

## Remedial Investigation Progress Update

### Boeing Commercial Airplanes, Fabrication Division – Auburn Plant

This focus sheet provides the results (through July 2011) of an environmental study, or remedial investigation (RI), of the Boeing Commercial Airplanes, Fabrication Division – Auburn Plant. You are invited to contact the Department of Ecology (Ecology) site manager with questions or concerns.

Past uses of chlorinated solvents from the Boeing Auburn Plant have resulted in plumes of contaminated groundwater in the upper aquifer that have moved beyond Boeing's property boundaries. The purpose of this focus sheet is to convey:

- The current known extent of the plumes.
- The potential for the known plumes to reach groundwater supply wells.
- The additional ongoing studies that are taking place or are planned.

A separate health consultation regarding this site is posted on the Washington State Department of Health (DOH) Site Assessment Web Page:

[www.doh.wa.gov/ehp/oehas/consults.htm](http://www.doh.wa.gov/ehp/oehas/consults.htm)

Recipients of the notice for this focus sheet are on an Ecology mailing list of interested parties. Members of the community may add themselves to this list to receive future announcements of the availability of publications and updates like this one for the site. Please contact Nancy Farman of Ecology by email at: [nfar461@ecy.wa.gov](mailto:nfar461@ecy.wa.gov), or by phone at: (360) 407-0272 to be added to (or removed from) the mailing list.

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#### *Special accommodations*

*If you need this document in a format for the visually impaired, call the Hazardous Waste and Toxics Reduction Program at 360-407-6700.*

*Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.*

## Site Background

Ecology issued a Permit and Amended Agreed Order (AAO) to the Boeing Commercial Airplanes Company (Boeing) in 2006. The permit and AAO was issued for the Boeing Fabrication Division – Auburn Plant (Boeing Auburn Plant) located at 700 15th St SW in Auburn, Washington. The AAO issued in 2006 fully supersedes an Agreed Order that was issued by Ecology in 2002. The AAO is a legal document written to ensure that the cleanup of contamination found in soil, surface water, sediment, and groundwater will meet the requirements of federal and state cleanup regulations. The cleanup regulations that apply are the:

- Federal Resource Conservation and Recovery Act (RCRA)
- State Model Toxics Control Act (MTCA)
- State Dangerous Waste Management Act

Ecology is overseeing Boeing's work to complete a remedial investigation and feasibility study (RI/FS) required by the permit and AAO. As part of the RI, Boeing is evaluating the extent of trichloroethene (TCE), and related volatile organic compounds (VOCs), found in the groundwater of the upper aquifer underneath and beyond portions of the Boeing Auburn Plant. Contaminated groundwater flows through the upper aquifer in a northerly to northwesterly direction. TCE-related VOC constituents such as cis-1,2-dichloroethene and vinyl chloride are also detected in the upper aquifer beyond the Boeing Auburn Plant.

## Results as of July 2011

### TCE Source Areas

The TCE contamination in groundwater is migrating north from two different origination areas, known as source areas, where the TCE was first released to the environment. Current data document what appear to be two overlapping plumes in the upper aquifer (Figure 1). For investigation purposes, the upper aquifer has been divided into three zones (Figure 3):

1. Shallow [10-30 feet below ground surface (BGS)]
2. Intermediate (about 40-60 feet BGS)
3. Deep (about 80-100 BGS)

At about 100 feet BGS, the upper aquifer in the Auburn Valley is underlain by a dense geologic formation, known as the Osceola Mudflow. The Osceola Mudflow is at least 55 feet thick beneath the western Boeing Auburn Plant boundary, and is comprised of clay and silt that will substantially slow the downward migration of contaminants.

TCE is often found in the groundwater at contaminated sites. Many TCE-contaminated sites have concentrations at their source areas that are higher than the concentrations reported at the Boeing Auburn Plant. For example, a typical release at a drycleaner may have TCE concentrations in groundwater as high as 10,000 µg/L<sup>1</sup> or more. (See the U.S. Environmental Protection Agency (EPA) Web site: [www.drycleancoalition.org/state.cfm](http://www.drycleancoalition.org/state.cfm) for individual site profiles).

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<sup>1</sup> Micrograms per liter

Elevated, but relatively low levels of TCE are present in groundwater beyond the Boeing Auburn Plant. The concentrations throughout the plume beyond the plant boundaries are not more than 10 µg/L higher than the 5 µg/L federal maximum contaminant level (MCL) set for drinking water. However, Washington State's Model Toxics Control Act requires that cleanup standards for TCE be lower than the federal drinking water standard. The current state cleanup level for the protection of drinkable ground water is 2.4 µg/L, about half the MCL.

### **Plume 1 Source:**

The source area for the Plume 1 was the former vapor degreaser (S-12b) and former metalbond tank line (A-08) located in Building 17-05. From 2004 through 2005, an interim action removed a majority of the TCE in soil and groundwater below Building 17-05.

The source area for Plume 1 originally had concentrations of TCE in groundwater of up to 1400 µg/L. Within a few hundred feet (horizontally) of the former vapor degreaser, the interim cleanup action successfully lowered the concentration of TCE in groundwater of the upper aquifer to below the detection limit of 0.2 µg/L. Now, the TCE concentration in groundwater at this location remains at or below 3 µg/L. The TCE concentrations rise gradually heading north beyond where the interim action took place. For comparison, the federal drinking water standard for TCE is set at a maximum contaminant level (MCL) of 5 µg/L.

### **Plume 2 Source:**

Because of elevated concentrations of TCE and vinyl chloride along the western Boeing Auburn Plant boundary, additional groundwater sampling and investigations were conducted in the summer of 2009. This work detected TCE at a well located near the wastewater treatment plant on the western property boundary. Subsequent investigations have shown that TCE and related VOCs are present in groundwater to the west and northwest of the Boeing Auburn Plant.

The source area for Plume 2 has not yet been conclusively determined. Ecology has requested, and Boeing is conducting additional investigations to locate the source area for Plume 2.

## **TCE Plume Extent**

Figure 1 illustrates the approximate horizontal extent, based on current information, of Plume 1 and Plume 2 in the intermediate zone of the upper aquifer. The intermediate zone of the aquifer has the most extensive detections of TCE in groundwater. Boeing is in the process of investigating the shallow aquifer beyond the Boeing Auburn Plant. Figure 2 shows the known extent of TCE in the shallow zone of the upper aquifer (using the data from July 2011 and grab samples taken in the fall of 2011). This representation will change as future data are included in the database. Ongoing studies by Boeing to determine the concentrations of TCE and related products in the shallow zone of the upper aquifer will help determine whether these contaminants could be vaporizing and moving up through the soil at concentrations of concern for human health. Figure 3 illustrates the general vertical configuration of Plume 1.

### **Plume 1**

Plume 1 extends north from the AMB Building (former location of Building 17-05) beneath Perimeter Road, 15th St. SW, and then roughly follows along the western side of the Interurban Trail toward Highway 18. Currently, the most northern detection of TCE related to Plume 1 in the shallow zone of the upper aquifer is under the parking lot south of the YMCA (1.0 µg/L).

Because shallow-zone groundwater wells in proximity to the YMCA due west, east, and northeast of the YMCA Building do not detect TCE; it appears that levels of TCE decline from 1.0 µg/L of TCE in the south parking lot to even lower levels or non-detection under the YMCA Building. In the intermediate zone of the upper aquifer, Plume 1 has a maximum TCE concentration of 11 µg/L, based on sampling and analysis results obtained in June 2011. This concentration occurs in a monitoring well just north of the AMB Distribution Center. However, throughout much of Plume 1, concentrations of TCE range from less than 1 µg/L to 5.5 µg/L. Ecology has requested, and Boeing is planning an investigation of the full extent of Plume 1. The dashed lines on Figures 1 and 2 show where additional work is needed to define the full extent of the plume.

## Plume 2

In general, Plume 2 extends west from Perimeter Road toward Milwaukee Ave. N. and north toward Highway 18 underneath the eastern half of the Supermall property. The highest known concentrations of TCE occur at intermediate-zone depths of the upper aquifer.

For Plume 2, groundwater analytical results from shallow grab samples [taken from wells completed in the intermediate zone] indicate that there is an area of detectible TCE in the shallow zone. This area is located southeast of the 15th St SW intersection with O St SW (Figure 2). As of July 2011, Boeing is in the preparatory stages of installing permanent groundwater-monitoring wells beyond the Boeing Auburn Plant to monitor groundwater in the shallow zone of the upper aquifer. During the late summer and fall of 2011, Boeing will install new groundwater monitoring wells to the north and to the south of the 15th St SW intersection with O St SW. Data from these wells will help determine the boundaries of the TCE in Plume 2 in the shallow zone of the upper aquifer.

In the intermediate zone of the upper aquifer, Boeing's investigation reveals that Plume 2 extends further north than Plume 1. At the well furthest north in the intermediate zone, TCE concentrations are measured at 5.1 µg/L. There is a possibility that groundwater is discharging to the wetlands to the northwest and to the west of Plume 2. Further characterization of the plume, of the TCE contamination, and of the groundwater flow rate and direction will clarify the plume conditions to the north. Based on current data, concentrations of TCE throughout groundwater in the intermediate zone of Plume 2, are less than 1 µg/L to 14 µg/L. Concentrations at the higher end of this range occur mostly at one well located on the interurban trail just beyond the western Boeing Auburn Plant boundary.

In the deep zone of the upper aquifer, TCE concentrations are between less than 1 µg/L and 5 µg/L. Boeing's ongoing investigations will provide additional information regarding the extent of TCE and related VOC detections in the shallow, intermediate, and deep zones of the upper aquifer. It is also possible that releases of TCE from other businesses and operations have contributed to the plumes Boeing is investigating.

## Contaminant Plumes and Drinking Water Supply Wells

Figure 4 shows the locations of the municipal supply and Group A wells within a mile of the site, relative to the TCE contamination being investigated at the Boeing Auburn site. Based on the current data documenting the extent of the contaminated groundwater in the upper aquifer; the groundwater flow directions; the groundwater well capture zones; the depth at which the supply wells draw groundwater; and the pumping rates at these wells, Ecology considers it unlikely that the City of Auburn's municipal supply wells (wells 1, 3A, 3B, and 4) have been affected by the TCE or related VOC contamination at the Boeing Auburn Plant.

Investigations to date have not defined the extent of contamination east of the Boeing Auburn Plant boundary. As a result, it is not definitively known whether TCE and related VOC contamination is reaching the South Auburn Water Association and the Auburn Park Community LLC supply wells from the Boeing Auburn Plant. The supply wells (Group A Wells) for the South Auburn Water Association (SAWA) and the Auburn Park Community are located in the upper aquifer and have yielded groundwater with detectable concentrations of TCE in the past. The reported data did not show concentrations for TCE above the federal maximum contaminant level (MCL) for drinking water of 5 µg/L. Ecology believes that even though these wells draw water from the upper aquifer, this VOC contamination is unlikely to be from the Boeing Auburn Plant due to the groundwater flow direction and the pumping rates at these wells.

Based on the reported sampling and analysis data, DOH reports that the concentrations of TCE in these wells show a decreasing trend over the past eight years. The SAWA has had no TCE detected above the state reporting limit (0.5 µg/L) since June 2004 (last measured in December 2010); and all levels reported have been below 5 µg/L, the federal MCL. Additional findings regarding the supply wells shown on Figure 4 are available in the Addendum to this focus sheet.

Although the municipal supply wells for the City of Auburn (1, 3A, 3B and 4) and the City of Pacific (East, West and South Wells) shown on Figure 4 are unlikely to be affected by VOC contamination from the Boeing Auburn Plant, it is possible that private wells could be drawing TCE-contaminated groundwater from the plumes in the upper aquifer. Ecology does not have a record of precise locations for private wells serving fewer than 15 connections (i.e., Group B wells) or other private wells. Ecology has requested and Boeing has agreed to conduct a second survey to locate private wells that may be drawing water from the area of TCE- and related VOC-contaminated groundwater. For this survey, Boeing will coordinate their efforts with the local, city, and county agencies to ensure the greatest likelihood of finding a private well. If private wells are identified as potentially drawing contaminated groundwater from the plume, Boeing will notify the well owners of the results of their survey.

## Potential Human Health Effects from TCE

TCE is a nonflammable, colorless liquid with a somewhat sweet odor and sweet burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, and spot removers. For a more complete definition of TCE, please see the Glossary.

People can be exposed to TCE by:

- Drinking contaminated water.
- Breathing in air that is contaminated with TCE vapors.
- Skin contact with contaminated water.

Also, when shallow groundwater contains VOCs, the potential exists for TCE to volatilize into the gas phase. As a vapor, TCE can move through the soil layer above the water table. Once in the soil layer, it may move into overlying buildings through cracks or other openings in the foundation and contaminate indoor air. This is called vapor intrusion. In order for there to be the potential for vapor intrusion, contamination must be present in the shallow zone of the upper aquifer. VOC contamination deeper in the upper aquifer generally does not result in vapor intrusion. Boeing is investigating the concentration of TCE in the shallow-zone groundwater and will evaluate whether the concentration of TCE in the shallow-zone groundwater could result in a health risk to indoor air quality.

Based on data received through July 2011, Ecology determined that TCE and related VOCs at the Boeing Auburn site are unlikely to have impacted city supply wells of Auburn and Pacific, as noted on Figure 4. The City of Algona receives its public water supply from the City of Auburn. Public drinking water supplies are subject to monitoring to protect public health. If unsafe levels of VOCs are found in the city supply water, the DOH requires more rigorous monitoring; and if high levels persist, the DOH requires additional treatment to reduce VOCs.

If long-term exposure to TCE were to occur, adverse effects would vary depending on the amount and duration of exposure. The extent of health effects is not clear and researchers continue to try to understand how these chemicals affect us. Breathing small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Drinking small amounts of TCE for a long time may cause liver and kidney damage, impaired immune function, and reproductive effects, although the extent of these effects is not known. Additional information regarding the effects from exposure to TCE may be found at the following web page: [www.atsdr.cdc.gov/toxprofiles/TP.asp?id=173&tid=30](http://www.atsdr.cdc.gov/toxprofiles/TP.asp?id=173&tid=30), or by contacting DOH (see contact information in the sidebar on page 1).

## Next Steps

In accordance with the permit, AAO and the requirements of the state cleanup regulations (RCRA and MTCA), Ecology will oversee Boeing's work to complete the remedial investigation activities at the Boeing Auburn site. These activities will include, but are not limited to:

- Determining the full extent of TCE and related VOC contamination in the upper aquifer.
- Identifying the source for Plume 2.
- Evaluating the vapor intrusion pathway in buildings on and off the Boeing Auburn plant property.

Ecology will make the results of this work available to the public upon request.

Ecology emphasizes that the investigation is ongoing. The size of the contaminant plume is likely to change as more results from future investigations become available. As a result, Ecology may also require expansion of the private well survey to account for any changes in plume dimensions.

Ecology does not normally request that facilities report ongoing results of the RI before the final RI Report is approved by Ecology. However, to keep the public informed of progress and results of the investigation and to give the community the opportunity to voice questions or concerns, Ecology is publishing this focus sheet. Ecology will consider the need for a public meeting based on the level of response to this focus sheet.

Figure 1

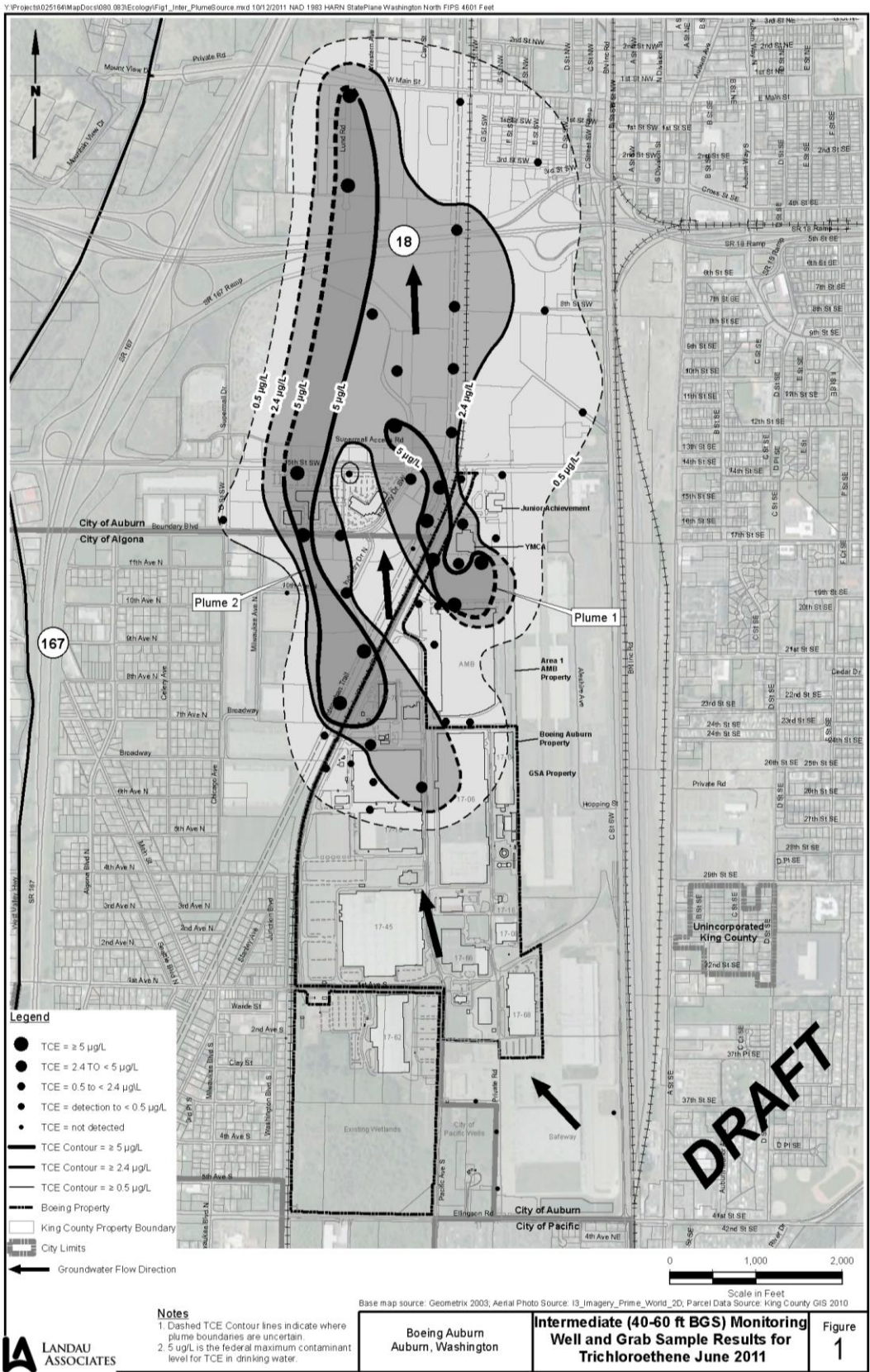


Figure 2

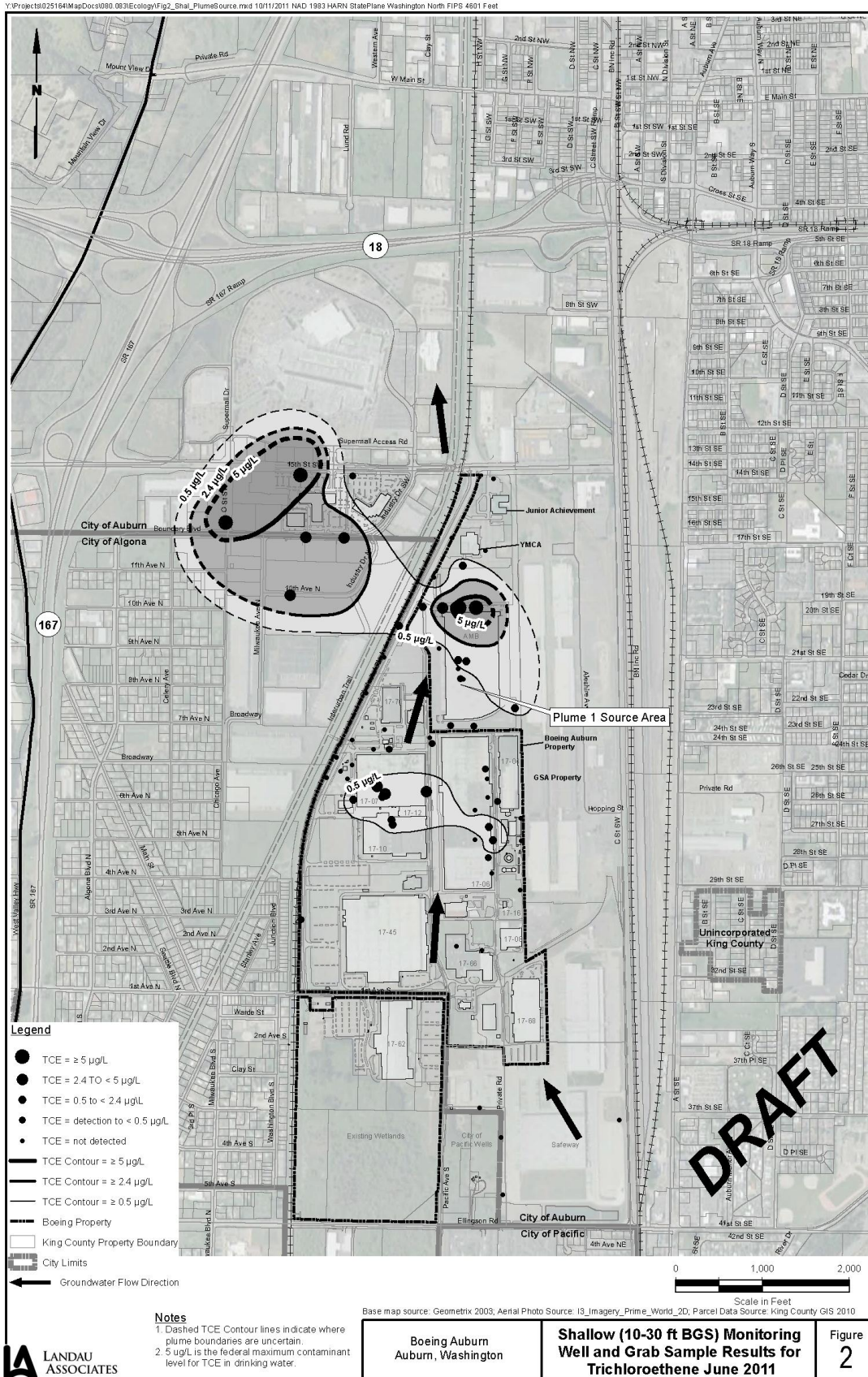




Figure 3

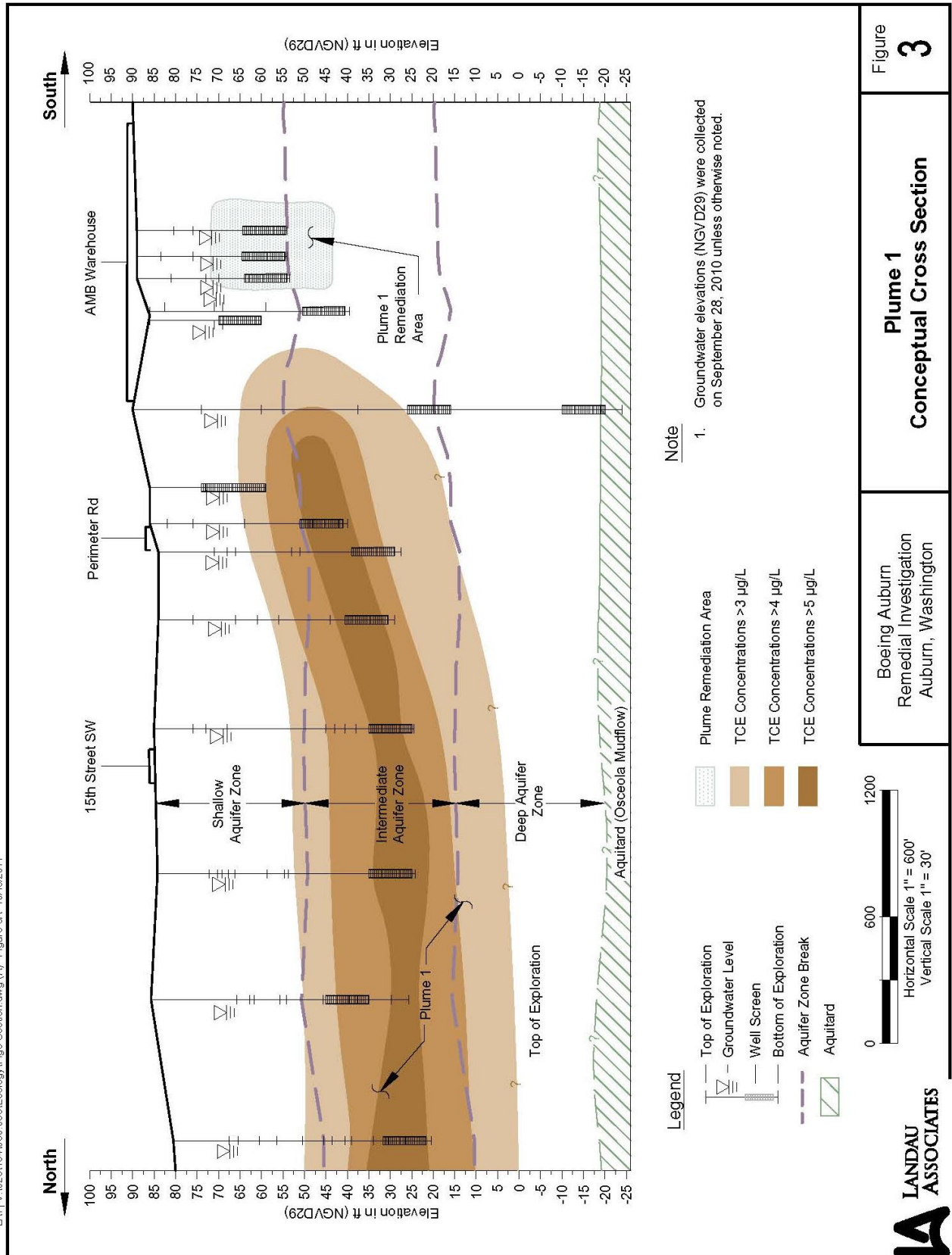
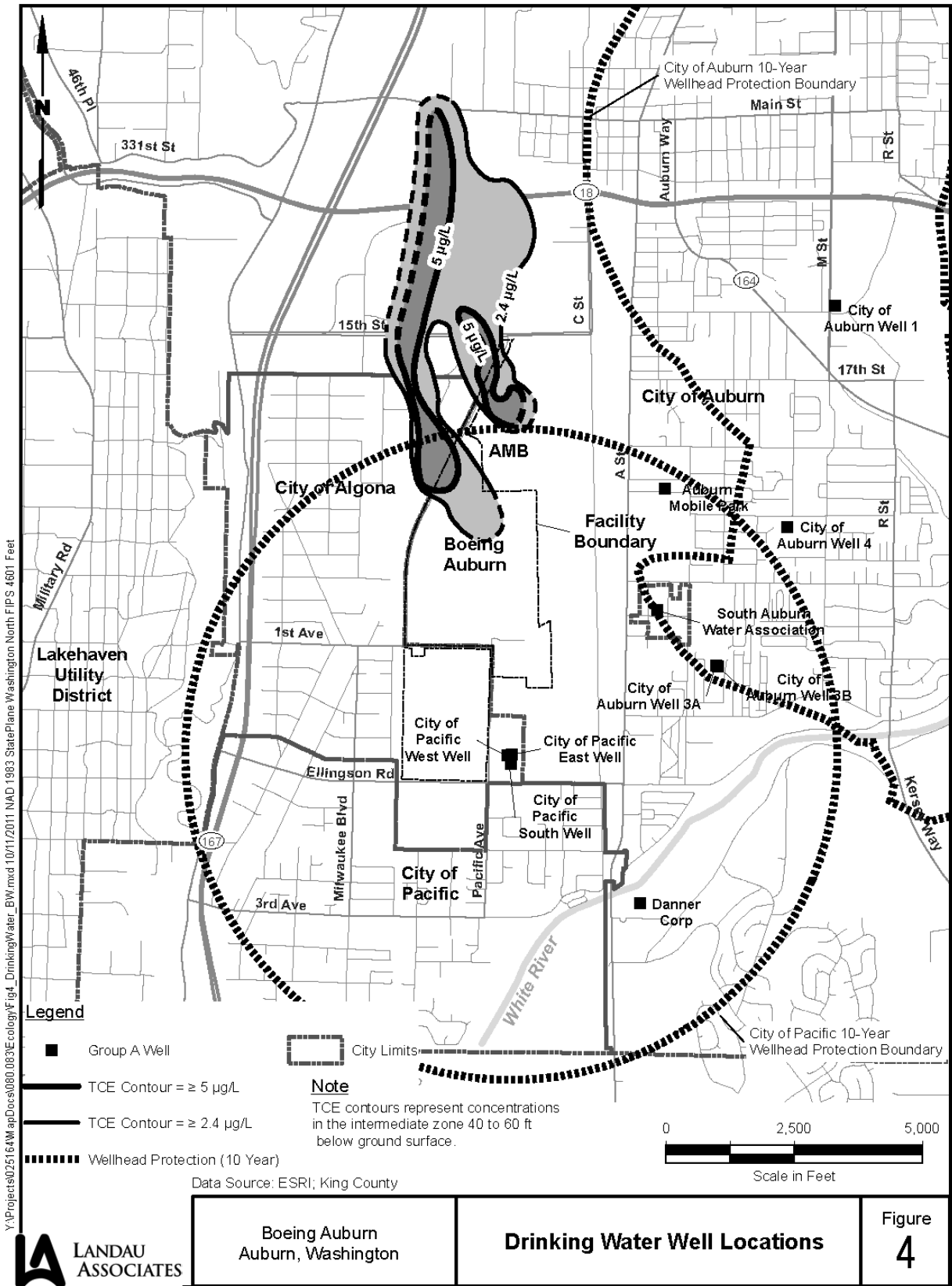


Figure 4



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## Glossary

**Deeper Aquifer:** The deeper aquifer includes the aquifer below the Osceola mudflow. Boeing determined the depth of the Osceola mudflow to begin at approximately 100 feet below ground surface. On the western property boundary of the Boeing Auburn Plant, it is estimated to be about 55 feet thick below the site.

**Groundwater:** When the term groundwater is used in this document, it refers to water that is present at and below a depth where the soil pores (spaces between soil particles) are saturated.

**Interim Action:** A remedial action conducted under WAC 173-340-430. Interim actions are taken to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility.

**MCL or Maximum Contaminant Level:** MCLs are standards set by EPA for drinking water quality. An MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems under the Safe Drinking Water Act. The limit is usually expressed as a concentration in milligrams or micrograms per liter of water.

**Osceola Mudflow:** A distinct deposit of sediment, which may be readily observed and is distinguishable from the soil units above and below. The Osceola Mudflow was formed from a major debris and mudflow on Mount Rainier which covered the Auburn Valley with fine-grained deposits of silt and clay.

**Remedial Investigation/Feasibility Study:** A remedial action that consists of activities conducted under WAC 173-340-350 to collect, develop, and evaluate sufficient information regarding a site to select a cleanup action under WAC 173-340-360 through 173-340-390.

**Soil Gas:** Soil particles below ground surface that are loosely packed are filled with pore spaces. These pore spaces contain liquids or gas. The gas in soils above the water table may be similar in composition to atmospheric air (though usually there is more carbon dioxide and less oxygen), but can also contain water and volatile chemicals in the vapor phase.

**Source Area:** The location where TCE is released to the environment, and typically where the greatest concentrations of TCE occur in soil and groundwater.

**Trichloroethene:** Also called trichloroethylene or TCE, a toxic chlorinated chemical solvent that was commonly used in the past as a degreaser for metal parts. It has been described as “probably carcinogenic to humans” (see [www.atsdr.cdc.gov/tfacts19.pdf](http://www.atsdr.cdc.gov/tfacts19.pdf)).

TCE is designated as a Hazardous Air Pollutant, is a common groundwater contaminant, and has been found at more than 1,500 hazardous waste sites. TCE enters the atmosphere as a vapor from degreasing operations or volatilization from contaminated soils, surface waters via direct discharges, and groundwater through leaching from disposal operations and hazardous waste sites. TCE is a chemical known as a “dense non-aqueous phase liquid” (DNAPL) which means that its molecular weight is heavier than that of water, and therefore it has a tendency to sink in water. Plumes of TCE generally migrate deeper into an aquifer with increasing distance from their release location (source area).

In addition, TCE can be released to indoor air from the use of TCE-containing consumer products, volatilization from water supplies, and vapor intrusion through walls and floors from contaminated soil and groundwater” (see [cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=215006](http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=215006)).

“Because of the pervasiveness of TCE in the environment, most people are exposed to low levels of TCE. The general U.S. population is exposed via inhalation, ingestion, or dermal pathways. Consumers are exposed through their use of wood stains, varnishes, finishes, lubricants, adhesives, typewriter correction fluid, paint removers, and cleaners that contain TCE. The health effects from TCE vary depending on the amount of TCE to which a person is exposed and how long the exposure lasts. EPA currently is reevaluating under which class of carcinogen (cancer-causing chemical) TCE will fall” (see [www.clu-in.org/contaminantfocus/default.focus/sec/Trichloroethylene\\_\(TCE\)/cat/Toxicology/](http://www.clu-in.org/contaminantfocus/default.focus/sec/Trichloroethylene_(TCE)/cat/Toxicology/)).

**Upper Aquifer:** The upper aquifer extends from the ground surface to approximately 100 feet below ground surface (bgs). For investigation purposes, Boeing has divided the upper aquifer into shallow, intermediate, and deep zones.

**Vapor Intrusion:** A process whereby volatile contaminants in soil gas (below ground) can enter a building located above or close to the subsurface contamination through cracks or other openings in the lowest floor. The contaminated groundwater at the very top of the water table is evaluated for the potential to contribute to vapor intrusion. It is only at this depth that the toxic volatile chemicals in groundwater can partition (partially move) into the vapor phase and contaminate soil gas and potentially indoor air.

**ADDENDUM\***

- The City of Pacific maintains three wells adjacent to the Safeway property at the southern boundary of the Boeing Auburn Plant. These wells are screened in the upper aquifer. Boeing has installed 11 wells and currently samples a series of 9 wells (i.e., sentry wells) near the city of Pacific municipal supply wells. These sentry wells are monitored to verify that no contamination is moving toward the supply wells from the east, including the former Boeing property that is now owned by the Safeway Corporation. These data are sent to the City of Pacific semiannually.
- The City of Auburn maintains four wells (well numbers 1, 3A, 3B, and 4 on Figure 4) within about a mile of the site. Well 1 is screened in the lower zone of the Upper Aquifer. Wells 3A, 3B, and 4 are all screened in the deeper aquifer below the Osceola Mudflow. Of these three wells, the City of Auburn currently pumps only well 4. The City of Auburn maintains the other wells to be used in an emergency. Neither the Boeing Auburn Plant nor the currently defined extent of the off-property plumes is within the City-defined, 10-year, time-of-travel zone of any City of Auburn wells.
- The South Auburn Water Association (SAWA), located approximately 0.25 miles east of the site, draws water from the deep zone of the upper aquifer. This well supplies approximately 47 connections. The SAWA well is estimated to pump at an average rate of 8 gallons per minute (gpm). VOCs are sampled from this system every 3 years. While there have been some detections of TCE in this well in the past, the current RI data do not confirm or eliminate the possibility that the source of this TCE is from the Boeing Auburn site. Based on groundwater flow directions, it is possible that there have been releases of TCE from other businesses, which have caused the TCE historically detected in the SAWA well.
- The Auburn Park Community LLC, a mobile home community located approximately 0.5 miles east of the site, draws water from the intermediate zone of the upper aquifer. This well supplies water to approximately 91 connections. The well is estimated to pump at an average rate of 16 gpm. VOCs are sampled from this system every year. TCE has been detected in this well at concentrations  $< 5 \mu\text{g/L}$  since May 1991, with a decreasing trend. The last detection ( $1.7 \mu\text{g/L}$ ) was measured in June 2010. The current RI data do not confirm or eliminate the possibility that the source of this TCE is from the Boeing Auburn site. Again, it is possible that there have been releases of TCE from other businesses, which have caused the TCE in the Auburn Mobile Home Park well.
- Danner Corporation, located approximately 0.5 miles south southeast of the site, is an aerospace equipment manufacturer that has a listed Group A system with a well that is 260 ft deep (i.e., beneath the upper aquifer). This well is upgradient of the site, and therefore is not likely to be affected by contamination from the site.
- The City of Algona receives its groundwater through an intertie with the City of Auburn.

\*(Summarized from the Technical Memorandum, Critical Area/Wellhead Protection Ordinance Review, by Landau Associates, April 14, 2010)