

Figure 1: NAPL and TCE Dissolved plume estimates based on current data

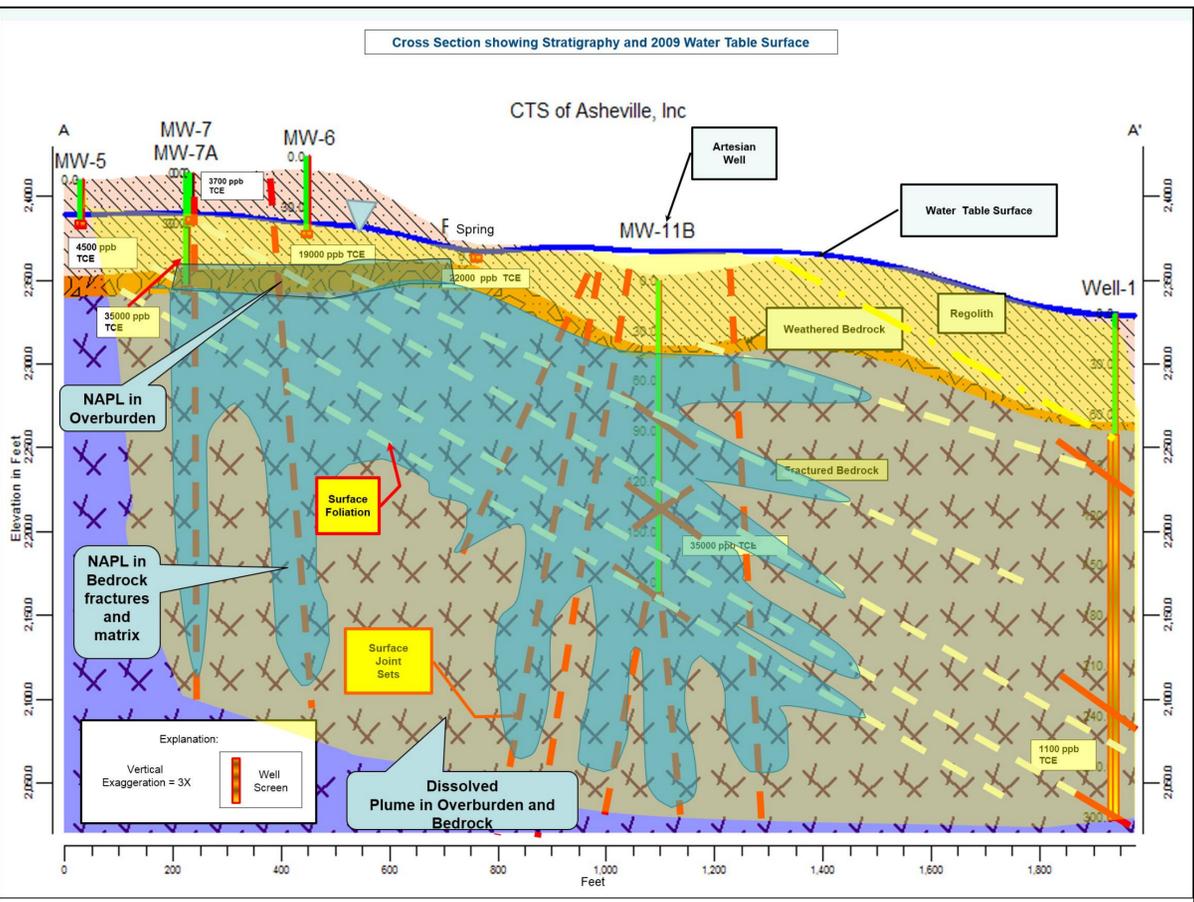


Figure 2: Schematic of Contaminant Distribution using existing groundwater and soil concentration data, Rockworks Cross-section based on the CTS (AMEC) boring logs (TSS), NC Survey Surface Mapping, and USGS 2D Fracture Depiction.

EPA Hydrogeologic and Contaminant Conceptual Site Model for CTS of Asheville, Inc Buncombe County, NC February, 2015

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Basis
Currently an EPA Remedial Investigation *has not been performed*. The data used to inform this CSM is presented in the North Carolina Remedial Investigation, the EPA NPL Listing Investigations, the EPA Potable Well Sampling, and the CTS Phase I NAPL Investigation. Among the activities that have taken place are monitoring well installation and sampling, private well sampling, borehole geophysics and evaluation (by the US Geologic Survey) in private wells, pumping evaluations in private wells, borehole geophysics in CTS monitoring wells, geologic mapping by the North Carolina Geologic Survey, spring and surface water sampling, membrane interface probe (MIP) screening, Laser Induced Fluorescence (LIF) screening, dye testing, and soil sampling.

Hydrogeology
The CTS site is a fractured Rock site with an overlying overburden of saprolite and partially weathered bedrock. The bedrock units are metamorphic. There are characteristics of the units showing deformation that results in fractures, foliation, and ductile and brittle faults, folds, faults and shears. The Mills Gap Fault Zone is a WNW-striking *Brittle Fault* zone with associated joints. There are NE-trending foliations and mylonitic foliations that are also indications the area has undergone significant tectonic stress that has provided secondary subsurface features that are mechanisms for hydraulic interconnection. Bedding Features are present in the bedrock, along cross-cutting structural features, that allow the hydraulic connection between units and across the bedding contacts. EPA packer testing, borehole geophysical logging and mapping have revealed that a fracture, joint, and faulting system exists that allows the hydraulic connection of distant drinking water wells and distant contaminant transport from the CTS facility.

Numerous N/NE striking joints and foliation parting fractures that together form a pathway of interconnected features for contaminated groundwater (known to occur in bedrock fractures near the CTS plant) to flow toward wells located at 14 Chapel Hill Church Road and in the Oaks subdivision. Numerous west-north west and east-southeast striking joints and foliation parting fractures (within the Mills Gap Fault Zone) that together form a pathway of interconnected features for contaminated groundwater, are known to occur in bedrock fractures near the CTS plant and known to flow toward the Rice property and 10 Concord Road.

The wells installed in the overburden contain saprolitic material (weathered material that has not been disturbed in which the parent rock structure remains) in which quartz and weathered mylonite veins are present that are pathways for migration in addition to the migration between granular material making up the overburden. Within the weathered zone the hydraulic conductivity is increased making it a preferential flow zone. Within the bedrock the fractures, foliation, and ductile and brittle faults, folds, faults and shears are also preferential flow paths along which water can migrate at a greater rate than through the rock matrix.

There is no hydraulic separation between the overburden and the bedrock. It is all one hydraulic unit or aquifer.

Contaminant Distribution
The current contaminant distribution is depicted in the figures. The contaminant composition is a NAPL in the overburden soil and weathered bedrock, a NAPL in the bedrock, and a dissolved phase contaminant plume in the overburden and bedrock. The NAPL and the dissolved phase are a mixture of petroleum hydrocarbons and chlorinated hydrocarbons.

NAPL
Within the overburden there is a pooled phase of NAPL and a residual phase of NAPL. Within the bedrock at the CTS facility there is only 1 well installed to 187' and the concentrations are at 35,000 ppb TCE. Because the NAPL is a mixture of material the solubilities will be enhanced. For example, in Gavaskar and Chen, 2004, the effective solubility of TCE is 11,000 ppb. The EPA NAPL boundary has been constructed using that concentration. Other NAPL indicators include membrane interface probe (MIP), Laser Induced Fluorescence (LIF), and dye testing. These were done in a limited area.

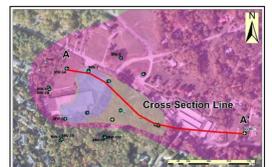
Within the bedrock NAPL contamination is present in the fracture system and also present in the rock matrix.

Springs also exhibit concentrations at 22,000 ppb TCE (greater than the Gavaskar and Chen effective solubility of 11,000 ppb). These springs are to the east of the site and at the contact between the weathered bedrock and bedrock.

Ambient air concentrations in the vicinity of the highly contaminated springs have been as much as 16 ug/m³ TCE (0.21 ug/m³ is TCE screening level) indicating the vapor phase developing from groundwater day lighting into the spring and then into the ambient air.

Dissolved
Within the overburden and bedrock there is also a dissolved phase groundwater contamination as depicted in the figures. The packer testing that took place in the private wells showed contamination migrating up from lower, more productive fractures up into the shallower, less productive fractures. Higher concentrations were shown at depth, rather than in the shallow fractures within the wells. Because of a well-developed fracture system to the NE, a private well (CHR) to the north demonstrated that when it was pumping the TCE concentrations increased to a maximum sample concentration of 1400 ppb and when there was no pumping it decreased to less than 5 ppb TCE. The borehole geophysics and surface geologic mapping, together with the pumping/concentration trend indicates connection to the highly contaminated CTS facility. Other wells are present north of the CTS site that are very low yield (0.5 GPM) and are not in the same fracture system that the CHR well (60 GPM) has at 495'.

A.R. Gavaskar and A.S.C. Chen (Eds.), Paper 18-03, 2004: Remediation of Chlorinated and Recalcitrant Compounds—2004. Proceedings of the Fourth International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2004). ISBN 1-57477-145-0, published by Battell Press, Columbus, OH.



The CTS Water Level map was not included except on the Cross section

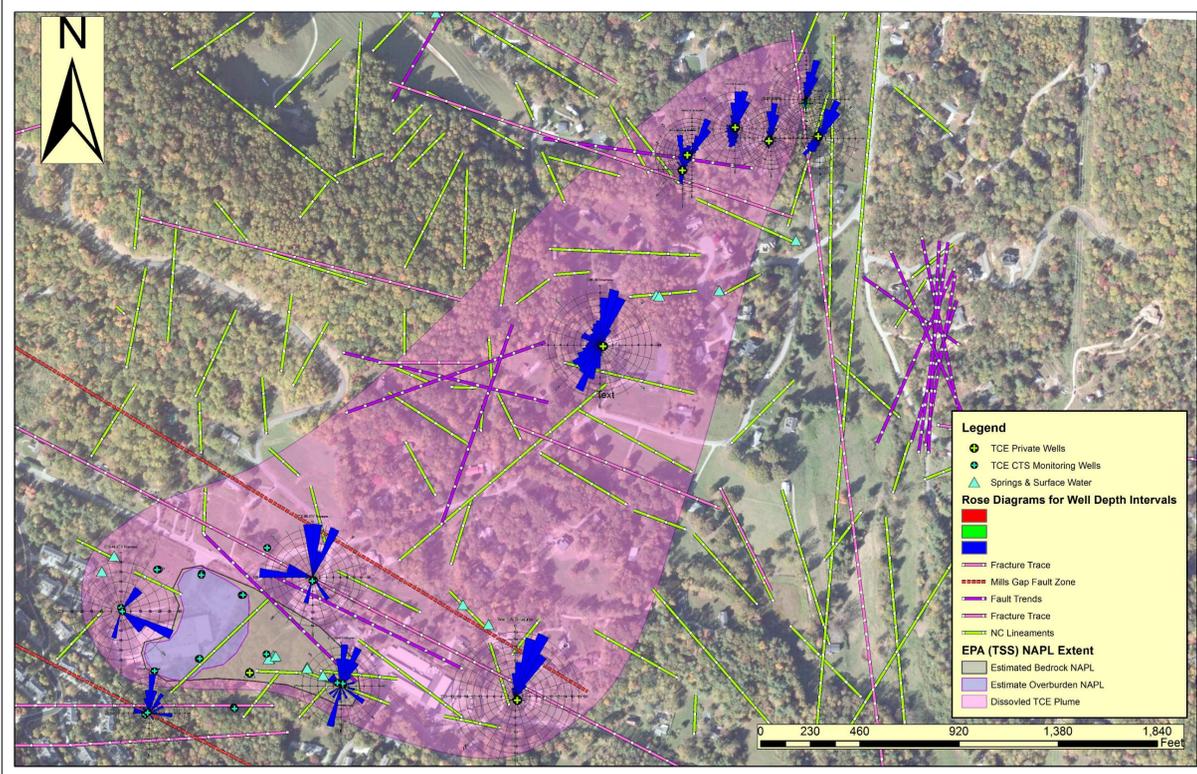


Figure 3: Dissolved TCE and NAPL in overburden and fractured bedrock. The Rose Diagrams show the subsurface fracture orientations as informed by the USGS Borehole Geophysics. The Rose Diagrams are a composite of all the logged fractures at different depth. The orientations are represented by the dark blue bars and indicate that there are consistent subsurface fracture sets that have the ability to be pathways for both NAPL and dissolved groundwater contamination.

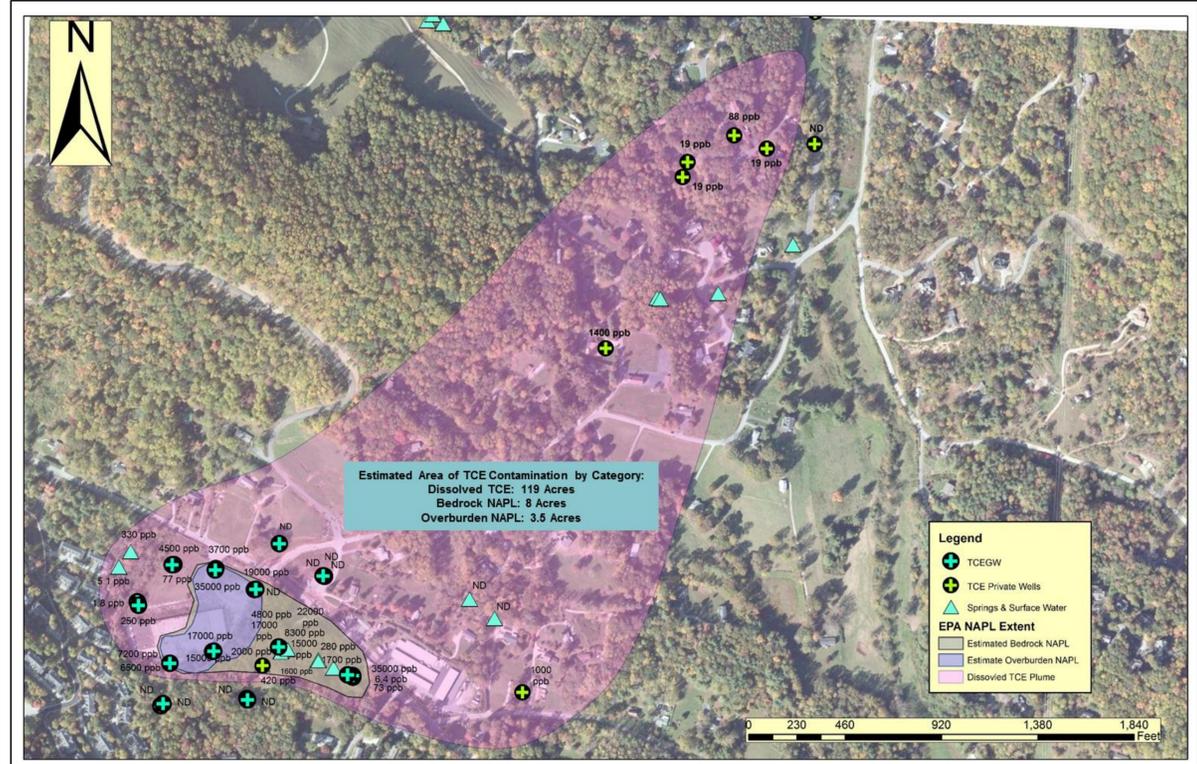


Figure 4: NAPL and Dissolved Phase Contamination in groundwater. Area of contamination is estimated based on Data currently available to EPA. The extent of dissolved phase contamination could be greater, especially along the plume boundary down Mills Gap Road.