RECORD OF DECISION

JONES ROAD GROUND WATER PLUME SUPERFUND SITE

TXN000605460
HARRIS COUNTY, TEXAS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6

SEPTEMBER 2010

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ABBREVIATIONS AND ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
ARARs	Applicable or Relevant and Appropriate Requirements
BLRA	Baseline Risk Assessment
bgs	Below ground surface
cm/s	Centimeters per second
CT	Central tendency
COC	Chemicals of concern
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Contaminant (chemical) of potential concern
DCE	1,2-dichloroethylene
DNAPL	Dense non-aqueous phase liquid
DHHS	Department of Health and Human Services
DOT	U.S. Department of Transportation
ESD	Explanation of Significant Difference
ELCR	Excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency (Region 6)
EPC	Exposure point concentration
FR	Federal Register
FS	Feasibility study
ft/d	Feet per day
FOD	Frequency of detection
gpm	Gallons per minute
GAC	Granular activated carbon
HCFCD	Harris County Flood Control District
HI	Hazard index
HQ	Hazard quotient
IC	Institutional control
ISCO	In-situ chemical oxidation
IRIS	Integrated Risk Information System
IARC	International Agency for Research on Cancer
kg	Kilogram
LTRA	Long term response action
MCL	Maximum Contaminant Level
µg/L	Microgram per liter
mg	Milligram
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
MSSL	Medium-specific screening level (EPA Region 6)

ABBREVIATIONS AND ACRONYMS (Continued)

NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NTP	National Toxicology Program
NAPL	Non-aqueous phase liquids
NOI	Notice of Intent
O&M	Operation and maintenance
PCE	Tetrachloroethylene, also known as perchloroethylene
PCL	Protective concentration level
POTW	Publicly-owned treatment works
RAO	Remedial action objectives
ROD	Record of Decision
RfD	Reference doses
RSL	Regional Screening Tables
RI	Remedial investigation
RI/FS	Remedial investigation and feasibility study
RME	Reasonable maximum exposure
RAO	Remedial action objectives
SDWA	Safe Drinking Water Act
SF	Slope factor
TAG	Technical assistance grant
TCE	Trichloroethylene
TCEQ	Texas Commission on Environmental Quality
TDLR	Texas Department of Licensing and Regulation
TPDES	Texas Pollutant Discharge Elimination System
TRRP	Texas Risk Reduction Program
TBC	To be considered
TMV	Toxicity, mobility, or volume
95% UCL	95% Upper confidence limit
USC	United States Code
VC	Vinyl chloride
VOC	Volatile organic compounds
WBU	Water bearing unit
ZVI	Zero valent iron

PART 1: THE DECLARATION

1.0 SITE NAME AND LOCATION

The Jones Road Ground Water Plume Superfund Site (Site) is located in Harris County, Texas. The National Superfund Database Identification Number is TXN000605460. The Site was finalized on the National Priorities List (NPL) on September 29, 2003. This Site has not been divided into separate operable units and all areas and media within the Site are addressed together in this Record of Decision (ROD).

2.0 STATEMENT OF BASIS AND PURPOSE

This decision document presents the "Selected Remedy" for the Jones Road Ground Water Plume Superfund Site in Harris County, Texas (Figure 2 - Site Location Map). The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300, as amended. The Selected Remedy for the Site is Alternative 4, In-Situ Enhancements to Pump and Treat. The Selected Remedy is described in detail in Section 19.2 (Description of the Selected Remedy) of this ROD.

This decision is based on the Administrative Record for the Site, which has been developed in accordance with Section 113(k) of CERCLA, 42 U.S.C. § 9613(k). This Administrative Record file is available for review at the Northwest Branch Harris County Library in Cypress, Texas; and at the Texas Commission on Environmental Quality (TCEQ) Central File Room in Austin, Texas; and at the United States Environmental Protection Agency (EPA, Region 6) Records Center in Dallas, Texas. The Administrative Record Index (Appendix B) identifies each of the items comprising the Administrative Record upon which the selection of the Remedial Action is based.

The State of Texas (TCEQ) concurs with the Selected Remedy.

3.0 ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

4.0 DESCRIPTION OF THE SELECTED REMEDY

The Selected Remedy for the Site is Alternative 4, In-Situ Enhancements to Pump and Treat. The in-situ treatments involve treating the soil and groundwater without removing them. A pilot study will be conducted to determine which in-situ treatments will be most effective and appropriate for the source area soil and groundwater, and the deep groundwater plume. The treatment technologies to be evaluated in the pilot study will likely include in-situ chemical oxidation (ISCO) for source area soil and shallow groundwater, and bioaugmentation for the deep groundwater plume.

The hydraulic containment/pump and treat operation would involve pumping groundwater from the subsurface in both the source area (less than 50 feet below ground surface (bgs)) and the deeper groundwater zones at high enough rates to prevent further migration of contaminants in groundwater. The pumped groundwater would then be treated to remove volatile organic compounds (VOCs). The selected remedy also includes the implementation of institutional controls.

5.0 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

6.0 DATA CERTIFICATION CHECKLIST

The following information is included in The Declaration (Part 1) and the Decision Summary (Part 2) of this ROD, while additional information can be found in the Administrative Record file for this Site:

- Chemicals of concern (COCs) and their respective concentrations (see Section 14.7 and Table 2);
- Baseline risk represented by the COCs (see Section 14.10.3);
- Cleanup levels established for chemicals of concern and the basis for these levels. (see Section 15.3);
- How source materials constituting principal threats are addressed (see Section 18.0);
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the Baseline Human Health Risk Assessment and this ROD (see Section 13.0).

- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy (see Section 13.0);

- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (see Section 17.7);

- Key factor(s) that led to selecting the remedy (see Section 19.1).

7.0 AUTHORIZING SIGNATURE

The Director of the Superfund Division (EPA, Region 6) has been delegated the authority to approve and sign this ROD.

U.S. Environmental Protection Agency (Region 6)

By: Pamela Phillips, Acting Date: 9/23/2010

Samuel Coleman, P.E., Director
Superfund Division (6SF)

CONCURRENCE PAGE
RECORD OF DECISION
JONES ROAD GROUND WATER PLUME SUPERFUND SITE

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9/21/10
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Mark Peycke — Date
Chief, Superfund Branch, Office of Regional Counsel

9/23/10
Pamela Phillips — Date
Deputy Director, Superfund Division

PART 2: THE DECISION SUMMARY

8.0 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The National Superfund Database Identification Number for the Site is TXN000605460. The Site is located in the northwest portion of Harris County, Texas, as illustrated on the Vicinity Map (Figure 1). The source of Site contamination is the former Bell Dry Cleaners facility, which is located within the Cypress Shopping Center at 11600 Jones Road, approximately one-half mile north of the intersection of Jones Road and FM 1960, outside the city limits of northwest Houston, Texas. The location of the former Bell facility and surrounding areas is illustrated on the Site Map (Figure 2). The hazardous substances present at the Site include tetrachloroethylene, also known as perchloroethylene (PCE), and related daughter products trichloroethylene (TCE), 1,2-dichloroethylene (DCE), and vinyl chloride (VC).

The former Bell facility is located on property consisting of a rectangular parcel of land of approximately 2.1 acres in size improved with a one-story building (Cypress Shopping Center), which is about 30,870 square feet in size and contains approximately 10 tenant spaces. The building is of steel-frame construction with metal exterior walls and a flat roof. The former Bell facility was located on the western side of the building adjacent to Jones Road. In addition to the former Bell facility, other tenants of Cypress Shopping Center have included several restaurants, executive suites, a used book store, and an automotive service shop, which conducts engine overhaul, brake repair, transmission repair and general automotive maintenance activities.

The area around the Site is characterized by residential, commercial, and light industrial development. Residential development has been active since the 1960s effectively eliminating wildlife habitat from the area. Jones Road is the principal north-south corridor through the area, and FM 1960 (approximately one-half mile to the south) provides a southwest-northeast corridor. Commercial development is dominant along Jones Road with residential and limited commercial development along the side streets. Cypress Creek is located approximately one mile to the northwest of the subject area, and White Oak Bayou is located approximately 3,500 feet to the south.

Homes in the area have private water supply wells, and some homes share a single well with others. However, a water line funded by the EPA and the TCEQ was installed in the area to provide a safe source of drinking water to the community. Approximately 51% of the well owners agreed to discontinue use of their water wells and begin using water from the water line. The water line connections were completed in November 2008. However, participation in the government-funded water line project was voluntary, and about 49% of the well owners declined to participate in the water line project and continue to use their private water wells. Septic systems in the area are used in the absence of a publicly-owned treatment works (POTW) infrastructure.

Permits from the Harris County Subsidence District are required for the installation of new public water supply (PWS) wells and larger wells that could contribute to subsidence. In 2003 the Texas Department of Licensing and Regulation (TDLR) designated a restricted water well drilling area around the Jones Road Site at the request of TCEQ. In this area, any new well installed in the restricted area must be drilled to a greater depth, and specific construction methods must be used to prevent cross-contamination. In 2006, Harris County promulgated rules that delineated a "No New Wells" area, which supersedes the TDLR restricted area. Both the "No New Wells" area and the drilling restriction area are shown on Figure 3. The areas do not overlap exactly, but both are large enough to entirely contain the groundwater plume.

The EPA is the lead agency for the Site remedial action selection and cleanup activities, and the TCEQ is the support agency. The source of monies for the Remedial Investigation/Feasibility Study (RI/FS) is the Superfund.

9.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section of the ROD provides the history of the Site and a brief discussion of the EPA's and the State's removal, remedial, and enforcement activities. Table 1 summarizes additional historical information about the Site. The "Proposed Rule" proposing the Site to the NPL was published in the Federal Register (FR) on April 30, 2003 (68 FR 23094, April 30, 2003). The Site was finalized to the NPL on September 29, 2003 (68 FR 55875, September 29, 2003).

9.1 History of Site Activities

The Cypress Shopping Center was constructed in 1984, and the former Bell facility began dry cleaning operations sometime in 1988 based on the date that the Texas Water Commission (TWC) issued a Notice of Registration for Solid Waste Management to the former Bell facility. The former Bell facility continued operating through May 2002 when the dry cleaning operations were shut down. The former Bell facility used at least one dry cleaning machine along with conventional laundry equipment. PCE was used by the former Bell facility as a dry cleaning solvent.

Water and other contaminants were removed by a water separator and drained out of the dry cleaning machine on a continuous basis into a 5-gallon plastic bucket. The drained liquid was then discharged into a steam-heated ceramic pot to evaporate the liquid. The pot was vented through the rear wall of the facility directly to the atmosphere. However, a conflicting disposal practice was indicated by the operator of the facility, who believed that the waste stream had been formerly disposed to the facility's septic system or to the storm sewer located immediately behind the shopping center.

9.2 History of Federal and State Investigations and Removal/Remedial Actions

The Site has undergone numerous investigations beginning in 1994 and continuing through 2008. The previous investigations include the following:

- October 1994: a *Phase I Environmental Site Assessment* was performed at the Cypress Shopping Center housing the former Bell facility by Associated Environmental Consultants, Inc. for Metro Bank as part of a property transaction.

The result of this assessment identified two 30-gallon drums of PCE and one above ground storage tank of PCE located outside near the back door of the former Bell facility. The report indicated that there was no visual observation of leakage and the chemical appeared well contained.

- June 2001: another *Phase I Environmental Site Assessment* was performed at the Cypress Shopping Center by Geo-Tech Environmental, Inc. for Sterling Bank to assist in the underwriting of a proposed mortgage loan of the property. The Phase I ESA identified leakage from a dry cleaning machine that was draining into the storm drains behind the former Bell facility.

- June 2001: Geo-Tech performed a *Limited Site Assessment*. The assessment included the installation of three soil borings to 25 feet. The soil borings were subsequently converting to temporary monitor wells. The soil samples results indicated the presence of PCE and DCE. In addition, PCE, TCE, and DCE were detected in the groundwater.

- November 2001: Geo-Tech performed a *Limited Site Assessment* at the former Bell facility. Three permanent monitor wells and two soil borings were installed and samples collected. The results for some of the soil samples showed the presence of PCE, and TCE was detected in one sample. Analysis of the groundwater samples revealed the presence of PCE, TCE, DCE, and VC.

- January 2002: Three additional monitor wells and one additional soil boring were installed and samples collected. Results of the soil analysis showed PCE, and the groundwater samples revealed concentrations of PCE, TCE, DCE, and VC.

- January 2003: The TDLR notified all licensed drillers in Harris, Waller, Grimes, Ft. Bend, Brazoria, Galveston, Montgomery, San Jacinto, Chambers and Liberty counties of more stringent specifications for drilled water wells within the Jones Road Ground Water Plume area.

- August 2003 – May 2008: Shaw performed a remedial investigation (RI) at the Site, which characterized the nature and extent of constituents present in environmental media at the Site. Soil, groundwater, and vapor intrusion samples were collected, and a bench scale treatability study was completed to evaluate the application of in-situ chemical oxidation and bioremediation treatment technologies. Routine quarterly groundwater sampling was also performed.

- January 2008 – November 2008: The EPA conducted a time-critical removal action that included the installation of a water line and connections to homes and businesses at the Site. Construction of the water line began in January 2008 and was completed in November 2008. A total of 144 service connections were completed. The waterline is serviced by the White Oak Bend Municipal Utility District.

9.3 History of CERCLA Enforcement Activities

In July 2009, the EPA and the settling party, who owned the former Bell Dry Cleaners property and building from which the release occurred, signed a "Settlement Agreement". According to the Settlement Agreement, which became final and effective on September 24, 2009, the settling party agreed to continue to provide access to EPA and its representatives, and to implement any future institutional controls needed at the Site property that is owned by the settling party. The settling party also agreed to pay $160,000 for response costs. This Settlement Agreement was based on records, which showed that the former Bell Dry Cleaners operated the facility until 2002, that the former Bell Dry Cleaners was responsible for the release of PCE, and deed records showing that the settling party owned the former Bell Dry Cleaners property and building since November 4, 1994.

10.0 COMMUNITY PARTICIPATION

The TCEQ held open houses and workshops in the community to update the community on activities at the Site on October 17, 2002, November 18, 2003, April 20, 2004, June 9, 2005, May 3, 2007, and May 15, 2008. In addition, the Texas Department of State Health Services presented the draft report on the assessment of the Jones Road Groundwater Plume for public comment at a community meeting. The EPA awarded a technical assistance grant (TAG) to the Jones Road Coalition for Safe Drinking Water in May 2004.

The Remedial Investigation (RI) Report, the Feasibility Study (FS), and Proposed Plan for the Site were made available to the public in May 2010. These documents can be found in the Administrative Record file and the information repositories maintained at the Northwest Branch Harris County Library at 11355 Regency Green Drive in Cypress, Texas, and at the Texas Commission on Environmental Quality Central File Room at 12100 Park 35 Circle, Building E, Room 103, in Austin, Texas. The notice of the availability of these documents was published in the Houston Chronicle on May 23, 2010. A public comment period was held from May 25 to June 28, 2010. The EPA, with assistance from TCEQ, conducted a public meeting on June 3, 2010, to discuss the Proposed Plan and receive comments from the community. The public meeting was held at the Matzke Elementary School located at 13102 Jones Road in Houston, Texas. These activities meet the community participation requirement of CERCLA 300.430(f)(3) and the NCP. In the Responsiveness Summary, EPA responded to all comments received during the public comment period. The Responsiveness Summary is included as part of this ROD.

11.0 SCOPE AND ROLE OF RESPONSE ACTION

The NCP, 40 CFR Section 300.5, defines an operable unit as a discrete action that comprises an incremental step toward comprehensively addressing a site's contamination problems. The cleanup of a site may be divided into two or more operable units, depending on the complexity of the problems associated with the site. The EPA and TCEQ have chosen to address the Site as a whole without division into operable units. The selected remedy addresses all contaminated environmental media at the Site with the primary objectives of preventing human exposure to contaminated groundwater, of preventing or minimizing further migration of contaminants, and to return the groundwater to its expected beneficial use. The Remedial Action Objectives are described in more detail in Section 15 below.

12.0 SITE CHARACTERISTICS

12.1 Physical Site Characterization

The Jones Road Ground Water Plume Superfund Site is located in northwest Harris County, on the Gulf Coast Plain. This physiographic province is characterized by nearly flat topography. The coastal plain is gently inclined toward the Gulf of Mexico at about 5 feet per mile or less. Most of the coastal area is low-lying and drained by meandering bayous and sloughs.

Locally, the area is characterized by residential, commercial, and light industrial development on mostly flat terrain with ditches and depressions present only as created by landscaping and drainage projects. Jones Road is the principal north-south corridor through the area and is an undivided multilane road. FM 1960 (approximately one-half mile to the south) provides a major southwest to northeast travel corridor and is a larger undivided multilane road providing peripheral access around the northwest edge of Houston. Commercial development is dominant along FM 1960 and Jones Road with residential and limited commercial development along the side streets.

Surface water drainage is managed primarily through open roadside bar ditches. Drainage at the Site generally flows into the ditches, then to drainage ways that flow south to White Oak Bayou. White Oak Bayou flows southeast into downtown Houston where it enters Buffalo Bayou. Buffalo Bayou flows through the Houston Ship Channel towards Galveston Bay and thence to the Gulf of Mexico.

12.2 Geology

The subsurface geology was identified by using available hydrogeologic publications of the area and geophysical logs of local public water supply wells and monitor wells MW-10 through MW-19, along with the review of lithologic logs prepared during the drilling of the monitor wells. Based on this information, the local geology above approximately 400 feet below ground surface (bgs) consists of clay, sand, and silt deposited in fluvial depositional environments. At least six major water bearing units were identified from approximately 60 feet bgs to 430 feet bgs. Sand units tend to be discontinuous laterally and major channels have developed as indicated by downward scouring into underlying clay units. In some cases scouring has occurred completely through the underlying clays into the next sand unit or units below the clays, thus creating hydraulic communication between sand units.

The shallow subsurface geology at the Site was deposited in a fluvial depositional environment, as shown by discontinuous silt and sand units deposited under high to medium energy flow regimes, and thick clay units deposited under low energy flow regimes. The Site is generally underlain by high plasticity clay from the ground surface to a depth of approximately 20 feet bgs.

An interbedded zone consisting of sand, silt, and silty clay underlies the high plasticity clay, and extends from a depth of approximately 20 feet to 35 feet bgs. The interbedded zone appears to be laterally continuous at the Site. High plasticity clay underlies the interbedded zone, and extends from a depth of approximately 35 feet to 60 feet bgs. The high plasticity clay includes randomly distributed discontinuous sand lenses comprising less than ten percent of the high plasticity clay zone.

The deeper subsurface geology includes the following intervals:

- A well developed sand zone from approximately 60 to 110 feet bgs. This sand zone is dominant across the Jones Road Site, but thinned to the north in monitor wells MW-15 and MW-16.
- Next, a clay zone with minor sand lenses is encountered from approximately 110 to 150 feet bgs.
- Next, a sand unit underlies the clay and extends from approximately 150 to 190 feet bgs.
- Below the sand lies another clay unit from approximately 190 to 205 feet bgs.
- Next, another sand unit from 205 to 230 feet bgs.
- The next clay unit extends from approximately 230 to 260 feet bgs.
- Next, the clay is underlain by sand from approximately 260 to 295 feet bgs where the Chicot Aquifer screen intervals occur.
- A clay unit extends from approximately 295 to 410 feet bgs, where the suspected top of the Evangeline Aquifer exists. However, the stratigraphy at individual wells is highly variable and rarely matches this generalized progression exactly.

12.3 Hydrogeology

The two major uppermost aquifers are the Evangeline Aquifer and the Chicot Aquifer. The Chicot Aquifer is the youngest unit and it outcrops at the Site. The Evangeline Aquifer underlies the Chicot Aquifer. The Chicot Aquifer provides good to superior quality water for local residential and agricultural use, whereas the Evangeline Aquifer provides primarily superior quality water to local municipal water works.

At the Site, the Chicot Aquifer is unconfined and therefore the overlying shallow sediments are a source of recharge for the aquifer. The Evangeline Aquifer at the Site acts as a confined aquifer system as illustrated by monitor wells MW-17 and MW-18. These wells were installed adjacent to one another with screen intervals of 410 to 430 feet bgs (Evangeline Aquifer) and 284 to 297 feet bgs (Chicot Aquifer). Groundwater levels revealed a hydraulic head difference of approximately 80 feet between the two wells, suggesting that the Evangeline Aquifer is under a confined or semi-confined hydraulic condition.

Hydraulic conductivity values for the Chicot Aquifer in Harris County range from 14 to 35 feet per day (ft/d), and 20 to 100 ft/d in the Evangeline Aquifer. Groundwater in these aquifers generally flows from the northwest to the southeast perpendicular to the Gulf of Mexico coastline, but is locally influenced by large municipal water well pumping. Recent groundwater elevation data obtained from gauging of the Chicot Aquifer monitor wells indicates that the flow is consistent to the southeast.

The depth to the bottom of the Chicot Aquifer/top of the Evangeline Aquifer has been estimated to be approximately 400 feet bgs. At the Site, five major Water Bearing Units (WBUs) have been identified within the Chicot Aquifer and at least seven major WBUs have been identified within the Evangeline Aquifer.

The local hydrogeology is characterized by the interconnection of sand units by downward erosion of channels (cutting) into lower clay units. Correlation of geophysical logs indicates that some downward channeling may have connected upper sand units to lower ones, making them locally hydrologically connected. Downward channeling likely created groundwater migration between the Chicot and Evangeline Aquifers. Chemical analyses for inorganic data showed similarities between water quality samples collected from WBUs at varying depths. Similar groundwater geochemistry within the sand units may suggest possible groundwater mixing between the Chicot and Evangeline Aquifers. However, no soil geochemical data was available from individual WBUs to support the theory.

Looking at the shallower WBUs in more detail, the first (shallow) WBU was identified from a depth of approximately 20 feet to 35 feet bgs consisting of interbedded sand, silt, and silty clay. Groundwater yield is the first WBU is poor, and would likely not be a viable groundwater resource for drinking water. Hydraulic conductivities of soil samples collected between 22 to 32 feet bgs ranged from 2.67×10^{-7} centimeters per second (cm/s), or 0.0008 ft/d, to 1.48×10^{-6} cm/s, or 0.0042 ft/d.

Historical measured groundwater elevations within monitor wells that penetrate the shallow WBU have been highly erratic (highly variable in elevation), possibly due to discontinuous perched water-bearing lenses within the shallow source area WBU. Water level fluctuations in the shallow monitor wells appear to relate to precipitation events and periods of drought. No potentiometric maps for the shallow WBU have been prepared to date due to the erratic groundwater elevation data.

The second WBU was identified at a depth of approximately 60 feet, and extended to approximately 110 feet bgs. The second WBU was comprised of fine sand and likely represents the first major WBU of the Chicot Aquifer. No geotechnical testing was performed on samples collected from the second WBU, nor was any hydrologic testing performed on the aquifer.

12.4 Source of Contamination

The source of PCE, and related daughter products including TCE, DCE, and VC, to soil and groundwater at the Site is the former Bell Dry Cleaners facility. PCE is a chlorinated hydrocarbon that is widely used as a cleaning solvent in the dry cleaning industry. PCE is a colorless nonflammable liquid at room temperature and has a density of 1.62 g/cm^3 compared to water, which is 1.00 g/cm^3. The former Bell facility used PCE in at least one dry cleaning machine. Improper management and disposal of the dry cleaning fluid waste (PCE) resulted in the release of PCE to the environment. The former Bell facility operated over a period of 14.5 years from January 1988 through June 2002.

PCE tends to sink through water and can exist in a saturated environment as a separate dense non-aqueous phase liquid (DNAPL). Therefore, when PCE is introduced into the subsurface, it sinks to the lowest point it can attain until reaching a low permeable barrier. At this point it spreads out under the influence of gravity (it can actually oppose groundwater flow) or can sink even further if fractures are present in the low permeable barrier. Unlike other hydrocarbons that are less dense than water and float near the surface of the water table, PCE can sink through water hundreds of feet, thus contaminating a much larger volume of groundwater

12.5 Nature and Extent of Soil Contamination

Several limited soil investigations were performed in the area until October 2003, when a thorough investigation was conducted around the former Bell facility. PCE is the most prevalent contaminant within the upper 35 feet of Site soils, with highest concentrations detected in soil borings located behind the former Bell facility and representing the suspected primary discharge area. The highest PCE concentration in soil was 620 milligram per kilogram (mg/kg), within the 20 to 21-foot bgs sample collected from soil behind the former Bell facility near the storm drain grate. The sample results indicated that contaminants immediately behind the former Bell facility are present down to at least 50 feet bgs. No DNAPL was observed during the investigation. Figure 4 presents a map showing the distribution of PCE in soils around the former Bell facility. The map was prepared by plotting the highest PCE concentration detected in each sample location, regardless of depth, to a maximum depth of investigation of 50 feet bgs. The area of contaminated soil is estimated to be approximately 26,000 square feet.

Soil samples collected from the ditch in locations north and south of the former Bell facility showed no detectable PCE.

12.6 Nature and Extent of Ground Water Contamination

Groundwater contamination originates from soil contamination in the source area. Dissolution of PCE from impacted soils has created a groundwater plume that has migrated laterally and vertically away from the source area, and in a downgradient direction. In the shallow groundwater-bearing unit (less than 50 feet bgs), the distribution of PCE in groundwater indicates that the groundwater flow direction is southwest (Figure 5). However, the flow direction within a deep aquifer (screened within depths from approximately 233 to 296 feet bgs) was found to be highly consistent to the southeast, with a groundwater gradient ranging from 0.00248 to 0.00267 ft/ft (Figure 6).

Mapping of PCE in the shallow monitor wells (less than 50 feet bgs) indicates that the PCE plume in the shallow zone has moved farther downgradient from the source area since it was investigated in 2003. The highest PCE concentrations are now detected in monitor well MW-6 near the southwest corner of the Cypress Shopping Center facility. The concentration of PCE in monitor well MW-6 was 6,000 µg/L in August 2003, but increased to a concentration of 167,000 μg/L in February 2008, and then dropped to 7480 μg/L in May 2008. A similar increase in PCE concentrations has occurred in monitor well MW-1, which was installed immediately downgradient of the suspected source area. The concentration of PCE increased from 3,900 μg/L in August 2003 to 27,900 μg/L in February 2008. The increase in PCE in monitor well MW-1 could be an indication that PCE is still being released from soils in the suspected source area. Figure 5 shows the distribution of PCE in shallow (less than 50 feet bgs) groundwater for the February 2008 sampling event. The area of contaminated shallow groundwater is approximately 60,000 ft^2 (approximately 1.4 acres), with an average thickness of 10 feet, and an assumed value for porosity of 0.25. Based on these assumptions, the volume of contaminated shallow groundwater (less than 50 feet bgs) is approximately 1.1 million gallons.

The distribution of PCE in nearby deeper zone water wells occurs primarily west, southwest, and southeast of the source area, but water wells located north and northwest of the source area are also impacted. Movement of the plume north and far west of the source area would not be expected under static groundwater flow conditions and in uniform/isotrophic geologic formations. However, groundwater flow conditions are likely not static; flow may be influenced by seasonal pumping of numerous private and commercial water wells surrounding the source area.

Historically, increased PCE concentrations have been observed during February and May sampling events, and may be related to surface drought conditions that promote increased water demand (pumping from water wells) to irrigate lawns in the area. PCE concentrations as high as 590 μg/L have been detected in the deep groundwater, but recent maximum concentrations have been less than 200 μg/L. Also, the subsurface geology is not uniform/isotrophic; the geology is comprised of complex fluvial deposits, such as paleo river channels and over-bank deposits that may provide lateral pathways to aquifers north and northwest of the source area. Table 2 presents the quarterly PCE groundwater sampling results from May 2003 through 2008. Estimates of the plume size based on surface distance measurements to impacted water wells, suggests that the width is approximately 2,000 feet, the length is approximately 3,000 feet, and the depth is approximately 300 feet. Figure 3 shows the overlapping extent of deep groundwater plumes. The area of contaminated groundwater in the deeper groundwater is approximately 3,384,279 ft^2 (approximately 77 acres), with an average thickness of 127 feet, and an assumed value for porosity of 0.25. These assumptions give a source area contaminated groundwater volume of 804 million gallons. This is probably a high end estimate because the groundwater plume area at individual depth intervals is smaller than the overlapping plume extent.

At the Jones Road Site, the complex subsurface geology precludes identification of distinct and continuous WBUs within the Chicot and Evangeline aquifers. As a proxy for distinct WBUs, the wells have been divided into various categories by screened intervals and depth to allow some analysis of travel paths for PCE contamination in the groundwater. The monitor wells and water wells have been divided into five groups, less than 200 feet bgs, 200 to 230 feet bgs, 231 to 260 feet bgs, 261 to 300 feet bgs, and 301 to 540 feet bgs. There are 49 wells (23 sampled) in the less than 200 feet group, 158 wells (65 sampled) in the 200 to 230 group, 94 wells (40 sampled) in the 231 to 260 group, 60 wells (19 sampled) in the 261 to 300 group, and 45 wells (8 sampled) in the 301 to 540 group. There are also 193 sampled wells for which the screened interval and total depth are unknown.

12.6.1 Wells Less Than 200 Feet BGS

For groundwater less than 200 feet bgs, the groundwater samples consist of many shallow samples at and near the former Bell facility, including multiple samples from nine shallow source area (less than 50 feet bgs) monitor wells near the former Bell facility, and multiple samples from 14 water wells to the south and mostly west of the former Bell facility. These results indicate that PCE has traveled vertically down and primarily southwest in the groundwater less than 200 feet bgs. The inferred groundwater flow direction is to the southwest. Figure 7 shows the inferred groundwater plume of PCE greater than the maximum contaminant level (MCL) in groundwater less than 200 feet bgs for November 2007.

12.6.2 Wells 200 to 230 Feet BGS

For groundwater in wells between 200 and 230 feet bgs, the groundwater samples consist of multiple samples from 65 water wells mostly to the west of the former Bell facility, and some to the southeast. These results indicate that PCE continued downward and primarily southeast in the groundwater 200 to 230 feet bgs. The inferred groundwater flow direction is to the southeast. Figure 8 shows the inferred groundwater plume of PCE greater than the MCL in groundwater from 200 to 230 feet bgs for November 2007.

12.6.3 Wells 231 to 260 Feet BGS

For groundwater in wells between 231 and 260 feet bgs, the groundwater samples consist of multiple samples from 2 monitor wells and 38 water wells mostly to the west of the former Bell facility, and some to the southeast. These results indicate that PCE continued downward and slightly northwest in the groundwater 231 to 260 feet bgs. The inferred groundwater flow direction is to the southeast. Figure 9 shows the inferred groundwater plume of PCE greater than the MCL in groundwater from 231 to 260 feet bgs for November 2007.

12.6.4 Wells 261 to 300 Feet BGS

For groundwater in wells between 261 and 300 feet bgs, the groundwater samples consist of multiple samples from seven monitor wells and 12 water wells mostly to the west of the former Bell facility, and some to the southeast. In groundwater 261 to 300 feet bgs, PCE has not been found above the MCL. There have been some scattered detections at concentrations below the MCL, but nothing consistent. It appears that PCE continued downward and slightly northwest in the groundwater 261 to 300 feet bgs, but PCE at concentrations above the MCL have not reached lower WBUs. The inferred groundwater flow direction is to the southeast, which has been well documented by groundwater elevations in the monitor wells. Seven monitor wells surround the PCE plume, and PCE has not been detected in any of the monitor wells screened to total depths between 258 and 297 feet bgs. Although VC was detected in several monitor wells in November 2007, samples from February 2008 did not detect VC. This brief appearance of VC, a product of PCE degradation, may be an indication that natural degradation processes are active.

At the Jones Road Site, PCE, TCE, DCE, and VC were not detected above MCLs in water samples collected from water wells drilled deeper than 300 feet bgs. There has been only one detection of PCE (0.23 µg/L at WE10814 in February 2006), but it was less than the MCL.

12.7 Fate and Transport

PCE within soils below the former Bell facility provide a continuous source of contamination to shallow WBUs. The fluvial nature of subsurface strata may provide preferential pathways for contaminant transportation from the shallow WBUs to the deeper aquifers through coalescing paleo river channels or overbank deposits. Groundwater withdrawals through water wells may also influence the direction of plume movement toward the neighborhood, especially during seasons of high water demand. Migration to deeper WBUs in the Chicot Aquifer and upper Evangeline Aquifer may be limited by aquitards that separate the sand units.

The most recent estimate of the average groundwater plume migration rate, based on information available through May 2008, has been calculated to be 90 feet per year, based on a plume length of 1800 feet from the source area divided by 20 years, which is the approximate time since the PCE release began.

12.8 Indoor Air

Vapor intrusion is the migration of volatile chemicals from the subsurface into overlying buildings. A vapor intrusion study was performed at the former Bell facility in February 2008, *Vapor Intrusion Study* (Shaw, 2008b) to determine if a completed pathway(s) exists for intrusion of vapors to workers in the Cypress Shopping Center (from the former Bell facility), and if indoor vapors could pose an unacceptable risk of chronic health effects due to long term exposure.

During the *Vapor Intrusion Study*, two indoor ambient air samples and two sub-slab air samples were collected inside the former Bell facility, for analysis of volatile organic compounds (VOCs) using EPA Method TO-15. Results of laboratory analysis were compared to the Tier II Table from the *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (EPA, 2002). PCE and TCE exhibited higher concentrations than the EPA Tier II target concentrations for the two ambient air samples. In one ambient air sample, the PCE and TCE concentrations were 14 micrograms per cubic meter ($\mu g/m^3$) and 1.8 $\mu g/m^3$, respectively. For the other ambient air sample, the PCE and TCE concentrations were 9.5 $\mu g/m^3$ and 1.7 $\mu g/m^3$, respectively. Fourteen other chemicals were detected but did not exceed the Office of Solid Waste and Emergency Response (OSWER) Tier II target concentrations, and were suspected to be related to household compounds (and other chemicals stored on-site) that would be expected to be found at low concentrations in ambient indoor air. Eight chemicals were detected in the sub-slab samples. PCE and TCE concentrations were 47,300 $\mu g/m^3$ and

9,080 μg/m^3 in one sub-slab sample, and 59,700 μg/m^3 and 1,930 μg/m^3 in another sub-slab sample, respectively. The sub-slab samples were evaluated by estimating attenuation factors relative to soil or groundwater concentrations to indoor air concentrations. For indoor air, the *Vapor Intrusion Study* concluded that a complete pathway for vapor intrusion exists, but very little vapor is migrating from the sub-slab soil into indoor air (the slab is an effective barrier to limit vapor intrusion).

13.0 CURRENT AND POTENTIAL FUTURE LAND AND WATER USES

This section of the ROD discusses the current and reasonably anticipated future land uses, and current and potential groundwater at the Site. This section also discusses the basis for future use assumptions. There are no surface waters on or near the Site. There are ditches in the area that drain rainwater into White Oak Bayou, approximately 1.5 miles to the south.

13.1 Demography

The Site is located in northwest Harris County, Texas. The Site is primarily contained in census tract 5524, with some overlap into tract 5525. The zip codes for the area are 77065 (west of Jones Road) and 77070 (east of Jones Road). Based on the most current demographics (2007 census), Harris County has a population of approximately 3.94 million people and has a land area of 1,729 square miles. This equates to a population density of approximately 2,279 people per square mile. The median age is 31.2 years and the majority of the population is between 17 and under 65 years old. Harris County has experienced substantial population growth, with most of that growth due to immigrants from other states and/or other countries. The minority population is growing and is expected to continue to grow, surpassing more than half of the county population, making Harris County a "majority minority" area. The population of Harris County is projected to grow to over 6 million by the year 2040 according to census estimates.

The area around the Site follows these same general demographics. The 2000 population of census tract 5524 was 4,266, with a median age of 33.9 years. Tract 5524 had a slightly lower percentage of minorities and was slightly older than the whole of Harris County. Census tract 5524 is north of FM 1960 and west of Jones Road.

13.2 Current and Potential Future Land Uses

Due to lack of zoning, Houston and Harris County has a diverse mixture of urban commercial and residential land use. Land use near the Site is a mixture of commercial and light industrial properties (generally focused along the north/south Jones Road corridor) and residential properties primarily located west of Jones Road. The immediate area around the Site is transitioning from low density to higher density as the City of Houston grows larger bringing development to peripheral areas. Comparison of the 1995 Satsuma, Texas Quadrangle Map to current aerial photos available on the internet indicates that additional commercial and residential development is replacing open spaces. Locally in particular, athletic fields have been replaced by apartments, and a mobile home park is being replaced with high density individual homes. Further densification of residential and commercial development is expected. Little or no industrial development is expected to take place, and the power line and drainage right-of-ways in the area may be expected to remain free from further surface development.

13.3 Current and Potential Future Ground Water Uses

The Site is located along the border between Harris County annexed or non annexed areas of the City of Houston with limited water and sewer infrastructure currently in place. A majority of the private homes are therefore on private well water supply and septic systems. Local area municipal utility districts and water supply districts are connecting water and sewer systems as new homes are built in the area, which is replacing the use of individual water wells and/or septic systems. A water line funded by the EPA and TCEQ was installed in the area to provide a safe source of drinking water to the community. Approximately 51% of the well owners agreed to discontinue use of their water wells and begin using water from the water line. The water line connections were completed in November 2008. However, participation in the government-funded water line project was voluntary, and about 49% of the well owners declined to participate in the water line project and continue to use their private water wells.

Permits from the Harris County Subsidence District are required for the installation of new public water supply wells and larger wells that could contribute to subsidence. Harris County has designated a limited area around the Jones Road Site as an area of "No New Wells", in a contaminated plume area designated by the EPA and TCEQ. In addition, TDLR has designated a restricted water well drilling area around the Jones Road Site. In this area, any new well installed in the restricted area must be drilled to a greater depth, and specific construction methods must be used to prevent cross-contamination. The Harris County delineated "No New Wells" area supersedes the TDLR restricted area. Both the "No New Wells" area and the drilling restriction areas are shown on Figure 3. The Proposed Plan, in Figure 5, incorrectly shows the extent of Harris County's "no new wells" area; the area is actually shown by the heavy black line instead of the green line. The result is that the "no new wells" area does not extend to the south as far as shown in the Proposed Plan, and does not totally encompass the southern extent of the deeper zone groundwater plume. The existing Harris County "no new wells" area has exactly the same boundaries as the Final Waterline Service Area. A corrected figure will be included in the Administrative Record for this ROD and has been published on the TCEQ Jones Road web site (http://www.tceq.state.tx.us/remediation/superfund/jonesroad/index.html).

The institutional restrictions on drilling new water wells in the area are generally expected to prevent the drilling of new water wells in the future, however, the continued use of groundwater from wells already in place is expected to continue at least into the immediate future.

14.0 SUMMARY OF SITE RISKS

Under the NCP, 40 CFR § 300.430, the role of the baseline risk assessment is to address the risk associated with a Site in the absence of any remedial action or control, including institutional controls. The baseline assessment is essentially an evaluation of the no-action alterative. (See 55 FR 8666 and 8710, March 8, 1990). The baseline risk assessment also provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the 2008 Baseline Risk Assessment (BLRA) for the Site and included in the November 2008 Remedial Investigation Report (Section 7 of the RI Report). The BLRA includes both a Baseline Human Health Risk Assessment and a discussion on the Ecological Risk Assessment Checklist performed for the Site.

A four-step process is utilized for assessing Site-related human health risks in the BLRA:

(1) Identification of Chemicals of Potential Concern (COPCs) – identifies those contaminants that are carried forward through the BLRA process based on frequency of detection (FOD) and a comparative analysis to EPA human health risk-based screening levels or other appropriate levels (i.e., MCLs);

(2) Exposure Assessment – estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well water) by which humans are potentially exposed;

(3) Toxicity Assessment – determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response), and;

(4) Risk Characterization (including the uncertainty analysis) – summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of Site-related risks. With the completion of this four-step risk assessment process, those exposure pathways and COCs found to pose actual or potential threats to human health at the Site are identified for remedial action.

The ecological assessment evaluates potential effects on ecological receptors resulting from the chemicals identified in environmental media at the Jones Road Site. The ecological evaluation used the Tier 1 Exclusion Criteria Checklist described in the Texas Risk Reduction Program (TRRP) (30 TAC §350). The evaluation indicated that no further action is necessary to protect ecological receptors at the Site.

14.1 Identification of Chemicals of Potential Concern

The EPA used a two-step screening process to select COPCs in indoor air and groundwater for the BLRA. The process evaluated the FOD and compared Site data to EPA human health risk-based screening levels or other levels (i.e., MCLs). First, those constituents detected at a frequency of five (5) percent or less in indoor air or groundwater were considered for elimination from the BLRA. Second, for each constituent carried forward to the second step of the screening process, the maximum detected concentration was compared to its human health risk-based screening level or other screening level for indoor air and groundwater, as identified below:

- Indoor Air- EPA draft generic screening levels for indoor air vapor intrusion, based on a residential scenario, a target excess lifetime cancer risk (ELCR) of $1x10^{-5}$, and a non-cancer Hazard Index (HI) of 1.

- Ground Water- The federal MCL, if one is available. For those chemicals without MCLs, the EPA Region 6 Medium-Specific Screening Levels (MSSL) for tap water based on a residential scenario, a target ELCR of $1x10^{-6}$, and a non-cancer HI of 1. It should be noted that at the time the BLRA was written (2008), the Regional Screening Tables (RSL) were not in existence. It should also be noted that those constituents considered for elimination in the first step were also compared to the MSSLs.

14.2 Screening of Groundwater Data

To determine the initial COPCs for groundwater, the maximum detected value for each contaminant was compared to its risk-based screening level. The risk-based values are the MSSLs for groundwater and the groundwater ingestion ($^{GW}GW_{Ing}$) protective concentration level (PCL) as specified in 30 Texas Administrative Code (TAC) §350.71(k). The screening levels are associated with a cancer risk of $1x10^{-06}$ and a systemic noncancer HI of 1. Where a chemical has risk-based values for cancer and non-cancer endpoints, the lower (i.e., more stringent) value was used for the screen.

It was assumed in the risk assessment that groundwater from any of the wells could be used as a drinking water source. The BLRA for groundwater compared concentrations of COPCs to the lower value of the MSSLs and the groundwater ingestion ($^{GW}GW_{Ing}$) PCL. If the maximum concentration of a chemical is below the lower of the MSSL and the $^{GW}GW_{Ing}$ PCL values, the chemical was removed from consideration in the BLRA. If the maximum concentration of a chemical is above the lower of the MSSL or $^{GW}GW_{Ing}$ PCL values, the chemical was identified as a COPC for groundwater, and the risk from exposure to that chemical was assessed. If a chemical is shown to present either a carcinogenic risk of $1x10^{-06}$ or greater, or a noncancer Hazard Quotient (HQ) greater than one, it is considered a COC.

At chlorinated solvent sites, PCE and its degradation products are commonly identified as COCs, and their MCLs are selected as cleanup levels in the Record of Decisions. The basis for this approach is OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (EPA, 1991*)*, which states that chemical-specific standards that define acceptable risk levels (e.g., MCLs) may be used to determine whether an exposure is associated with an unacceptable risk to human health or the environment and whether remedial action is warranted.

14.3 Screening of Soil Data

Several soil investigations were performed in the area. Results of soil laboratory analysis indicated PCE, TCE, DCE, and VC impact to soil with samples collected from four different sample zones (1 to 2 feet bgs; 16 to 19 feet bgs; 19 to 30 feet bgs; and 30 to 35 feet bgs). Review of the sample results concluded that PCE is the most prevalent contaminant within the upper 35 feet of Site soils, with highest concentrations detected in soil borings located behind the former Bell facility and representing the suspected primary discharge area. The highest PCE concentration in soil was 260 mg/kg, within the 16 to 17-foot depth sample collected from soil boring located behind the former dry cleaning facility.

14.4 Screening of Indoor Air Data

Concentrations of vapor measured indoors at the Site were compared to draft EPA air screening levels (EPA, 2002). Site-related contaminants (PCE, TCE, and cis-l,2-DCE) were detected, with PCE and TCE measured above conservative draft EPA screening levels in both indoor air samples. The comparison for these Site-related compounds indicates that, although intrusion of is potentially a complete pathway, very little vapor is currently migrating from the sub-slab soil into indoor air (Shaw, 2008b).

Table 3
Indoor Vapor Concentrations of PCE and Degradation Products
Jones Road Superfund Site
Houston, Texas

Indoor (Ambient) Sampling Location	PCE (ug/m^3)	TCE (ug/m^3)	cis-1,2-DCE (ug/m^3)	trans-1,2-DCE (ug/m^3)	VC (ug/m^3)
West Sump	9.5	1.7	1.7	<0.79	<0.51
Center Room	14	1.8	1.8	<0.79	<0.51
Screening Value (Shaw, 2008b; EPA, 2002)	8.1	0.22	35	70	2.8
Determination	Designate as a COPC for BLRA	Designate as a COPC for BLRA	Exclude from BLRA	Exclude from BLRA	Exclude from BLRA

14.5 Further Reduction of COPCs for Groundwater

The quantitative assessment of exposure and risk for a site is based on those chemicals considered COPCs for the Site. The COPCs are a subset of all the chemicals positively identified at a site and are those chemicals associated with site activities, and which are expected to pose more significant risks than other less toxic and less prevalent site chemicals that are not evaluated quantitatively. Because PCE was used in the dry cleaning process at the former Bell Cleaners facility, PCE and its potential degradation products (TCE, and VC) are considered to be of potential concern at the Site. Therefore, none of the COPCs identified in groundwater was excluded from the BLRA based on a frequency of detection evaluation.

14.6 Regulatory Screen for Groundwater

PCE, TCE, and VC all have MCLs. Therefore, these chemicals are designated as COCs at locations where municipal water will be supplied, and are not carried through the risk assessment for these locations. For private water well locations where use of municipal water is not anticipated, the groundwater risk assessment is based on exposure to PCE, TCE, and VC. Table 4 presents the regulatory screen, showing COPCs from the risk-based screen along with available MCLs.

Table 4
Comparison of Groundwater Concentrations to Regulatory Screening Values (MCLs)
Jones Road Superfund Site
Houston, Texas

COPC in Groundwater	MCL (ug/L)	Determination
PCE	5	Designate as a COC
TCE	5	Designate as a COC
VC	2	Designate as a COC

14.7 Final COPC Selection

The final COPC selected for the Site are as follows:

- Groundwater COPCs*:* PCE, TCE and VC.
- Indoor Air COPCs: PCE, TCE and VC

14.8 Toxicity Assessment

Site contaminants were assessed for carcinogenicity and for non-carcinogenic systemic toxicity. The incremental upper bound lifetime cancer risk, presented in this ROD as the ELCR, represents the additional Site-related probability that an individual will develop cancer over a lifetime because of exposure to a certain chemical (i.e., this ELCR is in addition to the general nationwide lifetime risk of cancer which is about one in three). To protect human health, EPA has set the acceptable additional risk range for carcinogens at Superfund Sites from 1 in 10,000 to 1 in 1,000,000 (expressed as 1×10^{-4} to 1×10^{-6}). A risk of 1 in 1,000,000 (1×10^{-6}) means that one person out of one million people could be expected to develop cancer as a result of a lifetime exposure to the Site contaminants. Where the aggregate risk from COCs based on existing ARARs exceeds 1×10^{-4}, or where remediation goals are not determined by ARARs, EPA uses the 1×10^{-6} as a point of departure for establishing preliminary remediation goals. This means that a cumulative risk level of 1×10^{-6} is used as the starting point (or initial "protectiveness" goal) for determining the most appropriate risk level that alternatives should be designed to attain. Factors related to exposure, uncertainty and technical limitations may justify modification of initial cleanup levels that are based on the $1x10^{-6}$ risk level. For non-carcinogenic toxic chemicals, the toxicity assessment is based on the use of reference doses (RfDs) whenever available. A reference dose is the concentration of a chemical known to cause health problems. The estimated potential Site-related intake of a compound is compared to the RfDs in the form of a ratio, referred to as the HQ. If the HQ is less than 1, no adverse health effects are expected from potential exposure. When environmental contamination involves exposure to a variety or mixture of compounds, a HI is used to assess the potential adverse effects for this mixture of compounds. The HI represents a sum of the hazard quotients calculated for each individual compound. HI values that approach or exceed 1 generally represent an unacceptable health risk that requires remediation.

14.8.1 Summary Toxicity Profiles

This information is synthesized from toxicity information reviewed in the following sources:

- Agency for Toxic Substances and Disease Registry's (ATSDR) toxicological profiles.
- EPA's Integrated Risk Information System (IRIS) database.
- National Center for Environmental Assessment (NCEA) issue papers.

Based on the results of both the risk-based and regulatory screens, the only COPCs considered in these sections are PCE, TCE, and VC for groundwater ingestion (by users of groundwater from private wells not supplied with municipal water), and PCE and TCE for inhalation of indoor air due to vapor intrusion.

- **Tetrachloroethylene:** The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known. High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high." In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. Results of animal studies, conducted with amounts much higher than those to which most people are exposed, show that tetrachloroethylene can cause liver and kidney damage (source of the RfDo). Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant. The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may be reasonably anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

- **Trichloroethylene:** Drinking TCE for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear. Some studies of people exposed over long periods to high levels of TCE in drinking water or in workplace air have found evidence of increased cancer. Breathing small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty in concentration. Breathing TCE for long periods may cause nerve, kidney, and liver damage. Skin contact with TCE for short periods may cause skin rashes. Some studies with mice and rats have suggested that high levels of TCE may cause liver, kidney, or lung cancer. Although there are some concerns about the studies of people who were exposed to TCE, some of the effects found in people were similar to effects in animals. In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that TCE is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that TCE is "probably carcinogenic to humans."

- **Vinyl Chloride:** The effects of drinking high levels of VC are unknown. Breathing high levels of VC can cause dizziness or drowsiness, and breathing very high levels can cause unconsciousness or even death. Some people who are repeatedly exposed to high levels of VC have developed changes in liver structure, nerve damage, and immune reactions. The lowest levels that produce these effects in people are not known. When in contact with the skin, it can cause numbness, redness, and blisters. Animal studies have shown that long-term exposure to VC can damage the sperm and testes, as well as cause changes in liver structure (source of the RfDo). VC is a known carcinogen (Class A). Studies in workers who have breathed VC over many years showed an increased risk of liver cancer. Brain cancer, lung cancer, and some cancers of the blood also have been observed in workers.

14.8.2 Non-Carcinogenic Effects

- **Ingestion Route:** The COPCs considered for non-carcinogenic effects from groundwater ingestion are PCE, TCE, and VC.

- **Inhalation Route:** The COPCs considered for non-carcinogenic effects from inhalation of indoor air are PCE, and TCE.

14.8.3 Carcinogenic Effects

- **Ingestion Route:** The COPCs considered for carcinogenic effects from ingestion of groundwater are PCE, TCE, and VC.

- **Inhalation Route:** The COPCs considered for carcinogenic effects from inhalation of indoor air are PCE and TCE.

14.9 Exposure Assessment

In the exposure assessment part of the BLRA, a detailed evaluation was completed for each potential exposure scenario at the Site. The exposure assessment involves several key elements, including the following:

- Definition of local land and water uses.
- Identification of the potential receptors and exposure scenarios.
- Identification of exposure pathways and routes.
- Estimation of exposure point concentrations

14.9.1 Land and Water Uses

Land and water use patterns are used to determine potential exposure pathways. The Site is located in an area that is a mix of residential and commercial properties northwest of the City of Houston in Harris County, Texas.

14.9.2 Potential Effects on Human Health

The BLRA assessed whether Site-related contaminants pose a current or future risk to human health if no remedial actions are performed. A large part of the BLRA is the determination as to whether a complete exposure pathway exists. In a BLRA, exposure pathways are means by which hazardous substances move through the environment from a source to a point of contact with human receptors. A complete exposure pathway must have four parts: (1) a source of contamination, (2) a mechanism for transport of a substance from the source to the air, surface water, groundwater and/or soil, (3) a point where human receptors come in contact with contaminated air, surface water, groundwater or soil, and (4) a route of entry into the body. Routes of entry can be eating or drinking contaminated materials (ingestion), breathing contaminated air (inhalation), or absorbing contaminants through the skin (dermal contact). Risks can be assessed when an exposure pathway is complete. If any part of an exposure pathway is absent, the pathway is said to be incomplete and no exposure or risk is possible. In some cases, although a pathway is complete, the likelihood that significant exposure will occur is very small. Risk assessments include a "pathways analysis" to identify those pathways that are complete and most likely to produce significant exposure.

14.9.3 Soil Impact to Human or Environmental Receptors

The soils in the source area that are impacted with PCE near the ground surface (to a depth of approximately 20 feet bgs) are primarily covered with concrete associated with the building foundation (Cypress Shopping Center) and concrete parking lot/back alley. There is currently a low potential for human exposure to soil through dermal contact or ingestion. Exposure to burrowing animals is also unlikely considering the highly urbanized area and unlikely ecological habitat. The concern for PCE in soil at this Site is migration of PCE from soil to groundwater.

14.9.4 Identification of Exposure Pathways and Routes

The following discussion presents a brief overview of the various exposure pathways and routes, which were evaluated for the Jones Road Site:

- **Groundwater Exposure Pathways/Routes:** Residents at locations within the groundwater plume, who are not anticipated to receive municipal water, are expected to be exposed to constituents in groundwater through the ingestion pathway.

- **Indoor Air Exposure Pathways/Routes:** Inhalation exposure of residents and indoor workers to VOC vapors are evaluated.

14.9.5 Identification of Exposure Assumptions

Mathematical models were used to calculate the intakes (i.e., the doses) of the COPCs for each receptor, using applicable exposure routes. Variables used in estimating doses include the exposure values that are used in the model. These parameters include variables such as daily ingestion rate of water, exposure duration, and body weight. In general, the exposure parameters that were used are standard values recommended by national and EPA Region 6 guidance (Shaw, 2008c). Regardless of the exposure route, the intake is presented as an estimated daily dose in units of milligrams of chemical per kilogram of body weight.

14.9.6 Exposure Point Concentrations

- **Groundwater:** To characterize the risk from future direct exposure to PCE, TCE, and VC in groundwater, an Exposure Point Concentration (EPC) was calculated from the subset of private wells that are not anticipated to receive municipal water and samples collected between August 2005 and November 2007. The EPC represents the 95% UCL of the mean chemical concentration of each chemical. The 95% upper confidence limit (95% UCL) of each COPC in groundwater were as follows:

  (a) PCE = 3.71 ug/L.

  (b) TCE = 0.663 ug/L.

  (c) VC = 0.614 ug/L.

- **Indoor air:** The COPCs and the values used as the EPCs for the assessment of indoor air exposure are as follows:

  (a) PCE = 14 $\mu g/m^3$.

  (b) TCE = 1.8 $\mu g/m^3$.

14.9.7 Exposure Factors

Standard default exposure factors presented in EPA Risk Assessment Guidance (EPA, 2001) were used for adult/child residents and industrial workers, while a combination of exposure factors based on EPA guidance and best professional judgment was used for adolescent recreational users. For the central tendency (CT) exposure scenario, the same set of exposure factors as the Reasonable Maximum Exposure (RME) exposure scenario were used (i.e., only the EPC was different).

14.10 Risk Characterization

Risk characterization integrates the information developed in the Exposure Assessment and the Toxicity Assessment into an evaluation of the potential current and potential future health risks associated with the COPCs in the shallow groundwater and indoor air. Risk characterization uses the information on the known toxic effects for contaminants and interprets them with the relevant exposures to determine what effects might be expected for the identified exposure levels, durations, and routes likely to occur.

14.10.1 Carcinogenic Risk

Carcinogenic risk is calculated by multiplying the estimated Chronic Daily Intake (CDI) that is averaged over a lifetime (lifetime-averaged dose) by a chemical and exposure-route-specific (i.e., oral or inhalation) cancer Slope Factor (SF). The calculation of carcinogenic risk, which assumes a low dose and linear relationship, is illustrated by the following equation:

Cancer Risk = CDI x CSF; where:

CDI = Chronic daily intake (intake averaged over a 70-year lifetime; mg/kg-day).

CSF = Chemical and route-specific cancer SF $(mg/kg\text{-}day)^{-1}$.

The linear equation is valid only at risk levels below estimated risks of $1x10^{-02}$. The combined upper-bound cancer risk for a particular exposure route is then estimated by summing the risk estimates for all the COPCs for that route. This approach assumes independence of action by the chemicals (i.e., there are no synergistic or antagonistic interactions), and that all the chemicals have the same toxicological endpoint (i.e., cancer, regardless of target organ). The total upper-bound cancer risk to the receptor population is estimated by summing the combined cancer risks for all chemicals from all relevant potential exposure routes.

In assessing the carcinogenic risks posed by a site, the NCP establishes an excess cancer risk of $1x10^{-06}$ as a “point of departure” for establishing remediation goals. Excess cancer risks lower than $1x10^{-06}$ are not addressed by the NCP. Excess cancer risks in the range of $1x10^{-06}$ to $1x10^{-04}$ may or may not be considered acceptable, depending on site-specific factors such as the potential for exposure, technical limitations of remediation, and data uncertainties. Risks exceeding

$1x10^{-04}$, which are considered unacceptable, require action to reduce exposures.

14.10.2 Non-Carcinogenic Hazard

Non-carcinogenic health effects are evaluated by calculating a HQ and HI. This is accomplished by dividing the CDIs of the COPCs, which are averaged over the exposure period, by chemical and route-specific RfDs. The HQ for a particular chemical is the ratio of the estimated CDI through a given exposure route to the applicable RfD. The HQ-RfD relationship is illustrated by the following equation:

HQ = CDI/RfD; where:

HQ = Hazard Quotient (unitless).

CDI = Chronic daily intake (averaged over the exposure period; mg/kg-day).

RfD = Reference dose (mg/kg-day).

The HQs quotients determined for each COPC by exposure route (i.e., oral or inhalation) are summed within an exposure scenario to obtain a total HI. The HI is an expression of the additivity of non-carcinogenic health effects. Additivity in response is generally only a valid assumption if different COPCs affect the same target organ or physiologically integrated systems. Because the RfDs determined for the multiple COPCs in a given exposure scenario usually represent a range of different target organs or systems, the calculated HI is considered conservative.

The methodology used to evaluate non-carcinogenic hazard, unlike the methodology used to evaluate carcinogenic risk, is not a measure of quantitative risk. The HQ or HI is not a mathematical prediction of the incidence or severity of those effects, but rather a relative indication of the likelihood of adverse health effects occurring. If an HQ or HI exceeds 1, there is a potential for adverse non-carcinogenic health effects occurring under the defined exposure conditions. It is important to note, however, that the derivation of individual RfDs incorporates a margin of safety through division by uncertainty factors sometimes spanning several orders of magnitude, and the RfDs for multiple chemicals in a given exposure scenario can potentially represent a number of different toxic endpoints. Therefore, an HQ or HI greater than 1 does not necessarily indicate that an adverse non-carcinogenic effect will occur. An HI less than or equal to one indicates that it is unlikely for even sensitive populations to experience adverse non-carcinogenic health effects.

14.10.3 Summary of Results

Table 15.1, Table 15.2, Table 16.1, Table 16.2, and Table 17 present summaries of cancer risk and non-cancer hazard to receptors due to contact with COPCs in groundwater, as well as inhalation of indoor air due to vapor intrusion. As the RME scenario is used as the basis for decision at the Site, only RME results are presented; however, CT exposure would be expected to be less.

These risk results for inhalation of indoor air are not modeled, but are based on direct measurements of indoor air. As such, they do not account for any possible background sources of VOCs.

- **Carcinogenic Risk Results**: The estimated risk from ingestion of groundwater was calculated for the adult and child resident, and the adult worker. Carcinogenic risk from exposure to groundwater is presented as a range, due to the use of two SFs for vinyl chloride to characterize exposures during adulthood (adult risk) and continuous exposures from birth based on the ages at which exposure would theoretically begin. Estimated cancer risk for the adult resident hypothetically exposed to groundwater (that is not from a municipal supplier) ranged from $3.9x10^{-05}$ to $4.8x10^{-05}$, which reflects the contributions of two risk estimates for exposure to vinyl chloride. This range is within the acceptable range of $1x10^{-06}$ to $1x10^{-04}$ described in the NCP.

  The estimated risk from inhalation of indoor air was calculated for the adult and child resident, and the adult worker. Estimated cancer risk for the hypothetical resident at the Center Room location was $4.5x10^{-05}$. Estimated cancer risk for the hypothetical indoor worker at the Center Room location was $1.4x10^{-05}$. All cancer risk estimates for inhalation to indoor vapors are within the acceptable range of $1x10^{-06}$ to $1x10^{-04}$ described in the NCP.

- **Non-Carcinogenic Hazard Results:** The estimated non-cancer hazard from ingestion of groundwater was calculated for the adult and child resident. Non-cancer hazard from groundwater ingestion was not evaluated for the adult worker since the more conservative receptor (child resident) was evaluated in regards to groundwater ingestion. The HI for the child resident was within the acceptable risk value. Estimated HI for the adult resident hypothetically exposed to groundwater (that is not from a municipal supplier) is $7.1x10^{-02}$. The estimated HI for the child resident is $1.8x10^{-01}$. These estimates for noncancer hazard to residents are below the acceptable HI value of 1 described in the NCP.

  The hazard from inhalation of indoor air was calculated for adult and child residents, and the adult worker. Estimated non-cancer HI for the hypothetical adult resident at the Center Room location was $8.0x10^{-02}$. For the child resident, inhalation HI was estimated as $8.1x10^{-02}$. The estimated non-cancer hazard for the hypothetical indoor worker at the Center Room location was $3.7x10^{-02}$. These values are below the acceptable HI value of 1 described in the NCP.

14.11 Summary and Conclusions

Results of the BLRA show that:

- Chemicals identified as COPCs in groundwater from wells that are not anticipated to receive municipal drinking water (PCE, TCE and VC) do not represent unacceptable cancer risk or non-cancer hazard to residents or workers from groundwater ingestion based on the risk assessment methodology. However, concentrations of these chemicals do exceed MCL values specified in the Safe Drinking Water Act (SDWA). Therefore, these chemicals present an unacceptable risk to human health and the environment. This approach is based on OSWER Directive 9355.0-30, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, (EPA, 1991), which states that MCLs may be used to determine whether an exposure is associated with an unacceptable risk to human health or the environment and whether remedial action is warranted.

- Chemicals identified as COPCs based on indoor air measurements (PCE and TCE) do not represent an unacceptable cancer risk or non-cancer hazard to hypothetical residents or to workers at the Site. As such, they would not be identified as COCs based on this risk assessment.

14.12 Uncertainty Assessment

The following discussion presents the major uncertainties associated with this BLRA.

- Uncertainty in environmental data.
- Uncertainty in exposure assumptions.
- Uncertainty related to toxicity assumptions.

The following sections will discuss the potential impacts on the risk characterization from each of these sources of uncertainties.

14.12.1 Uncertainty in Environmental Data

To determine concentrations of contaminants in environmental media, and to determine the full extent of site-related contaminants, requires collecting and interpreting analytical data based on a sampling plan. The sampling plan is derived by using what is known of the Site operations and related chemicals, soil types, and hydrogeology, to select a sampling strategy likely to provide the most information. Because groundwater sampling has been conducted quarterly since 2003 at the Jones Road Site, sufficient data are available to characterize the shallow and deeper groundwater-bearing zones, and to capture uncertainties related to water level fluctuations and other seasonal variations that could affect contaminant concentrations.

Groundwater data used in the BLRA were collected from private water wells at locations not anticipated to receive municipal drinking water, and monitor wells screened at depths in the same groundwater zone. Because of the number of wells sampled (231), and the availability of data from quarterly sampling, seasonal variability is assumed to be reflected in the data. Use of the maximum concentration of each chemical measured in any well to screen chemicals for further evaluation provides a conservative identification of a higher number of COPCs. Similarly, use of the 95% UCL of the mean concentration of each chemical provides a conservative estimate of exposure concentrations that incorporate the variability contained in the data.

Because this approach to data evaluation is designed to bias the COPC identification toward more chemicals and their assessment at higher concentrations, it is expected that resulting exposures and risks are conservatively overestimated.

Indoor air concentrations were based on single measurements of detected values. These values are not expected to represent stable estimates of concentrations over time. The indoor samples were taken at locations of maximum known groundwater contamination to provide a high bias to indoor air concentration measurements. Additionally, the BLRA considers all measured concentrations of chlorinated solvents as vapor intrusion from groundwater sources, and the exposure assessment was based on the maximum measured concentration of each chemical. Because no correction was made to the measurements to remove other likely indoor sources of chlorinated solvents, this assumption is expected to overestimate the actual contribution from vapor intrusion. This application of indoor air measurements is expected to result in over estimations of exposure.

14.12.2 Uncertainty in Exposure Assumptions

A number of uncertainties are associated with assumptions made in the exposure assessment. Areas of uncertainty include the calculation of intakes and the selection of exposure parameters. Uncertainties regarding exposure assumptions result from the variability of the different parameters such as ingestion rates and exposure durations both within and across populations. Best estimates from data sources compiled by regulatory agencies were used in assessing potential exposures. The values used for exposure frequency and duration factors are expected to over estimate exposure, although how well these assumptions fit the receptor population is unknown.

The composition of the groundwater plume and indoor air was assumed to be constant for the duration of exposures (30 years for residential exposures). In fact, changes are expected to occur over time with distance from the source and with degradation of PCE into its breakdown products, which increase in relative concentration. This uncertainty could result in either an over- or underestimation of risk.

14.12.3 Uncertainty in Toxicity Assumptions

Assumptions of toxicity at expected exposure doses were based on unit exposure values determined by regulatory agencies. Because of uncertainties in the studies used in determining toxicity, single to multiple order-of-magnitude adjustments are made in the process of determining safe exposure levels. Therefore, it is anticipated that the values will tend to overestimate expected toxicity at a given level of exposure.

Multiple chlorinated solvents may act on similar target organs and systems to produce similar toxic responses, and additivity of responses is assumed. Data are not available for these COPCs to quantify synergistic or antagonistic effects. If these chemicals exhibit synergistic effects, risk estimates would be underestimated. This potential is somewhat balanced by use of maximum or RME chemical concentrations in the assessment.

Finally, although there may be sensitive subsets of the population at the Site, the toxicity reference values incorporate uncertainty factors that are designed to be protective of these sensitive subpopulations. Combined with the RME assumptions, the net result of the evaluation should be protective of those members of the population.

15.0 REMEDIAL ACTION OBJECTIVES

The basis for taking action at the Site is the exceedance of drinking water standards (i.e., the MCLs) in groundwater that is a current or potential source of drinking water. The Remedial Action Objectives (RAOs) were developed for the Site for those COCs that exceed the MCLs. RAOs are also defined such that Applicable or Relevant and Appropriate Requirements (ARARs) are met.

The Site consists of the source area near the former Bell Dry Cleaner facility, where shallow soil and groundwater were impacted, and the deeper groundwater plume underlying the Site.

The expectations for contaminated groundwater in the NCP and the Site-specific conditions can be used to define the RAOs that the selected remedy should accomplish at the Site. Considering expectations for contaminated groundwater in the NCP and the Site conditions, the RAOs that the selected remedy should accomplish for the Site include the following:

15.1 Source Area RAOs

- Prevent future human exposure to contaminated groundwater at unacceptable risk levels.
- Prevent or minimize further migration of contaminants from source materials to groundwater (source control).
- Prevent or minimize further migration of the contaminant plume (plume containment).
- Return groundwater to its expected beneficial uses wherever practicable (aquifer restoration).

15.2 Deep Groundwater Plume RAOs

- Prevent future human exposure to contaminated groundwater at unacceptable risk levels.
- Prevent or minimize further migration of the contaminant plume (plume containment).
- Return groundwater to its expected beneficial uses wherever practicable (aquifer restoration).

15.3 Cleanup Levels

The following cleanup levels provide numerical criteria that can be used to measure the progress in meeting in the RAOs for the cleanup. PCE and daughter product concentrations in groundwater that exceed federal MCLs pose a risk to human health if consumed. The MCL values, which are established to protect the public against consumption of drinking water contaminants that present a risk to human health, constitute the allowable exposure level for these contaminants in groundwater. Remediation goals for groundwater are set equal to the MCLs.

- Tetrachloroethylene 5 µg/L
- Trichloroethylene 5 µg/L
- cis-1,2-Dichloroethylene 70 µg/L
- trans-1,2-Dichloroethylene 100 µg/L
- Vinyl Chloride 2 µg/L

The RAOs for preventing or minimizing further migration of contaminants from source materials (source control) to groundwater will be deemed to be achieved when groundwater achieves the MCLs. Attainment of the MCLs in the groundwater will show that migration of contaminants has been sufficiently controlled because there will be no remaining risk from groundwater. Because groundwater contaminants may be initially reduced below the cleanup levels and then subsequently rebound, a period of monitoring is necessary after the cleanup levels are achieved to insure that any rebound does not result in a future exceedance of the cleanup levels. Therefore, the Remedial Design will include provisions for a monitoring period following attainment of the cleanup levels to insure that rebound above the cleanup levels does not occur.

16.0 DESCRIPTION OF REMEDIAL ALTERNATIVES

16.1 Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA, 42 U.S.C. § 9621, establishes several other statutory requirements and preferences, including: (1) a requirement that EPA's remedial action, when complete, must comply with all applicable, relevant, and appropriate federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; (2) a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (3) a preference for remedies in which treatment permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances. Response alternatives were developed to be consistent with these statutory mandates.

16.2 Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were considered in the FS to address the contamination at the Site. The remedial alternatives discussed in this ROD were developed by choosing appropriate technologies from among those considered in the FS. Although all the considered technologies have proven themselves to be applicable for remediating the COCs present at the Site, some of the technologies are not expected to be effective at the Jones Road Site. Others, while potentially effective, were not deemed sufficiently efficient for serious consideration. In summary, three options for management of the contamination, in addition to a no action alternative, were selected for detailed analysis.

16.3 Common Elements

The alternatives (with the exception of Alternative 1) include the common remedial components as described below.

16.3.1 Institutional Controls (ICs):

ICs are non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. Although it is EPA's expectation that treatment or engineering controls will be used to address principal threat wastes and that groundwater will be restored to its beneficial use whenever practicable, ICs play an important role in site remedies because they reduce exposure to contamination by limiting land or resource use and guide human behavior at a site. For instance, zoning restrictions prevent site land uses, like residential uses, that are not consistent with the level of cleanup.

ICs are used when contamination is first discovered, when remedies are ongoing, and when residual contamination remains on-site at a level that does not allow for unrestricted use and unlimited exposure after cleanup. The NCP emphasizes that ICs are meant to supplement engineering controls.

ICs will be required to aid in the management of the hazardous substances left on-site, and to ensure the protectiveness of the selected remedy. ICs will include either restrictive covenants or deed notices to notify current and potential future deed holders and renters of the presence of hazardous substances, pollutants or contaminants, the presence of soil and groundwater remediation and monitoring systems and equipment installed at the Site, and identification of the areas where the soil and groundwater remediation and monitoring systems are installed at the Site. These ICs are designed to prevent the ingestion, disturbance of and contact with contaminated soils, and the use of the contaminated groundwater for drinking, farming, and irrigation of crops, to ensure satisfactory operation of the groundwater remediation and monitoring system, and to protect the integrity of all engineering controls placed on the Site. The restrictive covenants and/or deed notices will identify the reason or purpose for such covenants/deed notices, the affected property, the selected remedy, engineering controls, ground water use restrictions prohibiting the use of contaminated shallow and deep groundwater, and land use restrictions prohibiting the disturbance of contaminated soils. The covenants and/ or deed notices will include land use restrictions on the affected property which prohibit any intrusive activities that could compromise the integrity, alter, damage, destroy or interfere with the effectiveness of the soil and ground water remediation and monitoring systems, associated equipment, and other engineering controls in place or placed at the Site.

In order to prevent people from drilling a domestic well into the Jones Road Site contaminated groundwater plume, and thereby to prevent future exposure to contaminated groundwater, EPA will utilize an IC approved by Harris County. The Harris County Commissioners Court adopted a rule entitled *Rules of Harris County For The Placement of Waterwells* on May 16, 2006. The rule prevents the drilling of a domestic well into a contaminated groundwater plume or aquifer. A contaminated groundwater plume or aquifer means any aquifer or portion of aquifer that has been confirmed as contaminated by the TCEQ or EPA. Harris County designated an area around the Jones Road Site, shown on Figure 3, as an area of "no new wells" in a contaminated plume area. Harris County implements this rule by requiring an applicant to submit a request for a water well; the proposed location is then checked to determine whether it is located in a "no new well" area. Although Harris County is responsible for enforcing this rule; the effectiveness of the above IC will be evaluated as a part of the five-year review process. If additional ICs are determined to be appropriate, the placement of additional ICs may be implemented prior to the end of the 10-year long term response action period (LTRA). The LTRA is defined as a fund-financed remedial action involving treatment or other measures to restore ground-or surface-water quality for a period of up to ten years after the remedy becomes operational and functional.

The Proposed Plan, in Figure 5, incorrectly shows the extent of Harris County's "no new wells" area; the area is actually shown by the heavy black line instead of the green line. The result is that the "no new wells" area does not extend to the south as far as shown in the Proposed Plan, and does not totally encompass the southern extent of the deeper zone groundwater plume. The existing Harris County "no new wells" area has exactly the same boundaries as the Final Waterline Service Area. The EPA will work with TCEQ and Harris County to enlarge the "no new wells" area by a sufficient amount to fully encompass the groundwater contamination at the Site. This may also entail provisions for an alternative water supply source so that a water supply is available once new wells are restricted.

Because the preferred remedial action is expected to achieve restoration of the aquifer as a drinking water source, the number of properties impacted by the groundwater contamination is expected to decline over a 10-year period. The EPA will implement a system of short-term ICs during the 10-year LTRA period to provide notice to new landowners and reminders to existing landowners of the presence of COCs above remedial goals in the groundwater beneath the property. These short term ICs are designed to prevent exposure to contaminated groundwater. These short-term ICs will consist of overlapping controls, which may include, but are not limited to, county health notices, site inspections, or semi-annual notices to property owners/renters. The time-frames for the short-term ICs will be further developed during the Remedial Design.

Prior to the completion of the LTRA period, the EPA will coordinate with the TCEQ to identify which properties may require ICs should groundwater contamination, exceeding the remedial goals, remain after the 10-year LTRA period. EPA will provide the required property information to the TCEQ for the placement of ICs and work with the TCEQ to request each affected property owner voluntarily agree to record a restrictive covenant to serve as the IC. If the property owner does not agree to the restrictive covenant, the TCEQ shall record a deed notice to serve as the IC. The TCEQ will utilize the TCEQ administrative rules found at 30 TAC § 350.111 to implement these ICs included in the deed notices and/or restrictive covenants established prior to the end of the LTRA period for the Site.

Institutional controls may be necessary to prevent any potential future exposures that may result from construction or maintenance activities that may penetrate the pavement or foundation surfaces and create an exposure pathway to underlying contaminated soils. Institutional controls to address this potential exposure pathway will be included in the selected remedy, and will be crafted during the Remedial Design.

The IC can consist of either a restrictive covenant or a deed notice.

- Restrictive Covenant. An instrument filed in the real property records of the county where the affected property is located, which ensures that the restrictions will be legally enforceable by the TCEQ when the person owning the property is the innocent landowner. The covenant can only be filed by the property owner and is binding on current and future owners and lessees even if they are innocent owners or operators.

- Deed Notice. An instrument filed in the real property records of the county where the affected property is located and is intended to provide notice regarding the conditions of the affected property.

The ICs will be maintained until the concentration of contaminants in the groundwater are below levels that allow for unrestricted use and unlimited exposure, i.e., the concentrations of contaminants in the groundwater are below the established remedial goals.

16.3.2 Groundwater Monitoring

One of the performance measures for evaluation of the remedial alternatives is the collection of contaminant concentration data from the groundwater monitoring network. Groundwater monitoring would be quarterly for the first two years, and semiannually for years 3 through 5. This would be reduced to annual sampling if data appropriately demonstrates the effectiveness of remedy performance and shows enough stability to permit the reduction.

16.3.3 Indoor Air Sampling

Because the indoor air samples were collected in February, and may not be representative of the indoor air concentrations during the hotter summer months, additional indoor sampling will be performed during the summer as a part of the Remedial Design to confirm the initial results.

16.3.4 Five-Year Reviews

Because all alternatives will result in hazardous substances remaining on-site above health-based concentration levels, a review will be conducted within five years of commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. The five year reviews will continue no less often than every five years as long as the Site contains contamination above levels that allow use for unlimited and unrestricted exposure.

16.3.5 Operation and Maintenance

All alternatives except the No Further Action alternative include operation and maintenance activities and costs to continue operating and/or monitoring the remedy in the future. The present worth of the costs, which is shown for each alternative below, is estimated using a 7% discount factor. Present worth is the value in current dollars of these future costs. The future costs are discounted, or reduced, to reflect that future dollars are worth less than current dollars based on the earning capacity of money. For cost estimating purposes, the costs for all remedial alternatives, except the No Further Action alternative, assume a 30-year operational timeframe.

16.3.6 Plugging of Water Wells

With completion of the water line in November 2008 by EPA and TCEQ, a total of 144 water wells from residences and businesses were replaced by connections to the water line. Based on comments received at the Public Meeting, EPA will plug and abandon the water wells where water service is provided by the waterline. Plugging of these wells is necessary because active pumping of the wells may cause migration of the plume, and the old water wells may act as a conduit for contaminant migration. In a cooperative effort, EPA will coordinate with TCEQ to obtain EPA property access agreements from the homeowners for the purposes of sampling and monitoring wells, conducting remedial activities, and plugging and abandoning wells. However, EPA does not plan to begin plugging the wells until a determination is made regarding which wells may be needed for the groundwater monitoring network, for water extraction or injection wells, or for deep zone bioaugmentation treatment injection. The Remedial Design will determine the locations of these wells.

16.3.7 Water Service Connections

The EPA will provide people in the Site vicinity another opportunity to sign up to be connected to a water supply without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity.

16.4 Summary of Remedial Alternatives

16.4.1 Alternative 1: No Further Action

Estimated Implementation Time: 0 months
Estimated Capital Cost: $0
Estimated Annual O&M Costs: $0
Estimated Present Worth (7%): $0
Time to Achieve RAOs: not achieved

The No Further Action alternative constitutes the absence of any remedial actions. Under this alternative, no measures would be taken to address soil or groundwater contamination, and no measures would be taken to prevent human exposure to them. The RAOs will not be achieved. No Further Action is considered in this evaluation as a baseline for comparison to all other potential remedial actions, as required by the NCP.

16.4.2 Alternative 2: In-Situ Treatment

Estimated Implementation Time: 12 months up to 4 years if 4bioaugmentation treatments are needed (one per year)
Estimated Capital Cost: $3,336,660
Estimated O&M Costs: $2,022,510
Estimated Total Cost: $5,359,170
Estimated Present Worth (7%): $4,286,779
Time to Achieve RAOs: approximately 30 years

The in-situ treatment alternative would involve treating the soil and groundwater without removing them. The treatments would be as recommended in the Final Treatability Study Report contained in the Administrative Record. The treatability study evaluated ISCO, biostimulation, bioaugmentation, and zero valent iron (ZVI) as potential treatments. Treatment of the source area soil and groundwater with permanganate was recommended, along with bioaugmentation with lactate for deeper groundwater. Figure 3 shows the expected in-situ treatment areas. A pilot study will be conducted during the Remedial Design to prepare the actual design the in-situ treatments to be the most effective and appropriate for the source area soil and groundwater, and the deep groundwater plume.

Institutional controls for soil and groundwater as described above would be implemented.

ISCO would be applied to soil and shallow groundwater in the source area to destroy source area contaminants. Permanganate solution has been used for quantity and cost estimating purposes. Chemical oxidant would be injected through approximately 144 temporary injection sites to 50-feet bgs, spaced 20 feet apart, to treat the 160 by 320 foot area shown on Figure 3. It is anticipated that two applications of permanganate would be made to the shallow soils and groundwater approximately one year apart. Injections would be made from the outside in and from the bottom up to minimize horizontal and vertical induced migration caused by fluid displacement.

Bioaugmentation would be applied to hot spots within the deeper zones of groundwater to both destroy contaminants and enhance natural attenuation of contaminants. Monitor wells deeper than 260 feet bgs do not have detectable PCE concentrations. The number of water wells with PCE concentrations above the MCL in February 2008 was 41. The 10 most contaminated of these water wells would have bioaugmentation applied. Further applications of bioaugmentation (both in timing and choice of wells) would depend on the results of ongoing monitoring results. It is anticipated that four applications of bioaugmentation would be applied to the 10 most contaminated water wells, with at least one year between applications.

Preliminary design field investigations needed for this alternative may include:

- Hydraulic testing (slug test) to determine the hydraulic properties of the shallow groundwater;
- Hydraulic testing (slug test) of deeper groundwater zones;
- Pilot study to determine injection radius of influence and effectiveness of in-situ ISCO and bioaugmentation treatments; and
- Determining screen depths for inactive wells with unrecorded screens.

At the anticipated permanganate application rate to saturated soil a total of 2,800 kg of permanganate would be applied to the source area soil and groundwater by direct injection. Direct injection (jet grouting) is a commercial technology that is readily available and recommended for the application of permanganate.

Bioaugmentation would be applied through existing inactive water wells with permission/access granted to EPA from the well owner. The well owners who signed the TCEQ water line agreement relinquished control of their water wells to the TCEQ. These wells would be considered first for bioaugmentation. Some adaptation of the well plumbing would be necessary to inject bioaugmentation solution through the existing wells.

For performance monitoring, a reduced number of water wells would be sampled, although the wells sampled may vary from event to event. The 19 existing monitor wells would be sampled along with a representative selection of 31 private water wells (50 total). Water wells in each depth category would be sampled with wells both within the plume and outside the plume selected for sampling. During the remedial design, a formal list of wells to sample would be selected. All samples would be tested for VOCs to track plume concentrations and limits. A subset of 20 wells would be tested for MNA indicator parameters (e.g., pH, TOC, ORP, DO, sulfate/sulfide, nitrate/nitrite, carbon dioxide, ferrous iron, alkalinity, and bacterial community) during the quarterly sampling events to help evaluate the bioaugmentation treatments and MNA performance.

The cost estimates for Alternative 2 here differ in several ways from the cost estimates included in the FS. The cost estimate here includes the capital and O&M costs from the FS, with the addition of the following costs:

- $1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).
- $288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).
- $433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).

16.4.3 Alternative 3: Hydraulic Containment/Pump and Treat

Estimated Implementation Time: 12 months
Estimated Capital Cost: $4,439,040
Estimated O&M Costs: $3,776,310
Estimate Total Cost: $8,215,350
Estimated Present Worth (7%): $6,244,771
Time to Achieve RAOs: approximately 30 years

The hydraulic containment/pump and treat alternative would involve pumping groundwater from the subsurface in both the source area (less than 50 feet bgs) and the deeper groundwater zones at high enough rates to prevent further migration of contaminants in groundwater. The pumped groundwater would then be treated to remove VOCs. Alternative 3 does not directly address soil; although, some remediation of soils is expected as a result of pumping.

Institutional controls for soil and groundwater as described above would be implemented. For the shallow groundwater at the source area (less than 50 feet bgs), and depending upon hydraulic properties to be determined during the design phase, contaminated groundwater would be extracted at MW-1 and MW-6 to hydraulically control the migration of PCE contaminated groundwater. The extracted groundwater would be treated by air stripping to remove the PCE and the treated groundwater would be reinjected into the source area groundwater or disposed through the local sanitary sewer system or to an outfall under Texas Pollutant Discharge Elimination System (TPDES) permit.

For deeper groundwater, the plume appears to have traveled differentially due to the nature of sand/clay packages and local groundwater withdrawal rates. Hydraulic containment/pump and treat wells would need to be placed to intercept the plume accordingly. A total of 6 deep extraction wells would be needed, each with an extraction rate of 20 gallons per minute (gpm) at each well, for a total extraction rate of 120 gpm (Shaw, 2009b).

All of the extracted groundwater would be treated by air stripping to remove PCE contamination and the air waste stream would be run through GAC for polishing if necessary to prevent public exposure to PCE by inhalation. Treated groundwater would be released to the Harris County Flood Control District (HCFCD) drainage ditch, contingent on approval, discharged to sanitary sewer and POTW, if available, or reinjected into the WBU to offset potential subsidence. For the purpose of estimating costs, reinjection into the deep groundwater is assumed using six injection wells.

Preliminary design field investigations needed for this alternative include:

- Hydraulic testing (slug test) of shallow groundwater zones;
- Hydraulic testing (slug test) of deeper groundwater zones;
- Startup testing of air stripper treatment system; and
- Determining screen depths for inactive wells with unrecorded screens.

In the past, intermittent pumping from water wells may have served to hydraulically contain or partially contain the groundwater plume in deeper groundwater. With completion of the water line in November 2008 and subsequent reduced pumping of groundwater, plume containment may be lessened. The *Simple Capture Zone Modeling* (Shaw, 2009b, Appendix B) included in the Administrative Record indicates six wells in the Chicot Aquifer pumping at 20 gpm may be enough to establish hydraulic control of the deeper groundwater plume. Pumping deep groundwater for hydraulic containment/pump and treat would generate approximately 120 gallons per minute according to the *Simple Capture Zone Modeling*. This pumping rate might be large enough that the Harris-Galveston Subsidence District would object to this strategy. Reinjection of the treated groundwater may offset this concern. The groundwater pumped out would have to be treated before release or reinjection.

The amount of groundwater generated by hydraulic control in the shallow source area (less than 50 feet bgs) is expected to be negligible by comparison.

The air stripping/GAC treatment system would be divided into two parts, one east of Jones Road and one west of Jones Road. The open space behind (east of) the Cypress Shopping Center might serve as a location for the east treatment system. Open space along the south side of Tower Oaks Boulevard might serve as a location for the west treatment system. Institutional controls will be used to protect the long-term location and integrity of the treatment plants. The EPA will attempt to include a restrictive covenant to be filed by the property owner as a provision of the access agreements. As an alternative, a deed notice to be filed by TCEQ may be used in the absence of a restrictive covenant. Reinjection of treated groundwater might be used to mitigate or reduce subsidence caused by groundwater extraction. Reinjection of waste water from a Superfund site, (even if cleaned to concentrations below the laboratory detection limit) may not be permissible into a Class 1 drinking water aquifer. Reinjection of water will also require added energy consumption and additional operational costs associated with mechanical upkeep of injection wells, and reinjection of groundwater can also cause changes in groundwater flow patterns. The six injection wells may be installed upgradient of the deep groundwater plume for enhanced flushing of contaminants, or downgradient of the plume for increased hydraulic control. Locations of injection wells will be selected during remedial design.

Reinjecting treated groundwater to the deeper WBUs would require effluent discharge monitoring. Effluent testing on a monthly basis is assumed for purposes of the cost estimate. Recommended testing would likely include VOCs, semivolatile organic compounds; biochemical oxygen demand; pH; TOC; total kjeldahl nitrogen; ammonia nitrogen; nitrate and nitrite; total phosphorus; total suspended solids; oil and grease; and chemical oxygen demand. As treated groundwater would likely have relatively homogenous characteristics, the cost estimate assumes monthly testing for wastewater discharge characteristics would be sufficient.

Direct release of treated groundwater to a HCFCD drainage ditch would require approval from Harris County. Previously, this approval could not be obtained for disposal of well production water. For this reason, discharge to a ditch is not expected and is not reflected in the cost estimates.

Release by discharging to a sanitary sewer to a publicly-owned treatment works (POTW), if available, would require identifying a POTW willing to accept the water. The Jones Road Site is largely served by individual septic systems, so there may be no simple way to discharge directly to a sanitary sewer. Discharge to a sanitary sewer is not expected, and is not reflected in the cost estimates.

The performance of hydraulic containment/pump and treat would be monitored through routine groundwater sampling. A reduced number of water wells would be sampled, although the wells sampled may vary from event to event. The 19 existing monitor wells would be sampled along with a representative selection of 31 private water wells (50 total). Water wells in each depth category would be sampled with wells both within the plume and outside the plume. All samples would be tested for VOCs to track plume concentrations and limits. A subset of 20 wells would be tested for MNA indicator parameters during the quarterly sampling events to help evaluate MNA performance. Results would be used to verify hydraulic containment/pump and treat and evaluate the success of the hydraulic containment/pump and treat system.

The cost estimates for Alternative 3 here differ in several ways from the cost estimates included in the FS. The cost estimate here includes the capital and O&M costs from the FS, with the addition of the following costs:

- $1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).
- $288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).
- $433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).

16.4.4 Alternative 4: In-Situ Enhancements to Pump and Treat (Selected Remedy)

Estimated Implementation Time: 12 months up to 4 years if 4bioaugmentation treatments are needed (one per year)
Estimated Capital Cost: $5,699,520
Estimated O&M Costs: $3,776,310
Estimated Total Costs: $9,475,830
Estimated Present Worth (7%): $7,425,852
Time to Achieve RAOs: approximately 30 years

In-situ enhancements to the pump and treat alternative would involve pumping groundwater from the subsurface in both the source area and the deeper groundwater zones. Chemical or bioremediation enhancements would be added through injection wells to enhance destruction of PCE in the soil and groundwater.

This alternative is substantially similar to Alternative 3 with the addition of in-situ enhancement such as that described in Alternative 2. Institutional controls for soil and groundwater as described above would be implemented. In- situ treatment would be applied to soil and groundwater in the source area (less than 50 feet bgs).

ISCO would be applied to soil and shallow groundwater in the source area to destroy source area contaminants. This activity would be performed as described in Alternative 2.

Bioaugmentation would be applied to the deeper zones of groundwater with lower PCE concentrations to both destroy contaminants and enhance natural attenuation of contaminants. This activity would be performed as described in Alternative 2.

Pumping of groundwater for hydraulic control and treatment would be performed as described in Alternative 3, with exceptions made for periods of in-situ treatment application to allow time for the applied treatments to effectively destroy contaminants. It is anticipated that hydraulic containment/pump and treat of the source area shallow groundwater (less than 50 feet bgs) will be unnecessary after ISCO application to the area.

Preliminary design field investigations needed for this alternative include:

- Hydraulic testing (slug test) to determine whether shallow groundwater satisfies the regulatory threshold value required for a saturated formation to be classified as a WBU (30 TAC 350.52);
- Hydraulic testing (slug test) of deeper groundwater zones;
- Pilot study to determine injection radius of influence and effectiveness of in-situ ISCO and bioaugmentation treatments;
- Startup testing of air stripper treatment system; and

- Determining screen depths for inactive wells with unrecorded screens.

The cost estimates for Alternative 4 here differ in several ways from the cost estimates included in the FS. The cost estimate here includes the capital and O&M costs from the FS, with the addition of the following costs:

- $1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).
- $288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).
- $433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).

17.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. These nine criteria are categorized into three groups: threshold, balancing, and modifying. To be eligible for selection, a remedial alternative must meet the two threshold criteria described below, or in the case of ARARs, must justify why a waiver is appropriate. The two threshold criteria are:

- Overall Protection of Human Health and the Environment.

- Compliance with Applicable or Relevant and Appropriate Requirements.

The balancing criteria are used to weigh major tradeoffs among alternatives. The balancing criteria are:

- Long-term effectiveness and permanence.

- Reduction of toxicity, mobility, or volume of contaminants through treatment.

- Short-term effectiveness.

- Implementability.

- Cost.

The modifying criteria may prompt modification to the preferred remedy and are as follows:

- State/support agency acceptance.

- Community acceptance.

17.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

The overall protection of human health and the environment is a threshold criteria and must be met in order for the alternative to be eligible for selection as a remedial action. Alternative 1, No Further Action, does not meet this threshold; therefore, it cannot be selected. All of the other alternatives meet this minimum and are eligible for selection. Alternative 2 protects human health and the environment by in-situ destruction of contaminants, which will shorten the required monitoring period. Alternative 3 contains, pumps, and treats contaminated groundwater, removing contaminants to protect human health. Alternative 4 adds in-situ enhancements to Alternative 3 to reduce active treatment time. All of the alternatives rely on ICs to prevent the installation of groundwater wells for a source of drinking water and to prevent exposure to contaminated soils. All alternatives also include plugging and abandonment of water wells where people connected to the waterline installed by EPA and TCEQ. Plugging of these wells is necessary because active pumping of the wells may cause migration of the plume, and the old water wells may act as a conduit for contaminant migration and potentially contaminate new areas.

17.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP § 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate. Finally, there is a category of other federal or state advisories, criteria, or guidance, which may be used to develop a CERCLA remedy that falls into a category called "to be considered (TBC)" guidelines 40 C.F.R. § 300.400(g)(3).

The ARARs pertaining to remedial action at the Site are divided into action, chemical, and location specific categories as described below. In addition, TBCs criteria are discussed. These specific categories are described as follows:

- **Action Specific ARARs** are technology or activity based requirements or limitations on actions taken regarding hazardous substances, pollutants, and contaminants.

- **Chemical Specific ARARs** are promulgated values that include health or risk based standards, numerical values, or methodologies that, when applied to site-specific conditions, establish the acceptable amount or contaminant concentration that may be detected in or discharged to the ambient environment. These values focus on protecting public health and the environment. However, technological or cost limitations may influence some values, such as MCLs.

- **Location Specific ARARs** relate to the geographical position of the Site, such as state and federal laws and regulations that protect wetlands or construction in flood plains. The extent to which any location specific requirements may be considered depends solely on the sensitivity of the environment and any possible impact caused by remedial activities.

- **To-be-considered (TBC)** criteria are non-promulgated, non-enforceable guidelines, or criteria that may be useful for developing a remedial action or that are necessary for evaluating what is protective to human health and/or the environment. Examples of TBC criteria include EPA drinking water health advisories, reference doses, and cancer slope factors.

ARARs for the Site include the following:

Location-specific ARARs:

- Permits and Enforcement, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(e): This section of CERCLA states that "no federal, state, or local permit shall be required for any portion of a CERCLA remedial action that is conducted on the site of the facility being remediated," this includes exemption from the RCRA permitting process, note that the substantive requirements of the regulations must still be met.
- Clean Air Act Section 101; 40 C.F.R. § 52: This section calls for development and implementation of regional air pollution control programs.
- 40 C.F.R. § 50, National Primary and Secondary Ambient Air Quality Standards: This section establishes Ambient Air Quality Standards.
- Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, §§ 208(b) and 304: The proposed action must be consistent with regional water quality management plans as developed under Section 208 of Clean Water Act. Section 304 contains water quality criteria.

- 40 C.F.R. § 131, Water Quality Standards: States are granted enforcement jurisdiction over direct discharges and may adopt reasonable standards to protect or enhance the uses and qualities of surface water bodies in the state. EPA has authorized the State of Texas to enforce most water quality standards.
- Texas Risk Reduction Program (TRRP), 30 TAC § 350, Subchapter A, General Information: The criteria used to define a groundwater-bearing unit (GWBU) at the site are specified in 30 TAC § 350.4(a)(40).
- TRRP, 30 TAC § 350, Subchapter C, Affected Property Assessment; Groundwater Resource Classification: The criteria used to establish the Class 1 groundwater classification at the site is specified in 30 TAC § 350.52(1)(A).
- TRRP, 30 TAC § 350, Subchapter D, Development of Protective Concentration Levels: The criteria used to conduct an ecological risk assessment at the site and establish that the exclusion criteria were met are specified in 30 TAC § 350.77(b).
- TRRP, 30 TAC § 350, Subchapter F Institutional Controls: The criteria used to establish the use of institutional controls and the type(s) of institutional controls at the site are specified in 30 TAC § 350.111.
- Texas Department of Licensing and Regulation (TDLR): Licensed drillers/drilling companies are notified via TDLR notices/letters that define designated restricted drilling areas and advise drillers of potential contamination and the contaminated water bearing units. Based on this information the TDLR may prescribe more stringent site-specific drilling procedures, well construction, and well completion specifications. A designated restricted drilling area does not prohibit drilling and there is no "registration" by which to initiate enforcement. The TDLR may learn of drilling in a restricted drilling area via a complaint or after a State of Texas well report has been submitted to the TDLR by the licensed driller. If the well report indicates the well was not constructed and completed in accordance with the TDLR specifications defined for the restricted drilling area, the TDLR may initiate enforcement based on improper well construction and/or completion.
- Rules of Harris County for the Placement of Water Wells, Section 6 (2)(B)(i): The county engineer shall approve the drilling of a private water well if the well will not be drilled into or through an aquifer or groundwater plume that has been confirmed as contaminated by the Texas Commission on Environmental Quality or the United States Environmental Protection Agency, and placement of the well will not violate the rules adopted by the Texas Commission of Licensing and Regulation under Chapters 1901 and 1902, Occupations Code.

Chemical-specific ARARs:

- SDWA, 42 U.S.C. §§ 300f et seq.): These sections establish the basic framework for protection of drinking water through risk-based standards.
- MCLs for Organic Contaminants (40 C.F.R. § 141): This section provides primary drinking water standards including MCLs and maximum contaminant level goals (MCLGs) and establishes requirements for certain contaminants that are allowable in public water supply systems. The MCL values, which are established to protect the public against consumption of drinking water contaminants that present a risk to human health, constitute the allowable exposure level for these contaminants in groundwater.

Remediation goals for groundwater are set equal to the MCLs. The MCLs applicable to the Site are as follows: (a) Tetrachloroethylene: 5 µg/L; (b) Trichloroethylene: 5 µg/L; (c) cis-1,2-Dichloroethylene: 70 µg/L; (d) trans-1,2-Dichloroethylene: 100 µg/L; and (e) Vinyl Chloride: 2 µg/L.

- Texas Industrial Solid Waste and Municipal Solid Waste Regulations 30 TAC § 335: This provides guidelines for generators to determine if a solid waste is a hazardous waste. Texas has been authorized by EPA to enforce approximately 76% of the hazardous waste regulations, including the majority that may be ARARs for this Site.
- Waste Characterization 30 TAC § 335, Subchapter R: This part establishes criteria for designating a waste as a hazardous waste or as one of three classes of solid waste.

Action Specific ARARs:

- U.S. Department of Transportation (DOT) Rules for Hazardous Materials Transport (49 C.F.R. §§ 107, 171): These sections establish requirements for the transportation of hazardous materials including packaging, shipping, and placarding.
- Land Disposal Restrictions (40 C.F.R. § 268): This part restricts certain hazardous wastes from placement or disposal on land without treatment.
- Subtitle C, 40 C.F.R. §§ 260 through 264: These parts regulate the generation, transport, storage, treatment, and disposal of hazardous wastes generated in the course of a remedial action. It also regulates the construction, design, monitoring, operation, and closure of hazardous waste facilities.
- 40 C.F.R. § 264, Subparts B, C, D; Management of Hazardous Waste Facilities: These parts establish minimum standards that define the acceptable management of hazardous waste for owners and operators of facilities that treat, store or dispose of hazardous waste.
- 40 C.F.R. § 264, Subparts I and J; Use and Management of Containers and Tank Systems: Subpart I sets operating and performance standards for container storage of hazardous waste. Subpart J outlines similar standards but applies to tanks rather than containers.
- Control of Air Pollution from Visible Emissions and Particulate Matter; 30 TAC § 111: This section requires that all reasonable precautions shall be taken to prevent particulate matter from becoming airborne, including use of water or chemicals for control of dust in the construction operations and clearing of land and on dirt roads or stockpiles.
- Control of Air Pollution by Permits for New Construction or Modification; 30 TAC § 116: This section requires a permit for construction or modification of any facility that may emit contaminants into the air, unless the facility qualifies for a standard exemption.
- General Air Quality Rules; 30 TAC § 101: This section requires that sampling be conducted at a source that emits contaminants into the air of the state and that any emissions events that occur be reported.
- Permits by Rule; 30 TAC § 106 Subchapter X; Waste Processes and Remediation; 30 TAC § 106.533: These sections provide that equipment used to extract, handle, process, condition, reclaim, or destroy contaminants for the purpose of remediation is permitted by rule if certain design and location criteria are met.

- TPDES Construction Stormwater Permit; 30 TAC § 205: This section requires submission of Notice of Intent (NOI) as a large construction activity (sites greater than 5 acres) for coverage under the general permit for stormwater discharges resulting from construction. Complying with the substantive parts of this permit include preparation of a stormwater pollution prevention plan and use of best management practices for managing stormwater, as well as other requirements. The NOI must be submitted at least 24-48 hours prior to construction. A Notice of Termination must also be submitted within 30 days after stabilization is complete. A copy of this information must also be submitted to the City if part of the stormwater discharges to the City storm sewer.
- Underground Injection Control; 30 TAC § 331: This section establishes requirements and prohibitions related to underground injection of fluids.
- Texas Pollutant Discharge Elimination System (TPDES) permit; 30 TAC § 308: This section requires a permit for any activity that may result in discharge into or adjacent to waters in the State.
- Texas Industrial Solid Waste and Municipal Solid Waste Regulations 30 TAC § 335: This requires adherence to record keeping and shipping requirements. Texas has been authorized by EPA to enforce approximately 76% of the hazardous waste regulations, including the majority that may be ARARs for this Site.
- Water Well Drillers and Water Pump Installers; 16 TAC §§ 76.1000 – 1009: These sections provide that monitoring wells installed and abandoned must meet certain design requirements and licensed drillers must install or abandon wells.
- 42 U.S.C. §§ 300f et seq., and 40 C.F.R. §§ 144 and 146: These sections address requirements for the construction, operation, and abandonment of wells.

To-be-considered (TBC) criteria for the Site include the following:

- Harris-Galveston Subsidence District, Rule 5.1; Registration of New Wells: All new wells, except leachate wells, monitor wells, and dewatering wells, must be registered by the well owner, well operator, or water well driller prior to being drilled. The District staff will review the registration and make a preliminary determination on whether the well meets the exclusions or exemptions provided in Rule 5.7. If the preliminary determination is that the well is excluded or exempt, drilling may begin immediately upon receiving the approved registration.
- Harris-Galveston Subsidence District, Rule 5.7; Exclusions and Exemptions: (a) Exemption: single-family dwellings with wells having a nominal casing diameter of 5 inches or less are excluded from the permit requirements; (b) Exemption: the permit requirements shall not apply to: (i) windmills serving a well with a casing diameter of four inches nominal or less, (ii) monitor wells, (iii) leachate wells, or (iv) dewatering wells. Although small single family wells are excluded from obtaining permit, the owner is required to register the well.
- 40 C.F.R. § 52; Approval and Promulgation of Implementation Plans: This part requires the filing of a notice with the state regarding intent to install a new stationary source for air pollution.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver. Compliance with ARARs is also a threshold criterion and must be met in order for the alternative to be eligible for selection as a remedial action. Alternative 1 – No Further Action, does not meet this threshold and cannot be selected. All other alternatives meet this minimum or are potentially eligible for an ARAR waiver.

As an example, the Safe Drinking Water Act, which establishes the basic framework for protection of drinking water through risk-based standards, is applicable to the Site because groundwater in the area has been used as drinking water. Alternative 2 is expected to comply with this ARAR because it is designed to reduce the contaminant levels to below the MCLs through in-situ treatment. Likewise, Alternative 3 is expected to comply with this ARAR because it is designed to reduce the contaminant levels to below the MCLs through pumping and surface treatment. Alternative 4 combines these two approaches. Therefore, all of the alternatives, except the No Further Action alternative, are expected to comply with this ARAR. Alternatives are listed in order of comparative advantage with respect to ARAR compliance.

- Alternative 2 complies with ARARs by destroying contaminants in-situ by chemical oxidation or biodegradation to reduce concentrations to levels below the cleanup levels. Because all reactions would take place in-situ, many of the ARARs would not apply for this alternative. Monitoring would provide a record of progress toward the MCLs in wells within the plume. No subsidence district issues would be applicable.

- Alternative 3 complies with ARARs by removing contaminants from the groundwater with a hydraulic containment/pump and treat system to reduce concentrations to levels below the cleanup levels. This would be slower than Alternative 4. There are potential conflicts with subsidence district concerns.

- Alternative 4 complies with ARARs by destroying contaminants in-situ and removing contaminants from groundwater with a hydraulic containment/pump and treat system to reduce concentrations to levels below the cleanup levels. There are potential conflicts with subsidence district concerns.

17.3 Long Term Effectiveness and Permanence

This is a balancing criterion that refers to expected residual risk and the ability to maintain reliable protection of human health over time, once remediation levels have been met.

Alternative 1 would not be effective or permanent. Among the remaining alternatives, greater long term effectiveness and permanence are attributed to those alternatives that remove or destroy a greater mass of contaminants by the end of the 30-year evaluation period. Alternatives 3 and 4 result in a greater reduction of mobility since groundwater is pumped and treated, which would limit the ability of the groundwater contaminants to move further downgradient. Alternatives 2 and 4 reduce the toxicity of contaminants in a shorter time period since the in-situ treatments of groundwater actually destroy the contaminants. Alternative 4 is the most effective and permanent alternative because it addresses source area and hot spot contaminants while maintaining hydraulic control of the contaminant plumes. Alternative 3 does not address source area or hot spot contamination, but controls plume migration. It is not considered as effective as Alternative 4. Alternative 2 addresses source area and hot spot contamination, but does not control plume migration.

17.4 Reduction of toxicity, mobility, or volume of contaminants through treatment

This balancing criterion relates primarily to the degree of toxicity, mobility, or volume (TMV) reduction that will be achieved by each alternative through treatment of COC-contaminated media.

Alternative 1 contains no treatment, so it is least favored by this comparison. Among the remaining alternatives, the degree to which treatment reduces TMV is evaluated to rank the alternatives. Alternatives 2 and 4 utilize in-situ treatment to address the source area associated with the former dry cleaning operations and the principal threat wastes. These alternatives offer a greater level of long-term effectiveness and permanence than Alternative 3 since source material, which could continue to contribute to the dissolved phase groundwater contamination, is treated. However, Alternative 2 does not control plume migration. Alternative 3 is effective in the long-term since pumping and treatment of groundwater would prevent the plume from migrating to potential downgradient receptors. However, Alternative 3 does not directly address the source area soil, which contains a principal threat waste.

Alternative 4 offers the greatest long-term effectiveness and permanence since in-situ treatments will reduce or remove contaminants in the source area soils and groundwater plumes while preventing the groundwater plume from moving towards potential downgradient receptors. Alternative 2 would rank next because it employs in-situ destruction of contaminants, and would likely destroy a larger mass of contaminants within 30 years than Alternative 3. Alternative 3 ranks slightly lower because the hydraulic containment/pump and treat system by itself would remove contaminants more slowly.

17.5 Short-term effectiveness

Short-term effectiveness is a balancing criterion that addresses the period of time needed to implement and operate the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction.

Alternative 1 would not be effective, so it is the least favored by this comparison. Among the remaining alternatives, preference is given to alternatives with fewer potential risks to workers and the community during implementation, and to alternatives that are effective in a shorter time period. In-situ treatment which is included in Alternatives 2 and 4 would be effective in the short term because chemical oxidation reaction rates are fast. It is expected that the bioaugmentation treatments will reduce contaminants at a slower rate, but with greater potential for continuing reductions over the longer term. The short term risks associated with in-situ treatment application should be manageable with a well implemented Site health and safety plan. Alternatives 2 and 4 would take longer to implement in the short –term since ISCO and bioaugmentation treatments would take place over a four year time frame. Alternative 3 would take the shortest amount of time to implement since no in-situ treatments are used. Workers will face potential exposure to contaminated media during construction, operation, and maintenance. Compliance with a Site-specific health and safety plan will mitigate these risks. Wastes produced by Alternatives 3 and 4 will include contaminated drill cuttings, contaminated water from well development and decontamination, and spent treatment media.

Alternative 4 ranks best for short term effectiveness because contaminants would be destroyed in-situ or removed by the hydraulic containment/pump and treat system, leading to the shortest expected time to achieve the cleanup levels. There would be some short term risks during construction and ISCO application.

Alternative 2 would rank next because it employs in-situ destruction of contaminants, but has no ongoing hydraulic containment/pump and treat aspect to address contaminants from beyond the reach of the in-situ treatment application. There would be some short term risks during ISCO and bioaugmentation application. Alternative 3 ranks slightly lower because the lack of in-situ contaminant destruction would leave more contaminants in the groundwater at any comparable future time. There would be some short term risks during construction.

17.6 Implementability

Implementability is a balancing criterion that addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternative 1, No Further Action, is inherently implementable as no actions are required, so is most favored by this comparison. Among the remaining alternatives, technical feasibility, administrative feasibility, and availability of services and materials are evaluated to rank the alternatives. ISCO and bioaugmentation (components of Alternatives 2 and 4) are commercially available technologies that have been used at numerous contaminated soil and groundwater sites for the same chlorinated solvents. Before ISCO or bioaugmentation injection can begin, a pilot study will have to be conducted to determine the injection radius of influence and quantity of amendments necessary to degrade the contaminants. The results of the pilot study could impact the number and spacing of injection locations in the source area. Prior to beginning bioaugmentation in the deeper groundwater, well owners would have to grant access and permission to use existing wells. If existing wells cannot be used, new injection wells will have to be drilled. Hydraulic containment/pump and treat (components of Alternatives 3 and 4) would require administrative coordination to maintain permission to install extraction wells, injection wells, piping, and treatment plants. Significant labor, equipment and materials would be required for installing the systems. Groundwater extraction and air stripping are well developed technologies and commercially available.

Alternative 2 ranks first (best) in implementability because the in-situ treatment applications could be accomplished within the first four years, with only monitoring necessary later.

Alternative 3 ranks next because the hydraulic containment/pump and treat system would require significant time to construct and operations would continue with adjustments as necessary over time. Alternative 4 ranks last because it combines the implementation of in-situ treatment application with the complexity of constructing and operating a hydraulic containment/pump and treat system over time.

17.7 Cost

Cost is a balancing criterion that facilitates comparison of alternatives. Alternative 1 has no associated costs, so is most favored by this comparison. Alternative 2 has a total capital cost of $3,336,660 and O&M costs of $2,022,510, and a present value total of $4,286,779. Alternative 3 has a total capital cost of $4,439,040 and O&M costs of $3,776,310, and a present value total of $6,244,771. Alternative 4 has a total capital cost of $5,699,520 and O&M costs of $3,776,310, and a present value total of $7,425,852. O&M and periodic costs are calculated for a 30-year evaluation period.

In terms of present value costs over the 30-year period, Alternative 4, In-Situ Enhancements to Pump and Treat is the most expensive, and Alternative 2, In-Situ Treatment is the least expensive. In terms of capital costs, Alternative 4 is the most expensive, and Alternative 2 is the least expensive. In terms of O&M costs, Alternative 4 is the most expensive, and Alternative 2 is the least expensive. The estimated capital and annual O&M cost for each alternative is provided on Table 18. Table 19 includes the detailed estimated costs for the Alternative 4, the selected remedy.

The cost estimates for all alternatives except Alternative 1 differ in several ways from the cost estimates included in the FS. The cost estimates here includes the capital and O&M costs from the FS, with the addition of the following costs:

- $1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).
- $288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).
- $433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).

17.8 State Agency Acceptance

State Agency Acceptance considers whether the State agrees with U.S. EPA's analyses of the FS Report and Preferred Remedy in the Proposed Plan. The State of Texas prepared the RI and FS reports, and has been an active participant in preparation of the Proposed Plan as well as this ROD. The State of Texas supports the Selected Remedy. The State's concurrence letter is attached in **Appendix A**.

17.9 Community Acceptance

Community Acceptance considers whether the local community agrees with U.S. EPA's analyses and preferred alternative described in the Proposed Plan. Throughout the Site project there has been continued public interest. During the public comment period for the Proposed Plan, both oral and written comments were received. The comments and the responses are included in the Responsiveness Summary, Part 3 of this ROD. Based on the comments, some in the community remain concerned about the impact of the groundwater contamination and the remedial action, but understand the reasons for implementing the Selected Remedy. Based on EPA's interpretation of comments received during the public comment period and the questions received at the public meeting, the community concurs with the Selected Remedy identified in this ROD.

18.0 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. The principal threat concept is applied to the characterization of source materials at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, non-aqueous phase liquids (NAPL) in groundwater may be viewed as source material. Principal threat wastes are those materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. Non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure.

The impacted soil associated with the former dry cleaner is regarded as a principal threat waste because of its potential to impact additional groundwater. The limited extent of PCE impact to soil indicates the main pathway for PCE transport was likely vertical in the form of dense non-aqueous phase liquid (DNAPL). However, although high concentrations of PCE have been detected in soil, no DNAPL was observed during Site investigations. The lack of observed DNAPL in soils and/or groundwater is a common occurrence at dry cleaner sites based on the experience of the TCEQ Dry Cleaner Remediation Program. Contamination that exists in the dissolved-phase groundwater plume at the Site is considered low-level threat waste.

19.0 SELECTED REMEDY

The selected remedy for the Site is Alternative 4, In-Situ Enhancements to Pump and Treat. The in-situ treatments involve treating the soil and groundwater without removing them. A pilot study will be conducted to collect Site specific data for the Remedial Design, including area of influence during chemical injection, chemical dose, pumping rate and volume, and reaction times. The treatment technologies to be evaluated in the pilot study include ISCO for source area soil and shallow groundwater, and bioaugmentation for the deep groundwater plume.

The hydraulic containment/pump and treat operation would involve pumping groundwater from the subsurface in both the source area (less than 50 feet bgs) and the deeper groundwater zones at high enough rates to prevent further migration of contaminants in groundwater. The pumped groundwater would then be treated to remove VOCs. The selected remedy also includes the implementation of institutional controls.

19.1 Summary of the Rationale for the Selected Remedy

Based upon an analysis of the remedial action alternatives using the nine evaluation criteria and the alternatives' ability to achieve the RAOs, and consideration of requirements of CERCLA and the requirements of the NCP, EPA has determined that Alternative 4, In-Situ Enhancements to Pump and Treat, is the most appropriate remedy for the Jones Road Site. The selected remedy provides adequate protection of human health and the environment and complies with ARARs. Because it aggressively treats the source area soil and shallow groundwater, the selected remedy meets the statutory preference for selection of a remedy that involves treatment of principal threat wastes.

Alternative 4 offers the greatest long-term effectiveness and permanence because the in-situ treatments will reduce or remove contaminants in the source area soils and groundwater plumes while preventing the groundwater plumes from moving towards potential downgradient receptors. Several options were evaluated, but the selected remedy provides the most efficiency, cost effectiveness, and reliability, through treatment and plume containment in the least amount of time. The selected remedy provides the necessary treatment to protect human health and the environment and is expected to meet the remedial action objectives.

19.2 Description of the Selected Remedy

In-situ enhancements to the pump and treat alternative will involve pumping groundwater from the subsurface in the source area and the deeper groundwater zones for hydraulic control of contaminant migration, as well as in-situ treatments. Groundwater pumping exceptions will be made for periods of in-situ treatment application to allow time for the applied treatments to effectively destroy contaminants. Institutional controls for both soil and groundwater as described above would also be implemented.

A pilot study will be conducted to determine which in-situ treatment will be most effective and appropriate for the source area soil and groundwater, and the deep groundwater plume. The treatment technologies to be evaluated in the pilot study will likely include ISCO for source area soil and shallow groundwater, and bioaugmentation for the deep groundwater plume.

The final in-situ treatment designs will be prepared as a part of the Remedial Design, however, it is anticipated that it will include the following:

- The chemical oxidant (permanganate, for example) for the ISCO treatments would be injected through approximately 144 temporary injection sites to 50 feet bgs, spaced 20 feet apart, to treat the 160 by 320 foot area shown on **Figure 3**. Two applications of oxidant would be made to the shallow soils and groundwater approximately one year apart. Injections would be made from the outside in and from the bottom up to minimize horizontal and vertical induced migration caused by fluid displacement.

- Bioaugmentation will be applied to hot spots within the deeper zones of groundwater to both destroy contaminants and enhance natural attenuation of contaminants. The treatments would be applied through existing inactive water wells with the permission of the well owner. The well owners who signed the TCEQ water line agreement relinquished control of their water wells to the TCEQ. These wells would be considered first for bioaugmentation. Some adaptation of the well plumbing may be necessary to inject the bioaugmentation solution through the existing wells.

- The 10 most contaminated deep zone water wells would have bioaugmentation applied. Further applications of bioaugmentation, both in timing and choice of wells, would depend on the results of ongoing groundwater monitoring. Four applications of bioaugmentation would be applied to each well, with at least one year between applications.

Pumping of groundwater for hydraulic control and treatment would be performed with exceptions made for periods of in-situ treatment application to allow time for the applied treatments to effectively destroy contaminants. The final hydraulic containment/pump and treat designs will be prepared as a part of the Remedial Design, however, it is anticipated that it will include the following:

- Groundwater would be pumped from the subsurface in both the source area shallow groundwater (less than 50 feet bgs) and the deeper groundwater zones at high enough rates to prevent further migration of contaminants in groundwater. The pumped groundwater would then be treated to remove VOCs. For the shallow groundwater at the source area, and depending upon hydraulic properties to be determined during the Remedial Design phase, groundwater in the shallow zone would be extracted at MW-1 and MW-6 to hydraulically control of the migration of the contaminated groundwater. Hydraulic containment/pump and treat of the source area shallow groundwater will likely be unnecessary after ISCO application to the area.

- A total of 6 deep extraction wells would be needed, each with an extraction rate of 20 gpm for a total extraction rate of 120 gpm. For the deeper groundwater plume, **Figure 10** shows the expected locations of extraction wells for hydraulic containment/pump and treat.

- All of the extracted groundwater would be treated by air stripping to remove the VOCs. The discharged air waste stream would be run through vapor-phase granular activated carbon (GAC) filters for polishing if necessary to prevent public exposure to VOCs by inhalation. Treated groundwater would be released to the drainage ditch, contingent on approval, or discharged to sanitary sewer and POTW, if available, or reinjected to offset potential subsidence. Reinjection of the treated water is expected to be the approach used at the Site.

- The air stripping/GAC treatment system would likely be broken into two facilities, one east of Jones Road and one west of Jones Road. The open space behind (east of) the Cypress Shopping Center may serve as a location for the east treatment system. Open space along the south side of Tower Oaks Boulevard may serve as a location for the west treatment system.

- Pumping deep groundwater for hydraulic containment/pump and treat would generate approximately 120 gallons per minute. This pumping rate may be large enough that the Harris-Galveston Subsidence District would object to this strategy. Reinjection of the treated groundwater may offset this concern. The groundwater pumped out would have to be treated before release or reinjection. The amount of groundwater generated by hydraulic control in the shallow source area (less than 50 feet bgs) is expected to be negligible by comparison.

Groundwater monitoring would be quarterly for the first two years of the remedial action, then semiannually for years 3 through 5. Monitoring may be reduced to annual sampling if data trends show enough stability to permit the reduction.

Preliminary design field investigations needed for this alternative may include:

- Hydraulic testing (slug test) of shallow groundwater zones;

- Hydraulic testing (slug test) of deeper groundwater zones;

- Pilot study to determine injection radius of influence and effectiveness of in-situ ISCO and bioaugmentation treatments;

- Determining screen depths for inactive wells with unrecorded screens.

Another component of the selected remedy is the collection of additional indoor air samples during the summer as a part of the Remedial Design to confirm the initial results.

In addition, with completion of the water line in November 2008 by EPA and TCEQ, a total of 144 water wells from residences and businesses were replaced by connections to the water line. The selected remedy also includes plugging and abandonment of water wells by EPA where people connected to the waterline. Plugging of these wells is necessary because active pumping of the wells may cause migration of the plume, and the old water wells may act as a conduit for contaminant migration. However, EPA does not plan to begin plugging the wells until a determination is made regarding which wells may be needed for the groundwater monitoring network, for water extraction or injection wells, or for deep zone bioaugmentation treatment injection. The Remedial Design will determine the locations of these wells.

In addition, the EPA will provide people in the Site vicinity another opportunity to sign up to be connected to a water supply without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity.

Finally, the selected remedy includes five-year reviews because hazardous substances will remain on-site above health-based concentration levels. The initial review will be conducted within five years of commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. The five year reviews will continue no less often than every five years as long as the Site contains contamination above levels that allow unlimited use and unrestricted exposure. The EPA will review all ARARs during the five-year review to determine if any of the standards have been either modified or have new standards that impact the existing standards provided in the selected remedy. If such new standards or modified standards call into question the selected remedy's protectiveness, then the new standards or modified standards may result in the selected remedy's modification consistent with the explanation of significant differences, or amended ROD provisions provided in the NCP.

19.3 Summary of Estimated Remedy Costs

For the selected remedy (Alternative 4: In-Situ Enhancements to Pump and Treat), the estimated capital cost is $5,699,520; the estimated total O&M Cost is $3,776,310; and the estimated present worth (using a 7% discount rate) total cost is $7,425,852.

The cost estimate for Alternative 4 here differs in several ways from the cost estimate included in the FS. The cost estimate here includes the capital and O&M costs from the FS, with the addition of the following costs:

- $1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).
- $288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).
- $433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).

A cost summary is presented in Table 18. Table 19 includes the detailed estimated costs for the Alternative 4, the selected remedy. The cost estimate is based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of changes in the price of reagents used in the treatment process, qualifying bids for performance of the remedial action, and progress of the treatment process due to Site and weather conditions. Cost changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference (ESD), or a ROD amendment. The total present worth cost is calculated using a 30-year O&M period. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

19.4 Expected Outcomes of the Selected Remedy

The expected outcome of the selected remedy is a return of the contaminated portions of the shallow source area WBU and the deep WBUs to their beneficial uses as a potential drinking water supply. Additional expected outcomes include preventing human exposure to contaminated groundwater at unacceptable risk levels, and preventing or minimizing further migration of contaminants from source materials to groundwater and migration of the groundwater plumes. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is implemented. The estimated time necessary to achieve the groundwater restoration goal consistent with the use of the groundwater as a potential drinking water supply is 30 years. The selected remedy will impact the land surface use and groundwater use as necessary for operation of monitoring wells and the water treatment plant(s) until the RAOs are achieved.

19.4.1 Final Cleanup Levels

The remedial goals identified in the ROD must be met at the completion of the remedial action throughout the groundwater contaminant plume. The cleanup levels are as follows:

- Tetrachloroethylene 5 µg/L
- Trichloroethylene 5 µg/L
- cis-1,2-Dichloroethylene 70 µg/L
- trans-1,2-Dichloroethylene 100 µg/L
- Vinyl Chloride 2 µg/L

20.0 STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP §300.430(f)(5)(ii), the EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the TMV of hazardous substances, pollutants, and contaminants as a principal element, and it includes a bias against offsite disposal of untreated wastes. The following sections discuss how the selected remedy meets these statutory requirements.

20.1 Protection of Human Health and the Environment

The selected remedy for the soil and groundwater at this Site will meet the RAOs and cleanup levels as well as provide adequate protection of human health and the environment. The selected remedy, which includes treatment of the principal threat wastes in the soil and shallow groundwater in the source area with ISCO, treatment of the deep groundwater plume in the hot spots with bioaugmentation, operation of a hydraulic containment/pump and treat system, and the implementation of ICs, is expected to control risks and potential migration, and to restore the groundwater to below drinking water standards.

These remedial actions will be effective and permanent in the long-term provided long-term monitoring, O&M, five year reviews, and enforcement of institutional controls are performed. The Site will be available for residential and/or commercial/industrial use, which is compatible and consistent with the land use in the area.

20.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all Federal and any more stringent State and local ARARs that pertain to the Site. The remediation levels and RAOs used in the design of the selected remedy were developed based on the ARARs described in this ROD. Based on existing information, the proposed design of the selected remedy should ensure that the remedial action, once fully and successfully implemented, will comply with all ARARs identified in this ROD. The selected remedy is expected to comply with identified ARARs through the use of standard engineering and waste management techniques.

20.3 Cost Effectiveness

The selected remedy is cost-effective because the remedy costs are proportional to its overall effectiveness (see 40 CFR §300.430(f)(l)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all Federal and any more stringent State/Local ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated (in the FS Report) by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). The overall effectiveness of each alternative was then compared to each alternative's cost to determine cost-effectiveness. The selected remedy has the highest cost of the alternatives considered, but it also is the most effective and permanent alternative, and has the best reduction in toxicity, mobility, and volume because it addresses the source area and hot spot contaminants through treatment while maintaining hydraulic control of the contaminant plumes. The selected remedy also ranks best for short term effectiveness because contaminants would be destroyed in-situ or removed by the hydraulic containment/pump and treat system, leading to the shortest expected time to achieve the cleanup levels. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value.

20.4 Use of Permanent Solutions to the Maximum Extent Practicable

The EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element, bias against off-site treatment and disposal, and considering State and community acceptance. The selected remedy is necessary to ensure the long-term effectiveness and permanence of this cleanup.

20.5 Preference for Treatment as a Principal Element

Reduction of TMV through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. Treatment is the primary component of the selected alternative. The source area soil and shallow groundwater will be treated in-situ with ISCO. In addition, the deep groundwater plume will be treated in-situ with bioaugmentation. Finally, the extracted groundwater will be treated by air stripping prior to re-injection or discharge.

20.6 Five-Year Review Requirements

Because the selected remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review must be conducted within five years of the initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment. Pursuant to CERCLA Section 121(c), 42 U.S.C. § 9621(c), and as provided in the current guidance on Five Year Reviews [OSWER Directive 9355.7-03B-P, *Comprehensive Five-Year Review Guidance* (June 2001)], EPA must conduct a statutory review within five years from the initiation of construction at the Site.

21.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The Proposed Plan for the Site was released for public comment on May 28, 2010. The Proposed Plan identified Alternative 4, in-situ enhancements to pump and treat, institutional controls, and monitoring of contaminated groundwater as the preferred alternative. Based upon its review of the written and verbal comments submitted during the public comment period, the EPA determined that Alternative 4 is the selected remedy, with some modifications as identified below.

The Proposed Plan, in Figure 5, incorrectly showed the extent of Harris County's "no new wells" area; the area is actually shown by the heavy black line instead of the green line in Figure 5 of the Proposed Plan. The result is that the "no new wells" area does not extend to the south as far as shown in the Proposed Plan, and does not totally encompass the southern extent of the deeper zone groundwater plume. The existing Harris County "no new wells" area has exactly the same boundaries as the Final Waterline Service Area. A corrected figure will be included in the Administrative Record for this ROD and has been published on the TCEQ Jones Road web site (http://www.tceq.state.tx.us/remediation/superfund/jonesroad/index.html). The EPA will work with TCEQ and Harris County to enlarge the "no new wells" area by a sufficient amount to fully encompass the groundwater contamination at the Site. This may also entail provisions for an alternative water supply source so that a water supply is available once new wells are restricted.

In addition, based on comments received at the Public Meeting, EPA will plug and abandon the water wells where water service is provided by the waterline installed by EPA and TCEQ. Plugging of these wells is necessary because active pumping of the wells may cause migration of the plume, and the old water wells may act as a conduit for contaminant migration. Currently 144 water wells have been replaced by connections to the water line. However, EPA does not plan to begin plugging the wells until a determination is made regarding which wells may be needed for the groundwater monitoring network, for water extraction or injection wells, or for deep zone bioaugmentation treatment injection. The Remedial Design will determine the locations of these wells. Plugging and abandonment of the water wells will increase the estimated capital cost of the remedial action by $1,188,000.

In addition, the EPA will provide people in the Site vicinity another opportunity to sign up to be connected to a water supply without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity. Providing additional water line connections will increase the estimated capital cost by $288,500.

Finally, based on comments received during the public comment period, the EPA agrees that institutional controls are necessary to prevent any potential future exposures that may result from construction or maintenance activities that may penetrate the pavement or foundation surfaces and create an exposure pathway to underlying contaminated soils. Institutional controls to address this potential exposure pathway will be included in the selected remedy, and will be crafted during the Remedial Design.

22.0 REFERENCES

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PART 3: RESPONSIVENESS SUMMARY

23.0 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

The Responsiveness Summary summarizes the comments received regarding both the remedial alternative and general concerns about the Site submitted during the public comment period and the EPA's responses to these comments. The Administrative Record file for the Site contains all of the information and documents supporting this ROD. This Administrative Record file includes a transcript of the public meeting held by the EPA on June 3, 2010, to describe the preferred alternative. The questions and answers discussed during this meeting can be found in the meeting transcript included as part of the Administrative Record.

This Responsiveness Summary summarizes comments submitted during the public comment period and presents the EPA's written response to each issue, in satisfaction of community relations requirements of the NCP. The EPA's and TCEQ's responses to comments received during the public meeting are provided below and in some cases include subsequent expanded responses to those comments as appropriate.

Comment: In May of 2008, again in February of 2009, and in March of 2010, there were a number of wells, ranging from five to six wells, that all tested positive for vinyl chloride. A number of these wells are actually outside of the plume area. Based on these results, are the plume boundaries going to be extended to encompass this extended contaminated area?

EPA Response: Yes, the plume boundaries will be extended to encompass all of the contaminated area. In the Superfund Program, a site area is defined by the extent of the contamination. The Site boundaries may grow or shrink based on the location of contamination that is above the action levels.

Comment: Have the homeowners in Tower Oaks been notified that the monitoring wells described in the previous comment, monitoring wells that are located on the site of Tower Oaks, that these contaminants have been found multiple times? House Bill 3030, which was passed in 2003, I believe, because of what happened at this Site, required notification to homeowners within 30 days of the analysis result.

TCEQ Response: Yes, TCEQ sent a project notice when the vinyl chloride was detected, and when the vinyl chloride was detected above the MCL. Approximately 1,200 letters notifying the public of that occurrence were mailed. Regarding House Bill 3030 and the notification, Jones Road was the Site that initiated that legislation, and TCEQ honored that notification provision.

Comment: The water system is not complete. My ditches are left in disarray. The shoulder of the road on Tall Timbers, which is one of the streets in front of my property, is sinking down to the asphalt. It deteriorated for 6 inches because I cannot get TCEQ and EPA or the Water District or the County to finish the job. They took care of the damage for me personally, I did want to state that, but the ditch is still damaged, and now the County Road is getting damaged and nobody cares.

EPA Response: This work was done as a part of the waterline installation and service connections completed in 2008. Thank you for noting that the damage to your property was addressed following the water line construction. It may be that the conditions described are in the road right-of way maintained by Harris County. If so, you may wish to contact Harris County for any maintenance repairs necessary in the road right-of-way.

Comment: Some community members are still using their water wells. EPA is proposing putting bacteria into the water bearing zones and using hydraulic containment to push the contamination to the wells that are currently clean like mine. I am very concerned about how we will be treated and what decisions are going to be made. I do not think EPA is really concerned about what we think. I want to know what is going to happen to my well when EPA starts doing the remedial action. If the well gets totally contaminated, am I going to be compensated for tearing up my well?

EPA Response: No, compensation will not be provided for any water wells that become contaminated. The bioaugmentation treatments will be designed in the Remedial Design to only treat the contaminated plume area, and wells currently outside of the plume area should not be impacted. In addition, the EPA will provide people in the Site vicinity another opportunity to sign up to be connected to a water supply without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity. This meets the remedial action objective to reduce exposure to Site contamination. Regarding the remedial action, the EPA will initially do a pilot study to evaluate potential movement of the materials injected into the water bearing zones. The EPA will design the injection treatments so that the injected materials will only go as far as necessary to address the contamination sources. The shallow source area groundwater goes down to 35 feet below ground, and is not being used for drinking water that EPA is aware of, and injection of the treatment materials into this zone is not expected to impact drinking water wells. The bioaugmentation treatments planned for the deeper groundwater zones will help the natural occurring bacteria at the Site to grow and break down the contamination. The bioaugmentation treatments will be performed in the areas with the highest contaminant concentrations. EPA will evaluate where the water wells are located, and perform groundwater modeling to design the water extraction system for hydraulic containment while minimizing the impact to existing water wells as much as possible.

Comment: I am not on the waterline now, and I feel like I am going to get forced on it and lose my well anyway because of remediation.

EPA Response: It is not EPA's goal to force anyone off their water wells, however, the groundwater at the Site has been contaminated, and the remedial action is necessary to cleanup that contamination. When people have concerns about their wells, they should contact EPA and EPA will address each one on a case-by-case basis. EPA will provide people in the Site vicinity another opportunity to sign up to be connected to a water supply without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity.

Comment: Will the in-situ chemical oxidation treatment (ISCO) materials be filtered out by the standard carbon filter on water wells?

EPA Response: Carbon filters are good at trapping organic chemicals as well as things like chlorine. Many other chemicals are not attracted to carbon at all, such as sodium or nitrates, and they pass right through. It is expected that the ISCO oxidizers, such as permanganate, will not be filtered out by the carbon filters.

Comment: In Alternative No. 2 in EPA's presentation, it is indicated that EPA might inject this product into 140 locations. Are these the wells on the sites where people have already connected to the water line?

EPA Response: No. The 144 ISCO treatment injection locations will be placed in the parking lot area of the strip shopping center where the former dry cleaner was located. These treatments are for the shallow soil and groundwater source area (less than 50 feet deep). There will not be any ISCO treatments injected into any water wells. The deep groundwater treatments will be injected in approximately 10 of the highly contaminated wells, but those treatments are for bioaugmentation, not ISCO.

Comment: So the referenced 140 sites are punctured with something around …

EPA Response: Yes, the EPA will evaluate how far the injected materials can get pushed out from the injection locations. Given the area where the contamination is, it is estimated that 144 injection points will be required to address the source of the contamination.

Comment: Regarding Alternative No. 3, it was indicated that the remedial alternative was pump and treat. Does this use on-site equipment? And you mentioned earlier that this may take up to 30 years. So will we see a treatment plant, though it might be small, in the neighborhood for a period of about 30 years?

EPA Response: Yes, the groundwater extracted will require treatment to ensure that all the contaminants are adequately removed. The planned treatment system uses an air stripper to remove the solvents in the groundwater and a follow-up granular activated carbon filter. The location of the water treatment plant, or plants (two may be required) will be determined during the Remedial Design phase. The treatment plant(s) will be required as long as the pump and treat system is operating, and the remedial action is estimated to take 30 years to accomplish.

Comment: The objective of the source area treatments is to slow the migration of this contaminated material out of this source area. Why not just dig the soil up and get it out, that way it cannot sink down and cannot migrate anywhere? Cannot have vapors coming up. Why not just take the worst contaminated area and get rid of that bad soil?

EPA Response: Excavation and off-site disposal of contaminated soils was considered in the Feasibility Study as one of the potential remedial approaches. With excavation, a large volume of contaminated soil could be rapidly removed. However, excavation would require demolition of the buildings and relocation of the current tenants. In addition, there would be logistical difficulties during demolition of the building and loading and transportation of materials in a congested traffic area. Excavation was not retained as a soil remediation technology because of the traffic impacts and difficulties involved in handling the contaminated soil in a developed residential and commercial neighborhood. Also, relocating the current tenants was considered impractical.

Comment: If you are extracting groundwater for the pump and treat remedy, how far will that drop down the aquifers? I'm outside of either of those groundwater plume zones. I'm curious if you will be pulling enough water out that I will have to get a deeper well in order to keep water.

EPA Response: The EPA plans to re-inject the extracted water after treatment in order to minimize any subsidence issues that may occur, as well as minimizing any lowering of the water table. While other alternatives were considered for extracted water disposal, such as discharging the water to drainage ditches, re-injection will provide the above benefits.

Comment: Does the EPA have an independent environmental impact study done on the remedial action that you are proposing?

EPA Response: No, an independent Environmental Impact Study will not be done for the remedial action at the Site. The Superfund program uses a process that is similar to an Environmental Impact Study. The Superfund program investigates a site and considers alternatives for addressing any concerns that are identified. The EPA does rely on the State agencies, contractors, and community members, including community members who have technical assistant grants that are reviewing this work.

Comment: Anything I would do as a private citizen would have to have an EPA study done on it to tell what the impact on the environment would be, and I guess that's all I'm asking. Does your own office have an independent survey of what you are doing to make sure you have not done something to our soil to further contaminate it?

EPA Response: No, an independent survey is not being planned. However, the remedy being used at this Site is being used at many other sites. The EPA is using it for this Site based on experience on how the process performs at those other sites. This experience at the other sites informs EPA that it will work for this Site and will not have significant impact on the environment. When the EPA does the feasibility studies, extensive evaluation of different remedies and alternatives are completed. The EPA considers remedies that have been used throughout the country, including roughly a thousand Superfund Sites. Dry cleaners have contaminated many sites throughout the country, and the EPA has experience with this type of remedy for this type of contaminants, and believes that it will work and be safe for this Site.

Comment: I had been getting letters from TCEQ saying that I will be hooked up to the water line. However, I was never notified when the water line could be connected. I even signed the paperwork for a connection, but the connection was not made. Will the door be opened again for a water line connection? And why does it cost $3,500 to run a water line 50-feet from the connection point to the house?

EPA Response: Yes, the EPA will provide people in the Site vicinity another opportunity to sign up for a connection to the waterline without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity. Additional water line connections meets the remedial action objective to reduce exposure to Site contamination. The cost for the water line connections depends on a number of factors, including the cost of the water meter, whether the water main line is on the opposite side of the road from the house, how far the house is back from the road, plumbing connections necessary to connect to the house plumbing, etc. For the connections performed under the agreement with TCEQ, the total also included the cost for disconnecting the plumbing and electrical service to the water well on the property. The actual connection cost for each house varies based on these factors.

Comment: Is White Oak Manor aware that EPA is preparing to provide another opportunity to sign up for a connection to the water line?

EPA Response: No, as of now they do not know that, however, future notifications will be provided regarding additional water line connections. When the water line went in, the capacity was expected to be adequate to provide the water to them.

Comment: I live directly west of Monitor Well No. 14, and the vinyl chloride is creeping into that well, which is going against the groundwater flow. Why is that? The EPA is showing the ground flow to go from the northwest to the southeast.

EPA Response: The Site has very complex geology, and the reasons for contaminant flow across or against the apparent groundwater flow gradient are not clear. However, it may be that the high pumping rates in the area caused the contaminant movement. There may also be a preferential groundwater flow pathway as a result of an old paleo channel or an area with high permeability. Vinyl chloride also has a low molecular weight and is lighter than water and lighter than tetrachloroethylene, and may tend to concentrate in zones with preferential flow paths that are different from the zones that the other contaminants concentrate in because the other contaminates may sink to a greater extent. As stated previously, EPA defines the area of the Superfund site based on where we the contamination exists above the cleanup levels.

Comment: Vinyl chloride has the lowest MCL in terms of parts per million of contamination. Is it more toxic than the other contaminants?

EPA Response: Yes, the reason that vinyl chloride has the lowest MCL is that it is considered the most toxic of the contaminants at the Site. However, vinyl chloride is the last toxic contaminant on the breakdown pathway of tetrachloroethylene before ethylene, which is the end product of tetrachloroethylene breakdown and has low toxicity. The goal of the bioaugmentation treatments is to establish enough of the microbes to complete the breakdown so that vinyl chloride is not to present anymore.

Comment: Is there any way I could sign up to have my well monitored? I'd be happy to give samples.

EPA Response: The monitoring program, including well locations, will be determined during the remedial design phase. It is prudent to monitor in areas where vinyl chloride is present, and EPA will consider your well if possible.

Comment: The third alternative that EPA discussed was pumping out the water and pumping it back in. Obviously, I think that would be the best because of subsidence problems in this area. However, it could push the contaminated water to wider locations. So my question is: has EPA given any thought to how and what level to pump the water back in to try to contain the spreading of the contaminated water that has not been treated yet? Will EPA be continually monitoring during the time when you are injecting to make sure that you are not causing a problem somewhere else?

EPA Response: The location and design of the re-injection wells will be determined in the Remedial Design phase. The re-injection of treated groundwater would be typically be down gradient of where the contaminant plume is located. Moving it southeast would be downgradient of where the contamination is. Groundwater extraction with downgradient re-injection would create two effects including plume containment as a result of the extraction, and creating a hydraulic barrier downgradient by re-injecting it. This will also help to maintain the water levels in the wells. If the re-injection wells are in the wrong place, there is a possibility that the contaminate plume will move around the sides of the re-injection area. All of the remedy alternatives, except the no action alternative, include groundwater monitoring insure that (1) reductions of the contaminant levels of the groundwater are occurring, and (2) the groundwater is being contained and is not spreading.

Comment: Will EPA be injecting into the upper aquifer or the lower aquifer?

EPA Response: The re-injection will occur in the Chicot Aquifer into zones somewhere below the shallow source area groundwater zone and above a depth of approximately 300 feet. The actual injection depth will be determined during the Remedial Design phase.

Comment: I have never seen any of the maps that show where the Chicot Aquifer and the Evangeline Aquifers are. Can you draw the picture?

EPA Response: Descriptions of the Chicot and Evangeline Aquifers are included in the Remedial Investigation Report, which is a part of the Administrative Record. In summary, the Chicot Aquifer is the youngest unit and it outcrops at the Site. The Evangeline Aquifer underlies the Chicot Aquifer. The top of the Chicot Aquifer is at the surface, and the top of the Evangeline Aquifer it at a depth of about 400 feet. The Chicot Aquifer provides good to superior quality water for local residential and agricultural use, whereas the Evangeline Aquifer provides primarily superior quality water to local municipal water works. At the Site, the Chicot Aquifer is unconfined and therefore the overlying shallow sediments are a source of recharge for the aquifer. The Evangeline Aquifer at the Site acts as a confined aquifer system. Recharge to the Evangeline Aquifer is primarily from infiltration of precipitation into the outcrop area of the aquifer, which is about 25 miles north of the Site.

Comment: EPA going to pull 125,000 gallons a day out of the aquifer. It could affect my water table. I just had it fixed up at 200 feet deep. I'm about 60 feet into the aquifers. If EPA pulls that much water out, it could well affect how much water I have in a dry spell. There could be a whole lot of things involved with this, especially if you pull it out for 30 years. It is going to affect the County, because my tax dollars are going to be affected if my well goes dry. We do not have access to a water supply. You have not brought in a Municipal supply. I really do not want one, but it could happen. Dry wells in those property areas could well affect my property values and all the values in Tower Oaks that are not affected right now. So the County could lose money, my property values could go down just because you're pulling 120,000 gallons a day out of my well system. So if you inject it back in the ditches, which sounds absolutely ludicrous to me, you pump it into the aquifer up above us, down below us is not really going to serve us a purpose. I mean, how thick is that area? How much water are we talking about in that area? Does 125,000 gallons not matter? Is it a drop in the bucket, or is that a good percentage of amount of water in that area?

EPA Response: A more detailed groundwater model is one of the things planned for the remedial design. The Feasibility Study Report includes a groundwater model report, but it is not a sophisticated model. It only evaluated the pumping rates required to capture the contaminate plume. The more detailed model will evaluate the impacts mentioned and evaluate what the movement of the water table will be. EPA recognizes your concerns, and they have to be looked at. The last thing that EPA wants is to cause people's wells to go dry or to cause further subsidence at this Site.

Comment: I think EPA identified two “no drilling zones” including one for the Texas Drillers and the outside zone that is also a “no drilling zone” according to Harris County. So the outer perimeter actually encloses everything, but there's no new well drilling in that.

EPA Response: Yes. However, the Proposed Plan, in Figure 5, incorrectly showed the extent of Harris County's "no new wells" area; the area is actually shown by the heavy black line instead of the green line in Figure 5 of the Proposed Plan. The result is that the Harris County "no new wells" area does not extend to the south as far as shown in the Proposed Plan, and does not totally encompass the southern extent of the deeper zone groundwater plume. The existing Harris County "no new wells" area has exactly the same boundaries as the Final Waterline Service Area shown on Figure 5 of the Proposed Plan. The EPA will work with TCEQ and Harris County to enlarge the "no new wells" area by a sufficient amount to fully encompass the groundwater contamination at the Site. This may also entail provisions for an alternative water supply source so that a water supply is available once new wells are restricted.

Comment: Regarding the waterline agreement for the 144 residents who were connected, we were told that our water wells would be plugged by, I think it was the end, or late in the year of 2008. We assumed from the beginning that the EPA was funding this project. I know it was the EPA and TCEQ and Harris County. But now the remaining problem is the wells are not plugged. Now, we have gone back, or the Jones Road Coalition has gone back, and asked the question why are you not plugging our wells for the last couple of years? We have been told it is a money thing by TCEQ responding to us. I kind of feel personally that the whole thing is actually EPA and that if TCEQ or the State does not have the money, than EPA ought to be funding the plugging of the wells. At least that was the general idea. And, of course, I do not know whether many of you know that because our wells are not plugged, every year we are required to have that back-flow preventer looked at, and we are having to pay for that. So as long as the wells are not plugged, then we have an ongoing something to address. At least it is not much, but it is unexpected. We just need to know who is in charge of that, the EPA or is it TCEQ?

EPA Response: Based on comments received at the Public Meeting, EPA intends to include plugging and abandonment of water wells where people connected to the waterline. Plugging of these wells is necessary because active pumping of the wells may cause migration of the plume, and the old water wells may act as a conduit for contaminant migration. However, EPA does not plan to begin plugging the wells until a determination is made regarding which wells will be needed for the groundwater monitoring network, for water extraction or reinjection, or for deep zone bioaugmentation treatment injection. The Remedial Design will determine the necessary monitoring and injection wells.

Comment: When the remediation starts, for us that are still on the wells, like this one other gentleman, can we get the wells retested again monthly as this remediation starts? Currently, at my request, my well is not being tested now. They stopped a long time ago. It was still safe at the last test. But it might be important information to EPA to know what the wells are producing once these chemicals are being broke down. In other words, is EPA testing all the wells that are still being used and filtered?

EPA Response: No, once the water line was installed and online in November 2008 monitoring was reduced. However, some wells will be needed for monitoring the performance of the remedial action. The required monitoring wells well be determined during the Remedial Design phase.

Comment: When the remediation starts or whatever you choose, will EPA start testing our wells again for a while to make sure EPA is not screwing it up? EPA should look at all of the wells.

EPA Response: One of the things that EPA had in the remediation plan initially is quarterly monitoring. EPA has not adopted the final monitoring plan, which will be done in the Remedial Design. EPA considers it a very good idea to look at the wells again before we begin remediation.

Comment: Back in 2003, the EPA had said several times throughout that year that the cleanup would take five to six years. Obviously it has taken a little longer than that, and we have not started yet. Could you provide a timeframe of when, possibly the remedial action would actually start? And you talked about 30 years earlier. Do you really believe that it will take 30 years in that baseline of other sites that you've cleaned up with a similar chemical?

EPA Response: The timeframe is not currently a precise number. A detailed schedule will be developed during the Remedial Design. The Remedial Design, which will be completed prior to beginning the remedial action, will probably take on the order of about 12 to16 months to complete. Part of that will be to complete the pilot test, which will take a significant amount of time. Regarding the length of time to reliably achieve the cleanup levels, 30 years is not an unreasonable timeframe for meeting cleanup goals at the Site. What typically happens with this type of site is that the contamination may be reduced to a significantly lower level at an earlier date, but many times it is difficult to get the contaminants down to their MCLs. This is because the source area contamination continues to diffuse into the aquifers and contribute the groundwater plumes. The result is that pumping must be continued for a long time. By applying the in-situ chemical oxidation and the bioaugmentation treatments to destroy the source area and the deeper hot-spot contamination, the remaining contamination is at a lower concentration and the required pumping time should be somewhat reduced.

Comment: If the contamination area is expanded, is it possible that no drill area is going to also expand?

EPA Response: The drilling restriction area was put in place by the Texas Department of Licensing and Regulation (TDLR). At the present time this area fully encompasses the contaminated area, however, should future contaminant plume expansion occur outside of the drilling restriction area, then the EPA and TCEQ will work with TDLR to revise the area as necessary to fully include the contaminant plume. The "no new wells" area was put in place by Harris County. The EPA and TCEQ will work with Harris County to enlarge the "no new wells" area by a sufficient amount to fully encompass the groundwater contamination at the Site. This may also entail provisions for an alternative water supply source so that a water supply is available once new wells are restricted.

Comment: If the remediation efforts lower the water table, is there a prohibition, also, against digging your well in a no drill area?

EPA Response: The "no new wells" area was put in place by Harris County. Harris County has determined that the deepening of existing wells is also prohibited.

Comment: A comment about that: I think, I may be mistaken, that the wells can still be drilled at last I heard, but there are so many regulations in the casing size and protection for different levels to go down that it would be cost prohibitive to drill a well or to deepen a well. That is the last I had heard from supposed experts about what you could or could not drill in the area, but I may be wrong.

EPA Response: The TDLR established a restricted drilling boundary with defined water well construction specifications for an area around the Site. However, Harris County established a "no new wells" area around the Site that does prohibit the drilling of water wells. The two areas overlap somewhat, but not exactly.

Comment: What is the life cycle of vinyl chloride? I mean, if it just sits down in the ground, is it going to be there for three or four years or ten years before it goes through the natural deep grade cycle and becomes a stable element to your hoping that it will achieve?

EPA Response: Vinyl chloride at the Site is present as a breakdown product of tetrachloroethylene. Vinyl chloride may be broken down under either aerobic (contains oxygen) or anaerobic (no oxygen present) conditions. How long it remains in groundwater depends on the existing conditions, and may stay in groundwater for a long time. How long vinyl chloride will remain in Site groundwater under current conditions is unknown, but the reason for the bioaugmentation is to provide an extra boost to break it down more quickly.

Comment: So the early reactions from the PCE through the several steps you identified previously are fairly rapid down to the vinyl chloride state, and then it appears, to me, that it is slow in degrading from vinyl chloride to that base product you mentioned.

EPA Response: PCE and its more highly chlorinated breakdown products are more readily degraded in an anaerobic, reducing environment. Vinyl chloride, which is less chlorinated, can degrade under either aerobic or anaerobic conditions, but is more easily broken down in an aerobic environment. The relative breakdown rates of these chemicals is dependent on a number of factors, including the amount of carbon present, whether the conditions are aerobic or anaerobic, the types of bacteria present, nitrate and sulfate concentrations, etc., and the rates may change as the conditions change in different parts of the groundwater plume. However, bioaugmentation has been shown to completely breakdown PCE and its daughter products to non-toxic forms.

Comment: One of the problems that we are having currently, as mentioned earlier, was the fact that we still have wells that are uncapped, which was part of the TCEQ Water Line Agreement. So one question I have is: Once we move forward, is it going to be funded for completion, or is it going to be funded on an annual basis?

EPA Response: The remedial action will likely be funded on an annual basis. This is to allow the most efficient use of money by not having large sums applied to projects that may not be needed for several years.

Comment: TCEQ has been very good about putting information on their website concerning this Superfund Site. And I've got a glimpse that all EPA is talking about is putting this information into the repository in the library. Personally, I think that is kind of archaic, being the web services that we have today, plus the fact that it is very inconvenient, because you never know when it is being updated. So will the EPA consider having a website or taking on the TCEQ website and continuing on with that to keep the community updated?

EPA Response: It is anticipated that the current TCEQ website will be maintained as a cooperative effort between EPA and TCEQ. EPA will also continue to place documents into the Site repositories and will continue updating the Site Status Summary for the Site, which is on the internet at:

http://www.epa.gov/earth1r6/6sf/pdffiles/0605460.pdf

Comment: Since there is a moratorium on well water, and all of Harris County is supposed to be on surface water by 2020, is that going to make any effect as far as the well is concerned or what is the point?

EPA Response: One of EPA's remediation requirements is to clean up an aquifer to its beneficial uses. Regarding the Chicot Aquifer, it is considered to be a Class 1 drinking water aquifer and EPA requires that it be cleaned up to the drinking water standards. In addition, if remediation is not done, then the groundwater contamination could migrate downgradient and may expose other people.

Comment: In the Feasibility Study, there is a report in the back with some conflicting statements. In one section, it states that the local water gradient is moving to the southwest; and in another section it states that it is moving to the southeast.

EPA Response: The *Simple Capture Zone Modeling Report*, which is attached to the Feasibility Study, describes the deep zone water gradients in several directions at different times as a result of variable groundwater pumping rates. However, it does state that the current groundwater gradient is both southwest and southeast. The southwest direction is a typographic error, and the current groundwater gradient is in the southeast direction.

Comment: The Simple Capture Zone Modeling Report has conflicting statements in regards to the local water gradient; section 1.0 says it is moving southwest and section 3.0 states it is moving southeast. Which is correct?

EPA Response: Both flow directions are correct because they occurred at different times. The *Simple Capture Zone Modeling Report*, which is attached to the Feasibility Study, describes the deep zone water gradients in several directions at different times as a result of variable groundwater pumping rates. When the *Simple Capture Zone Modeling Report* was written in 2009, the gradient was described as "now more southwesterly" in Section 1. In Section 3.0, the report refers to a letter from Shaw that was dated 2007 (*Deep Monitor Well Groundwater Gauging and Rainfall Data, Jones Road Superfund Site).* According to that letter, there was a "southeasterly flow direction" at the time. The *Simple Capture Zone Modeling Report* therefore describes the gradient at different points in time that are separated by several years.

Comment: We pointed earlier the fact that the vinyl chloride is showing up to the west, and to the southwest as well, of the existing plume in the monitored wells. That being the case, is there any proposal to go further beyond the existing monitoring wells to see what the extent of the vinyl chloride is to the west and to the south?

EPA Response: Yes, sampling will be performed as necessary during the Remedial Design phase to confirm the current extent of contamination. EPA's goal is to keep the plume from moving further and identify areas where there may be people that could be impacted by it.

Comment: It appears there are no plans for additional monitoring wells, since vinyl chloride has already been detected in the monitor wells outside the plume boundaries; is this a prudent strategy?

EPA Response: Additional monitoring wells will be used as necessary to identify the extent of the ground water plumes and evaluate the performance of the remedial action. The number and location of additional monitoring wells will be determined during the Remedial Design.

Comment: Statements regarding in-situ chemical oxidation (ISCO) described it as having significant health and safety concerns. Could you explain a little bit more what those concerns are?

EPA Response: The health and safety issues for ISCO involve safely handling the oxidants by workers because the materials used are strong oxidants. These materials, in not handled correctly, may react energetically with combustible materials and also release oxygen that could help support a fire. The oxidizers may cause burns to skin, eyes, and mucous membranes upon contact. The life span of the oxidizing chemicals is relatively short after they are injected into the subsurface, and may range from several hours (for hydrogen peroxide) to several months (for permanganate). The byproducts of the oxidizer reactions are considered safe and non-toxic.

Comment: When will the sampling results from March 2010 be available? Where will they be posted?

EPA Response: The March 2010 sampling results are posted on the TCEQ website for the Jones Road Ground Water Plume within the "Remedial Investigation Documentation" section (see the last bullet). The EPA will place the sampling results into the Site repositories. As information becomes available, it is anticipated the TCEQ will continue to maintain and update their Jones Road website at:

http://www.tceq.state.tx.us/assets/public/remediation/superfund/jonesroad/table2feb09andmarch10_1.pdf

Comment: Will water sampling continue during the Remedy Selection and Remedial Design stages?

EPA Response: Water sampling may be performed during the Remedial Design as necessary for completion of the design. In addition, future sampling will be performed to monitor the performance of the remedial action, and the design of this future sampling program will be determined as a part of the Remedial Design.

Comment: If so, how frequently and which agency (TCEQ/EPA) will do this?

EPA Response: The EPA, with assistance from TCEQ, will be responsible for future groundwater sampling at the Jones Road Site. The sampling location and frequency will be determined during the Remedial Design.

Comment: Where will the results be posted (TCEQ/EPA web site)?

EPA Response: The EPA will place the sampling results into the Site repositories, and TCEQ is expected to continue maintaining and updating their Jones Road website at:

http://www.tceq.state.tx.us/remediation/superfund/jonesroad/index.html

Comment: Ground water flow is toward the southeast, based on the Feasibility Study. Please explain how vinyl chloride is showing up in monitor wells located to the southwest and northwest of the plume area.

EPA Response: The Site has very complex geology, and the reasons for contaminant flow across or against the apparent groundwater flow gradient are not clear. However, it may be that the high pumping rates in the area caused the contaminant movement. There may also be a preferential groundwater flow pathway as a result of an old paleo channel or an area with high permeability.

Comment: It appears two of the Remedial Action Objectives are conflicting:

a. Remove and/or treat groundwater containing concentrations exceeding the MCLs established under the Safe Drinking Water Act; restore all impacted water bearing units for use by the local community.
b. Prevent current and future use of the groundwater impacted by past site operations with ground water contaminants in excess of the MCLs.

I interpret this to mean: (a) you are going to restore the water bearing units allowing community use; and (b) the community will be required to get off ground water. Please explain the meaning of these objectives.

EPA Response: The Remedial Action Objectives mentioned do not conflict with each other, but instead complement each other. The objective to prevent future human exposure to contaminated ground water at unacceptable risk levels, or above the MCLs, provides protection until such time as the other objective, return of ground water to its expected beneficial uses wherever practicable (through removal and/or treatment), has successfully restored the ground water. Once the ground water has been restored, the objective to prevent exposure above the MCLs will not apply because there will be no exposure above the MCLs.

Comment: If homeowners will be required to switch to surface water (i.e. hook up to the water line), what will that process look like?

EPA Response: Additional water service connections are contingent on the water service provider being able to provide additional capacity and the homeowner's agreement to the hookup provisions. However, in general, the hookup process will consist of several things, including evaluation of the well location on the property, where well plumbing enters the house, and where the water line is located on the street (which side). Then the most efficient water line routing from the water main line to the house, and point of entry into the house, will be determined. In addition, the plumbing between the well and the house will be disconnected, the well electrical hookup will be removed, and a temporary cap place on the well.

Comment: Will the wells belonging to homeowners that have hooked up to the White Oak MUD remain uncapped for future use by the EPA? If so, will they be used for studying subsurface water patterns, chemical injection or both? Which wells will be used?

EPA Response: Some, but not all, of the wells will remain unplugged. EPA intends to include plugging and abandonment of water wells where people have connected to the waterline, with the exception that the wells needed for the groundwater monitoring network, water extraction or reinjection, or for deep zone bioaugmentation treatment injection will not be plugged. The Remedial Design will determine the necessary monitoring and injection wells.

Comment: Does the TCEQ water line agreement allow the use of homeowners wells for chemical injection?

EPA Response: Yes, according to the water connection agreement, the well owner agreed to relinquish use of and access to the well to TCEQ, and agreed that the well may be used for any investigation or remediation purpose.

Comment: The pump and treat plan estimates pumping more than 172,000 gallons of water per day, this is more than 6 times the average pumped by homeowners and businesses that switched to the water line. Will the potential drawdown be studied and will an estimated ground water level be established so homeowners with shallower wells can determine if this pumping will affect them?

EPA Response: The effects of the ground water containment system will be studied as a part of the modeling to be conducted during the Remedial Design. EPA will determine the pumping rates and location of the extraction and injection wells so that containment of the plume can be achieved while at the same time minimizing, as much as possible, the impacts on the water wells. However, for containment of the plume to be effective, the area of the plume will require additional drawdown compared to the rest of the aquifer to prevent the plume from migrating to new areas. The magnitude of this additional drawdown will be determined during the Remedial Design. It is also likely that variable aquifer conditions, resulting from changing aquifer recharge rates and variable pumping rates from aquifer users, may make it necessary to vary the amount of drawdown in the area. Because aquifer water levels are affected by these variable factors, it will not be possible to provide a useful ground water level estimate for each well. As an alternative to the existing water wells, the EPA plans to provide people in the Site vicinity another opportunity to sign up to be connected to the waterline without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity.

Comment: Does the TCEQ have any further responsibilities or duties concerning the site and if so what are they?

EPA Response: Yes, the TCEQ is the support agency for the remedial action at the Jones Road Site. This support includes things such as financial support, document review, consultation with EPA, etc. The EPA is the lead agency for the remedial action.

Comment: We have asked some questions tonight, and you have made some notes or she has some notes of ones that we did not get definitive answers. Will the EPA or TCEQ be responding to those, to at least the Jones Road Coalition or to us individually?

EPA Response: The EPA will respond to every comment in the Responsiveness Summary, which will be attached to the ROD and be a part of the Administrative Record for the Site.

Comment: Will EPA respond to comments received through the end of the comment period?

EPA Response: The comment period ends on June 28, 2010. The EPA will respond to every comment received during the comment period in the Responsiveness Summary, which will be attached to the ROD and be a part of the Administrative Record for the Site.

Comment: Does that mean we will not get an answer to these individual questions that we have asked tonight that you were not able to answer because you had to check on those until that time?

EPA Response: That is correct. The EPA will respond to every comment in the Responsiveness Summary, which will be attached to the ROD and be a part of the Administrative Record for the Site. However, you may call EPA to discuss the Site or any of these issues just for your information.

Comment: The District's public water system providing service to the Jones Road Superfund Site must comply with the Texas Commission on Environmental Quality, "TCEQ", capacity requirements. Water capacity for any significant and unspecified increase in connections served in Jones Road Superfund area as indicated by Mr. Baumgarten during the June 3, 2010, Public Meeting may not be currently available and may require substantial infrastructure construction for wells (or surface water capacity purchase), tanks, pumps, and distribution system line modifications. The White Oak Board requests that authorized representatives for any governmental entity or contractor meet with the Board and their representatives to discuss procedures for obtaining water capacity prior to committing any additional capacity for future government funded projects in Jones Road Superfund Site area that may be served by the District.

EPA Response: Comment noted. Additional water service connections are contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity.

Comment: The EPA has utilized all of the water capacity purchased from the District for the 144 connections served as part of the initial EPA government funded hook-up program and any additional connections added will require a capital contribution for infrastructure costs.

EPA Response: Comment noted. Additional water service connections are contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity.

Comment: The White Oak Board and representatives were initially informed by Harris County representatives assisting in the negotiation of water capacity and water service that all wells that were part of government funded hook-up program would be plugged in accordance with State of Texas plugging requirements to safeguard against contamination of customer and public water supplies. District representatives were informed on the day of the EPA water line construction project kick-off meeting on December 6, 2007, that wells for participants hooked up as part of government funded project would not be plugged due to uncertainty on which wells will be continued to be used as monitoring or remediation wells. The White Oak Board with the assistance of their consultants developed an alternative plan to address the potential for contamination of the public water system which included installation of a "high health hazard" rated backflow prevention assembly at the entry point to the residence or structure and annual inspection as required by TCEQ. This also included residential connections which normally do not require a "high health hazard" level of backflow protection and this alternative may not adequately protect the privately maintained internal plumbing system of the residence if the existing private well is reactivated and connected back to the plumbing system of the residence. The alternative cross-connection protection requirements have created a potential thermal expansion damage/injury situation where private plumbing lines may rupture causing property damage and injury. All customers in the Superfund Site were notified of this potential problem in workshops conducted by the District and thermal expansion information was contained in the water service agreement executed by the customer. One instance of thermal expansion damage was reported subsequent to completion of the government funded hook-up program. The alternative cross-connection protection requirements have also caused a financial hardship on customers relative to backflow assembly maintenance and annual inspection costs. As information, the

District currently requires any new customer that was not part of the government funded hook-up program in the Jones Road Superfund Site service area to plug any existing water well in accordance with State of Texas requirements prior to hook-up to the public water supply system and does not require a "high health hazard" rated backflow assembly for a typical residential or commercial water service connection meeting these requirements. The White Oak Board recommends plugging all wells in accordance with State of Texas plugging requirements that were part of the initial hook-up phase and plugging any other wells that are part of any future government funded hook-up program that will not be used for monitoring and remediation work. Additionally, the White Oak Board recommends development of a protocol to safeguard residential or commercial customers that will have an active monitoring or remediation well on their property so that they will no longer require a "high health hazard" rating for service connection.

EPA Response: Comment noted. The EPA intends to include, as a part of the remedial action, plugging and abandonment of water wells where people connected to the waterline installed by EPA and TCEQ. However, EPA does not plan to begin plugging the wells until a determination is made regarding which wells may be needed for the groundwater monitoring network, for extraction wells, or for deep zone bioaugmentation treatment injection. The Remedial Design will determine the locations of these wells.

Comment: Section 1.2.3.3 on Soil Impact to Human or Environmental Receptors concludes that there are low potential exposure pathways to the contaminated soil under the foundation and under the parking lot surface. This seems to not consider the possibility that construction and maintenance activities on this property may penetrate these surfaces and potentially expose workers to the contaminated soils. We request that institutional controls be placed to notify workers and prescribe appropriate protective measures for workers that penetrate these surfaces and are potentially exposed to PCE contaminated soils. Additionally, should a penetration be made on the building slab for maintenance or construction purposes, the penetration should be sealed after the work is complete to prevent indoor air quality degradation and exposure. An institutional measure should be required to enforce this possible situation.

EPA Response: The EPA agrees that institutional controls are necessary to prevent any potential future exposures that may result from construction or maintenance activities that may penetrate the surfaces and create an exposure pathway to underlying contaminated soils. Institutional controls to address this potential exposure pathway will be included in the selected remedy, and will be crafted during the Remedial Design.

Comment: As discussed during the public meeting held by the EPA on June 3, 2010, the Vapor Intrusion Study was conducted in a cooler time of year. We agree that there is a need to re-sample indoor air quality in the summer months to detect possible contribution from soil contamination below the building. Please modify Section 1.2.6.3 of the Feasibility Study with the findings from that evaluation and adjust the protective measures accordingly.

EPA Response: The additional indoor air sampling will be conducted as a part of the Remedial Design, and the results will be included in the Remedial Design report. The Remedial Design will address the results as necessary so that the remedial action is protective of human health and the environment.

Comment: As residents' wells in the Jones Road area age and need reworking and maintenance (deepen, replace, etc.) over the next 30 years or so, there will be a need for additional residents to tie-in to surface water for drinking as the wells cannot be drilled due to institutional controls. We encourage the EPA Superfund Program to cover the costs for the capacity and tie-in fees for residents in the well drilling exclusion areas. Additionally, as the ground water plume moves, additional residents and businesses may be impacted and should be allowed to tie-in to the surface water for drinking water purposes with incurred costs covered by the EPA Superfund Program for any capacity and tie-in fees.

EPA Response: The EPA plans to provide people in the Site vicinity another opportunity to sign up to be connected to the waterline without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity. Following the end of the sign up period, residents will still be able to connect if sufficient capacity exists, however, the resident will be responsible for arrangements with the provider, and responsible for all water line connection costs.

Comment: On Figures 16, 17, 18 and 19, we request modifying the legend for the thick black line to read: "Final Water Line Service Area Boundary, Harris County Prohibits Well Installation" to more accurately describe the Harris County Commissioners Court Order of March 4, 2008. A copy of this Order is attached.

EPA Response: The requested changes to the legend for the referenced figures will be made and the revised figures will be included in the Administrative Record for this Record of Decision.

Comment: The green line "Area of Institutional Controls (No use of Groundwater by Harris County)" in Figures 16, 17, 18 and 19 is attributed to a requirement of Harris County; however, this is not correct. This green line should either be removed or the legend revised to read: "Aggregate area of institutional controls on groundwater well drilling."

EPA Response: The green line on Figures 3 and 16 of the Feasibility Study has been adjusted to accurately show the area where well installation is prohibited by Harris County. There is no green line on Figures 17, 18, and 19. The revised figures will be included in the Administrative Record for this Record of Decision.

Comment: We recognize that the remediation of the ground water plume is complicated by the fact that approximately half of the property owners in the Jones Road Area continue to use ground water for drinking water. We recognize that this situation poses plume treatment challenges and creates a condition of possible exposure to contaminants through drinking water. For these reasons, we recommend that the EPA continue to periodically sample and analyze for PCE, degradation byproducts, and those chemicals used for remediation purposes until remediation of the groundwater plume is complete. We recommend this sampling also due to the condition that the plume is moving, and such sampling and analyses will keep the groundwater users updated on the position of the plume and serve to caution them on the risk of using ground water for drinking water purposes. We also request that the EPA provide written reporting of the analytical results to the residents, business and property owners with clear comparisons to applicable drinking water standards. The EPA should determine the frequency of this sampling based on risk related to consumption of drinking water from this groundwater source.

EPA Response: Ground water sampling will be performed as necessary to design the remedial action, and during the remedial action monitoring will be conducted to evaluate its performance. The monitoring program, including well locations, will be determined during the Remedial Design phase. The EPA will implement a system to provide notice to new landowners and reminders to existing landowners of the presence of contaminants above remedial goals in the groundwater. The sampling results will also be placed in the Site repositories.

Comment: Based on the information made available to-date of the different alternatives, we generally agree with the EPA's recommended alternative of treating contaminating soil and groundwater treatment in Alternative 4 which may be the most protective of the environmental and public health. Barring any technical and environmental issues with this proposal, we suggest certain modifications if this alternative is chosen. First, in treating the contaminated soil, some of the most contaminated soil located in the back alley of the strip center (source area) should be removed and properly disposed off-site. Concerning the ground water plume remediation plan, we encourage the reinjection of treated water in order to maintain groundwater levels for use by those who continue to use groundwater for drinking water and to guard against subsidence.

EPA Response: Excavation and off-site disposal of contaminated soils was considered in the Feasibility Study as one of the potential remedial approaches. With excavation, a large volume of contaminated soil could be rapidly removed. However, excavation would require demolition of the buildings and relocation of the current tenants. In addition, there would be logistical difficulties during demolition of the building and loading and transportation of materials in a congested traffic area. Excavation was not retained as a soil remediation technology because of the traffic impacts and difficulties involved in handling the contaminated soil in a developed residential and commercial neighborhood. Also, relocating the current tenants was considered impractical. Regarding groundwater, the treated groundwater would either be released to the drainage ditch, contingent on approval, discharged to sanitary sewer and POTW, if available, or reinjected into the WBU to offset potential subsidence. Reinjection of the treated water is expected to be the approach used at the Site. The design of the treated groundwater disposition system will be determined during the Remedial Design.

Comment: Figure 9 of the Feasibility Study relies on sets of samples taken from 2001 to 2006. More updated sampling is required to guide the remediation efforts. We recommend that the EPA should conduct more soil testing.

EPA Response: The design of the shallow source area treatments will be completed during the Remedial Design phase. It may be necessary to collect additional soil samples in order to complete the design or to conduct/evaluate any studies that are performed. Any additional soil sampling results will be included in the Remedial Design report.

Comment: There are several deeper wells located in the plume as illustrated in Figure 14 with screened intervals deeper than the plume. We are concerned that these wells may act as a conduit to allow the plume to move the contamination deeper.

EPA Response: The EPA agrees that plugging of water wells in the area is necessary because active pumping of the wells may cause migration of the plume, and the old water wells may act as a conduit for contaminant migration. The EPA intends to include, as a part of the remedial action, plugging and abandonment of water wells where people connected to the waterline installed by EPA and TCEQ. However, EPA does not plan to begin plugging the wells until a determination is made regarding which wells may be needed for the groundwater monitoring network, for extraction or injection wells, or for deep zone bioaugmentation treatment injection. The Remedial Design will determine the locations of these wells. The EPA will also provide people in the Site vicinity another opportunity to sign up to be connected to the waterline at no cost, and any new connection performed under this agreement will also include provisions for plugging any water well on the property.

Comment: It appears that the contamination plume may extend outside of the original "project area." Harris County is concerned about the owners of the properties this may affect, and feels that the adding on to the public water option should be made available to them. Harris County also appreciates EPA's willingness to re-open the public water supply option to those residents within the current boundaries who chose not to originally sign on to the system. It cannot be assumed, however, that the current provider of public water for the project area, White Oak Bend MUD, has the capacity to serve additional areas, and we request that the EPA consult with White Oak Bend MUD on this matter. Additionally, if Alternative 4 is chosen as the preferred method of remediation, plans should be made to accommodate residents outside the area and within the area not on the waterline whose wells may be compromised by the volume being pumped during the remediation process.

EPA Response: The EPA will work with TCEQ and Harris County to enlarge the "no new wells" area by a sufficient amount to fully encompass the groundwater contamination at the Site. This may also entail provisions for an alternative water supply source so that a water supply is available once new wells are restricted. The EPA plans to provide people in the Site vicinity, and any others in an expanded "no new wells" area, an opportunity to sign up to be connected to the waterline without having to pay the connection fee. Additional water service connections are, however, contingent on the water service provider being able to provide additional capacity. The EPA plans to work with the White Oak Bend M.U.D., and/or other providers in the area, to provide the necessary capacity. Following the end of the sign up period, residents will still be able to connect if sufficient capacity exists, however, the resident will be responsible for arrangements with the provider, and responsible for all water line connection costs.

Comment: On behalf of requests from residents for connections to the water line (about one year after the completion of the water line), the TCEQ contacted EPA to inquire about the potential availability of funds for the connections. At that time, EPA indicated the project was completed, the signing deadline was past, and funding was not available for additional connections. This information was conveyed to the residents' State Representative by the TCEQ and communicated to those residents. The TCEQ and an aide from the State Representative's office first learned that the EPA was considering the re-opening of water line connections to the community at public meeting held on June 3.

EPA Response: Comment noted. One of the remedial action objectives in this Record of Decision is to prevent future human exposure to contaminated groundwater at unacceptable risk levels. A significant effort was made in the past to inform the community regarding the groundwater contamination, and to provide every opportunity for community members to take advantage of the water line connections offered at no cost. However, only about half of the well users ultimately took advantage of that offer. Moving forward, the EPA believes that it is appropriate to re-open the opportunity to connect to the water line at no cost as a component of the final remedy for the Site for several reasons. The main reason is to prevent exposures to groundwater that is contaminated above the MCLs, but another reason is to minimize, to the greatest extent possible, the impact on other area water wells. Water wells within the plumes may act as conduits for transmission of contaminated water, and may adversely impact the remedial action as a result of any variable pumping rates for those wells. This is because one of the goals of the remedial action is to contain the spread of the contaminated plumes, while at the same time minimizing impacts on other area water wells that may result in reduced water tables and well capacities. Accomplishing this will require a careful balancing of the location and pumping rates for the containment extraction wells, and the use of water wells within the plume, with potentially variable pumping rates, will add to the difficulty of this task. Therefore, for the above reasons, another opportunity for water line connections should be provided.

Comment: Remediation activities and potential impact to residents/businesses on water wells: the TCEQ was conscientious in providing information to the community about the water line, voluntary participation, relinquishment, and plugging of wells and any potential impact that remedial actions may have to those well owners who elected to continue using their water wells (e.g., water table draw down near pump and treat extraction wells or potential localized impact to water-bearing units in the vicinity of injection/treatment such as ISCO or bioaugmentation).

EPA Response: Comment noted.

FIGURES

Figure 1 – Vicinity Map

Figure 2 – Site Location Map

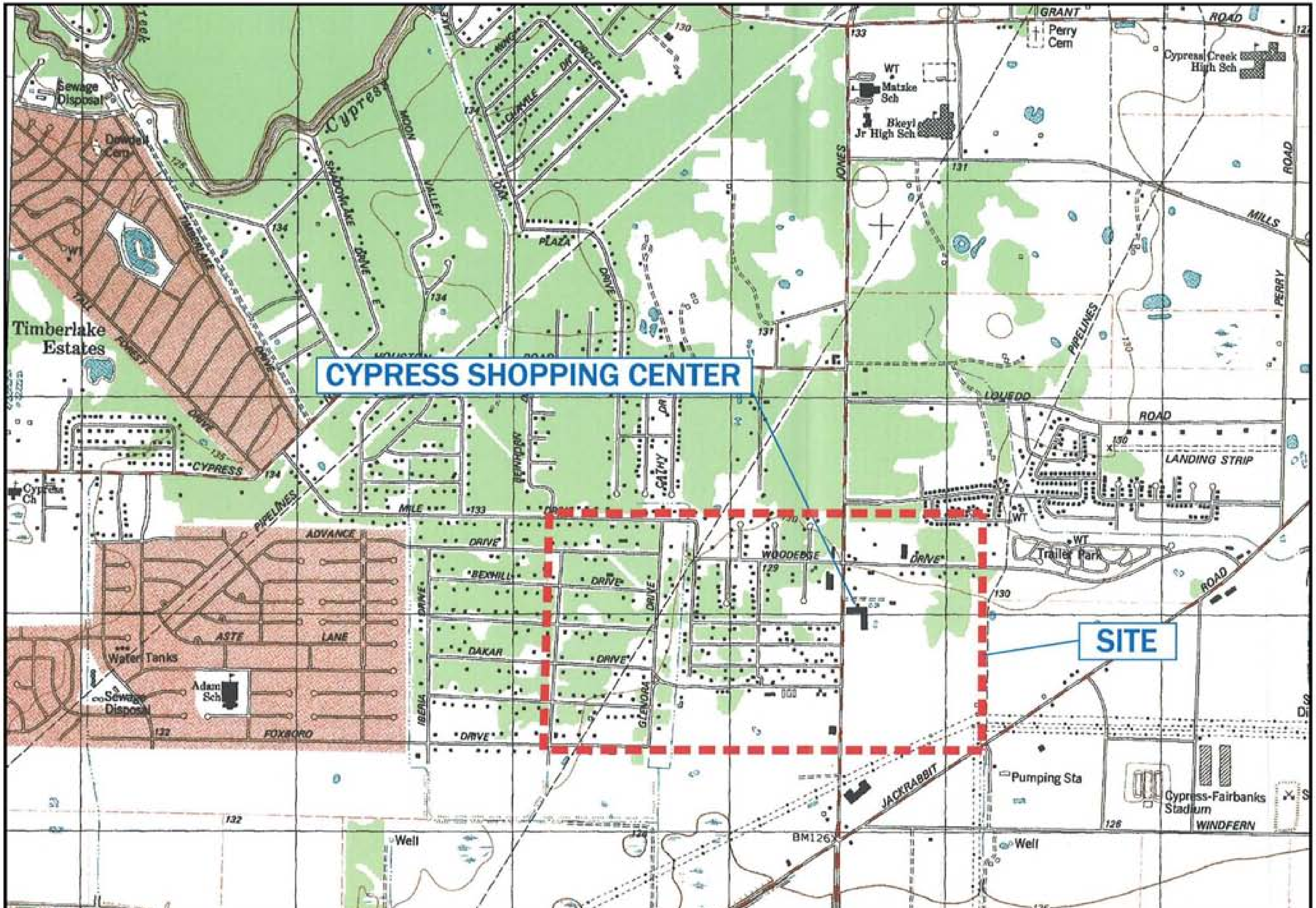


Figure 3 – Jones Road Superfund Site

Figure 4 – PCE Distribution in Soils

(less than 50 feet below ground surface)

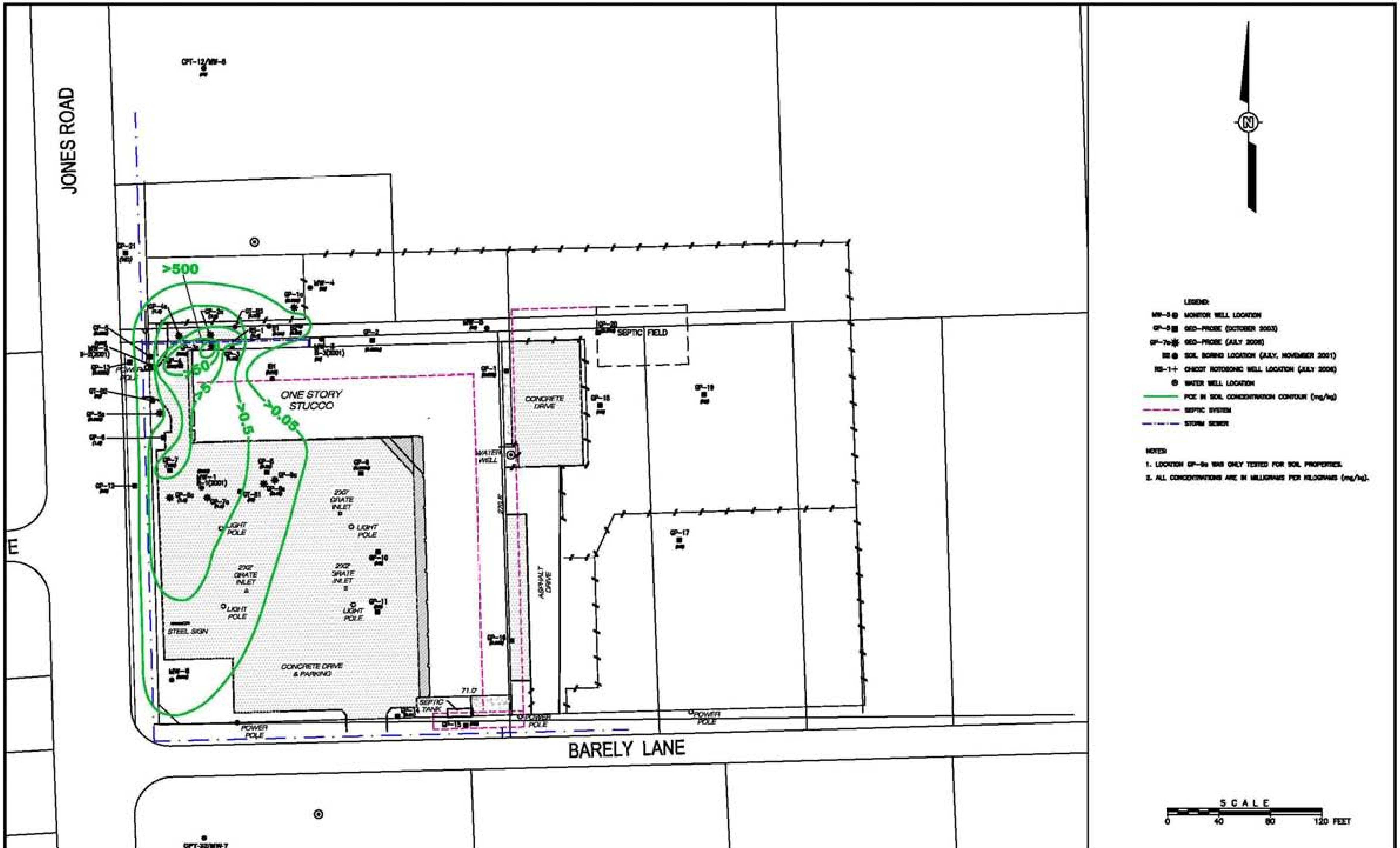


Figure 5 - PCE Distribution in Groundwater

(less than 50 feet below ground surface – Source Area)

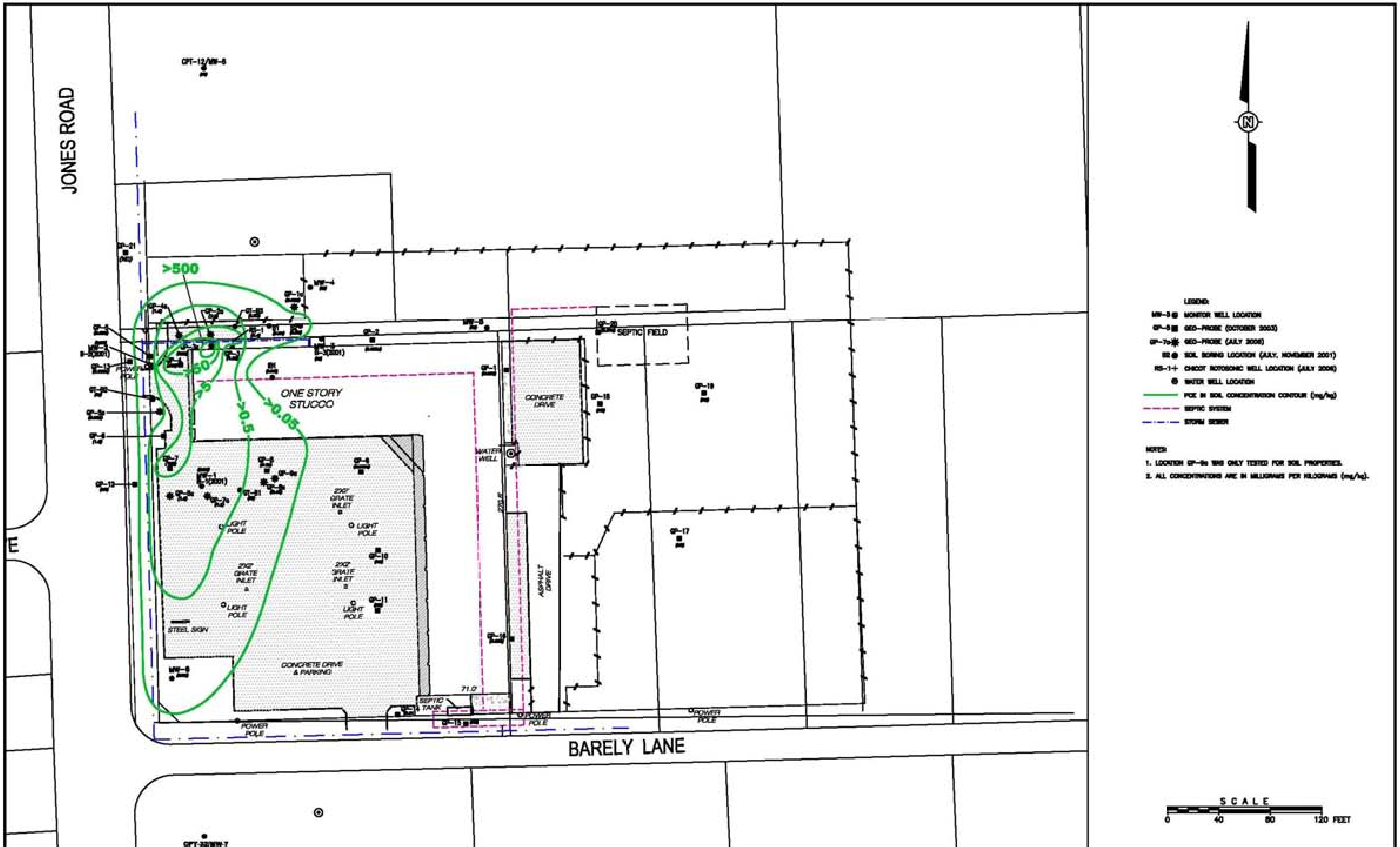


Figure 6 – Potentiometric Surface Map, Deep Groundwater Zone

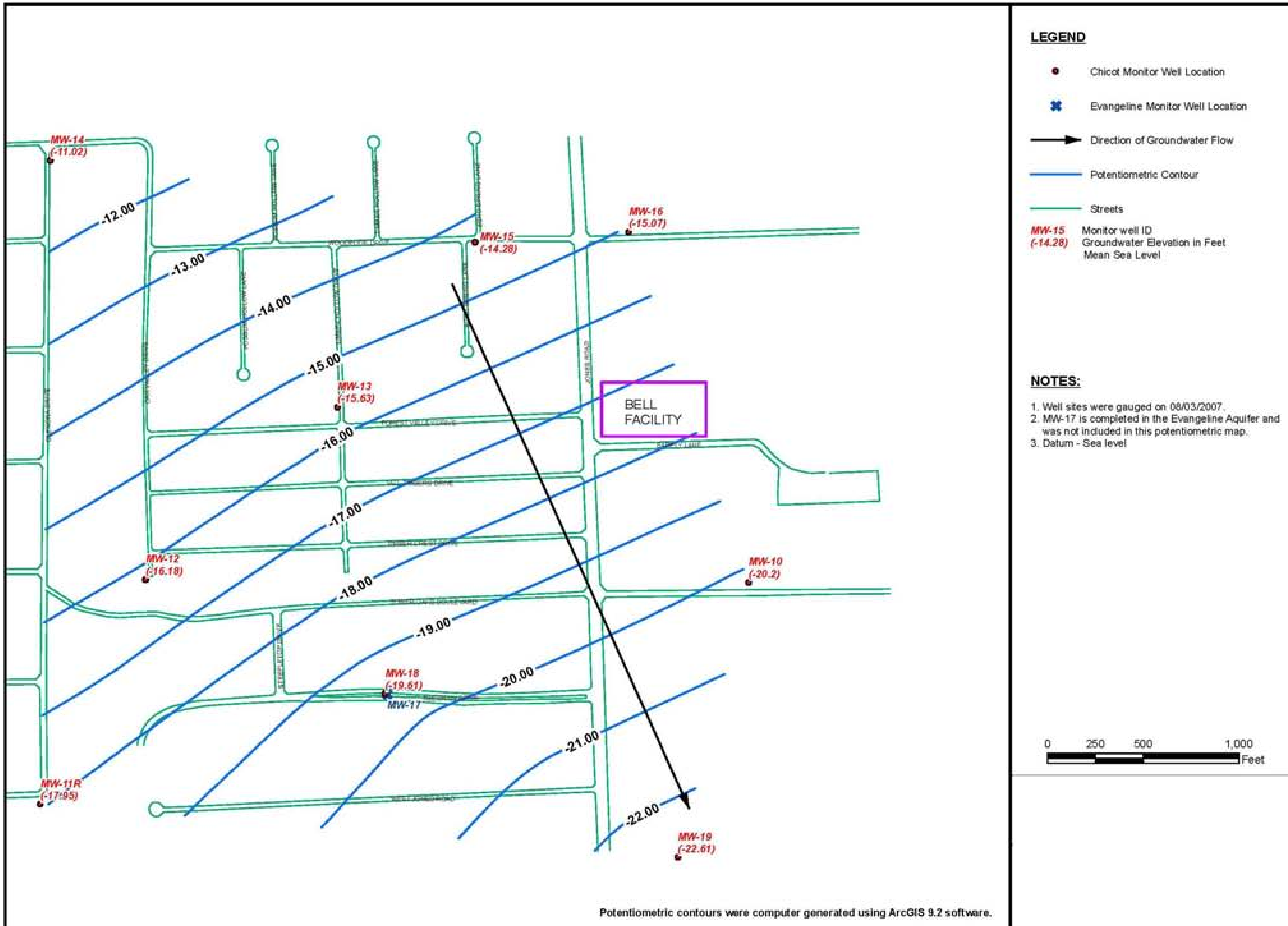


Figure 7 – PCE Distribution in Groundwater

(less than 200 feet below ground surface)

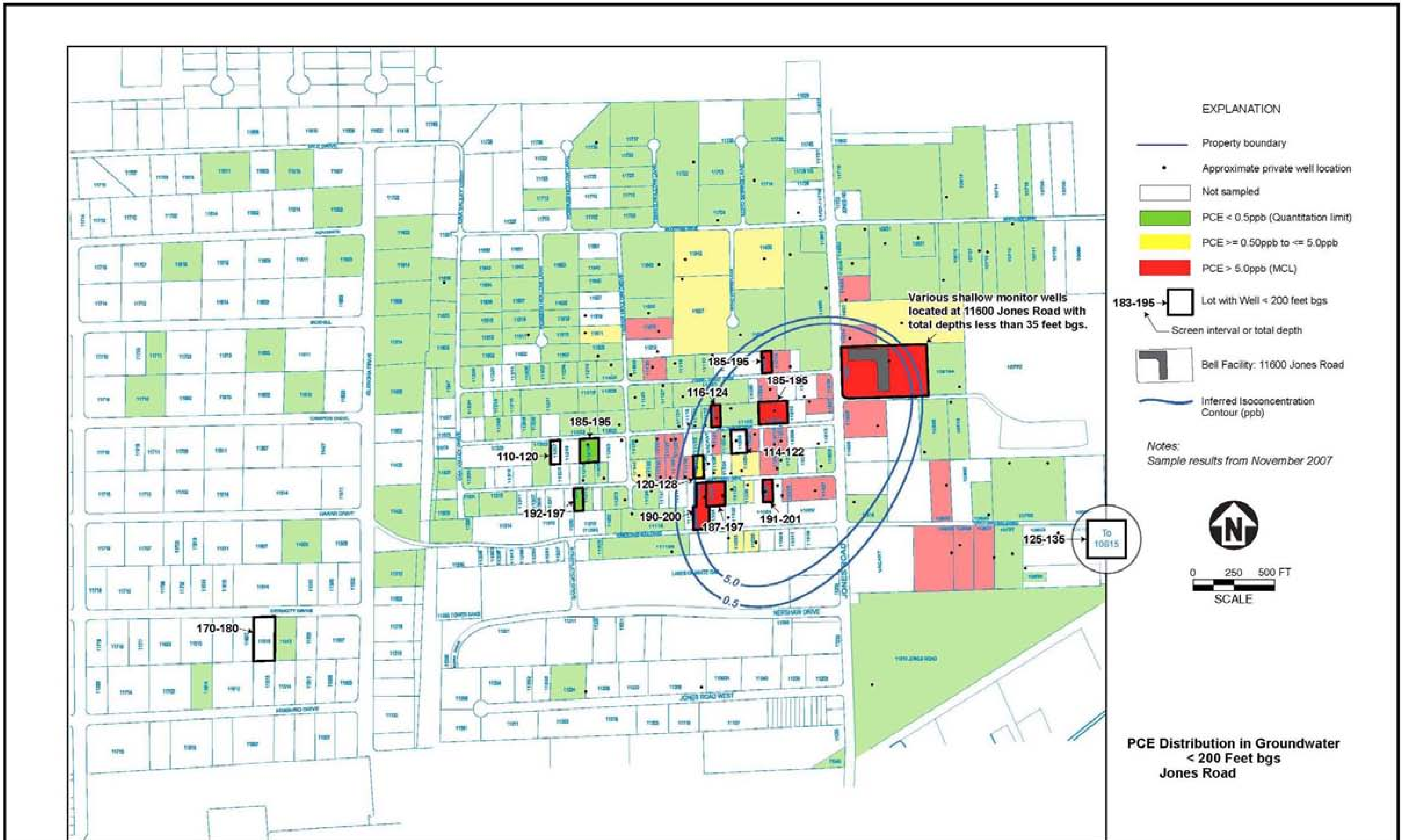


Figure 8 – PCE Distribution in Groundwater

(200 – 230 feet below ground surface)

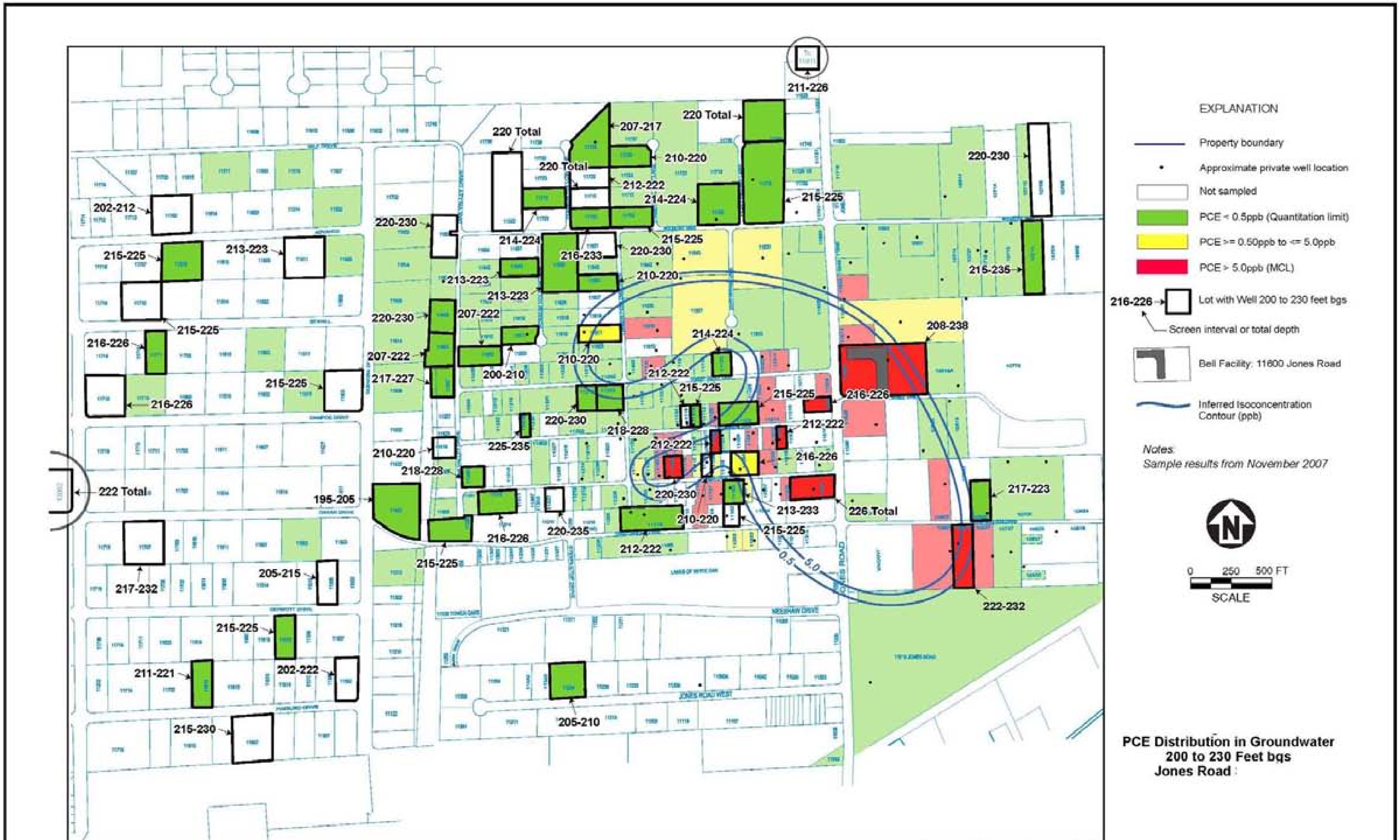


Figure 9 – PCE Distribution in Groundwater

(231 - 260 feet below ground surface)

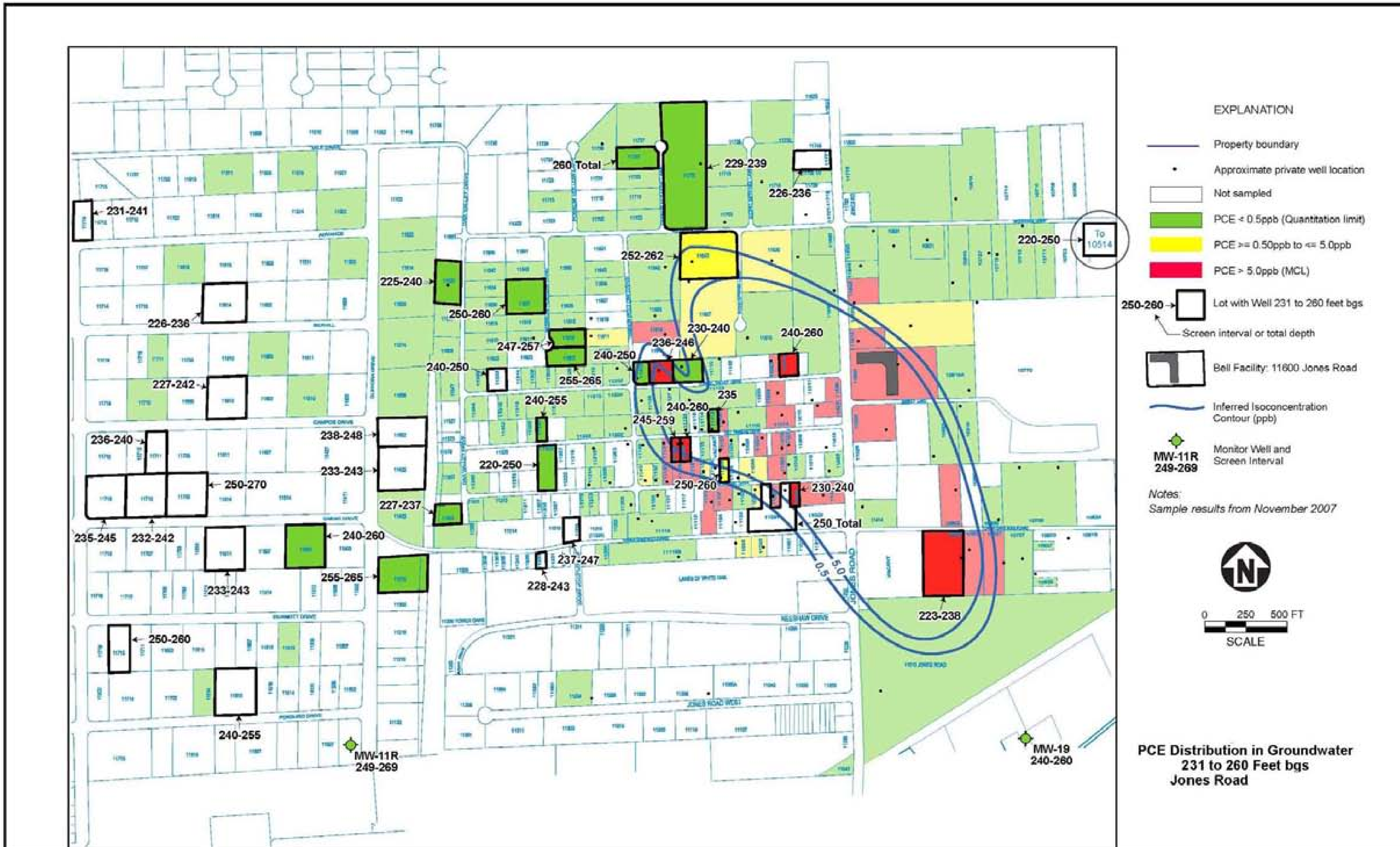
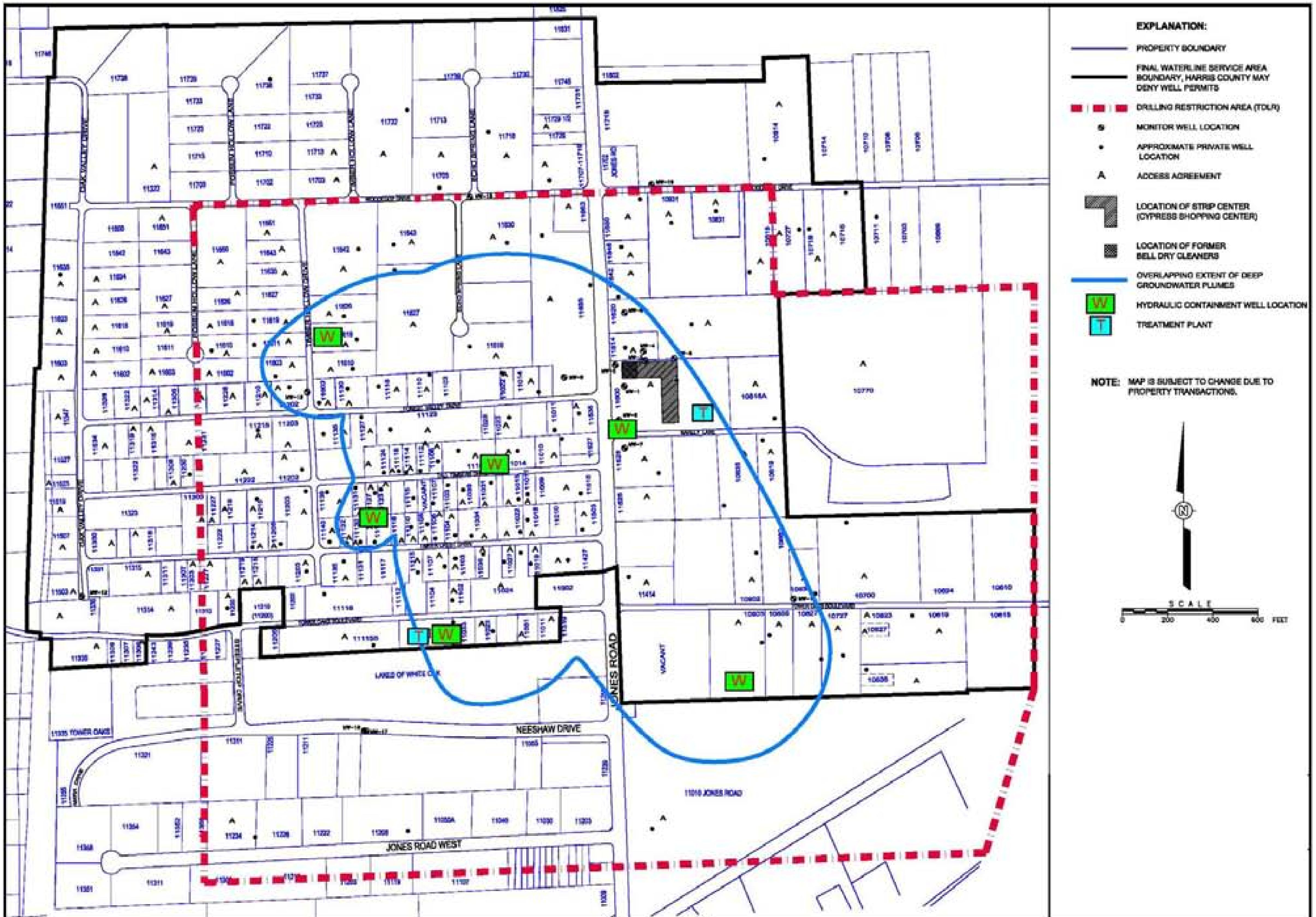


Figure 10 – Hydraulic Containment / Pump and Treat



TABLES

Table 1
Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
January 4, 1988	The Texas Water Commission (TWC) issued a *Notice of Registration for Solid Waste Management* (not a waste management permit) to Dae (Jimmy) Kim doing business as (DBA) Bell Dry Cleaners (Bell) at 11600 Jones Road. The notice recognized the Bell facility as a Small Quantity Generator of hazardous waste associated with the dry cleaning industry (40 Code of Federal Regulations Part 261; waste codes F001, F002, F004, and F005).
September 1, 1993	The TWC changed its name to The Texas Natural Resource Conservation Commission (TNRCC).
November 4, 1994	Associated Environmental Consultants, Inc. submitted *Phase 1 Environmental Assessment Report for Shopping Center Located at 11600 Jones Road*. The report was prepared for Metro Bank, N.A., and found no indication of the obvious presence or potential for contamination of the site based on property ownership review, examination of aerial photographs, available regulatory information, physical inspection of the site, and preliminary asbestos study. The report documented the presence of two 30-gallon drums and one aboveground storage container containing tetrachloroethylene (PCE) associated with the Bell laundry operation, and the PCE was reported to be recycled or disposed by Safety-Kleen of Houston, Texas. New and used motor oil, antifreeze, solvent for parts washing, used batteries, and used oil filters were associated with operations at Advanced Auto Repair. The auto repair related wastes were reported to be recycled or disposed by States Environmental Oil Services, Inc.
December 20, 2000	The Texas Department of Health (TDH) reported results from the public water system at Finch's Gymnastics USA to contain concentrations of PCE above the EPA established drinking water standards (0.005 ppm). Monthly sampling was conducted in January through May of 2001 by the TDH confirming these initial test results.
February 6, 2001	The TNRCC Drinking Water Monitoring Team, Public Drinking Water Section, submitted a *Tetrachloroethene Maximum Contaminant Level Exceedance* letter to Finch Gymnastics (10903 Tower Oaks Boulevard), advising Finch Gymnastics to "investigate the source of contamination, hire a competent engineer to review treatment alternatives, and/or seek alternative sources for water to prevent customer exposure and the risk of a violation".
June 5, 2001	Geo-Tech Environmental, Inc. (Geo Tech) submitted a *Phase 1 Environmental Site Assessment report for* the 11600 Jones Road site for Sterling Bank on behalf of Bell "to assist in the underwriting of a proposed mortgage loan of the property". During inspection of the property leakage from the dry cleaning machine was noted to be draining into the storm drains behind the Bell facility. The Phase 1 report recommended a subsurface soil and groundwater investigation around the dry cleaner to determine if facility operations impacted the area.
July 9, 2001	Geo-Tech submitted a *Limited Site Assessment* report for the Bell facility. Three soil borings were installed and subsequently converted into temporary monitor wells. Soil and groundwater samples taken from the west and front side of the Bell facility were impacted with PCE and degradation products. The report recommended that the owners enter into the TNRCC Voluntary Cleanup Program (VCP) to remediate the site and obtain a certificate of completion.
July 30, 2001	The TNRCC Drinking Water Monitoring Team, Public Drinking Water Section, submitted a *Prevention of a Violation of the Tetrachlorethene Standard* letter to Finch's Gymnastics USA & Childcare (10903 Tower Oaks), commending Finch's for providing "an alternative water source (bottled water) to their customers before formal notice of violation was issued for exceeding the standard for tetrachloroethene (PCE)". The letter also confirmed receipt of notification from Finch's that bottled water was in use, and that the TNRCC would continue to monitor the water supply (well water) on an annual basis, and that public notification would not be required.

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Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
August 2001	Geo-Tech submitted *Voluntary Cleanup Program Site Investigation Report* to the TNRCC documenting previous work completed at the Bell facility during the *Phase 1 Environmental Site Assessment* (Geo-Tec, June 2001) and the *Limited Site Assessment* (Geo-Tec, July 2001).
October 24, 2001	Dae Kim DBA Bell Dry Cleaners and Henry T.T. Lucky, Inc. (property owner of 11600 Jones Road) entered an agreement with the TNRCC to participate in the Texas Voluntary Clean Up Program (VCP).
December 12, 2001	Geo-Tech submitted a *Letter Report* to the VCP Project manager at TCEQ to document the installation of three permanent monitor wells (MW-1 through MW-3) and two soil borings (B-1 and B-2) at the Bell facility on November 2, 2001. Soil and groundwater analytical results indicated impacts by PCE and degradation products.
February 7, 2002	Geo-Tech submitted a letter report to the TNRCC Voluntary Cleanup Program on behalf of the Bell facility owner, Dae Kim. The letter report provided updates of Limited Site Assessment activities performed at the Bell facility on November 2, 2001 and additional investigation performed on January 4, 2002. During the additional investigation, one soil boring (IB-1) and three additional permanent monitor wells (MW-4 through MW-6) were installed. Soil boring IB-1 was installed inside the Bell facility. PCE, TCE, DCE, and VC were detected in shallow (less than 35 feet bgs) soil and groundwater samples at concentrations above Texas Risk Reduction Program (TRRP) Tier 1 Protective Concentration Levels for soil and groundwater ingestion in a residential setting.
February 14, 2002	The TNRCC Superfund Site Discovery and Assessment Program (SSDAP) sampled the water well and inside sink at Finch's Gymnastics U.S.A. and Childcare (Finch's) at 10903 Tower Oaks Boulevard, Houston, Texas. The sample results revealed PCE levels above the United States Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) of 5 parts per billion (ppb).
March 13 through 20, 2002	The TNRCC SSDAP conducted sampling of 43 wells in the Jones Road area. The samples were submitted to the Lower Colorado River Authority in Austin, Texas for analysis of VOCs using EPA Method 524.2. The analytical results revealed organic concentrations above background and/or the practical quantitation limit (PQL).
March 6, 2002	The TNRCC submitted a notification letter to Bell informing them that Finch's well had been impacted by PCE, and that if Bell was a potential source of the PCE, then Bell would be required to take additional measures to prevent exposure to affected water. The notification also indicated that if Bell failed to take the appropriate measures, the TNRCC would take the required measures to prevent exposure, and seek cost recovery from Bell in the future. The letter also requested a greatly accelerated schedule for pursuing delineation of the plume from the Bell site.
March 11, 2002	The TNRCC submitted a notification letter to Bell that the VCP would require him to perform emergency response actions to protect public health and safety from the threat caused by the PCE contaminated water.
March 14 through 20, 2002	Groundwater sampling of 44 area water wells within a 0.25-mile radius of the Bell facility performed by the TNRCC and Bell's consultant, Geo-Tech Environmental with review, validation, and DUS of the samples performed by Shaw. Bell's treatment system contractor installed eight granular activated carbon (GAC) filters on the wells that were contaminated with PCE, including Finch's water well. However, Bell failed to pay the contractor, and the contractor subsequently removed the GAC filters. The TNRCC replaced the GAC filters at the time of their removal by the contractor. Up to this date, approximately 150 wells or the 216 wells identified within a 0.5-mile radius of Bell were sampled, and at least 16 wells were discovered to be impacted by PCE at concentrations above the MCL.

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Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
March 26, 2002	The TNRCC submitted a letter instructing Bell to install and maintain carbon filters at additional sites and to conduct vapor monitoring at three sites.
March 27, 2002	The TNRCC submitted a letter to Bell indicating that Bell must submit a signed schedule for identifying all wells within a 0.5-mile radius of the Bell facility for sampling the wells located in the neighborhood on the west side of Jones Road. Bell was also instructed to schedule the installation of GAC filters on any wells impacted by PCE. Bell was to provide the schedule information to the VCP by April 1, 2002, or the VCP would initiate the fifteen day notice period for the termination of the VCP agreement.
March 27, 2002	The TNRCC submitted a letter to Lucky asking Lucky to submit a written statement by April 1, 2002 indicating that Lucky was committed to performing the emergency response measures described in the March 26 and 27, 2002 letters to Bell if Bell chose not to continue participation in the VCP. If Bell withdrew from the VCP and Lucky failed to commit to continue the VCP, then VCP would initiate termination of the VCP agreement with Lucky.
April 1, 2002	Lucky submitted a letter to the TNRCC stating that Lucky and Bell were committed to performing the required emergency response measures by April 12, 2002.
April 16, 2002	Bell and Lucky failed to perform the required emergency response measures, and withdrew from the VCP. The TNRCC submitted a letter notifying Lucky that the TNRCC would withdraw from the VCP agreement.
May 1, 2002	The TNRCC issued Emergency Order Docket No. 2002-0584-IHW-E to the estate of Dae Kim DBA Bell Dry Cleaners and Henry T.T. Lucky, Inc. The order specified action including (1) install and maintain filtration systems on impacted wells and prepare a sampling plan for the same; (2) sample and analyze all wells within a 0.5-mile radius of the site; (3) install filtration systems on any new wells found to be impacted; (4) perform an investigation to determine the source and delineate the plume; (5) submit a groundwater investigation report; (6) perform more investigation if deemed necessary by the Executive Director.
May 13 through 20, 2002	A *Focused Site Inspection* was performed at the site. 52 groundwater samples were collected to substantiate the release and migration of contaminants. Groundwater samples were analyzed by the LCRA.
June 10, 2002	The dry cleaning machine at the Bell facility was emptied of PCE and transported to another dry cleaning facility for use. This date marks the last use of PCE at the Bell facility.
September 1, 2002	The TNRCC changed its name to The Texas Commission on Environmental Quality (TCEQ).
September 12, 2002	The TCEQ Litigation Division issued a *Superfund Referral* requesting that the Bell case be referred to the Superfund Program based on "(1) documented releases of hazardous substances and hazardous wastes; (2) the site is inactive with respect to the management and disposal of hazardous waste since Bell no longer uses PCE in its process; (3) Bell have inadequate funds to address the cleanup; and (4) enforcement is no longer and effective option for addressing the contamination at the site".
September 18, 2002	The TCEQ prepared a *Compliance Evaluation Investigation* (CEI) report documenting several Notice of Violation (NOV) reports issued to Bell for mismanagement of waste materials. The NOVs were related to improper documentation of waste disposal records. Review of partial records provided by Bell indicates that Safety-Kleen Systems (SK) transported 5,115 lbs in 1999; 1,755 lbs in 2000; 1,157 lbs in 2001; and 787 lbs of waste PCE in 2002.
October 2002	Groundwater sampling event. TCEQ installed GAC filtration systems on 21 water wells where PCE concentrations were detected above the MCL.

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Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
October 17, 2002	TCEQ presented a questions and answers meeting with the public regarding the Jones Road Groundwater Plume.
December 2002	PCE, DCE, and chloromethane were detected in a sample collected from a public water supply (PWS) well located at Finch's Gymnastics USA and Childcare at concentrations exceeding the United States Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) of 5 parts per billion (ppb). Bottled drinking water was subsequently provided to the facility patrons and staff.
January 2003	Groundwater sampling event. TCEQ installed GAC filtration systems on 21 water wells where PCE concentrations were detected above the MCL.
January 24, 2003	The Texas Department of Licensing and Regulation notified all licensed drillers in Harris, Waller, Grimes, Ft. Bend, Brazoria, Galveston, Montgomery, San Jacinto, Chambers and Liberty counties, of more stringent specifications for drilled water wells within the Jones Road Groundwater Plume area. Department of Health (TDH) reported results from the public water system at Finch's Gymnastics USA to contain concentrations of PCE above the EPA established drinking water standards (0.005 ppm).
January 30, 2003	The TCEQ SSDAP Remediation Program issued an interoffice memorandum summarizing the Jones Road ground water plume. The memo indicated that 228 wells were sampled in the area, and 23 wells had detections of PCE at or above the EPA MCL of 5 ppb. The memo also indicated that GAC filtration systems had been installed 23 wells, and that 18 wells contained PCE concentrations below the MCL. The boundaries of the plume as the southern end of Echo Spring (northern boundary); Tower Oaks (southern boundary); Timber Hollow (western boundary); and eastern side of Jones Road (eastern boundary).
February 3 through 10, 2003	Groundwater sampling event of approximately 250 locations.
April 2003	The TCEQ prepared Hazard Ranking System Documentation Record for the Jones Road Ground Water Plume (CERCLIS Site ID Number TXN 000 605 460) in cooperation with Region VI of the EPA. The Hazard Ranking Score for the site was determined to be 46.5
April 30, 2003	The Jones Road site was proposed for addition to the NPL.
May 19 through 23, 2003	May 2003 Groundwater sampling event.
June 10, 2003	Interoffice Memorandum from the TCEQ Jones Road DQO Team to the TCEQ Superfund Team Leader (Jim Sher) recommending additional investigation at the Jones Road site. The recommendations included delineation of the shallow groundwater plume from its source (Bell); quarterly monitoring of select residential water wells and maintenance of filter systems; gathering and assimilation of additional well, hydrological, and other data; and investigation of additional source areas. Delineation recommendations included installation of 46 Cone Penetrometer Test (CPT) points to a depth of approximately 40 to 60 feet bgs; installation of 14 temporary monitor wells, collection of 65 shallow groundwater samples; and laboratory analysis by a mobile laboratory.
July 2003	Jones Road area was surveyed and base maps were subsequently prepared using survey information.

Table 1
Chronology of Site Investigations and Significant Events
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Shaw Project Number 137226

Date	Event
August 19, 2003	Shaw prepared a Health and Safety Plan (HASP) for surface soil sampling, drilling, installation of monitor wells, residential water sampling, and surveying. The HASP detailed the procedures to be followed during site activities in accordance with the Occupational Safety and Health Administration (OSHA), Shaw standard operating procedures, and all other federal, state, and local procedures applicable to the type of remedial investigation tasks performed at the Jones Road site.
August 4 through 12, 2003	August 2003 quarterly groundwater and treatment system monitoring event. One hundred forty-one (141) groundwater samples, 18 field duplicate samples and 6 field blank sample were analyzed by LCRA Environmental Laboratory Services. The analytes requested for water samples were Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) Method 524.2, metals (calcium, iron, magnesium, and manganese) by EPA 200.7, sulfide by EPA 376.2, and sulfate by EPA 300.0.
August 25, 2003	Field activities for the remedial investigation began. Thirty-seven CPT test borings and three monitor wells were installed. Soil and groundwater samples were collected. Documented in an April 2004 report.
August 30, 2003	Shaw submitted a *Remedial Investigation Work Plan* , and a *Field Sampling Plan (FSP)* for soil and groundwater investigations at the site. The FSP presented the requirements and standard operating procedures for conducting field operations and all sampling, handling, and collection activities at the Jones Road site.
September 29, 2003	Jones Road Groundwater Plume Site was listed on the National Priority List (NPL).
September 30, 2003	Shaw meeting with TCEQ. Discussed water well sampling data collected during August 2003 sampling event; remedial investigation work and data collected; elevation and position survey of data points; preparation of maps presenting the sampling data; identification of soil sampling locations; installation of remaining monitor wells; Geoprobe sampling in concert with Color Tec screening and mobile laboratory; engineering investigation of Finch's water well system; CLP sampling personnel and equipment/supplies; identification of subsurface utilities; rental of office/warehouse space for routine quarterly sampling events; and historical database search with aerial photographs/historical use of adjoining properties (to 11600 Jones Road).
October 1 through 14, 2003	TCEQ internet and telecom search to locate contacts of the Harris County Permit Department for drawings and specifications of the septic system installation at 11600 Jones Road.
October 17, 2003	The TCEQ prepared *Amendments to the Field Sampling Plan* . The purpose of the document was to amend the original FSP prepared by Shaw, dated August 30, 2003, to include anticipated shallow soil and groundwater investigations associated with the Bell facility. The original FSP was intended for collection of deep groundwater samples from private wells in the area, and not shallow soils and groundwater. Specifically, the FSP amendment describes the methods/processes for collection of soil and groundwater using a Geoprobe Rig (direct push technology (DPT)), shallow groundwater samples, soil samples, photoionization detector screening, Color Tec screening, mobile laboratory analysis of soil and groundwater, and Contract Laboratory Program (CLP) analysis of soil samples.
October 22, 2003	Soil sampling was conducted at 21 geoprobe locations. Groundwater samples were collected at selected locations. Documented in an April 2004 report.
November 10 through 20, 2003	November 2003 quarterly groundwater and treatment system sampling event.
November 18, 2003	TCEQ community meeting with slide presentation of conceptual site model for the 11600 Jones Road area.

Table 1
Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
February 12 through 20, 2004	February 2004 quarterly groundwater and treatment system sampling event.
February 16, 2004	Shaw submitted a *Remedial Investigation Work Plan Addendum* , and a *Field Sampling Plan Addendum* to address collection and comparison of inorganic water quality parameters.
April 20, 2004	TCEQ community meeting with slide presentation, including a three dimensional visualization model of the source area based on soil and groundwater data.
April 28, 2004	Shaw submitted *Remedial Investigation - Geoprobe; October 2003* to the TCEQ. 21 soil borings (GP-1 to GP-21) were installed to a maximum depth of 35 feet bgs during the period from October 22 - 29, 2003. The purpose of the investigation was to identify potential discharge points to the shallow soil, including a storm drainage grate outside the back door of the Bell facility, roadside ditches that receive stormwater from the grate, areas associated with the septic system (field and tank), areas where sewer pipes are located, and the foundation of the building. All soil and groundwater samples were collected using DPT drilling methods. Soil samples were analyzed by an off-site fixed-based laboratory performing under the Contract Laboratory Program (CLP) of the EPA. Selected soil and groundwater samples were analyzed by an on-site mobile laboratory (ESN) which was mobilized to the site for a limited time. 17 groundwater samples, 40 soil samples, 1 field blank, 1 equipment rinsate blank, and 1 decon water sample were analyzed by ESN mobile laboratory. The analytes requested were VOCs by SW-846 Method 8260B . The soil samples were reported on a wet-weight basis. This was a variance obtained from TCEQ as this was a mobile laboratory set up for quick turnaround. The results of the mobile laboratory analyses were compared to a field screening technique which also reported results on a wet-weight basis. The purpose of the investigation was to delineate and identify "hot spot source" areas of contamination into the shallow soils (upper 35 feet) in the immediate vicinity of the Bell facility and to assess the Color Tec field screening method on soil matrix samples against analysis performed by an on-site mobile laboratory. Color Tec method was determined to have poor comparison to laboratory methods for soils. Laboratory results indicated impact to soil in 9 of 21 DPT borings from four different sample zones (1-2 feet bgs; 16-19 feet bgs; 19-30 feet bgs; and 30-35 feet bgs).
April 29, 2004	Shaw submitted *Remedial Investigation - CPT; August/September 2003,* to document field activities performed August 25 through September 8, 2004 around the Bell Facility. 37 Cone Penetrometer Test (CPT) borings (CPT-1 through CPT-7 and CPT-10 through CPT-37) were installed to obtain electronic soil boring logs and to collect select groundwater samples. No soil samples were collected. The CPT borings were installed to approximate depths of 60 feet bgs. Groundwater samples were submitted to Severn Trent Laboratories in Houston, Texas for analysis of VOCs using Method 8260. The groundwater samples were also tested using the Color Tec field screening method to determine the accuracy of the Color Tec method to fixed laboratory analysis. The correlation was determined to be excellent. Analytical results revealed detectable PCE, TCE, DCE, and VC concentrations within water samples collected approximately 30 feet bgs in the interbedded zone near the Bell facility. One sample collected from CPT-32 (south of Bell across Barely Street) was detected at a depth of approximately 50 feet bgs. Monitor wells MW-7 through MW-9 were installed based on the CPT investigation data.
May 2004.	EPA awarded a technical assistance grant (TAG) to the Jones Road Coalition for Safe Drinking Water.
May 3 through 13, 2004	May 2004 quarterly groundwater and treatment system sampling event.

Table 1
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Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
May 17, 2004	Shaw submitted *Remedial Investigation - Water Well Inventory Survey, May 2004* . The report was prepared to document information about active or past drinking water sources through interviews with individuals, and to submit TCEQ well inventory forms for their completion and return to the TCEQ. 47 locations were included in the survey, and a summary table of the information was prepared, along with an updated base map with approximate well locations and water use status.
June 30, 2004	Shaw submitted *Remedial Investigation - Water Well Inspections to Support Planning for Water Level Measurement Collection* . The report was prepared to verify the status of select existing private water wells in the Jones Road area, and to assess their potential use as data collection points for water level measurements. The report was also prepared to evaluate the wells for potential retrofit for water level measurement purposes. Field inspections were performed on June 15, 2004.
July 22, 2004	Shaw submitted *Remedial Investigation - Data Logger Assessment to Support Planning for Water Level Measurement Collection* report. The report was prepared to assess and evaluate the viability of using data loggers to obtain digital water level data from water wells in the Jones Road area. The report also compared costs and technical specifications of various different data logger brands.
August 9 through 27, 2004	August 2004 quarterly groundwater and treatment system sampling event.
Date Unknown	TCEQ staff conducted file searches and collected available water drillers logs in the project area. Well construction information was determined to be available for only 30 to 40% of the wells in the area. Initial records search of public water supply (PWS) files were performed, and four geophysical logs were located with a 2- to 3-mile radius of the Bell facility. Shaw conducted a detailed file review and collected additional geophysical logs and hydrologic testing information associated with PWS wells located within a 3-mile radius of the Bell facility.
August 26, 2004	Shaw submitted *3D Visualization Development* . A three dimensional visualization model of the source area was prepared based on soil and groundwater data. The purpose of the model was to provide a visualization to better understand the spatial relationships of the impacts to soil and groundwater, and provide a spatial data analysis tool to support the planning of future investigations.
August 26, 2004	Shaw submitted *Remedial Investigation - General Groundwater (Inorganic) Quality Characterization and Comparison, March 2004* . The purpose of the investigation was to characterize general inorganic groundwater quality parameters from select monitor wells and private water wells, and also to compare water quality between wells to assess whether the groundwater from different wells represented the same, similar, or different water- bearing units to help assess the nature and extent of contaminant migration. Groundwater samples were collected from 3 monitor wells and 15 private wells. The groundwater samples were submitted for analysis of magnesium, iron, calcium, sodium, potassium, barium, zinc, boron, chloride, alkalinity, nitrate, sulfate, total dissolved solids (TDS), total organic carbon (TOC), phosphate, fluoride, biological oxygen demand (BOD), and chemical oxygen demand (COD).
September 22, 2004	Shaw meeting with TCEQ. Discussed preparation of maps to illustrate PCE distribution in groundwater; preparation of an inventory of all reports related to the project; recommendations for the pending CPT investigation; drilling methods for installation of the proposed deep monitor wells; waste classification related to deep well installation; water well retrofit for installation of data loggers; hydrologic data gathering performed by TCEQ; Shaw's key personnel to be assigned to the Feasibility Study process; surveying related to the water well retrofits and CPT installations; investigation at Finch's Gym; and status of report deliverables.
October 19, 2004	The Texas Department of State Health Services presented the draft report on the assessment of the Jones Road Groundwater Plume at a Community meeting.

Table 1
Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
November 2 through 18, 2004	November 2004 quarterly groundwater and treatment system sampling event.
November 10, 2004	Shaw submitted *Remedial Investigation - CPT; August 2004* , to document field activities performed August 25 through 27, 2004. Ten CPT borings (CPT40 through CPT49) were installed near the 10902 Tower Oaks property and 10819 Barely Lane, which was an area suspected to be a separate source of groundwater contamination (other than 11600 Jones Road). Soil samples were not collected as part of this assessment. All collected groundwater samples were submitted to Liberty Analytical, in Cary, North Carolina as part of the EPA Contract Laboratory Program (CLP). All sample analyses were run for volatile organic compounds (VOCs) using the CLP Method OLCO3.2. In addition, field screening of groundwater samples for PCE was also performed in the field using the Color-Tec procedure. Results of the laboratory showed no PCE concentrations above the contract required quantitation limit (CRQL), and that additional source areas are not located in the locations where samples were collected.B88
December 8, 2004	Shaw submitted *Interim Report for Well Head Retrofit/Cleanout* . The report documented work performed by Wellco Drilling Services to retrofit five water wells to accommodate the installation of pressure transducers for electronic water level measurement purposes. Specifically, the report documented all equipment removed from the wells, the amount of drop pipe installed, and the depth from surface where each pressure transducer was installed. For each well, Wellco removed the existing production pipe; video taped the inside of the wells; ran natural gamma geophysical logs to assess the integrity of the wells and to determine the screened intervals/total depths; installed one-inch diameter PVC drop tubes; installed pressure transducers through the drop tubes; and installed new well caps.
January 20, 2005	Martin Survey Associates, Inc., Houston, Texas, performed a survey of position and top-of-casing elevations of nine private wells and monitor wells MW-6 through MW-9. Martin also performed a survey of CPT-40 through 49 locations.
February 7 through 16 and March 1, 2005	February 2005 quarterly groundwater and treatment system sampling event.
February 9, 2005	Martin Survey Associates, Inc. updated the survey maps/data by adding the locations and top-of-casing elevations of deep monitor wells MW-10 through MW-19. Previous existing survey data included locations and elevations of shallow monitor wells MW-6 through MW-9, CPT borings CPT-40 through CPT-49, and nine private water wells in the general study area.
February 17, 2005	Shaw submitted 2-Dimensional and 3-Dimensional figures for August 2004 groundwater sampling results.
February 22, 2005	Shaw submitted *First Three-Month Water Level Measuring Event Report, January 2005.* The report summarized water level elevation data collected from electronic pressure transducers installed in five water wells completed within the Chicot Aquifer. The purpose of the investigation was to determine the effects of private well pumpage on the aquifer; observe seasonal impact on groundwater levels; and determine the groundwater flow direction and gradient within the Chicot Aquifer. The transducers were installed during the period from October 4 through November 18, 2004, and were programmed to collect continuous groundwater elevation data on 15 minute intervals. The data were reported through January 4, 2005, and revealed that the Chicot aquifer is very prolific and pumping, atmospheric pressure, and rainfall has little effect upon water levels. The general groundwater flow direction was determined to be south.
April 6, 2005	During a project meeting between TCEQ and Shaw E&I, it was decided to install nine deep monitor wells in the Chicot aquifer and one deep monitor well in the Evangeline aquifer.

Table 1
Chronology of Site Investigations and Significant Events
Jones Road Groundwater Plume Federal Superfund Site (SUP075)
Harris County, Texas
Shaw Project Number 137226

Date	Event
May 2 through 18, 2005	May 2005 quarterly groundwater and treatment system sampling event.
May 26, 2005	Shaw submitted *Revised RI Planning/RI Scope Memorandum*. The memorandum presented a range of remedial strategies that may be applicable to the site with discussion of the relative advantages and disadvantages of each, and recommendations for collection of additional data during future RI investigations. The range of remedial strategies discussed included (1) No Further Action; (2) Institutional Controls; (3) Monitored Natural Attenuation; (4) Containment (caps & covers, subsurface horizontal barriers, and hydraulic containment); (5) In-Situ Treatment (soil vapor extraction, chemical oxidation, bioremediation, chemical reduction); and (6) Excavation. The memorandum also discussed the role of groundwater modeling in future understanding of the site and application of treatment technologies. Recommendations included acquisition of additional data including soil oxidant demand (SOD) tests, sieve analysis, polymerase chain reaction (PRC) to determine the type of bacteria in the subsurface, dissolved organic gasses, groundwater field parameters (pH, oxidation-reduction potential (ORP) and dissolve oxygen (DO) collection), soil total organic carbon (TOC), and treatability studies.
June 8 & 9, 2005	Shaw submitted access request letters for drilling, staging drilling equipment and storing investigation derived waste at multiple properties in the Jones Road area, related to installation of deep monitor wells into the Chicot Aquifer.
June 9, 2005	Shaw submitted *Traffic Control Plan; Chicot and Evangeline Monitor Well Installation*, to the Harris County Public Infrastructure Department Permitting Division for installation of seven deep monitor wells in road right-of-ways. The traffic control plan specified hours of operation, communication devices, warning signs, and locations where the proposed wells were to be installed.
June 9, 2005	TCEQ presented a community meeting to present a proposed water line installation.
June 28, 2005	The TCEQ submitted *Jones Road Revised Conceptual Site Model* to Shaw for general information about the site. The CSM provided a site description, data acquisition up to June 2005, regional geology/hydrology, initial CSM scenarios, description of exposure pathways and routes, data gaps, fate and transport characteristics, and observations supporting the revised CSM. Several model scenarios were considered, but the most likely scenario was determined to be vertical migration of PCE as dense non-aqueous phase liquid (DNAPL) to deeper aquifers, and lateral migration of dissolved phase PCE to shallow and deep aquifers.
July 28, 2005	Shaw submitted *Addendum to the Field Sampling Plan; June 2005*. The scope of the field work outlined in the addendum to the Remedial Investigation Work Plan was to further characterize the dense, non-aqueous phase liquids (DNAPL) and dissolved-phase contaminants in groundwater units at the site, and collect treatability samples for use in the feasibility study. The addendum specified sampling to be performed using standard investigative methods including geoprobe boring installation, rotosonic drilling, mud rotary drilling, and field screening using the Color-Tec method developed by Ecology and Environment, Inc.
August 4, 2005	TCEQ Community Meeting Handout.
August 4 through 16, 2005	August 2005 quarterly groundwater and treatment system sampling event.

Table 1
Chronology of Site Investigations and Significant Events
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Date	Event
October 5, 2005	Shaw submitted *Final Groundwater Elevation Data Report, October 2004 - August 2005.* The report summarized water level elevation data collected from electronic pressure transducers in five water wells. This report was a continuation of the investigation reported in *First Three-Month Water Level Measuring Event Report, January 2005* (Shaw, February 22, 2005), with the extended investigation period October 2004 through August 2005. Slight water level elevation changes throughout the year were suspected to be related to pumping demand upon the aquifer during peak use seasons (summer) and less use seasons (winter). Groundwater flow direction remained unchanged to the south, with an average groundwater gradient of 0.011032 foot/foot.
October 31 through November 4, 2005	Installed deep replacement monitor well MW-11R and deep monitor well MW-19. The screen for monitor well MW-11R was installed from 249 to 269 feet bgs, and the screen for monitor well MW-19 was installed from 240 to 260 feet bgs.
November 9 through 16, 2005	November 2005 quarterly groundwater and treatment system sampling event.
February 6 through 16, 2006	February 2006 quarterly groundwater and treatment system sampling event.
February 10, 2006	Shaw received authorization from Harris County to construct a temporary water line in the road right-of-way from 11603 to 11610 Possum Hollow Lane. An application for construction was submitted by Shaw on January 31, 2006.
March 8, 2006	Wellco Services installed a temporary water line from a water well at 11610 Possum Hollow Lane to 11603 Possum Hollow Lane. The water well at 11603 Possum Hollow Lane became inoperable and the owner was not allowed to install a new well.
March 10, 2006	Wellco Services replaced a down-hole submersible pump in the water well at 11106 Tall Timbers Drive.
March 23, 2006	Shaw submitted *Chicot Monitor Well Installation Report; July - November 2005*, which documented the installation of 10 deep monitor wells MW-10 through MW-19. Monitor wells MW-10, MW-11R, MW-12 through MW-16, MW-18, and MW-19 were installed within the Chicot Aquifer. Monitor well MW-17 was installed within the upper portion of the Evangeline Aquifer. The wells were installed during intermittent periods from July 6, 2005 through November 3, 2005.
April 16, 2006	Shaw submitted *Draft Remedial Investigation Report.* The report summarized investigations performed to date at the site and identified several data gaps. The draft report was not finalized, and additional assessments were performed following submittal of the draft document prompting preparation of a second (revised) Remedial Investigation Report in 2008.
May 8 through 18, 2006	May 2006 quarterly groundwater and treatment system sampling event.
July 18 through 22, 2006	July 2006 sampling event (resampling event for May 2006 quarterly groundwater and treatment system sampling event select sample locations).
August 8 through 24, 2006	August 2006 quarterly groundwater and treatment system sampling event.
August 24, 2006	Shaw submitted *2006 Addendum to the Field Sampling Plan, July 2006*. The Addendum Field Sampling Plan (FSP) presented the additional requirements and procedures for installation of one Chicot monitoring well using rotosonic drilling; and installation of nine geoprobe soil borings.

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Jones Road Groundwater Plume Federal Superfund Site (SUP075)
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Date	Event
September 7, 2006	Water well at 11234 Jones Road was diagnosed by Wellco Drilling Services and determined to need a pump replacement.
November 6 through 15, 2006	November 2006 quarterly groundwater and treatment system sampling event.
December 22, 2006	The pump and ancillary equipment in the water well at 11234 Jones Road replaced.
January 24, 2007	Shaw submitted *July 2006 Geoprobe Investigation, Former Bell Dry Cleaner Property, 11600 Jones Road* documenting the installation of nine DPT borings (GP-1A through GP-9A) to depths of approximately 50 feet bgs. Soil and groundwater samples were collected for analysis of PCE. The highest PCE concentrations were detected in soil in borings GP-2A and GP-3A behind the former dry cleaning facility (near the back door on either side of the septic system line. PCE concentrations generally increased with depth.
February 6 through 14, 2007	February 2007 quarterly groundwater and treatment system sampling event.
February 12, 2007	Shaw submitted *Treatability Study Work Plan* for conducting a bench-scale treatability study for the site. The purpose of the work plan was to describe remedial technologies and methodologies for treatability studies that would be useful for in-situ remediation of VOCs in soil and groundwater. The work plan presented treatment options using activated persulfate in-situ chemical oxidation (ISCO), potassium permanganate ISCO, bio-stimulation, bioaugmentation, and abiotic treatment using zero valent iron.
May 2, 2007	Shaw submitted *Attempted Well Installation, Former Bell Dry Cleaner Property, 11600 Jones Road* documenting failed attempts to install a deep monitor well in the source area in July 2006. The well was proposed to determine the extent and concentrations of PCE in soil and groundwater below the source area and to provide a well for future monitoring, application of treatment reagents, or to provide a groundwater withdrawal point for extraction and treatment of groundwater. The original plan was to install a well to a depth of approximately 320 feet bgs. However, the drilling method (Rotosonic) was not successful due to drill pipe failure during attempted installation of well RS-1 (107 feet bgs total depth), and RS-2 (97 feet bgs total depth). Soil samples were collected but water samples were not. PCE was detected in samples to a depth of 82 feet bgs, with the highest concentrations detected at 45 feet bgs. No PCE was detected between 82 feet bgs and 107 feet bgs (total depth of investigation). However, heat generated during drilling may have liberated VOCs from the soil samples. No dense non-aqueous phase liquid (DNAPL) was detected during the sampling event.
May 3, 2007	TCEQ community meeting slide presentation.
May 7 through 16, 2007	May 2007 quarterly groundwater and treatment system sampling event.
May 18, 2007	The steel down-hole pump conductor tubing was removed and replaced with PVC conductor tubing in the water well located at 11107 Timbercrest. The steel tubing was corroded and had a nickel-sized hole in one of the tubing joints. The old tubing was subsequently disposed after confirmation rinsate sampling.

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Date	Event
July 20, 2007	Shaw submitted *Vapor Intrusion Study Work Plan* for performing a vapor intrusion study at the former Bell Dry Cleaner site at 11600 Jones Road. The work plan proposed collection of two ambient air vapor samples within the former dry cleaning facility, and collection of two sub-slab vapor samples from two shallow soil borings installed immediately below the facility floor.
August 7 through 13, 2007	August 2007 quarterly groundwater and treatment system sampling event.
October 4, 2007	Shaw submitted *JR11600 Pre-Design Information* , which included a letter report, field notes, water flow diagram, meter readings taken August 6-10, 2007, photographic documentation of the public water supply system, and historical analytical results for the water well located at 11600 Jones Road.
October 16, 2007	Shaw submitted *Final Treatability Report* documenting a bench-scale treatment study performed on select soil and groundwater samples collected at the 11600 Jones Road site. The study included applications of ISCO, bio-stimulation/bioaugmentation, and abiotic treatment using zero-valent iron. The study concluded that ISCO using potassium permanganate would be most effective for removing source area PCE, and that bio-stimulation/bioaugmentation could be used to treat deeper zones.
November 5 through 14, 2007	November 2007 quarterly groundwater and treatment system sampling event.
November 12, 2007	Shaw submitted *Deep Monitor Well Gauging and Rainfall Data* report, which documented alternate-week groundwater gauging of ten deep monitor wells in the Jones Road area during the months of March through August 2007. The report also documented rainfall data from a local rainfall data collection station during the months of January 2006 through August 2007.
December 11 & 12, 2007	Meeting in Austin, Texas between Shaw, TCEQ, USGS, and EPA to define the Remedial Investigation outline and discuss installation of source area monitor wells, pilot-scale treatment study, vapor intrusion study, baseline risk assessment, post waterline groundwater monitoring, preparation of a conceptual site model (CSM), and groundwater modeling.
December 13, 2007	Site walk by Shaw to determine potential locations for conducting a pilot study and for installation of source area monitor wells.
December 17, 2007	Shaw submitted a memo *Groundwater Model Required Parameters* that identified input parameters required to construct, calibrate, and run a groundwater flow and transport model for the Jones Road site.
February 4 through 13, 2008	February 2008 quarterly groundwater and treatment system sampling event.
February 5, 2008	WL Construction performed a soil investigation for the EPA to identify potential contamination exposure to workers that might be encountered during installation of the water line. Soil samples were collected at 3 locations at a depth of 16 feet bgs, north and south of the Bell facility storm drain outfall. Laboratory results indicated no detectable VOCs. No formal report has been issued.
May 5 through 14, 2008	May 2008 quarterly groundwater and treatment system sampling event.
May 15, 2008	TCEQ community meeting slide presentation.

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Date	Event
May 29, 2008	Shaw submitted *Source Area Conceptual Site Model.* The CSM presented cross sections through the source area, showing the subsurface lithology and distribution of contaminants near the former Bell facility. The CSM supports previous theories of downward migration of NAPL beneath the Bell facility, with dispersion of dissolved-phase PCE within the permeable sand and silt zones.
June 6, 2008	Shaw submitted *Revised Draft Pilot Test Work Plan.* The work plan outlined treatment technologies of in-situ chemical oxidation using sodium permanganate, and in-situ bioaugmentation in two locations within the source area, at depths approximately 22 to 37 feet bgs. The work plan also described field methods to implement them in two treatment studies.
June 11, 2008	Shaw submitted *Design Information - TCEQ Small Public Water System (PWS).* The report documented an engineered design of the proposed GAC filtration system to be installed at 11600 Jones Road.
June 24, 2008	Shaw submitted *Groundwater Model Identification Report*.
July 24, 2008	Shaw submitted a *Vapor Intrusion Study*. The purpose of the study was to determine if completed pathway(s) exist for intrusion of vapors to workers in the Cypress Shopping Center (from the Bell facility), and if indoor vapors would pos an unacceptable risk of chronic health effects due to long-term exposure. 2 indoor air and 2 sub-slab air samples were collected. Results exceeded OSWER Tier II target concentrations for PCE and TCE. The report concluded that the air pathway is complete, but that the measured concentrations did not pose an unacceptable health risk to workers.
August 19, 2008	Shaw completed construction of a comprehensive database of soil and groundwater data for the site.
August 28, 2008	Shaw submitted a *Remedial Investigation Report.*
August 29, 2008	Shaw submitted a *Regional Conceptual Site Model.*
August 29, 2008	Shaw submitted a *Baseline Risk Assessment Report.*
November, 2008	Water line construction completed.
February, 2009	First post water line groundwater sampling event.
April 15, 2009	Shaw submitted a Final Remedial Investigation Report.
July 8, 2009	Shaw submitted *Simple Capture Zone Modeling.*

TABLE 2

QUARTERLY PCE GROUNDWATER SAMPLING RESULTS

JONES ROAD GROUNDWATER PLUME SITE QUARTERLY SAMPLING RESULTS

Updated: July 1, 2008

Location ID	May '03	Aug. '03	Nov. '03	Feb. '04	May '04	Aug. '04	Nov. '04	Feb. '05	May '05	Aug. '05	Nov. '05	Feb. '06	May/ Jul. '06	Aug. '06	Nov. '06	Feb. '07	May '07	Aug. '07	Nov. '07	Feb. '08	May '08	Additional Comments
AD11502	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	ND	NS	NS	NS	ND	NS	ND	NS	NS	
AD11511	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	ND	NS	ND	ND	
AD11603	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	NS	NS	NS	ND	
AD11619	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	
AD11702	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	ND	ND	NS	NS	ND	
AD11714	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	ND	NS	NS	NS	
BH11603	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	NS	ND	NS	NS	
BH11614	NS	NS	NS	NS	NS	ND	NS	ND	NS	NS	ND	NS	ND	ND	NS	NS	ND	ND	NS	ND	ND	
BH11710	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-no access
BL10810	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
BL10818A	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
BL10819	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.069 LJ	ND	ND	0.071 LJ	ND	ND	
BL10825	ND	ND	ND	ND	.5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	UR	
CP11510	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	
CP11610	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	ND	NS	NS	NS	ND	
CP11650	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
CP11710	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	NS	ND	NS	NS	
CP11711	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	ND	NS	ND	NS	
CP11718	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	NS	ND	NS	NS	NS	NS	NS	NS	NS	
DK11503	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	
DK11603	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	
DK11611	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	NS	ND	NS	NS	NS	ND	NS	ND	ND	
DK11702	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND	NS	NS	NS	ND	NS	NS	NS	NS	
DK11703	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND	NS	NS	NS	ND	NS	NS	NS	ND	ND	
DK11707	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	
DK11710	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
DK11718	NS	NS	NS	NS	ND	NS	ND	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	ND	NS	NS	NS	
DK11719	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
DM11502	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	
DM11506	NS	NS	NS	NS	NS	ND	NS	ND	NS	NS	ND	NS	ND	NS	NS	NS	ND	ND	NS	NS	NS	
DM11507	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	ND	NS	ND	NS	
DM11509	NS	NS	NS	NS	NS	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
DM11513	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	ND	NS	ND	
DM11515	NS	NS	NS	NS	NS	NS	ND	NS	ND	NS	NS	NS	ND	NS	NS	NS	ND	ND	NS	ND	NS	
DM11715	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No access, unable to contact owner.
ES11610	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	NS	Gate Locked NS
ES11627	1.9	1.6	2.2	3.40	3.1 J	2.4	3	6.1	4.2	2.7	1.1	3.1	3.3	2.4	4.2	7.1	6	4	2.9	2.8	4.1	Filtration System added Feb. '05.
ES11630	NS	0.3 J	ND	ND	ND	1	ND	ND	0.99	0.17 J	1.6	1.4	1.9	1.0	1.1	0.63	1.1	0.97	0.95	0.75	1	
ES11643	0.3 J	ND	ND	.35 J	ND	ND	0.36 J	ND	0.57	0.84	0.86	0.55	0.76	0.56	0.5	0.41 LJ	0.59	0.95	1.3	0.58	0.69	
ES11703	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	ND	NS	ND	Jul. '06, Aug. '06, Nov. '06, Feb '07, May '07, Aug '07, and Feb '08 - no power to well; house under construction.
ES11713	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ES11718	NS	NS	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	Nov. '06 no access gate locked.
ES11730	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FB11502	NS	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	ND	NS	ND	ND	
FB11506	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Lot is gated. No access, unable to contact owner.
FB11607	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Nov. '06 & Feb '07 - sampling refused by owner.
FB11610	NS	NS	NS	NS	ND	NS	ND	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-no access
FB11614	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	NS	NS	ND	NS	NS	NS	NS	ND	NS	NS	
FV11011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares Well with JR11535
FV11014	204	178	240	590	240	210	240	200	210	200	270	470	230	230	281	207	206	11.6	115	103	97	Filtration System
FV11022	36.2	53.2	48	42	36	57 J	40	37	38	57	45	44	47	52	62.2	64.8	42.3	43.4	64	57	74.1	Filtration System
FV11023	183	153	190	240	190	210	170	140	120	130	150	90	130	130	145	142	130	104	93.1	89.2	111	Filtration System
FV11025	NS	NS	NS	NS	5.5	7.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Filtration System Refused by Owner. Sampling refused by owner as of Nov. '04
FV11102	NS	6.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No access from owner, filtration system refused.
FV11110	0.6	0.9	0.68	0.81	ND	0.98	0.20 J	0.36 J	0.51	0.57	0.46 J	0.33 LJ	0.47 LJ	ND	0.32 LJ	0.35 LJ	ND	0.39 LJ	0.23 LJ	ND	ND	

						JONES ROAD GROUNDWATER PLUME SITE QUARTERLY SAMPLING RESULTS															Updated: July 1, 2008
Location ID	May '03	Aug. '03	Nov. '03	Feb. '04	May '04	Aug. '04	Nov. '04	Feb. '05	May '05	Aug. '05	Nov. '05	Feb. '06	May/ Jul. '06	Aug. '06	Nov. '06	Feb. '07	May '07	Aug. '07	Nov. '07	Feb. '08	May '08	**Additional Comments**
FV11118	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.076 J	ND	ND	ND	ND	ND	0.069 LJ	ND	ND	0.10 LJ	ND	ND	Owner installed filtration system as of Feb. '06.
FV11123	ND	ND	0.23J	ND	ND	0.29 J	0.15 J	0.25 J	ND	0.16 J	0.15 J	ND	0.19 LJ	ND	0.10 LJ	0.13 LJ	ND	ND	0.12 LJ	ND	ND	
FV11127	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FV11130	11.3	5.3	8.1	10	7.6	4	3.2	6.9	4.8	5	7.9	3.7	9.9	11	14.6	17.5	31.6	36.6	40.4	45	59.5	Filtration System
FV11135	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FV11202	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
FV11203	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FV11210	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Owner installed filtration system as of Feb. '06. Sample taken from faucet May 07'
FV11215	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	0.16 LJ	ND	ND	ND	ND	ND	ND	ND	ND	Owner installed filtration system as of Feb. '06.
FV11226	ND	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FV11231	ND	NS	NS	NS	2.6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	NS	ND	Feb '07 and Feb '08 - No power to the well.
FV11302	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FV11306	ND	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Shares well with FV11314
FV11315	NS	NS	NS	NS	ND	NS	ND	ND	ND	ND	ND	ND	0.26 LJ	ND	ND	ND	ND	ND	ND	ND	ND	
FV11319	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
FV11322	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	No Access-Gate Locked Nov '07
FV11326	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11302	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
GL11310	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11402	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11422	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No access. Gate locked.
GL11502	NS	NS	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
GL11503	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
GL11506	NS	NS	NS	NS	NS	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11514	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11606	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11614	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11622	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
GL11702	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-not sampled per owner's request.
JR11010	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.14 J	ND	0.18 LJ	ND	ND	0.13 LJ	ND	ND	ND	0.28 LJ	0.21LJ	0.37LJ	
JR11043	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.083 LJ	ND	ND	0.14	ND	UR	Shares w/PWS well JR11035. Too far south, not on the map.
JR11319	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No Well
JR11414	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
JR11427	9	9	12	19	14	20	20	21	24	24	24	21	29	31	43.2	47.4	43.9	50.4	41.2	37.4	44.8	Filtration System
JR11503	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
JR11515	0.7	1	0.75	0.62	ND	1	0.58	0.82	0.57	1.2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Oct.'05-not
JR11526	NS	1.2	1.8	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares well with JR11528.
JR11527	NS	NS	NS	180	94	79	120	93	190	68	89	100	94	100	124	127	141	137	122	110	137	Could not sample prior to Nov. '03. Filtration System.
JR11528	1.3	1.5	1.3	2.6	1.5	3	2.2	3.1	1.7	2.9	3.6 J	6	3.4 J	3.10	4.3	4.5	3.9	6.6	9.6	6.6	8.6	Filtration system installed June '06.
JR11535	121	101	71	ND	69	45	84	64	140	64	57	67	50	71	67.4	84.7	75.1	85.5	83.9	74.7	93.2	Filtration System. Feb. '04 result is correct. Shares well with FV11011.
JR11600	0.8	1.1	1.4	2.7	2.4	1.8 J	1.9 JV	1.8	2.2	2.2 JV	2	3.3 J	2.1	3.40	3.4 J	5.3	4.4	4.2	7.1	6.2	5.9	
JR11614	8.8	10.2	14	15	15	21	16	18	19	22	36	31	28	33	42.5	23.4	30.8	33.8	33.8	28.2	48.1	Filtration System
JR11620	ND	ND	0.15J	.43J	ND	.39 J	0.29 J	0.44 J	0.15 J	0.36 J	0.40 J	0.43 LJ	0.46 LJ	ND	0.58	0.7	0.63	ND	1.1	0.72	1.8	
JR11642	0.6	1.2	0.86	2.2	0.77	1.7	1.4	1.6	0.64	1.6	1.6	2.3	2.1	1.6	1.7	1.6	3.8	11.3	24	28	39	Filtration System
JR11646	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
JR11650	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	UR	
JR11655	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.14 LJ	ND	ND	ND	ND	ND	ND	0.092 LJ	ND	ND	
JR11663	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
JR11702	ND	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JR11707	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	UR	

							JONES ROAD GROUNDWATER PLUME SITE QUARTERLY SAMPLING RESULTS															Updated: July 1, 2008
Location ID	**May '03**	**Aug. '03**	**Nov. '03**	**Feb. '04**	**May '04**	**Aug. '04**	**Nov. '04**	**Feb. '05**	**May '05**	**Aug. '05**	**Nov. '05**	**Feb. '06**	**May/ Jul. '06**	**Aug. '06**	**Nov. '06**	**Feb. '07**	**May '07**	**Aug. '07**	**Nov. '07**	**Feb. '08**	**May '08**	**Additional Comments**
JR11718	ND	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	No access. Gate locked May '07.
JR11729	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JR117291/2	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
JR11731	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JR11911	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Too far north, Not on map
JRW11050A	ND	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11107	ND	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11111	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares Well with JRW11107
JRW11115	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares Well with JRW11107
JRW11203	ND	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11206	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11215	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11222	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11234	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
JRW11351	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11352	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11354	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
JRW11358	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
MI11502	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
MI11507	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	NS	ND	NS	ND	NS	
MI11510	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	ND	ND	NS	ND	ND	
MI11515	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	
MI11603	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
MI11611	NS	NS	NS	NS	ND	NS	NS	ND	NS	NS	ND	NS	NS	ND	NS	NS	ND	NS	ND	NS	NS	
OV11503	NS	NS	NS	NS	ND	ND	ND	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11507	NS	NS	NS	NS	NS	ND	ND	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	NS	ND	No power to well in Nov. '05 and Feb. '06.
OV11519	NS	NS	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
OV11523	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
OV11527	NS	NS	NS	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
OV11534	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11547	NS	NS	NS	NS	.38 J	ND	ND	ND	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11602	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11603	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11610	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11618	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11623	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11626	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	Pump broken Nov. '05; shares well with OV11618
OV11634	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
OV11635	NS	NS	NS	0.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Feb '04 duplicate samples: ND & 0.91
OV11642	ND	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
OV11650	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Owned by PH11651. No Well
OV11651	NS	NS	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
OV11738	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
PH11602	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
PH11603	ND	NS	NS	NS	ND	ND	ND	ND	2.8	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No water to well Nov. '05; gets water from PH11610
PH11610	ND	NS	NS	NS	ND	ND	ND	ND	3.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
PH11611	ND	NS	NS	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
PH11618	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PH11619	ND	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Re-sampled July '06.
PH11626	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	No power to well Aug '07
PH11627	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PH11643	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PH11650	ND	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.051 LJ	ND	ND	
PH11651	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	Feb. '07 not sampled per owner's request
PH11702	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PH11703	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-not sampled per owner's request.
PH11710	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-not sampled per owner's request.
PH11713	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PH11722	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

						JONES ROAD GROUNDWATER PLUME SITE QUARTERLY SAMPLING RESULTS															Updated: July 1, 2008
Location ID	**May '03**	**Aug. '03**	**Nov. '03**	**Feb. '04**	**May '04**	**Aug. '04**	**Nov. '04**	**Feb. '05**	**May '05**	**Aug. '05**	**Nov. '05**	**Feb. '06**	**May/ Jul. '06**	**Aug. '06**	**Nov. '06**	**Feb. '07**	**May '07**	**Aug. '07**	**Nov. '07**	**Feb. '08**	**May '08**	**Additional Comments**
PH11723	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-not sampled per owner's request.
PH11733	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-not sampled per owner's request.
PH11738	NS	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PH11739	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	Nov. '06 - no access gate locked; Feb '07 - not sampled per owner's request.
TC11010	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No Well
TC11018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.27 LJ	ND	ND	ND	
TC11019	1.5	2.9	1.4	2.5	.5 J	5.1	2.4	3.8	5.3	3.8	5.4	ND	ND	8.8	7.4	13.2	23	20.6	17.4	22.8	35	Filtration System
TC11022	4.7	5.3	6.8	6.1	7.4	6.2	7.5	9.5	8	12	15	15	16	17	19.4	15	12.3	11.2	8.6	9.2	11	Filtration System. Re-sampled July '06.
TC11027	NS	NS	NS	NS	10	6.6	13	12	8.7	10	23	17	18	11	NS	NS	16	21.9	21.1	22.4	32	Filtration System. No power to the well through Feb '04. Re-sampled July '06. Nov. '06 and Feb '07 - no power to well.
TC11034	ND	0.5	ND	ND	ND	ND	ND	ND	ND	0.37 J	0.28 J	0.28 LJ	0.31 LJ	0.73	0.37 LJ	0.57	ND	0.23 LJ	0.58	ND	0.33 LJ	
TC11035	1.6	ND	0.26J	1.4	.4 J	0.31 J	0.99	0.33 J	ND	0.57	2.1	1.1	1.1	0.82	1.9	2.5	ND	2.3	4.9	2.5	0.71	
TC11103	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.14 J	ND	0.090 LJ	ND	ND	ND	ND	ND	ND	ND	ND	Filtration System
TC11104	58.4	50.2	96	140	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Currently sharing water with the well located at TC11034.
TC11106	1.4	1.9	1.4	2.2	2.3 J	2.9	2.7	2.3	ND	4.4	4	4	3	3.10	2.9	3.5	2.4	2.6	3.3	2.4	2.8	2 wells- 1st drilled
TC11107	13.4	11	15	14	17	16	18	21	18	21	19 J	17	20	21	32.8	35.7	NS	29.1	31.1	39.4	42.3	Filtration System. Unable to sample because pump head disconnected Aug '07.
TC11108	ND	0.5	ND	.18J	ND	.2 J	ND	0.16 J	ND	3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares well with TC11106.
TC11110	1.2	1	1.2	1.5	ND	1.9	1.8	1.3	2.6	1.8	2.3	3.1	3.1	3.40	3.1	2.2	2.2	1.7	2	1.8	2.2	
TC11115	NS	12.3	16	12	21	21	19	20	30	23	13 J	24	32 J	15	41.5	38	33.1	29.1	44	32.3	NS	Gate Locked/ Filtration System
TC11118	2	1.7	2.6	4.4	3 J	6.1	3.3	3.7	3.1	3.5	4.4	5.7 J^	ND	5.60	5.8	4.8	4.5	5.5	5.6	6.6	7.6	Filtration System
TC11126	2.7	3.2	3.1	5.1	6.6	10	5.7	7.7	7.1	7.1	6.7	7.2 J^	7	5.10	10.1	8.6	7.1	8	7.4	NS	11.6	Filtration System. No power to well Feb '08.
TC11130	1.9	1.9	1.4	3.7	3.8 J	4.4	1.9	1.4	1.8	3.4	3.2	2.3	4.4	7.30	10.8	6.4	6.3	5.2	5.3	4.2	4.1	Filtration System installed Oct. '06.
TC11131	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares well with TO11116.
TC11132	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	NS	ND	Nov. '06 no access gate locked. No power to well Feb '08.
TC11135	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TC11140	ND	NS	ND	.19J	.42 J	ND	ND	ND	0.32 J	0.30 J	0.38 J	0.29 LJ	0.38 LJ	0.40 LJ	0.47 LJ	0.44 LJ	ND	0.53	0.61	0.40LJ	0.51	Feb '07 - sample taken from kitchen faucet per owner's request.
TC11203	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TC11206	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TC11214	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	NS	Nov. '06 and Feb '07 no access gate locked. Gate Locked '08
TC11215	ND	NS	NS	NS	NS	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	The pump had problems, the sampler could not complete the purge in Feb. '05.

JONES ROAD GROUNDWATER PLUME SITE QUARTERLY SAMPLING RESULTS																						Updated: July 1, 2008
Location ID	May '03	Aug. '03	Nov. '03	Feb. '04	May '04	Aug. '04	Nov. '04	Feb. '05	May '05	Aug. '05	Nov. '05	Feb. '06	May/ Jul. '06	Aug. '06	Nov. '06	Feb. '07	May '07	Aug. '07	Nov. '07	Feb. '08	May '08	Additional Comments
TC11219	ND	NS	NS	ND	ND	ND	ND	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TC11222	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Part of TT11303
TC11227	ND	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TC11303	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TC11315	NS	NS	NS	NS	ND	ND	ND	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TC11318	ND	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TC11330	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TC11331	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	No power to the well Nov. '04 to Feb. '06 No power to well Aug '07.
TH11602	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TH11603	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.64	ND	ND	ND	ND	ND	ND	ND	ND	Multiple spigots needed to be used to get the pump running continuously.
TH11610	10.6	3.1	11	6	6.4	11	4.1	9.8	15	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Filtration system removed prior to Aug. '05 at owner's request.
TH11611	ND	ND	ND	ND	.27 J	ND	0.21 J	ND	ND	0.32 J	0.36 J	0.66	ND	0.57	1.1	0.85	0.85	0.91	0.84	0.34LJ	0.39 LJ	
TH11618	7.9	ND	ND	4.8	7.6	5.6	ND	2.3	22	ND	ND	ND	0.64	ND	ND	26.2	136	89.9	93.5	98.5	113	Filtration System
TH11619	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Per owner request, not sampled Aug.'05.
TH11620	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19 J	0.15 J	0.21 LJ	0.11 LJ	ND	ND	0.056 LJ	ND	ND	0.071 LJ	ND	ND	
TH11627	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Currently sharing water with the well located at TH11635.
TH11635	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TH11642	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19 J	0.18 J	ND	0.20 LJ	0.24 LJ	0.19 LJ	0.27 LJ	0.21 LJ	0.22 LJ	0.32 LJ	ND	ND	
TH11643	ND	NS	NS	NS	ND	ND	ND	ND	ND	0.11 J	ND	ND	ND	ND	ND	ND	ND	ND	0.059 LJ	ND	ND	
TH11651	NS	NS	NS	NS	ND	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TH11703	ND	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TH11713	NS	NS	NS	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TH11722	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TH11723	NS	NS	NS	NS	NS	ND	NS	NS	NS	ND	ND	7.8 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	Feb. '06- Owner independently sampled well and declined filtration system.
TH11733	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.11 LJ	ND	ND	ND	ND	NS	ND	ND	ND	
TH11737	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO10610	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Too far east, not on map.
TO10615	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Too far east, not on map.
TO10619	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares Well with TO10627
TO10623	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares Well with TO10627
TO10624	ND	NS	NS	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO10627	ND	NS	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO10635	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO10700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO10700LP	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	Well discovered Nov. 2006
TO10727	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.051 LJ	ND	ND	
TO10827	0.5	NS	0.97	1.5	1.3	2	1.7	2	2.6	3.4	2.0 J	2.6	3	3.50	3.4	4	6	5.6	5	5.1	4.8	Flitration system installed July 2007.
TO10830	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO10835	2	2.8	3.8	6.6	8.8	7.8	6.2	13	10	9.7	5.9	ND	NS	10.0	14.8	18.1	15.5	NS	24	29.6	38.5	Filtration System. No access Aug '07.
TO10860	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No Well
TO10902	7.1	13.8	16	12	10	16	17	19	16	21	28 J	41	41	41	37.9	48.2	20.4	35.1	24.6	26.8	22.5	Filtration System. Re-sampled July '06.
TO10903	18.2	16.8	7.9	37	20	22	25	28	42	33	41	51 J^	54	56	66.5	67.4	65.2	74.2	99	75.3	87.9	Filtration System. Re-sampled July '06.
TO11002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	MUD.
TO11011	ND	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-no power to well.
TO11022	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No Well

						JONES ROAD GROUNDWATER PLUME SITE QUARTERLY SAMPLING RESULTS															Updated: July 1, 2008
Location ID	**May '03**	**Aug. '03**	**Nov. '03**	**Feb. '04**	**May '04**	**Aug. '04**	**Nov. '04**	**Feb. '05**	**May '05**	**Aug. '05**	**Nov. '05**	**Feb. '06**	**May/ Jul. '06**	**Aug. '06**	**Nov. '06**	**Feb. '07**	**May '07**	**Aug. '07**	**Nov. '07**	**Feb. '08**	**May '08**	**Additional Comments**
TO11023	NS	NS	NS	NS	0.51	0.64 J	0.38 J	0.63	1.6	0.76	0.55	0.35 LJ	0.6	ND	0.56	1.5	1.4	1.7	2.1	1.2	NS	Difficult to access. Gate Locked '08
TO11024	24.5	19.9	30	37	15	18	22	25	18	32	33	42	25	NS	NS	NS	NS	NS	NS	NS	NS	Filtration System. No power to well Aug. '06, Nov. '06, Feb. '07, May 07, Aug '07', Nov '07, and Feb '08. May '08
TO11033	0.5	0.8	NS	1.1	1.2	1.4	1.4	1.4	1	NS	1.9	2.1	2.7	3.9	3.7	4.2	4.2	4	2.8	1.8	1.8	No power to well Aug. '05.
TO11051	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Shares Well with TO11033
TO11102	0.3 J	0.8	0.64	0.92	NS	1.1	0.99	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Sampling crew was unable to contact owner. Difficult to access.
TO11104	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	MUD
TO11112	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Well Broken
TO11115B	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO11116	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Shares Well with TC11131
TO11116M(	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO11202	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	
TO11205	ND	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TO11210	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	MUD
TO11230	ND	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	NS	ND	ND	No power Nov. '04 to Feb. '06 and Nov '07.
TO11235	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO11239	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO11305	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO11309	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO11310	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO11314	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TO11335	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No Access , Gate locked. Aug '07-not sampled per property manager's request.
TO11338	ND	NS	NS	NS	ND	ND	ND	0.25 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TT11011	13.2	10.8	6.2	18	16 J	31 J	21	26	31	29	32	37	39	32	42.1	57.1	48.1	52.7	69	67.4	55	Filtration System
TT11014	27.3	25.7	24	38	28	20	16	25	20	32	27	59	44	26	31.6	99.6	106	95.2	140	80.6	105	Filtration System. Re-sampled July '06.
TT11015	*ND	*ND	*ND	*ND	*ND	*ND	*ND	*ND	*ND	30	30	38	42	28	32.6	36.8	27.3	23.1	28	28.6	23.5	* Filtration System inside the Garage. Difficult access, unable to contact owner.
TT11031	NS	5.3	7.1	12	9.1	11	7.4	12	14	9.2	15	14	13	7.6	11.9	10.5	13	9.3	NS	8.1	12.1	Filtration System -No Access-Gates Lock Nov '07
TT11039	ND	0.8	NS	0.2J	.23 J	ND	0.88	0.45 J	0.63	2.7	3.6	1.9	NS	NS	NS	NS	NS	NS	NS	NS	NS	May '06-no access
TT11102	0.4 J	1.1	ND	0.55	0.54	0.84	0.82	0.93	0.86	1.3	1.5	1.3	ND	0.76	0.64	0.26 LJ	0.28 LJ	ND	0.22 LJ	ND	ND	
TT11103	ND	ND	ND	0.12J	ND	ND	ND	ND	ND	0.15 J	0.21 J	0.16 LJ	ND	ND	ND	0.073 LJ	ND	ND	ND	ND	ND	
TT11106	22.4	7.4	6	9.9	12	19	7.9	7.9	6.7	4.8	6.5	6.4	4.8	33	66.3	62.9	62.4	45.5	31	16.3	11.6	Filtration System. Pump replaced Mar. '06.
TT11107	4.2	3.7	5.3	7.5	5.2	9.7	9.4	16	19	35	44	38 J	57	98	120	142	129	158	230	183	186	Filtration System
TT11112	ND	ND	ND	ND	ND	ND	0.093 J	0.24 J	0.27 J	0.23 J	0.28 J	ND	ND	ND	ND	0.085 LJ	ND	ND	0.17 LJ	0.17LJ	ND	
TT11114	ND	ND	ND	ND	ND	ND	ND	0.17 J	0.16 J	0.26 J	0.23 J	ND	0.11 LJ	ND	0.15 LJ	0.15 LJ	ND	ND	0.16 LJ	ND	ND	
TT11115	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	New residence Feb. '07.
TT11118	1.4	1.6	1.5	1.3	1.2	1.7	1.2	1.5	1.3	1.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No power as of Nov. '05.
TT11123	4.5	NS	2.7	2.7	NS	8.9	5.8	8.8	NS	8.1	6.8	6	NS	4.10	3.7	NS	NS	NS	11	NS	NS	Filtration System. Difficult to access. Feb. '07, May 07', and Aug '07, and Feb '08. May '08
TT11124	ND	0.6	ND	0.54	.4 J	ND	0.34 J	0.28 J	0.26 J	0.33 J	0.42 J	0.47 LJ	0.37 LJ	ND	0.35 LJ	0.32 LJ	ND	0.38 LJ	ND	0.43LJ	ND	
TT11127	4.7	3.1	3.9	14	21	23	13	20	15	15	4.6	2.8	ND	3.50	2	12.4	14.6	16.4	23	23.3	21.1	Filtration System

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Location ID	**May '03**	**Aug. '03**	**Nov. '03**	**Feb. '04**	**May '04**	**Aug. '04**	**Nov. '04**	**Feb. '05**	**May '05**	**Aug. '05**	**Nov. '05**	**Feb. '06**	**May/ Jul. '06**	**Aug. '06**	**Nov. '06**	**Feb. '07**	**May '07**	**Aug. '07**	**Nov. '07**	**Feb. '08**	**May '08**	**Additional Comments**
TT11131	**3.6**	**3**	**3.4**	**6**	**5.8**	**5.8**	**4.7**	**4.9**	**3.4**	**6.6**	**4**	**4.8**	**6.3**	**4.0**	**4.5**	**8.3**	**10.8**	**13.1**	**23**	**25.4**	**18.5**	Filtration System
TT11139	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
TT11202	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Re-sampled July '06.
TT11203	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0.16 J**	**0.17 J**	**ND**	**ND**	**ND**	**0.17 LJ**	**0.18 LJ**	NS	NS	NS	NS	NS	Owner requests no further sampling as of Feb. '07
TT11215	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Re-sampled July '06.
TT11219	**ND**	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TT11222	**ND**	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
TT11227	**ND**	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
TT11230	NS	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
TT11303	**ND**	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Re-sampled July '06.
TT11306	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Planned to re-sample July '06 - no power to well.
TT11322	NS	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Re-sampled July '06.
TT11323	NS	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
WE10514	NS	NS	NS	NS	NS	NS	NS	NS	NS	**ND**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	Too far east, not on map.
WE10708	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
WE10710					NS	NS	NS	NS	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
WE10711	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Re-sampled July '06.
WE10715	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
WE10719	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
WE10727	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
WE10814	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0.23 LJ**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	No power May and Aug. '05.
WE10815	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	Re-sampled July '06.
WE10831	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
WE10931	**ND**	NS	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	
WE11322	**ND**	NS	NS	NS	**ND**	**ND**	**ND**	**ND**	**ND**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Sampling Results Summary																						
	May '03	**Aug. '03**	**Nov. '03**	**Feb. '04**	**May '04**	**Aug. '04**	**Nov. '04**	**Feb. '05**	**May '05**	**Aug.' 05**	**Nov. '05**	**Feb. '06**	**May/Jul. '06**	**Aug. '06**	**Nov. '06**	**Feb '07**	**May '07**	**Aug. '07**	**Nov. '07**	**Feb. '08**	**May '08**	**EXPLANATION OF COLORS**
Number of sampling results in	104	45	67	69	158	153	157	151	107	118	126	138	140	143	133	136	141	142	138	138	141	PCE < 0.5 ppb (Quantitation Limit)
sampling results in yellow	22	26	20	21	16	19	19	16	22	20	16	15	16	17	18	13	12	11	13	10	11	PCE >=0.5 to <= 5.0
Number of sampling results in	17	19	20	24	27	29	23	26	25	25	27	27	22	25	24	28	28	30	30	31	29	PCE > 5.0 ppb (MCL)
Number of sampling results in yellow and	**39**	**45**	**40**	**45**	**43**	**48**	**42**	**42**	**47**	**45**	**43**	**42**	**38**	**42**	**42**	**41**	**40**	**41**	**43**	**41**	**40**	
TOTAL ADDRESSES	143	90	107	114	201	201	199	193	154	163	169	180	178	185	175	176	181	183	181	179	181	
number of Filtration Systems	24	24	24	27	29	32	32	33	33	31	31	31	32	32	33	33	34	34	35	35	35	

Note: All results are prior to filtration system, unless otherwise indicated in comments.

* Filtration System inside the Garage. No access. Sampling at nearest outside faucet prior to August 2005.

Table 3
Indoor Vapor Concentrations of PCE and Degradation Products
Jones Road Superfund Site
Houston, Texas

Indoor (Ambient) Sampling Location	PCE (ug/m^3)	TCE (ug/m^3)	cis-1,2-DCE (ug/m^3)	trans-1,2-DCE (ug/m^3)	VC (ug/m^3)
West Sump	9.5	1.7	1.7	<0.79	<0.51
Center Room	14	1.8	1.8	<0.79	<0.51
Screening Value (Shaw, 2008b; EPA, 2002)	8.1	0.22	35	70	2.8
Determination	Designate as a COPC for BLRA	Designate as a COPC for BLRA	Exclude from BLRA	Exclude from BLRA	Exclude from BLRA

Table 4
Comparison of Groundwater Concentrations to Regulatory Screening Values (MCLs)
Jones Road Superfund Site
Houston, Texas

COPC in Groundwater	MCL (ug/L)	Determination
PCE	5	Designate as a COC
TCE	5	Designate as a COC
VC	2	Designate as a COC

TABLE 5

SELECTION OF EXPOSURE PATHWAYS

JONES ROAD SUPERFUND SITE

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Ground Water	Ground Water	Tap Water	Resident	Adult	Ingestion	Quantitative for Anticipated Private Sources	Exposures to groundwater from private wells at residences not anticipated to receive municipal water are considered complete. Some residences will be supplied with municipal water, and any affected city well would be out of service until remediated.
						Inhalation	Quantitative	Exposure to indoor vapors assumed complete.
						Dermal	None	Intake of volatile compounds through dermal exposure during showering is assumed to be less than by ingestion and inhalation pathways based on reduced frequency and duration of exposure and by reduced contact with skin surface through volatilization.
					Child	Ingestion	Quantitative	Exposures to groundwater from private wells at residences not anticipated to receive municipal water are considered complete. Some residences will be supplied with municipal water, and any affected city well would be out of service until remediated.
						Inhalation	Quantitative	Exposure to indoor vapors assumed complete.
						Dermal	None	Intake of volatile compounds through dermal exposure during showering is assumed to be less than by ingestion and inhalation pathways based on reduced frequency and duration of exposure and by reduced contact with skin surface through volatilization.
				Indoor Worker	Adult	Ingestion	Quantitative	Pathway excluded; municipal water is supplied to area businesses, and any affected city well would be out of service until remediated.
						Inhalation	Quantitative	Pathway excluded for some residences who will be supplied with municipal water, and any affected city well would be out of service until remediated. Exposures to groundwater from private wells at residences not anticipated to receive municipal water are considered complete.
						Dermal	None	Pathway excluded; the indoor worker is not expected to engage in activity that would result in substantial dermal contact (showering, etc.).

TABLE 6

SELECTION OF EXPOSURE PATHWAYS

JONES ROAD SUPERFUND SITE

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Ground Water	Air (via vapor intrusion)	Indoor Air	Resident	Adult	Inhalation	Quantitative	Indoor air concentrations were detected and measured.
					Child	Inhalation	Quantitative	Indoor air concentrations were detected and measured.
				Indoor Worker	Adult	Inhalation	Quantitative	Indoor air concentrations were detected and measured.

TABLE 7

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current-Future

Medium: Ground Water

Exposure Medium: Ground Water

Exposure Point	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source (5)	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Tap Water	Tetrachloroethylene	0.056 LJ	110 =	ug/L	TT11014 *	NA	0.5 - 10	110	NA	0.43 C	5	MCL	Y	ASTV
	Trichloroethylene	0.04 LJ	5.7, 10 U	ug/L	JR11515, MW-14*	NA	0.5 - 10	5.7, 10 U	NA	0.028 C	5	MCL	Y	ASTV
	Vinyl Chloride	0.11 LJ	4.5, 10 U	ug/L	MW-11R *	NA	0.5 - 10	4.5, 10 U	NA	0.015 C	2	MCL	Y	ASTV

Footnote Instructions:

(1) (=) = Analytical result is valid with no QC qualifiers.
(2) Highest detected value for the data set
(3) Specify source(s) for the "Background Value".
(4) EPA Region 6 Medium-Specific Screening Levels (January 2004); risk = 1E-06, hazard = 1; N/C - non-carcinogenic or carcinogenic
(5) (ASTV) = Above screening toxicity value
(MCL) - Maximum Contaminant Level specified in the Safe
(6) * = Refer to Feasiblity Study for locations

TABLE 8
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future

Medium: Ground Water

Exposure Medium: Air (via Vapor Intrusion)

Exposure Point	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source (5)	COPC Flag (Y/N)	Rationale for Selection or Deletion (6)
West Sump, Center Room	Tetrachloroethylene	9.5	14.0	ug/m^3	Center Room	2/2	1.4 - 1.4	14.0	N/A	8.1 C		EPA, 2002	Y	ASTV
	Trichloroethylene	1.7	1.8	ug/m^3	Center Room	2/2	1.1 - 1.1	1.8	N/A	0.022 C		EPA, 2002	Y	ASTV
	cis-1,2-Dichloroethene	1.7	1.8	ug/m^3	Center Room	2/2	0.79-0.79	1.8	N/A	35 N		EPA, 2002	N	BSTV
	trans-1,2-Dichloroethen	0.79 U	0.79 U	ug/m^3	Center Room	0/2	0.79-0.79	0.8	N/A	70 N		EPA, 2002	N	BSTV
	Vinyl Chloride	0.51 U	0.51 U	ug/m^3	Center Room	0/2	0.51-0.51	0.51	N/A	2.8 C		EPA, 2002	N	ASTV

TABLE 9
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Medium: Ground Water
Exposure Medium: Ground Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	UCL (Distribution)	Maximum Concentration (Qualifier) (1)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale (2)
Tap Water	Tetrachloroethylene	ug/L	3.24E+00	Nonparametric	110 =	3.71E+00	ug/L	Bootstrap	See Appendix B
	Trichloroethylene	ug/L	6.21E-01	Nonparametric	5.7, 10 U	6.63E-01	ug/L	Bootstrap	See Appendix B
	Vinyl Chloride	ug/L	5.88E-01	Nonparametric	4.5, 10 U	6.14E-01	ug/L	Bootstrap	See Appendix B

Footnotes:

(1) (=) = Analytical result is valid with no QC qualifiers.

(2) See Appendix B in BLRA 2008 (Shaw, 2008c)

TABLE 10

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future

Medium: Ground Water

Exposure Medium: Air (via Vapor Intrusion)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Center Room	Tetrachloroethylene	ug/m^3	-	-	14.0	14.0	ug/m^3	max	1 sample point
	Trichloroethylene	ug/m^3	-	-	1.8	1.8	ug/m^3	max	1 sample point
	Vinyl Chloride	ug/m^3	-	-	0.51	0.51	ug/m^3	max	1 sample point

TABLE 11
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Future
Medium: Ground Water
Exposure Medium: Ground Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference (2)	Intake Equation/ Model Name (1)
Ingestion	Resident	Adult	Tap Water	IRw	Ingestion Rate of Water	2	L/day	EPA, 1997	
				IRWadj	Age-adjusted Ingestion Rate	1.1	L-year/kg-day	EPA, 1991b	
				MF	Modifying Factor	0.001	mg/ug	EPA, 1989	
				EF	Exposure Frequency	350	days/year	EPA, 1991b	
				ED	Exposure Duration	30	years	EPA, 1989	Intake from Birth (carcinogen) =
				BW	Body Weight	70	kg	EPA, 1989	EPC x IRwadj x MF x EF
				ATc	Averaging Time - carcinogen	25550	days	EPA, 1989	Atc
				ATnc	Averaging Time - non-carcinogen	10950	days	EPA, 1989	
		Child	Tap Water	IRw	Ingestion Rate of Water	1	L/day	EPA, 1997	
				MF	Modifying Factor	0.001	mg/ug	EPA, 1989	
				EF	Exposure Frequency	350	days/year	EPA, 1991b	Intake (noncarcinogen) (adult or child) =
				ED	Exposure Duration	6	years	EPA, 1989	IRw x MF x EF x ED
				BW	Body Weight	15	kg	EPA, 1989	BW x Atnc
				ATc	Averaging Time - carcinogen	25550	days	EPA, 1989	
				ATnc	Averaging Time - non-carcinogen	2190	days	EPA, 1989	

Footnote Instructions:

(1) Refer to Section 3.6 of the HHRA for information regarding modeled intake development.

(2) Refer to Refence Section of the Record of Decision for information regarding rationale/reference.

TABLE 12 RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Medium: Ground Water
Exposure Medium: Air (via vapor intrusion)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference (1)	Intake Equation/ Model Name
Inhalation	Resident	Resident	Indoor Air	InhR	Inhalation Rate	20	m3/day	EPA, 1991b	Intake from Birth (carcinogen) = EPC x InhRadj x MF x EF / Atc
				InhRadj	Age-adjusted Inhalation Rate	11	m3-yr/kg-d	EPA, 1991b	
				MF	Modifying Factor	0.001	mg/ug	EPA, 1989	
				EF	Exposure Frequency	350	days/year	EPA, 1991b	
				ED	Exposure Duration	30	years	EPA, 1989	
				BW	Body Weight	70	kg	EPA, 1989	
				ATc	Averaging Time - carcinogen	25550	days	EPA, 1989	
				ATnc	Averaging Time - non-carcinogen	10950	days	EPA, 1989	
		Child	Indoor Air	InhR	Inhalation Rate	10	m3/day	EPA, 2002	Intake (noncarcinogen) (adult or child) = InhR x MF x EF x ED / BW x ATc (or ATnc)
				MF	Modifying Factor	0.001	mg/ug	EPA, 1989	
				EF	Exposure Frequency	350	days/year	EPA, 1991b	
				ED	Exposure Duration	6	years	EPA, 1991b	
				BW	Body Weight	15	kg	EPA, 1991b	
				ATc	Averaging Time - carcinogen	25550	days	EPA, 1989	
				ATnc	Averaging Time - non-carcinogen	2190	days	EPA, 1989	
	Worker	Adult	Indoor Air	InhR	Inhalation Rate	13	m3/day	EPA, 1997	Adult Intake (carcinogen or noncarcinogen) = InhR x MF x EF x ED / BW x ATc (or ATnc)
				MF	Modifying Factor	0.001	mg/ug	EPA, 1989	
				EF	Exposure Frequency	250	days/year	EPA, 1991b	
				ED	Exposure Duration	25	years	EPA, 1991b	
				BW	Body Weight	70	kg	EPA, 1989	
				ATc	Averaging Time - carcinogen	25550	days	EPA, 1989	
				ATnc	Averaging Time - non-carcinogen	9125	days	EPA, 1989	

Footnote Instructions:

(1) Refer to Refence Section of the Record of Decision for information regarding rationale/reference.

TABLE 13.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
JONES ROAD SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal	Absorbed RfD for Dermal		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s) *	Date(s) (MM/DD/YYYY)
Tetrachloroethylene	Chronic	1.0E-02	(mg/kg-d)	NA	NA	NA			R6 MSSLs/IRIS	Nov-07
Trichloroethylene	Chronic	3.0E-04	(mg/kg-d)	NA	NA	NA			R6 MSSLs/NCEA	Nov-07
Vinyl Chloride	Chronic	3.0E-03	(mg/kg-d)	NA	NA	NA			R6 MSSLs/IRIS	Nov-07

TABLE 13.2
NON-CANCER TOXICITY DATA -- INHALATION
JONES ROAD SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfDi		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s) *	Date(s) (MM/DD/YYYY)
Tetrachloroethylene	chronic	6.0E-01	mg/m^3	1.1E-01	mg/kg-day			R6 MSSLs/IRIS	Nov-07
Trichloroethylene	chronic	4.0E-02	mg/m^3	1.1E-02	mg/kg-day			R6 MSSLs/NCEA	Nov-07

* The Region 6 Medium-Specific Screening Levels (R6 MSSLs) refer to toxicity data from IRIS or NCEA.

TABLE 14.1
CANCER TOXICITY DATA -- ORAL/DERMAL
JONES ROAD SUPERFUND SITE

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal	Absorbed Cancer Slope Factor for Dermal		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s) (1)	Date(s) (MM/DD/YYYY)
Tetrachloroethylene	5.4E-01	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA		R6 MSSLs/other	Nov-07
Trichloroethylene	4.0E-01	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA		R6 MSSLs/NCEA	Nov-07
Vinyl Chloride (adult exposure)	7.2E-01	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	A	R6 MSSLs/IRIS	Nov-07
Vinyl Chloride (exposure from birth)	1.5E+00	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	A	R6 MSSLs/IRIS	Nov-07

TABLE 14.2
CANCER TOXICITY DATA -- INHALATION
JONES ROAD SUPERFUND SITE

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s) (1)	Date(s) (MM/DD/YYYY)
Tetrachloroethylene	5.9E-06	$(ug/m^3)^{-1}$	2.1E-02	$(mg/kg\text{-}day)^{-1}$		R6 MSSLs/other	Nov-07
Trichloroethylene	2.0E-06	$(ug/m^3)^{-1}$	7.0E-03	$(mg/kg\text{-}day)^{-1}$		Cal-EPA	Dec-04

Footnote Instructions:

NA: Not applicable to incomplete pathway

(1) The Region 6 Medium-Specific Screening Levels (R6 MSSLs) refer to toxicity data from IRIS, NCEA or other documents. Cal-EPA refers to the California EPA.

TABLE 15.1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground water	Ground Water	Tap Water	Ingestion	Tetrachloroethylene	3.7E+00	ug/L	5.6E-05	(mg/kg-day)	5.4E-01	(mg/kg-day)-1	3.0E-05	1.0E-04	(mg/kg-day)	1.0E-02	(mg/kg-d)	1.0E-02
				Trichloroethylene	6.63E-01	ug/L	1.0E-05	(mg/kg-day)	4.0E-01	(mg/kg-day)-1	4.0E-06	1.8E-05	(mg/kg-day)	3.0E-04	(mg/kg-d)	6.1E-02
				Vinyl Chloride (adult exposure)	6.14E-01	ug/L	7.2E-06	(mg/kg-day)	7.2E-01	(mg/kg-day)-1	5.2E-06					
				Vinyl Chloride (exposure from birth)	6.14E-01	ug/L	9.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	1.4E-05	1.7E-05	(mg/kg-day)	3.0E-03	0.0E+00	5.6E-03
			Exp. Route Total							Adult Expsoure	3.9E-05				Adult Exposure Hazard Index (HI)	7.1E-02
										Exposure from Birth	4.8E-05					
										Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media	

TABLE 15.2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Ground Water	Tap Water	Ingestion	Tetrachloroethylene	3 7146E+00	ug/L	see Table 15 1	(mg/kg-day)	see Table 15 1	(mg/kg-day)-1	see Table 15 1	2 4E-04	(mg/kg-day)	1 0E-02	(mg/kg-d)	2 4E-02
				Trichloroethylene	6 63E-01	ug/L	see Table 15 1	(mg/kg-day)	see Table 15 1	(mg/kg-day)-1	see Table 15 1	4 2E-05	(mg/kg-day)	3 0E-04	(mg/kg-d)	1 4E-01
				Vinyl Chloride	6 14E-01	ug/L	see Table 15 1	(mg/kg-day)	see Table 15 1	(mg/kg-day)-1	see Table 15 1	3 9E-05	(mg/kg-day)	3 0E-03	(mg/kg-d)	1 3E-02
			Exp Route Total									Child Hazard Index (HI)				1.8E-01
	Exposure Medium Total															1.8E-01
							Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media				

TABLE 16.1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	take/Exposure Concentratio		CSF/Unit Risk		Cancer Risk	take/Exposure Concentratio		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Air	Air	Indoor Air	Inhalation	Tetrachloroethylene	1.4E+01	ug/m^3	2.1E-03	mg/kg-d	2.1E-02	(mg/kg-d)$^{-1}$	4.4E-05	3.8E-03	mg/kg-d	1.1E-01	mg/kg-d	3.5E-02
		Center Room		Trichloroethylene	1.8E+00	ug/m^3	2.7E-04	mg/kg-d	7.0E-03	(mg/kg-d)$^{-1}$	1.9E-06	4.9E-04	mg/kg-d	1.1E-02	mg/kg-d	4.5E-02
			Exp. Route Total								4.5E-05				Adult Hazrd Index (HI)	8.0E-02
	Exposure Medium Total										4.5E-05					8.0E-02

TABLE 16.2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Air	Air	Indoor Air Center Room	Inhalation	Tetrachloroethylene	1 4E+01	ug/m³	see Table 16.1	mg/kg-d	see Table 16 1	(mg/kg-d)⁻¹	see Table 16.1	8 9E-03	mg/kg-d	1 1E-01	mg/kg-d	8.1E-02
				Trichloroethylene	1 8E+00	ug/m³	see Table 16.1	mg/kg-d	see Table 16 1	(mg/kg-d)⁻¹	see Table 16 1	1 2E-03	mg/kg-d	1 1E-02	mg/kg-d	1.3E-05
			Exp Route Total								see Table 16 1			Child Hazard Index (HI)		8.1E-02
	Exposure Medium Total										see Table 16 1					8.1E-02

TABLE 17
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
JONES ROAD SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Indoor Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	take/Exposure Concentrati		CSF/Unit Risk		Cancer Risk	take/Exposure Concentratio		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Air	Air	Indoor Air Center Room	Inhalation	Tetrachloroethylene	1.4E+01	ug/m^3	6.4E-04	mg/kg-d	2.1E-02	$(mg/kg\text{-}d)^{-1}$	1.3E-05	1.8E-03	mg/kg-d	1.1E-01	mg/kg-d	1.6E-02
				Trichloroethylene	1.8E+00	ug/m^3	8.2E-05	mg/kg-d	7.0E-03	$(mg/kg\text{-}d)^{-1}$	5.7E-07	2.3E-04	mg/kg-d	1.1E-02	mg/kg-d	2.1E-02
			Exp. Route Total								1.4E-05				Hazard Index (HI)	3.7E-02

Table 18

Cost Estimate Summary
Jones Road Ground Water Plume Superfund Site

Category	Alternative 1	Alternative 2	Alternative 3	Alternative 4 (Selected Remedy)
Capital	$0	$3,336,660	$4,439,040	$5,699,520
O&M	$0	$2,022,510	$3,776,310	$3,776,310
Total	$0	$5,359,170	$8,215,350	$9,475,830
7% Net Present Value	$0	$4,286,779	$6,244,771	$7,425,852

Note: The cost estimates for all alternatives except Alternative 1 differ from the cost estimates included in the FS. The cost estimates here includes the capital and O&M costs from the FS, with the addition of the following costs:

- *$1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).*
- *$288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).*
- *$433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).*

Table 19
Costs for Selected Remedy (Alternative 4)
Jones Road Groundwater Plume Superfund Site

Year	Undiscounted Annual O&M Costs	Undiscounted Capital/Periodic Costs	Undiscounted Total Annual Cost	Discount Factor	Discounted Annual O&M Costs	Discounted Capital/Periodic Costs	Discounted Total Annual Costs	Comments
1	$223,320	$4,835,040	$5,058,360	1.00000	$223,320	$4,835,040	$5,058,360	Install monitor/injection/extraction wells; remedial design; pilot studies; install groundwater treatment plants; apply ISCO & In-situ bio treatments
2	$223,320	$360,000	$583,320	0.96912	$216,424	$348,884	$565,308	Apply ISCO & in-situ bio treatments
3	$151,140	$180,000	$331,140	0.93036	$140,614	$167,464	$308,079	Apply in-situ bio treatments
4	$151,140	$180,000	$331,140	0.86523	$130,771	$155,742	$286,513	Apply in-situ bio treatments
5	$151,140	$24,080	$175,220	0.80467	$121,617	$19,376	$140,994	Five-year review
6	$115,050		$115,050	0.74834	$86,096	$0	$86,096	
7	$115,050		$115,050	0.69596	$80,070	$0	$80,070	
8	$115,050		$115,050	0.64724	$74,465	$0	$74,465	
9	$115,050		$115,050	0.60193	$69,252	$0	$69,252	
10	$115,050	$24,080	$139,130	0.55980	$64,405	$13,480	$77,885	Five-year review
11	$115,050		$115,050	0.52061	$59,896	$0	$59,896	
12	$115,050		$115,050	0.48417	$55,704	$0	$55,704	
13	$115,050		$115,050	0.45028	$51,804	$0	$51,804	
14	$115,050		$115,050	0.41876	$48,178	$0	$48,178	
15	$115,050	$24,080	$139,130	0.38944	$44,806	$9,378	$54,183	Five-year review
16	$115,050		$115,050	0.36218	$41,669	$0	$41,669	
17	$115,050		$115,050	0.33683	$38,752	$0	$38,752	
18	$115,050		$115,050	0.31325	$36,040	$0	$36,040	
19	$115,050		$115,050	0.29132	$33,517	$0	$33,517	
20	$115,050	$24,080	$139,130	0.27093	$31,171	$6,524	$37,695	Five-year review
21	$115,050		$115,050	0.25197	$28,989	$0	$28,989	
22	$115,050		$115,050	0.23433	$26,960	$0	$26,960	
23	$115,050		$115,050	0.21793	$25,072	$0	$25,072	
24	$115,050		$115,050	0.20267	$23,317	$0	$23,317	
25	$115,050	$24,080	$139,130	0.18848	$21,685	$4,539	$26,224	Five-year review
26	$115,050		$115,050	0.17529	$20,167	$0	$20,167	
27	$115,050		$115,050	0.16302	$18,755	$0	$18,755	
28	$115,050		$115,050	0.15161	$17,443	$0	$17,443	
29	$115,050		$115,050	0.14100	$16,222	$0	$16,222	
30	$115,050	$24,080	$139,130	0.13113	$15,086	$3,158	$18,244	Five-year review
TOTAL	**$3,776,310**	**$5,699,520**	**$9,475,830**				**$7,425,852**	

The cost estimates differ from the cost estimates included in the FS. The cost estimate here includes the capital and O&M costs from the FS, with the addition of the following costs:

$1,188,000 (additional capital cost for plugging and abandonment of water wells where service is provided by a water line; based on 180 wells at $6,000 each, plus 10% contingencies).

$288,500 (additional capital cost for providing new water line connections; based on 75 connections at $3,500 each, plus 10% contingencies).

$433,080 (additional O&M costs for annual groundwater monitoring after year 15 instead of once every five years; additional Present Worth cost of $100,610).

APPENDIX A

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

October 27, 2010

Mr. Samuel Coleman, P.E., Director
Superfund Division
U.S. Environmental Protection Agency Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

Re: Record of Decision
Jones Road Groundwater Plume Superfund Site TXN000605460
Harris County, Texas

Dear Mr. Coleman:

The Texas Commission on Environmental Quality (TCEQ) received the signed Final Superfund Record of Decision (ROD) for the Jones Road Groundwater Plume Superfund Site in Harris County, Texas via email on September 27, 2010. The TCEQ has completed the review of the above referenced document and concurs that the response action described is the most appropriate remedy for this site.

Sincerely,

Mark R. Vickery, P.G.
Executive Director

MRV/MCL/cw

APPENDIX B