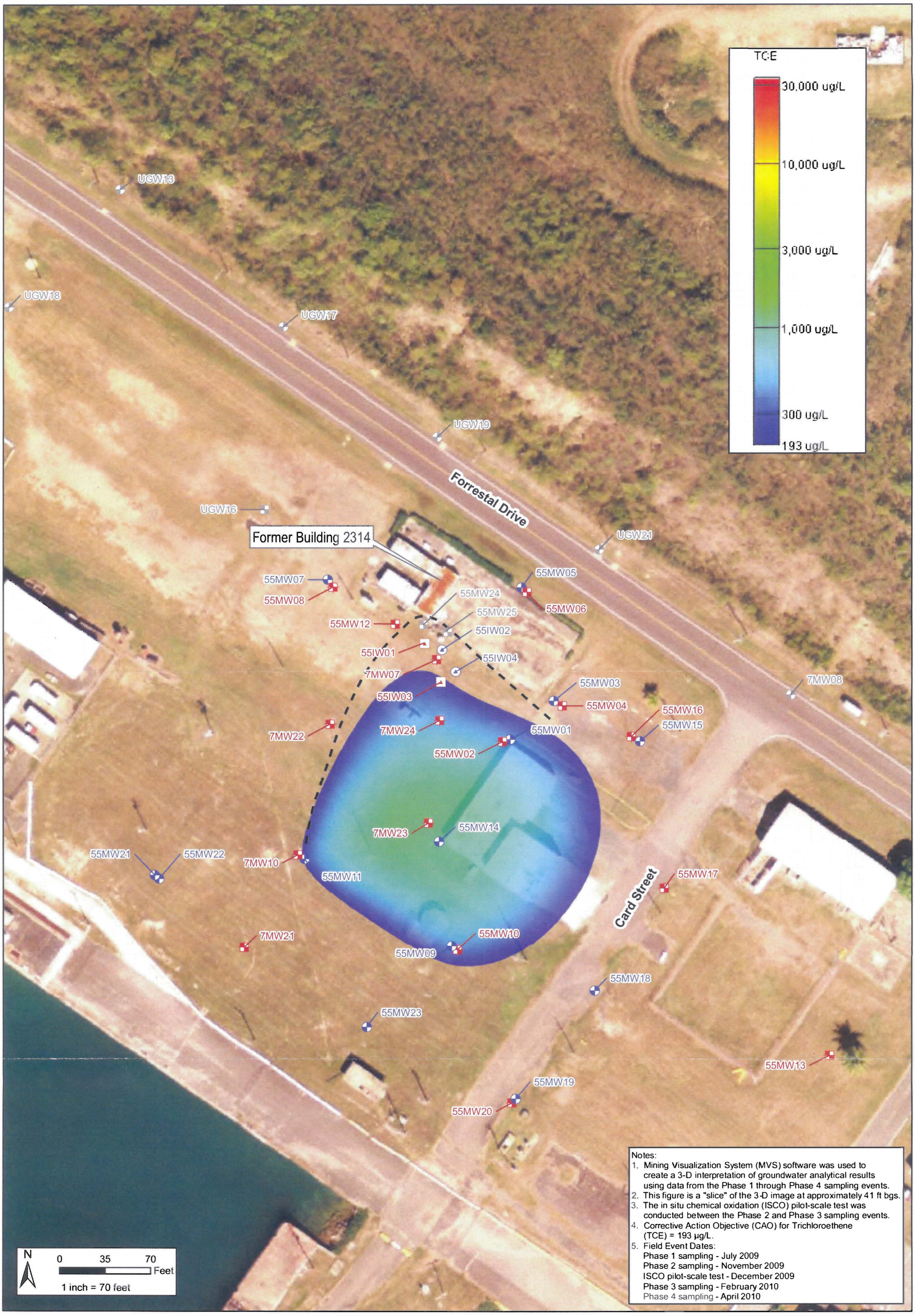

FIGURE 3
Deep Aquifer Zone TCE Concentrations – Baseline
SWMU 55
Naval Activity Puerto Rico