

PERIODIC REVIEW

Former GE-Dawson Facility

**220 South Dawson Street
Seattle, WA 98108**

**WAD 009278706
Facility Site ID #2522
Cleanup Site ID #2446**

**Northwest Regional Office
Hazardous Waste and Toxics Reduction Program**

[10/14/19 Public Comment DRAFT]

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1.0 INTRODUCTION

This document is a review by the Washington State Department of Ecology (Ecology) of Site conditions and monitoring data to ensure that human health and the environment are being protected at the former General Electric Aviation (GE) cleanup site¹. The former GE facility (WAD009278706) is located at 220 South Dawson Street, Seattle, Washington (hereafter referred to as the Site). Cleanup at the Site has been implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC).

Required cleanup activities at this part of the Site were established in a 2014 Consent Decree (CD) No. 14-2-09134-6 and the Ecology cleanup action plan (CAP) dated March 13, 2014. Some of these activities have been implemented, while others have not. The cleanup actions established in the CD and CAP have and will reduce contamination at the Site. However, they will also result in concentrations of hazardous substances (such as organic compounds associated with chlorinated solvent releases, and petroleum hydrocarbons) remaining at the Site which exceed standard MTCA cleanup levels².

WAC 173-340-420 (2) requires that Ecology conduct a periodic review of a Site every five years under the following conditions:

- (a) whenever Ecology conducts a cleanup action,
- (b) whenever Ecology approves a cleanup action under an Agreed Order or Consent Decree, or, as resources permit, and
- (c) whenever Ecology issues a no further action opinion, and one of the following conditions exists:
 - institutional controls or financial assurance are required as part of the cleanup;
 - a cleanup level is based on a practical quantitation limit; or
 - in Ecology's judgment, modifications to the default equations or assumptions using Site-specific information would significantly increase the concentration of hazardous substances remaining at the Site after cleanup. Or, the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors Ecology considers during its Periodic Review include [per WAC 173-340-420(4)]:

- a) the effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the Site;
- b) new scientific information for individual hazardous substances or mixtures present at the Site;

¹The site as defined by MTCA, WAC 173-340-200 includes the 220 South Dawson Street property and the location of the dissolved downgradient contamination plume extending approximately 1000 feet to the west.

² MTCA cleanup levels for soil are generally established under WAC 173-340-740 and -745. The MTCA cleanup levels for groundwater are generally established under WAC 173-340-720.

- c) new applicable state and federal laws for hazardous substances present at the Site;
- d) current and projected Site use;
- e) the availability and practicability of higher preference technologies; and,
- f) the availability of improved analytical techniques to evaluate compliance with cleanup levels.

Ecology publishes a notice of all periodic reviews in the Site Register and provides an opportunity for public comment.

The following sections of this Review discuss:

- Summary of Site Conditions [Section 2]
- Periodic Review and Effectiveness of Cleanup Actions [Section 3]
- Conclusions Reached During this Periodic Review [Section 4]

In addition, pursuant to requirements established in the 2014 CD and Ecology CAP, GE submitted the following:

- “GE Dawson Street Site Groundwater Potability Analysis, dated March 7, 2019;
- “GE Dawson Street Site 2019 5-Year Review Assessment, dated March 7, 2019

These reports have been appended to Ecology’s Periodic Review (Sections 6.5 and 6.6)

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site Description, History, and Surrounding Land Use

The 220 South Dawson Street Property is occupied by a building that was originally constructed in 1949. The building is surrounded by asphalt pavement. GE occupied the premises in 1949 and began the manufacture and repair of equipment used in aircraft in 1959.

The General Electric Aviation-Dawson (GEA/D) manufacturing facility is a RCRA interim status dangerous waste storage facility and operated its dangerous waste container storage unit from the time its Part A application was filed in August 1980 until 1989. However, from 1989 through early 1994 dangerous wastes were only accumulated for less than 90 days in the container storage area. The dangerous waste storage area was used to store various acids, petroleum products and solvents including TCE, 1,1,1-TCE, and PCE. These solvents were spilled/released to the environment, and along with their breakdown products, impurities (cis-1,2 dichloroethylene, trans-1,2 dichloroethylene, 1,1-dichloroethylene, vinyl chloride, 1,4-dioxane) and arsenic, are the primary contaminants for the cleanup.

Manufacturing operations ceased in 1994, and GE continued to use the property for office and warehouse space until it sold the property to new owners in 1996. Since 1996, the building has been used for various warehousing operations and offices by the new owners and/or their tenants.

The RCRA closure procedures for the dangerous waste storage area were three-fold: (1) remove any contaminated asphalt in the storage area, (2) remove any contaminated soils which exceed the clean closure performance standard defined in the May 1994 closure plan submittal and (3) perform confirmatory soil sampling to ensure that the clean closure performance standards were met. GE completed RCRA closure of its dangerous waste storage unit in 1995. However, in addition to the closure requirements described above, MTCA and Corrective Action Requirements also mandate that GE conduct an investigation and cleanup of the Site.

Directly to the north of the 220 South Dawson Street property is the McKinstry building at 5005 3rd Avenue South. Immediately west (and downgradient) are the Iridio building at 5050 1st Avenue South and a lot with a recently demolished building at 5033 1st Avenue South. These properties are known to be above the chlorinated solvent groundwater plume resulting from spills and leaks at the 220 South Dawson Street property.

2.2 Site Investigations - Nature and Extent of Contaminated Media

Releases occurred to the subsurface soils and groundwater from past GE operational practices at the former GE 220 S. Dawson Street facility or released from the aquifer as a result of changes in geochemical conditions resulting from those releases. Chemical data and other characterization information collected during site investigations have delineated the extent of contaminated

groundwater, soil, and air at the Site. The following subsections provide an overview of the information presented in the above-referenced documents.

The source area of the TCE, 1,1,1-TCA and TPH groundwater and soil contamination is the north section of the 220 South Dawson Street property where spillage and leakage of TCE, 1,1,1-TCA and petroleum hydrocarbon products occurred as a result of using chlorinated solvent degreasers and cutting machinery; leakage and spills of TCE and 1,1,1-TCA solvent product and RCRA waste; and leakage and spills of machine oils and engine oils within the north section of the building. The quantity of the solvent products spilled and leaked to subsurface and absorbed to vadose soil was unknown. Chlorinated solvents and petroleum hydrocarbons migrated through the vadose soils into the groundwater (approximately 7-10 feet below ground surface). The solvent and petroleum hydrocarbon products may have spread during the vertical infiltration through the vadose zone because of discontinuous thin layers of silt. The chlorinated VOC and petroleum hydrocarbon contaminants adsorbed onto the organic contents of soil will become a secondary source of the contamination. Absorbed soil concentrations and dissolved groundwater concentrations do not indicate the presence of dense aqueous phase liquid (DNAPL) at the Site.

Westerly migration of chlorinated solvents and petroleum hydrocarbon products in groundwater are mainly through the dissolved phase. Fate and transport of dissolved contaminants are primarily controlled by groundwater advection, dispersion/diffusion, retardation due to sorption, and degradation (reductive dechlorination). Reductive dechlorination of PCE and TCE by natural attenuation (NA) processes may have occurred at the Site, but effectiveness of the NA has been minimal. The dissolved chlorinated volatile organic compound (CVOC) plume spread and migrated under the southern portion of the 220 S. Dawson Street building, and the southern portion of the McKinsty building (to the north), and westwardly past 1st Avenue South. The dissolved CVOC plume continued to migrate westwardly and vertically, and in the downgradient area near First Ave S, to a depth of approximately 45 to 55 feet bgs. The current groundwater extraction system (located on the western property boundary of the 220 S. Dawson St. property) serves to reduce the footprint of the chlorinated solvent contaminated groundwater plume beneath the 220 South Dawson St. building and reduce the spreading via dispersion of groundwater contamination to the north and migration via advection westerly beyond the 220 S. Dawson Street property. The groundwater extraction system has also reduced the footprint for vapor intrusion in buildings above the on-property and off-property groundwater plume. Ecology's data analysis shows complete hydraulic containment of the on-property groundwater plume is not achieved; however, there is reduced migration of CVOC groundwater contamination from the 220 S. Dawson St. property.

CVOCs are in soil, shallow groundwater, and soil gas/vapors at the former GE building on the 220 South Dawson St. property. The CVOCs found at the Site include PCE, TCE, 1,1,1-TCA, 1,1-dichloroethene (DCE), cis-1,2 dichloroethene, trans-1,2-dichloroethene, vinyl chloride (VC). Elevated arsenic and 1,4 dioxane are also in groundwater.

Quarterly groundwater monitoring has been performed since 1997. The groundwater monitoring events include collecting samples from monitoring wells located upgradient, cross-gradient, and downgradient of contaminated groundwater areas.

From 1995 to 1996, GE conducted an independent (not under Ecology oversight) soil removal action at the 220 S. Dawson St. property. Ecology did not review or approve of the independent soil removal action work plans or reports. However, Ecology agrees that the independent removal action did remove significant amounts of contaminated soil above the water table. Following the independent soil removal action, GE estimates that less than 100 cubic yards of chlorinated solvent contaminated soil (above cleanup levels) remain above the water table in the inaccessible areas beneath the building and electrical poles located adjacent to the building. The amount of chlorinated solvent contaminated soil below the water table that exceeds current cleanup standards is currently unknown.

An independent interim action groundwater recovery system (which includes groundwater extraction and discharge) was designed and constructed in 1996 and began operating in August 1996. Groundwater was recovered from two wells (RW-1 and RW-2, shown on Figure A on the downgradient side of the 220 South Dawson St. property with the objective of containing and recovering contaminated groundwater beneath the property. This work was not reviewed or approved by Ecology; however, Ecology does believe it has significantly reduced off-property (beyond 2nd Avenue S.) migration of the chlorinated solvent groundwater plume. Ecology has required system optimization several times under past and current cleanup Agreed Order to increase capture of Site contaminated groundwater. The system was most recently modified in 2018 with the installation of recovery well RW-4 and the abandonment of recovery well RW-3 to assist with ISCO and ISCR injection remediation activities.

In 2001, Environmental Partners, Inc. (EPI), conducted investigations at the adjacent property (Liberty Ridge, formerly Western Cartage located at 5050 1st Avenue South) which is downgradient of the 220 South Dawson St. property to characterize soil and groundwater contamination (EPI, 2001). EPI designed their investigation to identify any contaminant source areas beneath the Liberty Ridge building. No on-property TCE sources were identified. Results of the EPI investigation generally confirmed the groundwater quality data collected during the GE quarterly groundwater monitoring events showing low levels of CVOCs in groundwater consistent with contaminant migration from sources at the 220 South Dawson Street property. The EPI investigation results did not reveal any contaminant sources other than those sources associated with GE's historic activities at the 220 South Dawson St. property. GE began sampling several of the EPI wells as part of its quarterly monitoring program in February 2004.

In 2002 Ecology and GE entered into an Agreed Order to complete the contaminated groundwater investigation, investigate indoor air contamination via the vapor intrusion pathway, and continue operation of the current groundwater extraction system with the addition of a groundwater contamination source area pumping well, RW-3. In August 2003 the groundwater recovery system was modified as required in the 2002 MTCA Agreed Order (Ecology 2002). A new recovery well (RW-3) was added and pumping locations and pumping rates were modified. The objective of this modified groundwater recovery system was to better contain and recover contaminated groundwater, focusing on the source area in the northern portion of the property. In 2018, a new groundwater recovery well (RW-4) replaced RW-3. RW-2 and RW-4 groundwater recovery wells are designed to operate at a combined rate of 16 gallons per minute (gpm) with permitted discharge to the King County sewer. GE is required to implement recovery well operating and maintenance procedures to maintain RW-2 and RW-4 pumping rates as close to

their design rates, 6.0 gpm and 10.0 gpm, respectively. GE continues to operate the RW-2/RW-4 groundwater extraction system.

An initial evaluation of the indoor air, at the former GE building located at 220 South Dawson Street, was conducted in 2004 using models to predict the expected indoor air volatile concentrations based on known volatile contaminant concentrations in the underlying groundwater. Ecology did not agree with modeling parameters and analysis, and thus did not approve the model results. In December 2005, Ecology required GE to collect sub-slab vapor, indoor and ambient air samples to evaluate the conditions within the GE building. Three additional rounds of indoor and ambient air sampling were conducted in 2006 and 2007. Pursuant to the results of the indoor air sample data and a subsequent 2007 Agreed Order between Ecology and GE, GE was required to install a sub-slab depressurization system in June 2007 and confirmation indoor and ambient air sampling was conducted in November 2007. The vapor intrusion mitigation (VIM) system was necessary to prevent building inhabitants from being exposed to sub-floor volatile contaminants entering the building due to vapor intrusion. This VIM system is currently operational. Monthly and annual checks on the VIM system have been required and ongoing since 2007 and all indoor air sampling results thus far have confirmed the effectiveness of the VIM system to keep indoor air concentrations below cleanup levels.

In 2006 an evaluation of the indoor air sampling results and potential exposure conditions performed at the former Interior Environments buildings located at 5033 1st Avenue S., downgradient of the former GE building indicated no unacceptable excess cancer exposure risk above $1\text{E-}05$, the basis Ecology at the time used to determine if an interim action (such as the installation of a vapor intrusion mitigation system) would be necessary. Ecology notes that this evaluation was not intended to determine compliance with the groundwater and indoor air cleanup levels where an individual excess cancer risk of $1\text{E-}06$ per constituent and total excess cancer risk of $1\text{E-}05$ is required.

In 2008, GE signed an Agreed Order to conduct a focused feasibility study (FFS) to evaluate remedial alternatives for the cleanup of soil, groundwater and indoor air contamination above cleanup levels at the Site. The primary contaminants of concerns (COCs) for soil, groundwater and vapor, as defined in the 2008 Agreed Order, include: TCE, 1,1,1-TCA, PCE, cis-1,2-dichloroethene (cis-1,2 DCE), trans-1,2-dichloro-ethylene, 1,1-dichloroethene, VC, arsenic, petroleum hydrocarbons as diesel and heavy oil, and 1,4-dioxane. Arsenic and 1,4-dioxane are not volatile substances and are not considered potential vapor intrusion COCs.

In 2010, Ecology finalized the Site Feasibility Study (FS) Report with Ecology modifications. Those Ecology modifications provided more accurate figures, tables and discussion of remedial alternatives evaluated for the final site soil, groundwater and indoor air cleanup. Ecology's technical and regulatory analysis under the Washington State MTCA cleanup regulations led to its final remedy selection of in-situ chemical oxidation injections on the 220 S. Dawson Street property and in downgradient portions of the groundwater plume; continued operation of the vapor intrusion mitigation system at the 220 S. Dawson Street building to protect workers from unacceptable vapor intrusion of sub-surface volatile contaminants; and continued operation of the groundwater extraction system located on the 220 S. Dawson Street downgradient property boundary.

In 2014, Ecology finalized and filed with King County Superior Court, the consent decree and Ecology final CAP (dated March 13, 2014). The Ecology CAP required the implementation of the final Site cleanup per Ecology's finalized and modified FS report, including the requirements for environmental covenants and institutional controls on properties above soil and groundwater contamination above unrestricted cleanup levels. Groundwater cleanup levels were set to be protective of indoor air vapor intrusion into buildings above the CVOC plume and protective of surface water beneficial uses; indoor air cleanup levels need to meet Method B unrestricted cleanup levels; and soil cleanup levels need to meet Method A or B unrestricted cleanup levels and also be protective of groundwater cleanup levels.

2.2.1 Contaminated Soil, Groundwater and Indoor Air ³

The Ecology cleanup action plan, dated March 14, 2014 summarizes the soil, groundwater and indoor air contamination above cleanup levels and the remedial actions required to meet required cleanup levels in those environmental media. In 2016, Ecology approved an Engineering Design Report that describes how initial cleanup activities would be constructed and implemented.

2.2.1.1 Contaminated Soils:

TPH diesel and heavy oil range contaminated soils above the 2014 cleanup levels remains at the Site. The building foundations prohibited further excavation of TPH contaminated soil under the building not previously removed in the 1995-1996 independent contaminated soil removal action (Dames and Moore, 1996). At the time, TPH contaminated soil was also inaccessible in this area adjacent to the building because of an active transformer and an adjacent power pole.

TCE contaminated soils above the 2014 cleanup level were left in place beneath the footing of a load-bearing exterior wall and in the north-central side wall. Residual TCE in soils in the former underground storage tank area are also present (just north of MW-5). As indicated earlier, the current TCE soil cleanup levels (protective of indoor air and groundwater cleanup levels) have decreased since the 1995-1996 independent action.

2.2.1.2 Contaminated Groundwater:

The monitoring well network is shown on Figure B and includes the following wells. Wells were initially installed in 1992 and 1994 as part of an independent action (no Ecology oversight). Subsequently, additional groundwater wells were installed under the 2002 Ecology-GE Agreed Order.

³ Ecology cleanup action plan, dated March 14, 2014.

- **Shallow (Water Table) Wells** – MW-1 through MW-13, MW-21S and EPI-MW - 3S and -4S, are all screened across the water table, to a total depth of 15 to 20 feet bgs
- **Intermediate Wells** – MW-8M, -14M, -15M, -16M, -17M, -18M, -19M, and -20M are all screened from approximately 20 to 30 feet bgs. EPI-MW-2D, -3D and -4D are all screened 25 to 30 feet bgs
- **Deep Wells** – MW-14D, -15D -16D, -17D, and -18D are all screened from 45 to 55 feet bgs.

2.2.1.2.1 Shallow Zone Groundwater

Chlorinated volatile organic compounds (CVOCs) Based on the 2014 Ecology CAP and subsequent routine groundwater monitoring at the Site, TCE is present at concentrations above the shallow site-specific MTCA Method B cleanup level (6.6 µg/L) mainly under the northern portion of the 220 S. Dawson St building. Historically, TCE was present at concentrations above shallow site-specific MTCA Method B cleanup levels below the Liberty Ridge building (immediately to the south). Cis-1,2-Dichloroethylene, 1,1,1-Trichloroethane (1,1,1-TCA), 1,1-Dichloroethene and Vinyl Chloride, and Tetrachloroethylene (PCE) have historically been found above their respective shallow zone cleanup levels. Ecology notes that the degradation of TCE does result in the daughter products cis-1,2-Dichloroethylene and Vinyl Chloride. Therefore, GE is still required to monitor for TCE, 1,1,1-TCA and PCE daughter products as long as TCE is present above cleanup levels

2.2.1.2.2 Intermediate and Deep Zone Groundwater

Chlorinated volatile organic compounds (CVOCs) TCE and 1,1-DCE are currently found above their respective cleanup levels below the Liberty Ridge property and further west of 1st Avenue South, as far as Colorado Avenue South. Ecology notes that the degradation of TCE does result in the daughter products cis-1,2-Dichloroethylene and Vinyl Chloride. Therefore, GE is still required to monitor for TCE, 1,1,1-TCA and PCE daughter products.

2.2.1.3 Sub-slab vapor and Indoor Air

Sub-slab samples below the 220 S. Dawson St. building were collected in December 2005. Both 1,1,1-TCA and TCE were consistently detected in sub-slab samples. 1,1,1-TCA concentrations ranged from 15 to 6,900 µg/m³, but were well below the interim action⁴ derived screening level

⁴ Ecology notes that the sub-slab vapor screening level for determining if an “interim action” vapor intrusion mitigation system installation is required is not identical (and a higher threshold concentration) than sub-slab vapor concentrations used in the

of 220,500 $\mu\text{g}/\text{m}^3$. TCE concentrations ranged from 44 to 3,700 $\mu\text{g}/\text{m}^3$, exceeding the interim action derived screening level of 22 $\mu\text{g}/\text{m}^3$.

Between 2005 and 2007, five rounds of indoor air samples were collected at the former GE building, located at 220 South Dawson St. Indoor air samples collected resulted in TCE detections (up to 0.515 $\mu\text{g}/\text{m}^3$ TCE) above the applicable MTCA Method B cleanup levels and the site-specific interim action levels⁵ in several areas of the building. The results of this sub-slab (and indoor air) sampling data led to the 2007 MTCA Agreed Order for the installation, operation and maintenance of the VIM system in the 220 S. Dawson St. building.

With the VIM system operational, ambient air and indoor air samples have been collected in November 2007⁶, 2017⁷ and 2019⁸. CVOC indoor air concentrations were below their respective cleanup levels. Quarterly VIM system performance monitoring (floor cross-slab pressure measurements with permanently installed manometers) continues to assess that the VIM system is operating as designed to create a negative pressure gradient maintained across the building floor and mitigate vapor intrusion of CVOC contamination soil gases below the building.

2.3 Cleanup Actions

2.3.1 Ecology Cleanup Action Plan (CAP) - 2014

Human Health and Environmental Concerns: Contamination at the Site poses a threat to human health and the environment, which is thus the subject of the Ecology 2014 CAP. The main human health and ecological concerns are briefly described below. There are also additional chemicals of concern not described here that are included in the cleanup level table (Table 2.4), which include arsenic, petroleum as diesel and heavy oil, and 1,4-dioxane.

- Chlorinated solvent contaminated soil presents a potential dermal, ingestion and inhalation exposure to construction workers, utility workers, and employees that work below grade in the chlorinated solvent release areas of the 220 S. Dawson Street property.

Likewise chlorinated solvent contaminated groundwater presents a potential dermal, ingestion and inhalation exposure to construction workers, utility workers, and employees that work below grade on downgradient properties.

- Chlorinated solvent contamination in groundwater poses a potential ingestion, dermal, and inhalation exposure if groundwater is extracted for above ground use, though at this time the groundwater is not being used for potable purposes.

MTCA cleanup level analysis for the Site. Shallow zone groundwater (protective of indoor air cleanup levels) and indoor air cleanup standards must ultimately be met after the VIM system is shut off, in order to meet the cleanup requirements of this CAP.

⁵At the time interim action levels were established at a total excess cancer risk of 1EE-05.

⁶ Verification that the VIM system was effective in mitigating unacceptable vapor intrusion into the 220 S. Dawson St building.

⁷ Required as part of the Ecology approved EDR persulfate groundwater injections.

⁸ Required as part of the Ecology approved contingent eZVI groundwater injections.

- Chlorinated solvent contaminated groundwater has the potential to migrate to the Duwamish River resulting in the consumption of impacted fish as well as ecological receptor exposure. Ecology believes that the operation of the interim action groundwater extraction system has reduced the off-property migration of CVOC contaminated groundwater to the extent that it has prevented further westerly migration of the plume toward (and to) the Duwamish River.
- Chlorinated solvent contaminated groundwater site wide and chlorinated solvent contaminated soils at the 220 S. Dawson Street building have the potential to produce indoor air contamination above cleanup levels in buildings located above or near the contaminated soil or groundwater without proper operation of an adequate optimized groundwater hydraulic control system, operation of the 220 S. Dawson Street building vapor intrusion mitigation system, and institutional controls to prevent building work that could exacerbate the vapor intrusion pathway. Chlorinated solvent contaminated groundwater also has the potential to create indoor air contamination above cleanup levels in new or existing buildings near or directly above the shallow zone contaminated groundwater if the underlying groundwater contamination increases.

The principal features of the Ecology 2014 CAP:

- the implementation of permanganate in-situ chemical oxidation (ISCO) treatments at the Site
- concurrent optimized hydraulic control at 2nd Avenue South using groundwater extraction wells RW-2 and RW-4.
- Ecology later approved the GE proposal to substitute persulfate ISCO groundwater injections instead of permanganate.
- A monitoring program will be implemented to confirm the effectiveness of the ISCO treatment and optimized hydraulic control.
- On-going operation and maintenance of the 220 S. Dawson Street vapor intrusion mitigation system;
- Institutional controls and environmental covenants on properties above the groundwater and soil contamination. Refer to Section 2.5;
- Financial assurance to help ensure the long-term operation and maintenance of the final remedial system.

2.4 Cleanup Levels, Points of Compliance and Immediate Action Levels

This section describes the principal regulatory considerations for Site cleanup levels. Cleanup levels and points of compliance for each contaminated environmental media are provided in Table 2.4. The rationale for these cleanup standards is provided in the following subsections.

Groundwater Cleanup Levels and Points of Compliance

Under MTCA and where groundwater is not a current drinking water source or has a low future probability for use as a drinking water source as defined by WAC 173-340-720(2), the groundwater cleanup levels may be defined under WAC 173-340-720(6). In the case of this Site cleanup, the groundwater cleanup levels must be protective of both the vapor intrusion pathway and the surface water cleanup levels based on the consumption of fish/aquatic exposure pathway. However, the TPH groundwater cleanup levels are based on the MTCA Method A unrestricted groundwater cleanup level for TPH-heavy oil and TPH-diesel. Groundwater cleanup levels shall be met at the **groundwater standard point of compliance** (throughout the Site) under WAC 173-340-720(8)(b).

CVOCs, semi-volatiles, TPH and metals

Per the requirements of WAC 173-340-720(2) and (6), the groundwater cleanup levels for TCE, PCE, VC, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, arsenic, TPH-heavy oil, TPH-diesel, and 1,4-dioxane at the Site need to be based on the lower of the following:

- Surface water concentrations that are protective of consumption of fish. The criteria for consumption of fish must consider Asian Pacific Islander (API) consumption rates as previously defined by Ecology. These are MTCA Method B surface water cleanup levels, adjusted for API fish ingestion pathway.
- Surface water concentrations protective of ecological receptors.
- Shallow aquifer zone (<20 feet bgs) groundwater concentrations that are protective of Method B air cleanup levels⁹.
- Concentrations established by applicable federal and state laws.
- For the case of arsenic, groundwater cleanup levels are based background as defined by the MTCA Method B cleanup levels.

As discussed above, the vapor intrusion exposure pathway is only complete for shallow zone groundwater. Based on site-specific conditions, shallow zone groundwater, has been defined as that groundwater between the water table and 20 feet below bgs. Under normal current and likely future groundwater conditions, the intermediate and deep aquifer zone groundwater does not mix with shallow zone groundwater in sufficient quantities to create a complete pathway from the intermediate and deep aquifer zone to indoor air. GE will need to ensure institution controls are in place to prevent mixing of the intermediate and deeper contaminated aquifer zones with the shallower contaminated aquifer zone. The site cleanup levels for shallow zone groundwater (water table to 20 feet) are the lower of groundwater cleanup levels protective of indoor air cleanup levels, concentrations established by applicable federal and state laws, and surface water

⁹Groundwater concentrations that are protective of construction/utility/site worker direct contact and inhalation. As discussed in the FFS and the associated Ecology comment letters, cleanup levels for protection of construction/utility/site worker direct contact are higher than other cleanup levels for other pathways. Therefore, these construction/utility/site worker based cleanup levels are considered met if the other more stringent cleanup levels for other required pathway receptors are met. (Ecology 2008/2009a/2009b)

cleanup levels protective of API fish consumption and ecological aquatic criteria. In most cases, groundwater cleanup levels protective of indoor air, as calculated using the PSC-Georgetown inhalation pathway interim measure action levels (IPIMALs¹⁰) were lower than API surface water, other federal/state criteria and ecological aquatic criteria, therefore are the shallow site-specific MTCA Method B groundwater cleanup levels.

The site groundwater cleanup levels for intermediate and deeper zone groundwater (below 20 feet bgs) are the lower of groundwater surface water cleanup levels for API fish consumption, other federal/state criteria, and ecological aquatic criteria (Ecology 2009a).

The MTCA Method A unrestricted groundwater cleanup level of 500 µg/L applies to both TPH-heavy oil and TPH-diesel (shallow, intermediate, and deeper zones of the aquifer).

Soil Cleanup Levels and Point of Compliance

Soil cleanup levels protective of groundwater are the site-specific MTCA Method B soil cleanup levels. The soil **standard point of compliance** applies and is defined as the soils throughout the Site from the ground surface to the uppermost ground water saturated zone (e.g., from the ground surface to the uppermost water table), WAC 173-340-740(6)(c).

CVOC and TPH

The MTCA requires that soil cleanup levels for TCE, PCE, VC, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE and 1,4-dioxane at the Site need to be based on the lower of the following:

- Concentrations protective of indoor air as determined based on soil concentrations protective of leaching to groundwater at concentration where groundwater would exceed cleanup criteria for indoor air (based on area-specific IPIMAL as discussed in Section 4.1.1).
- Concentrations protective of indoor air as a result of direct volatilization of chlorinated solvent constituents in the vadose zone with those volatiles migrating into buildings above.
- Concentrations established by applicable federal and state laws.
- Concentrations protective of site/utility/construction worker direct contact¹¹ and inhalation. The Site is located in a commercial and industrial zoned area.

¹⁰Ecology approved the same concentrations used as the PSC Georgetown groundwater IPIMALs for the shallow GW CUL (for further discussion see Ecology's July 13, 2009 response letter). These IPIMALs were the result of an empirical study correlating groundwater VOC data with indoor air VOC data, that then attempted to develop a mathematical relationship between the two (an "attenuation factor"). Ecology believes these are applicable to the GE site because the two cleanup sites lie above the same aquifer, have similar vadose zone characteristics, and share the same COCs (chlorinated volatile contaminants such as PCE, TCE, 1,1,1-TCA, and decomposition products of each). Based on Ecology's current understanding, Ecology does not believe there are significant geological differences in the vadose zones at the PSC-G and GE sites.

¹¹As discussed in the FFS and the associated Ecology comment letters, criteria for protection of construction/utility/site worker direct contact and inhalation are higher than other cleanup levels for other pathways. Therefore, these construction/utility/site worker based cleanup levels are considered met if the other more stringent cleanup levels for other required pathway receptors (such as the soil to groundwater and soil to indoor building air cleanup levels) are met.

The site-specific soil cleanup levels protective of groundwater and indoor air are the lowest of these criteria.

TPH in the heavy oil and diesel range remains in the unsaturated and saturated zones at several locations at the former GE building, located at 220 South Dawson Street. It is unlikely that the TPH soil and groundwater cleanup levels drive site cleanup actions. However, TPH soil cleanup levels are required under the MTCA for this Site cleanup. The MTCA unrestricted Method A soil cleanup level for TPH-heavy oil and TPH-diesel is based on protection of the TPH groundwater cleanup level.

In order for the subsurface soil contamination to be considered protective of indoor air in current and future building scenarios (different building uses or new construction) in the specific context of this Site, thus meeting the soil cleanup level requirements of WAC 173-340-740(3)(c)(iv)(B), the measured and sustained sub-slab vapor concentrations must be less than an action level set at 33 times the MTCA Method B indoor air cleanup levels.¹² If indoor air cleanup levels are met for this building, without the VIM system operating, and sub-slab vapor concentrations for volatile CVOCs consistently meet this 33 times indoor air action level, Ecology does not anticipate a need for further institutional controls to address the soil to indoor air pathway. If indoor air cleanup levels are met for the current building, without the VIM system operating, but sub-slab vapors remain above the 33 times MTCA Method B indoor air cleanup level, additional action(s) must be implemented. These actions may include one or more of the following:

- Implement contingent remedial measures (e.g., vapor extraction) to remediate sources of sub-slab vapor for the purpose of protecting the indoor air pathway. This approach would be proposed by GE or Ecology for approval prior to implementation;
- Implement institutional controls to ensure that, for example: a) future changes to the building do not lead to vapor intrusion (VI) impacts leading to exceedances of the indoor air cleanup standard, b) new construction or property activities in the future do not create a new, or exacerbate an existing VI exposure pathway, and/or (c) routine indoor air sampling in the existing, new construction or renovated building is in place to ensure future protectiveness. If Ecology determines that indoor air is again contaminated above MTCA Method B indoor air cleanup levels, Ecology will determine if contaminated subsurface soils must be removed and/or sub-slab depressurization system must be restarted or installed.

Indoor Air Cleanup Levels, Immediate Action Levels, and Points of Compliance

Vapor intrusion induced indoor air contamination must be remediated to achieve Method B indoor air cleanup levels at the **standard point of compliance**, throughout the Site.

¹²This is based on the 95% Upper confidence limit on sub-slab to indoor air attenuation factors calculated in the USEPA Vapor Intrusion Database, Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings, March 2012.

Cleanup Levels and Point of Compliance

Indoor air cleanup values are based on the lower of concentrations established by applicable federal and state laws, and MTCA Method B indoor air cleanup levels for unrestricted land use. Indoor air cleanup levels based on Method B cleanup levels are the most stringent and therefore the cleanup levels (Table 2.4)

Indoor Air Immediate Action Level

Ecology has established a site specific indoor air immediate action level¹³ (IAL) as the level that must immediately be met in indoor air to protect human health while the cleanup is progressing.

Should Ecology determine that IALs have been exceeded at any building near or above the subsurface soil or groundwater contamination, or that site conditions have changed during the remedial action (e.g., significantly increasing groundwater concentrations in areas where sufficient vapor mitigation has not been implemented, new vapor intrusion pathways introduced, etc.), Ecology may require an additional indoor air assessments and installation of a vapor intrusion mitigation system (VIMS).

¹³ The IAL is based on a typical working exposure, which assumes: 10 hour work day, 5 work days per week, and 50 work weeks per year. The establishment of this IAL serves as a protective interim measure, and does not substitute for the MTCA requirements to meet the Method B indoor air cleanup level at the Site through implementation of the Ecology selected remedy in a reasonable restoration timeframe.

Table 2.4 Summary of Applicable Cleanup Levels and Points of Compliance for the Site

| | Soil | Groundwater | | Indoor Air | Indoor Air |
|---|--|--|---|---|---|
| | MTCA Method B (mg/kg) | Shallow ¹⁴ Site-Specific MTCA Method B (µg/L) | Deeper ¹⁵ Site-Specific MTCA Method B (µg/L) | MTCA Method B (µg/m ³) | Immediate Action Level (µg/m ³) |
| Trichloroethylene | 0.044 | 6.6 | 30 | 0.37 | 1.30 |
| Tetrachloroethylene | 0.035 | 3.3 | 3.3 | 2.5 | 8.74 |
| Vinyl Chloride | 0.006 | 1 | 2.4 | 0.28 | 0.98 |
| cis-1,2 dichloroethylene | 2.95 | 590 | 450 | none ¹⁶ | none |
| trans 1,2 dichloroethylene | 0.89 | 163 | 590 | 3.8 | 13.3 |
| 1,1-Dichloroethylene | 0.023 | 3.2 | 3.2 | 12.74 | 44.52 |
| 1,1,1-Trichloroethane | 0.09 | 11 | 11 | 332 | 1125 |
| 1,4-Dioxane | NA | 69 | 69 | NA | NA |
| Arsenic | NA | 5 | 5 | NA | NA |
| TPH-Heavy Oil Range TPH-Diesel Range | 2000* | 500 | 500 | NA | NA |
| Point of Compliance | Standard Point of compliance for all media | Standard Point of compliance Water table to 20 feet bgs | Standard Point of compliance Below 20 feet bgs | Standard Point of compliance Indoor air throughout the Site | Not applicable |

Notes:

- NA – Not applicable
- µg/L – micrograms per liter
- µg/m³ – micrograms per cubic meters
- mg/kg – milligrams per kilogram
- bgs – below ground surface

2.5 Long-Term Compliance Monitoring

The Ecology CAP included compliance monitoring to document the effectiveness of the remedy. Groundwater has been monitored to evaluate whether or not the cleanup action is meeting the cleanup standard at the groundwater standard point of compliance. Until achieved, groundwater sampling within the network consists of 32 monitoring wells, as follows:

The monitoring well network is shown on Figure B and includes the following wells.

¹⁴Defined as the “shallow zone” or the top of the water table down to approximately 20 feet bgs.

¹⁵Defined as both the “intermediate” and “deep” zones of groundwater from approximately 20 to 65 feet bgs.

¹⁶ No toxicity data available

- **Shallow (Water Table) Wells** – MW-1 through MW-13, MW-21S and EPI-MW - 3S and -4S, are all screened across the water table, to a total depth of 15 to 20 feet bgs.
- **Intermediate Wells** – MW-8M, -14M, -15M, -16M, -17M, -18M, -19M, and -20M are all screened from approximately 20 to 30 feet bgs. EPI-MW-2D, -3D and -4D are all screened 25 to 30 feet bgs.
- **Deep Wells** – MW-14D, -15D -16D, -17D, and -18D are all screened from 45 to 55 feet bgs.

Groundwater is routinely analyzed for CVOCs including: TCE, PCE, 1,1-Dichloroethene, 1,1-DCA, 1,1,1-TCA, cis-1,2-DCE, trans-1,2-dichloroethene, and VC.

2.6 Environmental Covenants

Based on Ecology's 2014 CAP and the use of groundwater cleanup levels (shallow zone only) protective of vapor intrusion into buildings; groundwater cleanup levels (shallow and intermediate/deep zones) protective of surface water beneficial uses; and soil cleanup levels and the allowance for capping some contaminated soils in-place, an Environmental Covenant is a requirement of the Consent Decree for the 220 S. Dawson St property and all other properties above the groundwater plume. Environmental Covenants are required at a total of seven properties (Figure C).

These Covenants shall comply with the requirements of WAC 173-340-440 and shall:

- a. restrict withdrawal of groundwater at the Site;
- b. prevent subsurface activities that mix the contamination in the intermediate and deeper zone groundwater with contamination in the shallow zone groundwater;
- c. restrict future activities which have the potential to exacerbate the vapor intrusion pathway;
- d. restrict subsurface activities conducted within the soil and groundwater contaminated areas.

GE is required to make a good faith effort to secure an environmental covenant (in a form that has been approved by Ecology and that is consistent with WAC 173-340-440) on all the properties associated with the Site before seeking Ecology approval to resort to other legal or administrative mechanisms to meet institutional control requirements.

Environmental covenants have not yet been finalized or recorded with the King County Auditor. GE has delivered draft copies of the environmental covenants to the seven (7) property owners and stated it expects finalization of the ECs by the end of 2019. Ecology is making the finalization of environmental covenants (ECs) a high priority as this is a requirement of the

Ecology CAP and an important aspect of the cleanup that ensures protection of human health and the environment. Ecology will be working with GE to finalize the ECs as soon as possible.

3.0 Periodic Review

3.1 Effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the site

Today, concentrations of hazardous substances exceeding State soil and groundwater cleanup levels remain at the cleanup Site¹⁷. In some locations, this below ground soil and shallow groundwater contamination has also contaminated soil gas and indoor air.

To determine the effectiveness of cleanup actions implemented since 2014, the discussion below is organized by “action” required by the 2014 CAP.

2017-2018: Persulfate ISCO Groundwater Treatment Injections: GE implemented a persulfate in-situ chemical oxidation (ISCO) injection pilot study at the 220 S. Dawson Street property in March 2017, as required by the Ecology 2014 CAP. After six months of post-ISCO injection groundwater monitoring, no significant change in TCE groundwater concentrations were observed compared to historical groundwater concentrations. GE supplemented the ISCO pilot study by installing sodium persulfate impregnated cylinders (slow release “candles”) into strategic injection and monitoring wells in October 2017. Groundwater flows through the passive diffusion cylinders and carries diffused persulfate surrounding the well screens to downgradient areas of the contaminated aquifer. As with the previous persulfate ISCO injections, no significant change to TCE groundwater concentrations were observed in the following groundwater monitoring results. The reaction of TCE in groundwater with persulfate should have been immediate, therefore, the lack of observed TCE groundwater concentration decreases was a strong indicator of poor ISCO reagent residence time, poor contact with contaminants in groundwater, or poor distribution of ISCO injection reagent within the target aquifer areas and vertical zones. Persulfate can also react with itself and other natural occurring metals in the aquifer.

No ISCO groundwater injections were performed on the off-property TCE plume. In-situ groundwater injections on those off-properties did not occur because the pilot study failed to yield positive results that could be used to design a full scale on- and off-property ISCO groundwater treatment system. Coincident with the ISCO injections, GE collected indoor air samples and sub-slab soil gas samples below the 220 S. Dawson Street building. Indoor air TCE and other volatile contaminant concentrations were below the MTCA Level B unrestricted indoor air cleanup levels. Indoor air vinyl chloride concentrations were slightly above MTCA Level B unrestricted indoor air concentrations ($0.47 \mu\text{g}/\text{m}^3$ and $0.37 \mu\text{g}/\text{m}^3$) in two locations

¹⁷ “Site” or “Facility” is defined by WAC 173-340-200 as where hazardous substances have come to be located.

during one sampling event in June 2017¹⁸. This indoor air vinyl chloride concentration is below the site specific immediate action level (IAL), therefore, does not warrant immediate action by GE.

2019: Contingent ISCR Groundwater Treatment Injections: Given the failure of the ISCO groundwater treatment injections and in accordance with the contingent remedy allowance in the Ecology 2014 CAP, GE and Ecology agreed to an alternative in-situ chemical reduction (ISCR) groundwater treatment by injecting a slurry of zero-valent iron particles mixed with organic plant material (also referred to as eZVI). eZVI injections were completed in January and February 2019. The first three rounds of post eZVI injection groundwater monitoring were conducted in February, May and August of 2019. The August 2019 monitoring results started to show some evidence of reductive dechlorination occurring in the west end of the treatment area, which is demonstrated by small TCE concentration decreases, although not below site-specific cleanup levels, with slightly increasing cis-1,2-DCE concentrations. GE believes that the eZVI delivery and distribution in the east portion of the source treatment area was not effective and successful, possibly because of injection operation failure and/or heterogeneity from previous excavations. GE proposed to investigate the possibility of injections of emulsified vegetable oil (EVO) to stimulate in-situ bioremediation (ISB) treatment at the east portion of source area. In the meantime, GE will continue groundwater performance monitoring. As part of the Phase 2 groundwater treatment, GE is still planning to inject eZVI into the contaminated groundwater that has migrated beyond the 220 S. Dawson Street property.

Coincident with the eZVI injections, GE collected indoor air samples and sub-slab soil gas samples below the 220 S. Dawson Street building. Indoor air TCE concentrations were below the MTCA Level B unrestricted indoor air cleanup levels.

2019: Indoor Air Sampling at the 5005 3rd Avenue South building. GE sampled the indoor air on the southern side of the McKinstry building located at 5005 3rd Avenue South in January and August 2019. The south area of the building is closest to the source area TCE groundwater and soil contamination on the 220 S. Dawson St property. Trichloroethylene (TCE) concentrations for this sampling event were below the short-term acute indoor air toxicity action level ($7.5 \mu\text{g}/\text{m}^3$ TCE) for all four indoor air sample stations in both sampling events. The short-term indoor air TCE acute toxicity action level is intended to be protective of a developing fetus during the first trimester of pregnancy. TCE and other chlorinated solvent constituents analyzed for in this sampling event were also below the Ecology 2014 CAP immediate action level¹⁹ ($1.3 \mu\text{g}/\text{m}^3$ TCE) for all four indoor air sampling stations in both sampling events. TCE concentration for only one indoor air sampling station ($0.422 \mu\text{g}/\text{m}^3$ TCE) in January 2019, was slightly above the MTCA Level B unrestricted indoor air cleanup level²⁰ ($0.37 \mu\text{g}/\text{m}^3$ TCE). This indoor air TCE concentration is below the site specific immediate action level

¹⁸ The sub-slab soil gas samples collected in June 2017 (near these two indoor air samples) did not detect vinyl chloride above the reporting limit ($0.35 \mu\text{g}/\text{m}^3$), therefore the source of the indoor air vinyl chloride detected in these two indoor air samples is not likely from the nearby shallow TCE contaminated groundwater and soils.

¹⁹The immediate action level is based on a typical working exposure, which assumes a 10-hour work day, 5 workdays per week, and 50 work weeks per year.

²⁰This Method B unrestricted indoor air cleanup level is overly conservative for protecting workers in the McKinstry building as it assumes a residential home where the occupants are assumed present 24 hours per day, 7 days per week, 52 weeks per year.

(IAL), therefore, does not warrant immediate action by GE. Other chlorinated solvent constituents analyzed for in this sampling event were below MTCA Level B unrestricted indoor air cleanup levels in all four indoor air samples for both sampling events.

Ecology does not anticipate future indoor air sampling in the 5005 3rd Avenue South building unless there are increases in TCE and other volatile contaminants in nearby groundwater or soils, or if Ecology determines that there are new pathways for subsurface contaminant vapors to enter the building that were previously unknown or recently created (such as due to building renovations).

2014-2019: Continued reliance on the hydraulic control program:

GE also continues to operate a groundwater extraction system, on the west property boundary of the 220 S. Dawson St. property, to minimize TCE contaminated groundwater, above cleanup levels, from migrating west to off-property areas. To evaluate the performance of the groundwater extraction system and to evaluate groundwater concentrations at the Site over time, GE performs quarterly groundwater monitoring at the Site and off-property areas. Required operation and maintenance (O&M) actions keep the groundwater extraction wells pumping at their design rates. The groundwater extraction wells will remain operational until the 220 S. Dawson St. property source area groundwater contamination is remediated to cleanup levels.

Extraction well RW-3, located in the alley between former GE Building and adjacent McKinstry Building was abandoned and relocated to the west of the alley as RW-4 in June through August 2018. The RW-3 well abandonment and relocation was necessary to allow the property owner (McKinstry) to complete their exterior building renovation. Ecology approved the RW-3 abandonment plan and new RW-4 location. The new extraction well RW-4 was tested after installation (step-drawdown tests and short time constant rate pumping test), and has been operating since August 2018 along with continuous operation of well RW-2. Currently the new RW-4 is operated at the same extraction rate as the abandoned well RW-3. The design combined groundwater flow rate is 16 gallons per minute (gpm).

2014-2019: Continued reliance on the Vapor Intrusion (VI) program: Until TCE groundwater concentrations in the shallow aquifer zone and CVOC soil concentrations in the subsurface soils near and under the 220 S. Dawson St building decrease to levels protective of indoor air quality, a VI program is needed to ensure the protection of indoor receptors. Over the past twelve years GE's VI mitigation program has effectively protected these receptors in the 220 S. Dawson St building from VI-related health risks by continuing to operate a vapor intrusion mitigation system (VIMS) at the Site. The VIM system prevents human health (worker) exposure to elevated TCE concentrations from subsurface gases that enter the building via vapor intrusion.

The system has been in place and operating continuously since 2007. GE performs routine monthly inspections of the VIMS to ensure system functionality and that no modifications to the building or system components have occurred that could impact the system operation. Indoor air sampling events as part of the ISCO injection pilot study in 2017 and as part of the ISCR injection pilot study in 2019 confirmed the VIMS is functioning as designed and indoor air at the

220 South Dawson Street building is protective of human health. No other buildings, either on-Site or off-property, are at risk of elevated indoor air concentrations based on current groundwater concentrations and/or indoor air sampling results.

2014-2019: Five-year requirements for GE to ensure, over time, that contaminated Site groundwater is not being used for drinking water purposes, is not expected to be used for such purposes, and cannot be “practicably” used for such purposes: GE’s March 7, 2019, submittal, included in Section 6.5, Groundwater Potability Analysis, documents GE’s efforts to comply with this CAP requirement. Groundwater near the Site is not a current source of drinking water. There are no drinking water wells within a one-quarter mile radius of the Site and no drinking water wells downgradient of the Site. Drinking water is supplied to buildings in the vicinity of the Site, via an offsite City of Seattle water supply reservoir located approximately 1.3 miles northeast and upgradient of the Site. City/county ordinances and requirements of the State Health Department prohibit ground-water use near the Site.

2014-2019: Requirements for GE to demonstrate and maintain Financial Assurance for Site cleanup: GE has provided Ecology with an updated financial assurance mechanism to cover the long term costs of Site cleanup activities and long-term monitoring.

2014-2019: Imposition of controls: As stated in Section 2.6 Institutional Controls, environmental covenants (ECs) have not yet been finalized or recorded with the King County Auditor. GE has delivered draft copies of the environmental covenants to seven (7) property owners above the contaminated soil and contaminated shallow zone aquifer. GE states that they believe the ECs will be finalized by the end of the 2019. Ecology is making the finalization of environmental covenants (ECs) a high priority as this is a requirement of the 2014 Ecology CAP and an important aspect of the cleanup that ensures protection of human health and the environment. Ecology will be working with GE to finalize the ECs as soon as possible.

In 2019, GE sent written reminders to all seven property owners:

Due to the ongoing potential for groundwater contamination, Ecology believes that you should refrain from certain activities to prevent exposure to contaminated groundwater and the potential for vapor intrusion at your property. These are:

- 1. Do not withdraw groundwater at the site;*
- 2. Do not conduct subsurface activities (e.g. drilling wells, deep excavations) that may mix shallow groundwater (less than 20 feet below ground surface) with deeper groundwater (greater than 20 feet below ground surface). This will prevent mixing of potential contamination in one groundwater zone with another;*
- 3. Do not conduct activities that could compromise the existing groundwater monitoring wells and groundwater extraction system.*
- 4. Do not conduct activities within the soil and groundwater contaminated areas;*
- 5. Do not conduct activities that may compromise the VIMS and monitoring gauges at the adjacent 220 S. Dawson St building.*

Ecology will ask that GE provide these written reminders to all seven property owners annually.

McKinstry is currently (2019) conducting building and property renovations at the 220 S. Dawson St building. GE and McKinstry conducted regular conference calls to review the status of the renovations and confirm that those activities did not result in any situations counter to the above-listed restrictions.

3.2 New scientific information including new applicable state and federal laws for hazardous substances present at the Site

The cleanup at the Site is governed by MTCA regulations in Chapter 173-340 WAC. WAC 173-340-702(12) (c) provides that,

“A release cleaned up under the cleanup levels determined in (a) or (b) of this subsection shall not be subject to further cleanup action due solely to subsequent amendments to the provision in this chapter on cleanup levels, unless the department determines, on a case-by-case basis, that the previous cleanup action is no longer sufficiently protective of human health and the environment.”

As noted in Section 2.4, the Ecology 2014 CAP included tables of Site media cleanup levels. For **soil contamination**, the 2014 cleanup levels were based on:

- MTCA Method B cleanup levels for direct contact, protection of groundwater – not to result in an exceedance of the Site groundwater cleanup levels, and other worker exposure pathways.

For **groundwater contamination**, the Ecology 2014 CAP cleanup levels were based on:

- MTCA Method B surface water cleanup levels for the protection of Duwamish Waterway exposure pathways (ingestion of organism only) for Shallow, Intermediate, Deep aquifer zones.
- MTCA Method B cleanup levels for the protection of indoor air quality. These cleanup levels were based on Method B air levels, and were limited to volatile contaminants in the Shallow Aquifer Zone.

For **indoor air contamination** (via vapor intrusion), the Ecology 2014 CAP cleanup levels were based on:

- MTCA Method B cleanup levels based on the protection of residential use.

The Ecology 2014 CAP cleanup levels can potentially be no longer protective or MTCA-compliant for several reasons:

- Site receptors (or receptor behavior) have changed.
- Determinations regarding the inability of a groundwater contaminant to “reach” the Waterway have changed.
- The Practical Quantitation Limits (PQLs) values for certain contaminants and media have changed, and the 2014 cleanup levels were based on these PQLs.

- The 2014 cleanup levels were not sensitive to a particular, or new, pathway or migration route.
- The 2014 cleanup levels were calculated or established incorrectly.
- The understanding of contaminant toxicity has changed for a particular exposure route/pathway.
- Contaminant-specific inputs (such as bio-concentration factors) to the cleanup level Equations in WAC 173-340-720, -730, -740, or -750 have changed.
- ARAR values have changed.

The Ecology 2014 CAP media cleanup levels must therefore be examined to determine if:

a) *Site receptors (or receptor behavior) have changed.* Site receptors identified in the RI/FS and 2014 CAP have not changed.

b) *Determinations regarding the inability of a groundwater contaminant to “reach” the Waterway have changed.* Routine source area and downgradient groundwater monitoring data has continued per the Ecology 2014 CAP. There are no data indicating changes to reverse Ecology’s determination that continuous operation of the two groundwater extraction wells on 3rd Avenue S. reduces the amount of groundwater contamination leaving the 220 S. Dawson St property, thus the reason the downgradient plume does not currently extend to the Duwamish River. It is possible that the downgradient plume did at one time reach the Duwamish River prior to the installation and operation of the groundwater extraction wells (pre-1996).

c) *The PQLs used in the establishment of cleanup levels in the Ecology 2014 CAP have changed.* Based on Ecology’s review, there do not appear to be 2014 soil or groundwater contaminant cleanup levels based on PQLs. The analytical methods used to quantify contaminant concentrations in media samples at the Site are capable of achieving PQL/LOQs below cleanup levels.

d) *The cleanup levels established in the Ecology 2014 CAP were not sensitive to certain pathways or migration routes.* Ecology believes this is not the case. Refer to response (a) above. Ecology has determined that cleanup levels for soil, groundwater and indoor air have taken into account all known exposure pathways and migration routes.

e) *The cleanup levels established in the Ecology 2014 CAP were calculated or established incorrectly.* Ecology believes this is unlikely to be the case.

f) *The understanding of contaminant toxicity has changed for a particular exposure route/pathway; contaminant-specific inputs for the WAC 173-340 cleanup level Equations have changed; or, contaminant-specific ARAR values have changed.*

The groundwater cleanup levels established in the Ecology 2014 CAP, were based on protection of surface water beneficial uses (ingestion of fish under the Asian Pacific Islander fish consumption rates) and protective of unacceptable indoor air contamination via vapor intrusion.

If groundwater-protective soil cleanup levels and the groundwater cleanup levels (shallow, intermediate, and deep zones) were to be calculated in 2019, depending on the constituent of

concern, many of those cleanup levels would be lower (and some higher) than the 2014 Ecology CAP cleanup levels.

It is important to consider the groundwater cleanup level discussion above in their proper context. The source area (220 S. Dawson St property) groundwater contamination will be remediated to the 2014 Ecology CAP cleanup levels. The source area is over 2000 feet from the Duwamish River. Once the source area groundwater meets these cleanup levels, Ecology expects the groundwater extraction system on 2nd Avenue S. will be shut off, and the source input to the off-property groundwater plume will be significantly diminished.

At the same time, the off-property plume, based on data from downgradient groundwater monitoring wells – which has migrated no more than 800 feet from the source property - will also be remediated to the same Ecology 2014 CAP cleanup levels.

Based on the groundwater data available to date, Ecology is not certain that off-property hazardous constituents remediated to cleanup levels in the Ecology 2014 CAP will reach the Duwamish River. These and other considerations in WAC 173-340-702(12) will be taken in consideration by Ecology to determine if cleanup levels in the Ecology 2014 need to be revised.

3.3 Current and projected Site use

The current and projected Site use remains unchanged from the Ecology 2014 CAP. The Site, which lies within the Duwamish industrial corridor, is zoned General Industrial 2 (IG2) and is within the Urban designation of the Shoreline District Overlay (U/85) (City of Seattle 2008 zoning maps: (http://www.seattle.gov/dpd/Research/Zoning_Maps/default.asp)). Land uses in the Duwamish industrial corridor are predominantly light industrial (e.g., manufacturing and warehousing) with some commercial businesses, occasional residences, and vacant lots. The adjacent properties and properties between the Site and Slip 1 of the Lower Duwamish Waterway (Slip 1 is approximately 1,600 feet from the 220 South Dawson Street building, refer to Vicinity Map) are currently used or zoned for industrial purposes, which in the City of Seattle allows for some commercial use. Immediately south of the Site (cross-gradient), two residences are located between industrial operations. At this time, one of the residences appeared to be abandoned.

3.4 Availability and practicability of more permanent and higher preference technologies

The parts of the Ecology 2014 CAP remedy implemented, included hydraulic containment of source area contaminated groundwater, continues to be protective of human health and the environment (refer to Section 3.1). The implementation of the ISCO (persulfate), followed by the eZVI injections (contingent groundwater remedy) were completed with no adverse effects to human health and the environment. Ecology believes the ISCO and eZVI groundwater treatment technologies were the best options for groundwater remediation at this time. If the eZVI injections do not reduce TCE groundwater concentrations to cleanup levels, Ecology and GE will review, evaluate, and implement another groundwater cleanup technology(ies) practicable at this Site.

3.5 The availability of improved analytical techniques to evaluate compliance with cleanup levels.

Current analytical methods for soils, groundwater and indoor air are capable of achieving reporting limits (level of quantitation) at least as stringent as the cleanup levels established in the Ecology 2014 CAP and the revised 2019 cleanup levels under MTCA. Improved analytical techniques would not affect decisions or recommendations made for the Site.

4.0 CONCLUSIONS

4.1 Protectiveness, Remedy Performance and Determination of Whether Amendment of the CAP is Required:

The following conclusions are a result of this periodic review:

- Based on this periodic review, the cleanup actions completed so far at the Site under the Ecology 2014 CAP appear to be currently protective of human health and the environment and the remedy is anticipated to be protective upon completion. The basis for this determination is discussed in Sections 2.0 and 3.0 above.
- The Environmental Covenants for the seven properties below the on-site and off-site properties are not finalized and recorded. These Covenants are needed to ensure the protection of public health and the integrity of the cleanup action. GE estimates they will be finalized by the end of 2019 (See Section 2.6). Ecology and GE will make this a high priority to meet this deadline, or if not possible to meet this deadline, as soon as possible thereafter.
- Soil cleanup levels have not been met at the standard point of compliance for the Site. However, achieving all such cleanup levels was not a remedial action objective. The cleanup action has been determined to comply with cleanup standards by “containing” and covering/capping contaminated soils and requirements related to these technologies are currently being met. The long-term objective of the soil remedial action is to be protective of groundwater beneficial use (non-potable) and protective of surface water beneficial uses (ingestion of organism). Excavation or in-situ treatment of subsurface soils is not a requirement under the 2014 CAP.
- Groundwater cleanup levels (shallow and intermediate/deep zones) have not been met at the **standard point of compliance** yet. The initial pilot ISCO (persulfate) groundwater injections, required under the Ecology 2014 CAP, were ineffective to treat groundwater contamination, and failed to achieve cleanup levels. Therefore, full scale and downgradient area ISCO injections were not attempted. As a result, pilot eZVI contingent groundwater injections were performed on the 220 S. Dawson St property. The August 2019 post eZVI injection groundwater sampling has shown some localized reduced TCE concentrations in groundwater. A full scale and downgradient in-situ eZVI groundwater treatment is still planned by GE.

- Indoor air cleanup levels inside the 220 S. Dawson St building are attained by use of the VIM system. However, the final remedial action requires groundwater to meet cleanup levels protective of indoor air cleanup levels, therefore allowing the VIM system to be shut off. Continuation of the VIM system at the 220 S. Dawson St building protects indoor receptors working in areas where Shallow Aquifer Zone TCE concentrations remain above cleanup levels.
- The groundwater extraction system on 2nd Avenue S. continues to operate, with the exception for unanticipated pump failures and short durations of time when pump cleaning and maintenance is required. Extraction well RW-3 was abandoned and replaced by a new extraction well RW-4 during summer of 2018. The continuous operation of these groundwater extraction wells reduces the amount of contaminated groundwater from migrating to off-properties.
- Since 2010 EPA Regions 9 and 10 have identified short-term action levels for the protection of pregnant women exposed, via inhalation, to TCE. It is important that these action levels be recognized in future GE indoor air sampling of the 220 S. Dawson St building and other nearby buildings above the groundwater plume where necessary indoor air sampling is necessary to be protective of human health.
- It is also important that utility companies performing work in areas where the Water Table zone is contaminated with TCE be notified of these short-term action levels. While the action levels were developed for the protection of pregnant women breathing indoor air, these receptors could also be exposed to TCE outside, should they be involved in subsurface work that exposes them to contaminated soil gas. Likewise, GE should continue to provide annual notifications and the information regarding TCE exposures to property addresses within the Site's affected area. Residents and business owners contemplating significant subsurface work should be aware of the potential health risks.
- As discussed in Section 3.2, media cleanup levels have changed for a number of contaminants since the Ecology 2014 CAP was finalized. In some cases the cleanup levels that would be calculated for the Site today are lower than those established in the 2014 CAP. This is due to:
 - a) The Ecology Water Quality Program finalized its revisions to the Chapter 173-201A WAC regulations on August 1, 2016, in response to EPA's revised 40 CFR Part 131 NTR water quality criteria, and the
 - b) Availability of Native American Duwamish Waterway exposure factors, which include a higher assumed fish consumption rate than the cleanup levels established in the 2014 CAP. These ingestion rates are more conservative than the Asian Pacific Islander (API) consumption rates as previously defined by Ecology under the Ecology 2014 CAP.
 - Contaminated soils at the Site are covered/capped. Changes in soil cleanup levels, then, are of primary interest in terms of whether these changes signify a need to re-evaluate the likely effect of continued leaching on groundwater quality. That is, if soil cleanup levels should now be lower to be protective of 2019 calculated groundwater cleanup levels in order to be further protective of human health and the environment. Based on our first 5-

year review, Ecology does not believe this is the case at this time because groundwater contamination above 2019 calculated cleanup levels does not appear to reach the Duwamish River as long as the groundwater extraction wells are operating continuously.

- o New and lower groundwater cleanup levels, then, are also of primary interest with respect to the additional time required to achieve those lower 2019 calculated cleanup levels and the added level of protectiveness as a result of attaining those lower cleanup levels. Based on our first 5-year review, Ecology believes that the 2014 cleanup action's ability to achieve those 2014 groundwater cleanup levels is still likely to be protective of human health and the environment, if environmental covenants are in place and enforced; continuous operation of the 220 S. Dawson St. groundwater extraction system until source area groundwater is remediated to 2014 CAP cleanup levels; and source area and downgradient groundwater contamination is remediated to the 2014 cleanup levels, all of which should prevent contamination from migrating further west toward the Duwamish River.

Ecology therefore recommends the following:

- a) GE should re-calculate Method B direct contact and Method B groundwater-protection soil cleanup levels based on the new Ecology Water Quality Program revisions to Chapter 173-201A WAC regulations on August 1, 2016, in response to EPA's revised 40 CFR Part 131 NTR water quality criteria, AND the new Native American Duwamish tribal fish and shellfish consumption rates. The spreadsheets used to calculate these cleanup levels, as well as the tables generated should be made available to both Ecology and GE project managers;
- b) GE should re-calculate Method B surface water-protection groundwater cleanup levels based on the new Ecology Water Quality Program revisions to Chapter 173-201A WAC regulations on August 1, 2016, in response to EPA's revised 40 CFR Part 131 NTR water quality criteria, AND the new Native American Duwamish tribal fish and shellfish consumption rates. The spreadsheets used to calculate these cleanup levels, as well as the tables generated should be made available to both Ecology and GE project managers;
- c) GE should re-calculate Method B indoor air-protection shallow zone aquifer cleanup levels based on the most recent toxicity information, and compare with (b) above. It is possible that the Method B surface water protection shallow zone groundwater cleanup levels are more stringent than the Method B indoor air-protection shallow zone groundwater cleanup levels. The spreadsheets used to calculate these cleanup levels, as well as the tables generated should be made available to both Ecology and GE project managers;
- d) GE should re-calculate indoor air and VI-protective shallow groundwater zone immediate *action levels* based on the most recent toxicity information. This revised table should include "short-term" TCE action levels, protective of pregnant women breathing indoor air.

The cleanup levels produced in the tables described above in (a) through (d) do not replace the Ecology 2014 CAP's cleanup levels. Some of the 2014 cleanup levels are higher (and some lower) than levels that would be calculated and established today in 2019. The differences, however, do not, by themselves, suggest that the Site's cleanup action and cleanup levels should be revised at this time. Therefore, Ecology believes the 2014 consent decree and CAP should not be amended at this time to incorporate new, more protective cleanup levels. It is possible that this will eventually need to be done, under WAC 173-340-702(12) prior to the time at which GE is demonstrating compliance with all groundwater cleanup standards (per WAC 173-340-720(9)). But compliance demonstration is a number of years away and additional changes to the State's soil, air, and groundwater cleanup levels are possible over this timeframe. It therefore seems reasonable at this juncture to acknowledge the changes, and use them in determinations of protectiveness, but hold off on potentially amending the CD and CAP for simply this purpose. But, it should be clear to the Ecology and GE Project Coordinators which levels would be different if calculated today, why, and how much higher or lower these new levels are than those established in 2014.

4.2 Next Review

The next review for the Site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

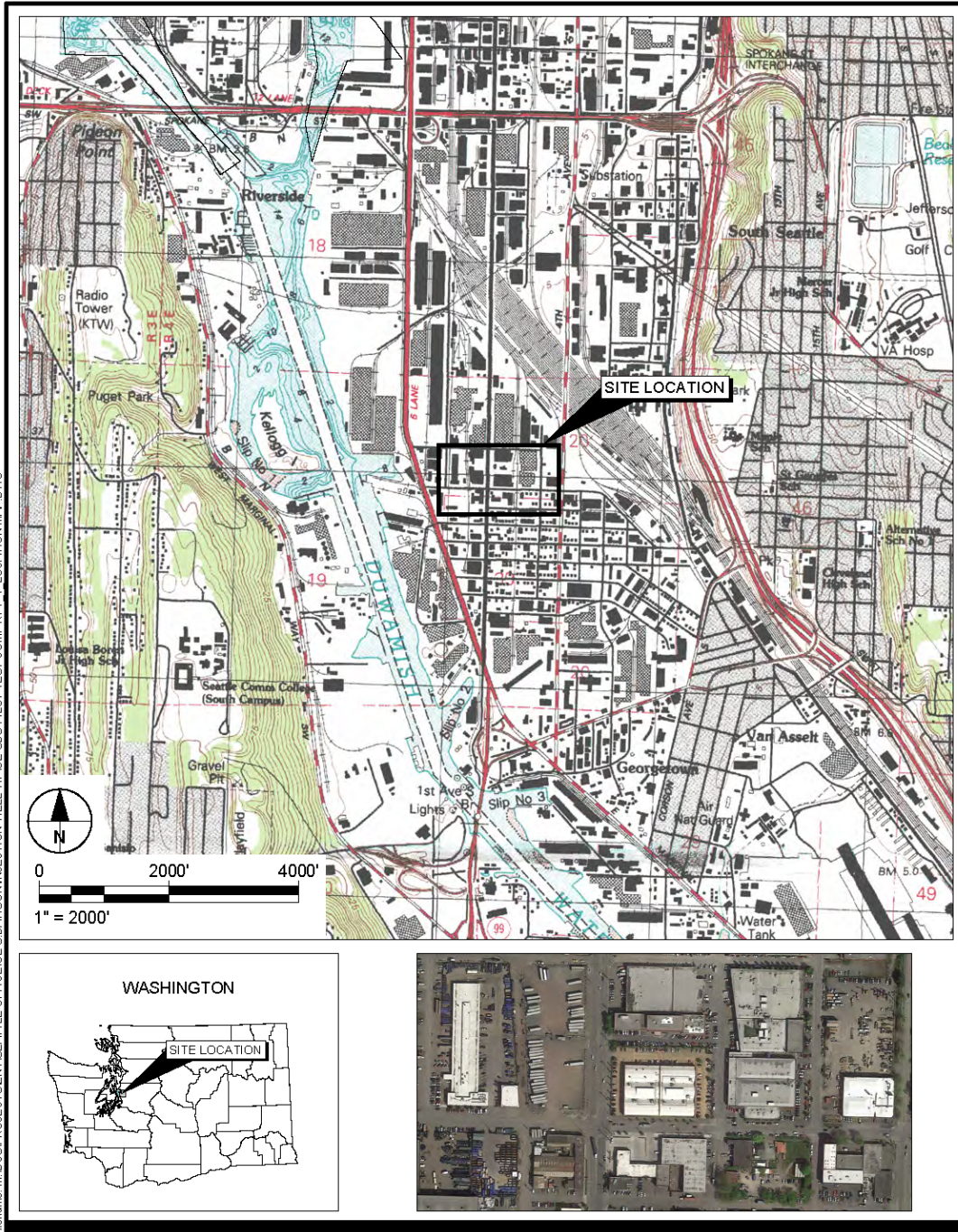
5.0 References

1. Engineering Design Report (EDR), for General Electric, Dated October 28, 2016 and Ecology contingent approval letter dated November 30, 2016.
2. Independent Interim Remedial Action of Soils, GEAE Plant 1 Facility, 220 S. Dawson, Seattle, Washington, Dames and Moore, December 17, 1996.
3. ISCO Pilot Study Completion Report GE South Dawson Street For General Electric, AECOM, October 27, 2017.
4. Addendum to the In-Situ Chemical Oxidation Pilot Study Completion Report, AECOM, March 23, 2018.
5. Engineering Design Report GE S Dawson Street, Phase 1 ISCR Injection Program, Former GE Aviation Division Facility, AECOM, November 16, 2018
6. 5005 3rd Avenue Building Indoor Air Quality Monitoring Plan Former GE Aviation Division Facility , December 18, 2018
7. Ecology Final Cleanup Action Plan, General Electric Facility, 220 S. Dawson St., Seattle, WA 98108, March 14, 2014.
8. Ecology, 2008. Letter RE Ecology comments on the *Draft Focused Feasibility Study Report* dated June 17, 2008. State of Washington, Department of Ecology, August 14, 2008.
9. Ecology, 2009a. Letter RE Ecology comments on the *Draft Focused Feasibility Study Report* dated October 17, 2008. State of Washington, Department of Ecology, July 13, 2009.
10. Ecology, 2009b, Letter, Ecology Determination that the Focused Feasibility Study is Approved With Revisions and Ready for Public Comment, State of Washington, Department of Ecology Dated December 24, 2009.

11. Environmental Partners, Inc, for Liberty Ridge, LLC, Phase II Environmental Site Assessment Report, dated February 12, 2001.

6.0 Appendices

6.1 Vicinity Map



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GE South Dawson Street
Completion Report
GE, Seattle, WA
Project No.: 60345071 Date: 10/18/17

VICINITY MAP



Figure: 1

6.2 Site Plan Figure



6.3 Groundwater TCE Plume Figure

Interpreted Trichloroethene (TCE) Groundwater Plume as measured at Site monitoring wells. Slightly Diving TCE Groundwater Plume - Shallow TCE groundwater contamination on the 220 S. Dawson Street property and Deeper Zone TCE Groundwater Contamination Off Property.

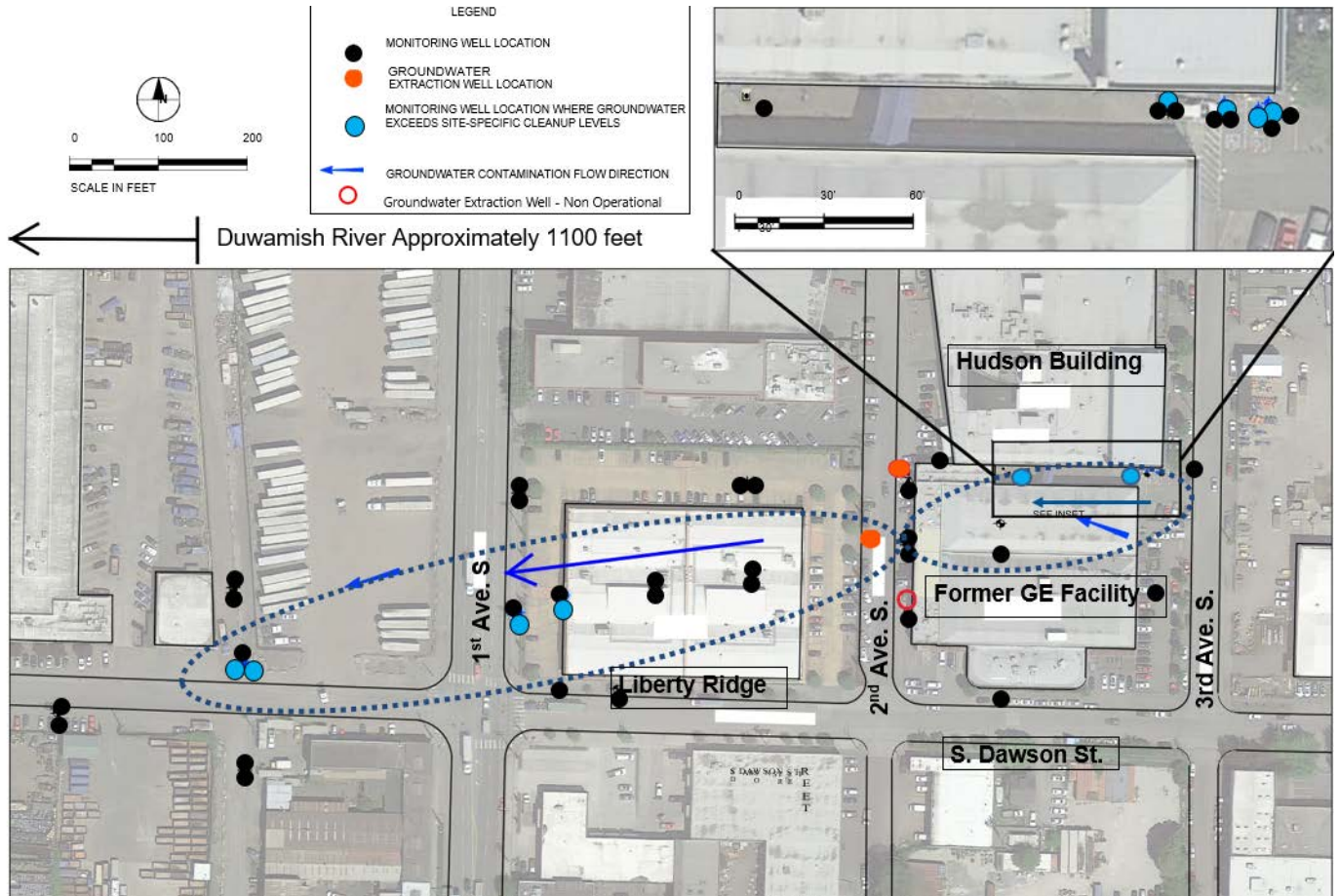
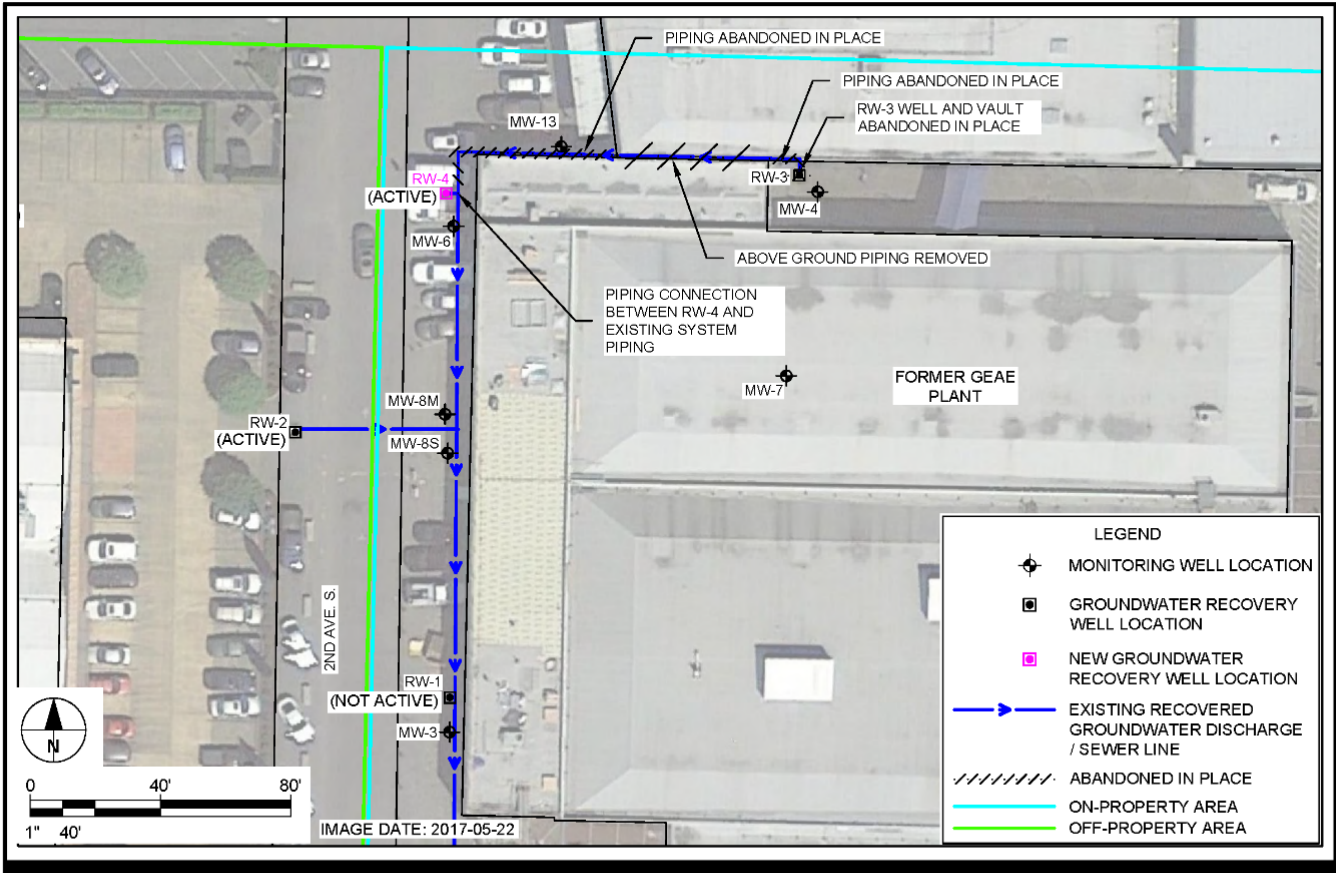


Figure A: Groundwater Extraction Well Locations

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Recovery System Modification
 Former General Electric South Dawson Street Site
 Seattle, WA
 Project No.: 60563407 Date: 10/01/18

RECOVERY SYSTEM LAYOUT

AECOM

Figure: □

Figure B: Groundwater Monitoring Network

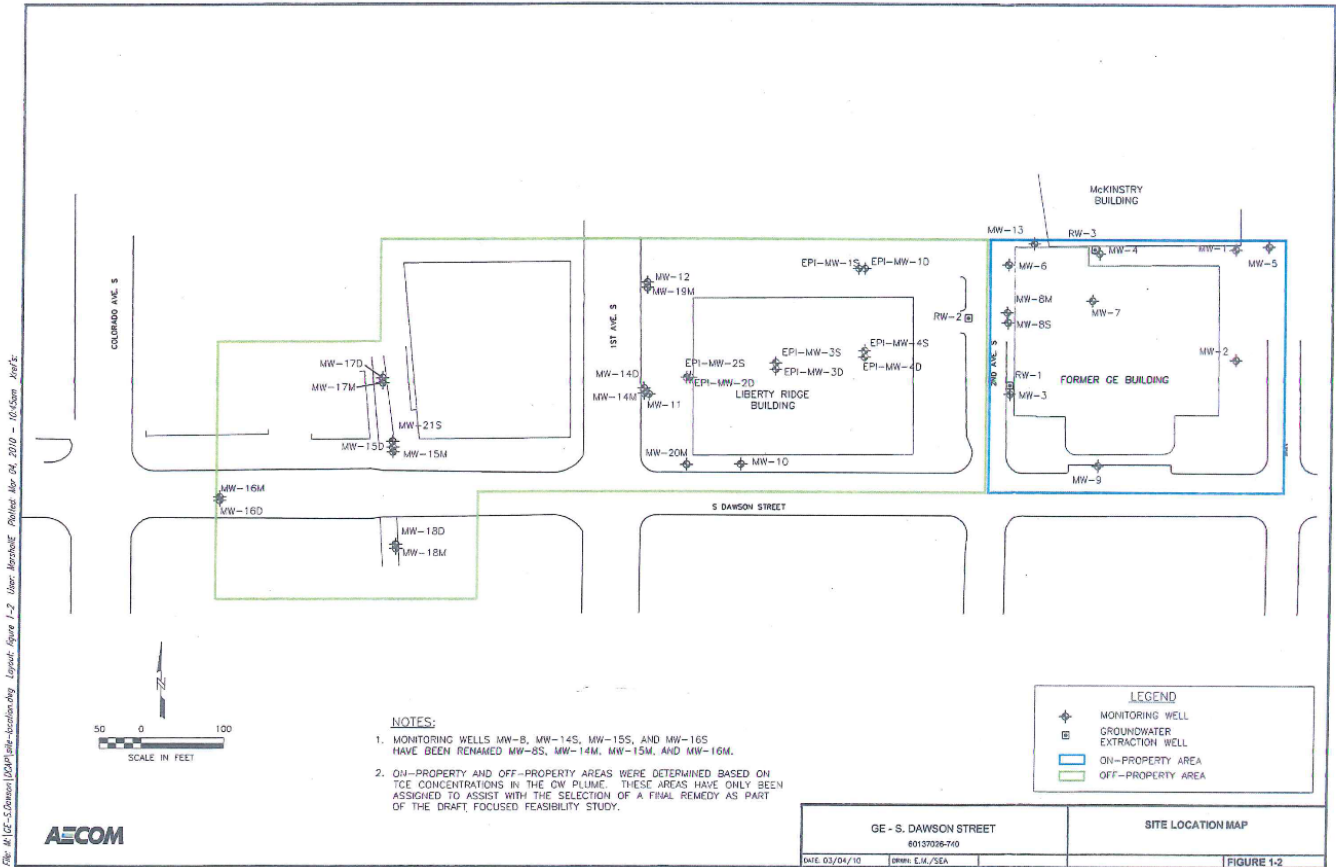
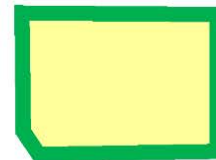
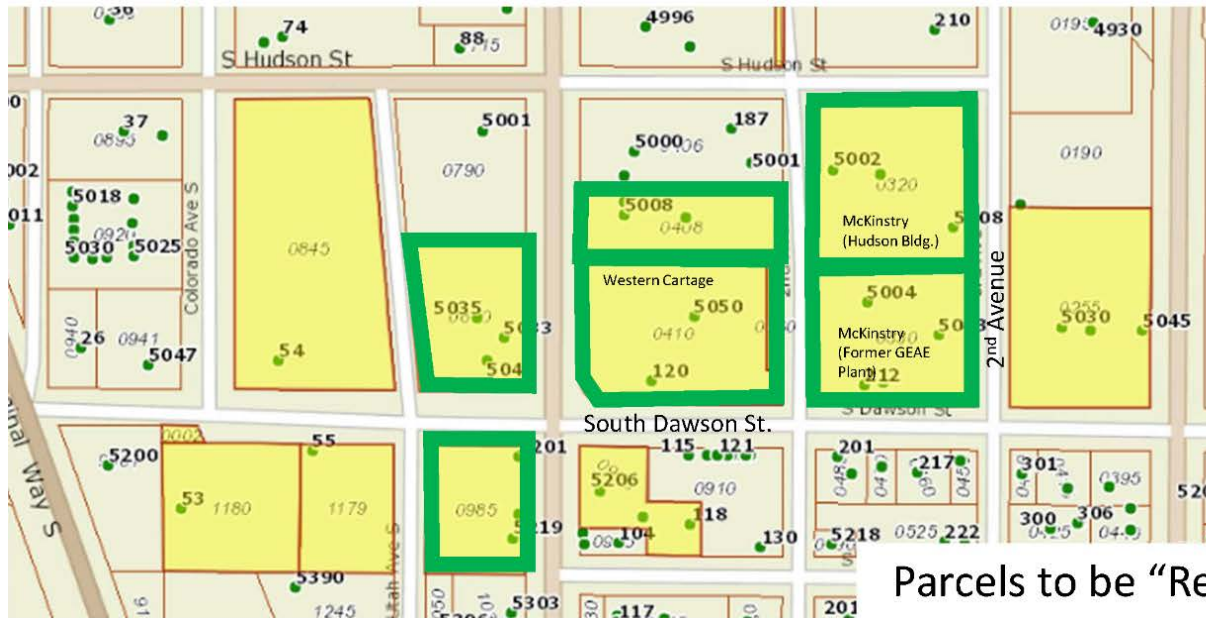


Figure C: Environmental Covenant Properties (7)



6.4 Photo Log

6.4.1 Photo 1 – 220 South Dawson St Building, View West



6.4.2 Photo – Liberty Ridge Building, 5050 1st Ave S., View West



6.5 Potability Determination: Five-year review, dated March 7, 2019

March 7, 2019

Mr. Dean Yasuda
Washington State Department of Ecology
Hazardous Waste and Toxics Reduction Program
Northwest Regional Office
3190 160th Avenue S.E.
Bellevue, Washington 98008

Subject: GE Dawson Street Site Groundwater Potability Analysis

Dear Mr. Yasuda:

AECOM Technical Services, Inc., (AECOM) has prepared this groundwater potability analysis on behalf of General Electric (GE) for the former GE Aviation Division facility (the Site) located at 220 South Dawson Street, Seattle, WA (Figure 1). The purpose of this analysis is to provide the Washington State Department of Ecology (Ecology) with sufficient information to confirm, as part of its 5-year review, whether groundwater at the Site continues to meet the original potability analysis that supported the Cleanup Action Plan¹ (CAP).

The Ecology Model Toxics Control Act (MTCA) allows use of non-potable groundwater levels based on surface water provided the site meets requirements of WAC-173-340-720(1)a, WAC-173-340-720(2)d, and WAC-173-340-720(6). Ecology has a preference, documented in WAC 173-340-720(1), that groundwater cleanup levels be based on the highest beneficial use and reasonable maximum exposure expected to occur under both current and future site use conditions. A site with groundwater that qualifies as non-potable under WAC 173-340-720(2) establishes cleanup levels under WAC 173-340-720(6). The following summarizes how the Site meets the requirements of WAC 173-340-720(2).

- “WAC-173-340-720(2) *Potable ground water defined. Ground water shall be classified as potable to protect drinking water beneficial uses unless the following can be demonstrated:*
 - (a) *The ground water does not serve as a current source of drinking water;*”
 - Groundwater near the Site is not a current source of drinking water. There are no drinking water wells within a one-quarter mile radius of the Site and no drinking water wells downgradient of the Site. The nearest potable well is a Group A (Seattle Public Utilities well) located approximately 6 miles south of the Site in the city of Seatac². The Beacon Hill Reservoir was replaced with an underground structure and Jefferson Park was created on top in 2009. The reservoir is located approximately 1.3 miles northeast and upgradient of the Site. Institutional controls (city/county ordinances and requirements of the State Health Department) prohibit ground-water use near the Site. The Site lies in a highly developed portion of Seattle where city water is readily accessible. The State Health Department and King County Board of Health, Title 12, Section 12.24.010A state that a drinking water supply must come from the highest quality source feasible. The City of Seattle water supply is the highest quality source available near the Site. Therefore, connection to the City of Seattle water supply is mandatory for businesses or residences in this area. In addition, WAC 173-160-171(3) specifies certain setback distances for water supply wells. The code stipulates that wells be set back at least 50 feet from public and building sewers and 5 feet from any existing building structure. Therefore,

¹ Ecology (Washington State Department of Ecology). 2014. *Cleanup Action Plan, GE South Dawson Street, Seattle, Washington*. March 2014.

² Data confirmed by King County, Department of Public Health – well ID GrpA_77050_04.
(https://green2.kingcounty.gov/groundwater/well-detail.aspx?well_id=431).

buildings structures and public/building drains near the subject property prevent the installation of water supplywells.

(b) *“The ground water is not a potential future source of drinking water for any of the following reasons:*

- (i) *The ground water is present in insufficient quantity to yield greater than 0.5 gallon per minute on a sustainable basis to a well constructed in compliance with chapter 173-160 WAC and in accordance with normal domestic water well construction practices for the area in which the site is located;*
- (ii) *The ground water contains natural background concentrations of organic or inorganic constituents that make use of the water as a drinking water source not practicable. Ground water containing total dissolved solids at concentrations greater than 10,000 mg/L shall normally be considered to have fulfilled this requirement; (NOTE: The total dissolved solids concentration provided here is an example. There may be other situations where high natural background levels also met this requirement.); or*
- (iii) *The ground water contains natural background concentrations of organic or inorganic constituents that make use of the water as a drinking water source not practicable. Ground water containing total dissolved solids at concentrations greater than 10,000 mg/L shall normally be considered to have fulfilled this requirement; (NOTE: The total dissolved solids concentration provided here is an example. There may be other situations where high natural background levels also met this requirement.); or*
- (iv) *The ground water is situated at a great depth or location that makes recovery of water for drinking water purposes technically impossible; and”*

- Groundwater at the Site is not a potential future source of drinking water but the rationale in technical requirements i, ii, or iii, above, do not clearly apply for unlikely future use of groundwater as drinking water at the Site. However, the provision under WAC-173-340-720 (2)(d) recognizes that even if a site does not meet the conditions of this subsection (WAC-173-340-720 (2)(b)) at some sites there is an extremely low probability that the groundwater will be used for a source of drinking water because of the site’s proximity to a surface water that is not suitable as a domestic water supply. Under WAC-173-340-720 (2)(d) at these sites groundwater can be classified as non-potable. WAC-173-340-720 (2)(d) is discussed below.

(c) *“The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection, at concentrations which exceed ground water quality criteria published in chapter 173-200 WAC. In making a determination under this provision, the department shall consider site-specific factors including:*

(i) *The extent of affected ground water;”*

- The extent of affected groundwater at the Site is known and is discussed Ecology Cleanup Action Plan³. Groundwater concentrations exceed drinking and surface water standards under the Site to a depth of approximately 16 feet below ground surface (based 2017 and 2018 data), and downgradient of the Site to a depth of 55 feet below ground surface. Chemically-affected groundwater has been defined in the horizontal direction and is limited to the area west of 3rd Ave South (eastern extent) and Utah Street (western extent). The distal end of the affected groundwater is 690 feet upgradient of the Duwamish River.

(ii) *“The distance to existing water supply wells;”*

- The nearest water supply well is about 6 miles to the south of the affected Site groundwater.

³ Ecology (Washington State Department of Ecology). 2014. *Cleanup Action Plan, GE South Dawson Street, Seattle, Washington*. March 2014.

(iii) *“The likelihood of interconnection between the contaminated ground water and ground water that is a current or potential future source of drinking water due to well construction practices in the area of the state where the site is located;”*

- As discussed above, water well installation and construction is not permitted in the industrial area of Seattle, where the Site is located, and groundwater in the vicinity of the Site is not a current or potential future source of drinking water. The lower Duwamish Valley is an important urban industrial and commercial area and future production of shallow groundwater in this densely developed area is highly unlikely. Connection to the city water supply is mandatory for businesses or residences in this area. WAC 173-160-171(3) specifies certain setback distances for water supply wells that also prevent well installation near the Site.

(iv) *“The physical and chemical characteristics of the hazardous substance;”*

- The physical and chemical characteristics of chlorinated solvents are well understood⁴ and the distribution of these chemicals in affected groundwater has been characterized and is discussed in CAP.

(v) *“The hydrogeologic characteristics of the site;”*

- The hydrogeologic characteristics of the Site are known through installation of 45 monitoring wells, extensive site-wide geoprobes, and completion of three pumping tests. The CAP discusses the Site geology and hydrogeology. The regional geology and hydrogeology are discussed in the Duwamish Study⁵.

(vi) *“The presence of discontinuities in the affected geologic stratum; and”*

- The CAP provides a description of the geology, which consists predominantly of fine to medium grained sands and silty sands and the sand fill within the lower valley is relatively homogeneous. Substantial clay layers that are laterally continuous and could cause discontinuities have not been encountered at the Site.

(vii) *“The degree of confidence in any predictive modeling performed. “*

- The nature and extent of affected groundwater has been evaluated based on Site data rather than modeling. The information presented in the CAP is based on field observation and data collection. Soil borings have been collected across the Site and have included locations upgradient, downgradient, and cross gradient of the impacted areas. A site-wide soil investigation and resulting soil excavation was conducted in 1995 and 1996. Groundwater quality data has been collected quarterly starting in 1998 and is ongoing. The information presented above is based on these observations and data and not modeling. Modeling was completed to assess the capture zone of the current containment system, as presented in the draft Recovery Well 4 Installation Completion Report⁶.

⁴ Wypych, 2001. Handbook of Solvents. Chemtec Publishing, Toronto, Ontario, Canada.

⁵ Fabritz, J., J. Massman, D. Booth 1998. Development of a three-dimensional numerical groundwater flow model for the Duwamish River Basin. Center for Urban Water Resources Management, University of Washington. Prepared for the Duwamish Basin Groundwater Pathways Study, City of Seattle and King County. August 1998.

⁶ AECOM. 2018. Recovery Well 4 Installation Completion Report, GE South Dawson Street. October 10, 2018.

“(d) Even if ground water is classified as a potential future source of drinking water under (b) of this subsection, the department recognizes that there may be sites where there is an extremely low probability that the ground water will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. An example of this situation would be shallow ground waters in close proximity to marine waters such as on Harbor Island in Seattle. At such sites, the department may allow ground water to be classified as non-potable for the purposes of this section if each of the following conditions can be demonstrated. These determinations must be for reasons other than that the ground water or surface water has been contaminated by a release of a hazardous substance at the site.

(i) The conditions specified in (a) and (c) of this subsection are met;”

- As stated above (a) and (c) are met.

(ii) “There are known or projected points of entry of the ground water into the surface water;”

- The groundwater in this area discharges in the lower Duwamish River located approximately 690 feet west of furthest downgradient point of the groundwater plume.

(iii) “The surface water is not classified as a suitable domestic water supply source under chapter 173-201A WAC; and”

- The lower Duwamish River is not classified as a suitable domestic water supply under chapter 173-201A WAC. The portion of the river where groundwater discharges lies within the EPA Lower Duwamish River Superfund Site and has been studied in some detail. The salt water wedge in the river typically extends about seven miles upriver and varies depending on the tidal influence and river discharge⁷. Groundwater from the Site area discharges in the general area of River Mile 1, within the marine area.

(iv) “The ground water is sufficiently hydraulically connected to the surface water that the ground water is not practicable to use as a drinking water source.”

- The groundwater is hydraulically connected to the surface water, as the Duwamish Basin aquifer is continuous across the area and with the river bank and bed. Domestic water supply production wells in the area would not be allowed in the foreseeable future under County ordinances and State regulations. If the unforeseen were to happen, and installation of a municipal or large domestic water supply well/well field were considered for the area, analysis prior to installation would show that potable groundwater production is not feasible and would be impacted by saline conditions in an unacceptable timeframe. Requirements prohibit installation of individual potable groundwater wells and require connection to municipal groundwater supply. Given the urban and industrial land use history in the area and the proximity to a major city, it is not foreseeable that the Site could transition from urban use to other uses where groundwater use would be feasible. The groundwater is sufficiently hydraulically connected to surface water that it is not practicable to use as a municipal water supply, even for a small municipality.

We hope this assessment provides sufficient information to support Ecology's upcoming 5-year review for the Site. If you have any questions or need any further information, please feel free to contact myself or Tom Antonoff.

⁷ Dexter R.N., D.E. Anderson, E.A. Quinlan, L.S. Goldstein, R.M. Stickland, S.P. Pavlou, J.R. Clayton, R.M. Kocan, and M. Landolt. 1981. A summary of knowledge of Puget Sound related to chemical contaminants. NOAA technical memorandum OMPA-13. Office of Marine Pollution Assessment, National Oceanic and Atmospheric Administration, Boulder, Colorado.

Sincerely,



Jason Palmer
Project Manager
AECOM
T: 206-403-4203
E: jason.palmer@aecom.com

cc: Tong Li, Groundwater Solutions
Tom Antonoff, GE

6.6 Five-Year Review Assessment of the Effectiveness of Institutional and Other Controls as Part of Cleanup,” dated March 7, 2019

March 7, 2019

Mr. Dean Yasuda
Washington State Department of
Ecology
Hazardous Waste and Toxics Reduction
Program
Northwest Regional Office
3190 160th Avenue S.E.
Bellevue, Washington 98008

Subject: GE Dawson Street Site 2019 5-Year Review Assessment

Dear Mr. Yasuda:

AECOM Technical Services, Inc., (AECOM) has prepared this 5-year review assessment on behalf of General Electric (GE) for the former GE Aviation Division facility (the Site) located at 220 South Dawson Street, Seattle, WA (Figure 1). The purpose of this assessment is to provide the Washington State Department of Ecology (Ecology) with sufficient information to evaluate, as part of its 5-year review, whether the ongoing remediation activities and institutional controls at the Site and off-property areas are protective of human health and the environment. This assessment was conducted in accordance with Section XX, XXVI, and Exhibit C of Consent Decree 14-2-09134-6 between GE and Ecology.

Summary of Remediation Activities

The Cleanup Action Plan¹ (CAP) for the Site requires active remediation to treat groundwater impacted by Site constituents of concern (COCs) as well as ongoing operations and monitoring (O&M) activities to prevent human health exposure to soil vapors beneath on-property buildings and the off-property migration of impacted groundwater.

GE implemented an in-situ chemical oxidation (ISCO) pilot study in March 2017 as required by the CAP. Following six months of monitoring after the ISCO injections were completed, no significant change was observed compared to historical groundwater COC concentration trends. GE supplemented the ISCO pilot study by installing sodium persulfate impregnated cylinders into strategic injection and monitoring wells in October 2017. As with the ISCO injections, no significant change to groundwater concentrations were observed. In accordance with the contingent remedy allowance in the CAP, GE and Ecology agreed to an alternative in-situ chemical reduction (ISCR) remedy to treat groundwater. ISCR injections were implemented in January and February 2019. The first round of ISCR groundwater monitoring was conducted in February 2019. Analytical results are pending as of the submittal of this assessment.

GE continues to operate a vapor intrusion mitigation system (VIMS) at the Site, within the 220 South Dawson Street building, to prevent human health (worker) exposure to elevated COC concentrations in soil vapor beneath the building. The system has been in place and operating continuously since 2007. GE performs routine monthly inspections of the VIMS to ensure system functionality and that no modifications to the building or system components have occurred that could impact the system operation. Indoor air sampling events as part of the ISCO pilot study in 2017 confirmed the VIMS is functioning as designed and indoor air at the 220 South Dawson Street building is protective of human health. No other buildings, either on-Site or off-property, are at risk of elevated indoor air concentrations based on current groundwater concentrations and/or indoor air sampling results.

¹ Ecology (Washington State Department of Ecology). 2014. *Cleanup Action Plan, GE South Dawson Street, Seattle, Washington*. March 2014.

GE also continues to operate a groundwater extraction system, to prevent Site groundwater with COC concentrations above Site-Specific Cleanup Levels (CULs) from migrating to off-property areas. The groundwater extraction system has been operating since 1996 and has been optimized several times to increase capture of impacted groundwater. The system was most recently modified in 2018 with the installation of recovery well RW-4 and the abandonment of recovery well RW-3 to facilitate remediation activities. As part of the 2018 modification activities, additional groundwater modeling was conducted to confirm appropriate groundwater extraction rates and an appropriate capture zone for the system. The current recovery well locations are shown on Figures 1 and 2. To evaluate the performance of the groundwater extraction system and to evaluate groundwater concentrations at the Site over time, GE performs quarterly groundwater monitoring at the Site and off-property areas. Recent 2018 groundwater concentrations (Figure 2) indicate that groundwater quality continues to improve on both the Site and off-property areas. The Site groundwater exceedance area is contained to a small alley between the buildings, and off-property exceedances are only slightly above the CULs. The clear disconnect between the shallow on-Site groundwater impacts and primarily deeper off-property impacts demonstrates the effectiveness of the groundwater extraction system.

Implementation of Institutional Controls

GE is currently in the process of coordinating Environmental Covenants (ECs) with property owners affected by Site impacts. The properties targeted for ECs are shown on Figure 2. GE estimates all the ECs will be in place by Summer 2019, and will provide a monthly summary to Ecology (as part of the required monthly progress reports) on the status of the ECs and which property owners have been verbally informed of the potential risks posed by the Site. The ECs will be structured to meet the requirements of WAC 170-340-440 and Section 6, #18 of the CAP. In short, the ECs will:

- Restrict withdrawal of groundwater at the impacted properties,
- Prevent subsurface activities that mix the contamination in the intermediate and deeper groundwater with contamination in the shallow zone groundwater,
- Restrict future activities which have the potential to exacerbate the vapor intrusion pathway, and
- Restrict subsurface activities conducted within the soil and groundwater contaminated areas.

GE has been in constant contact with the two property owners primarily impacted by Site activities, which are the owners of the Site buildings (McKinstry) and the immediately downgradient property (Liberty Ridge). Both parties are provided copies of all pertinent Site documents and analyses, were specifically provided the current Engineering Design Report to review and provide comments, and participated in calls with GE and Ecology to ask questions about the Site and discuss concerns about the Site remedy.

McKinstry is currently conducting building and property renovations at the Site. GE and McKinstry conducted regular conference calls to review the status of the renovations and confirm that those activities did not result in any situations counter to the above-listed restrictions. No other known on-Site or off-property activities would violate the anticipated EC restrictions.

Conclusions

Based on the ongoing Site remediation activities and more than 20 years of operations and monitoring data, impacts from the Site are being mitigated and do not pose a risk to human health or the environment. GE continues to actively treat Site groundwater impacts through implementation of the ISCR injections, which is one of the most practical and permanent remedial technologies applicable to the Site. Groundwater impacted above CULs on the Site is contained by the groundwater extraction system and is not migrating to off-property areas, and long-term monitoring demonstrates that groundwater concentrations are generally decreasing. The VIMS eliminates the exposure pathway to human receptors in the 220 South Dawson Street building as confirmed by indoor air sampling results. No new applicable state or federal laws have been implemented, or new scientific information identified, that would alter the requirements of the Consent Decree or remedial actions prescribed in the CAP.

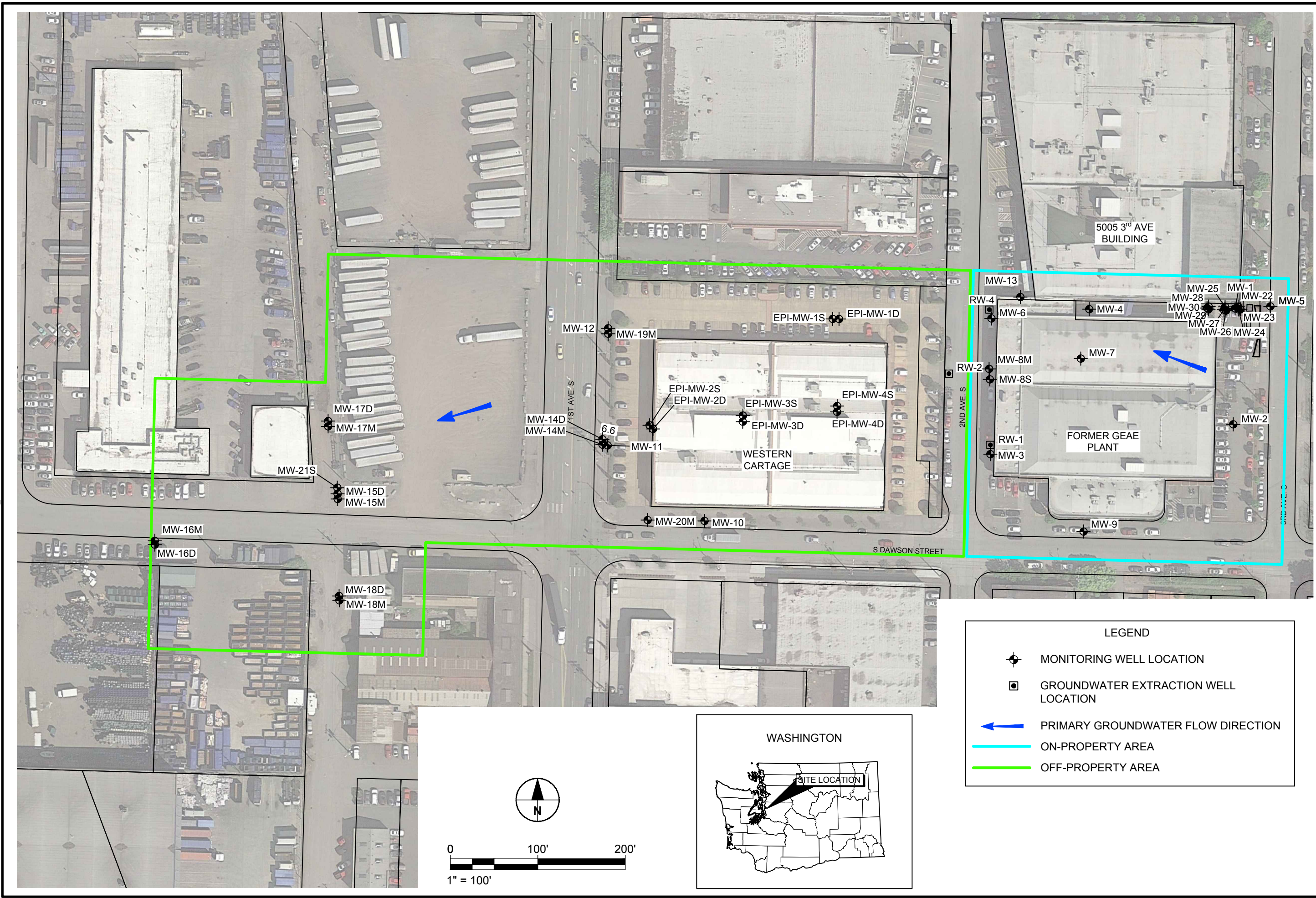
We hope this assessment provides sufficient information to support Ecology's upcoming 5-year review for the Site. If you have any questions or need any further information, please feel free to contact myself or Tom Antonoff.

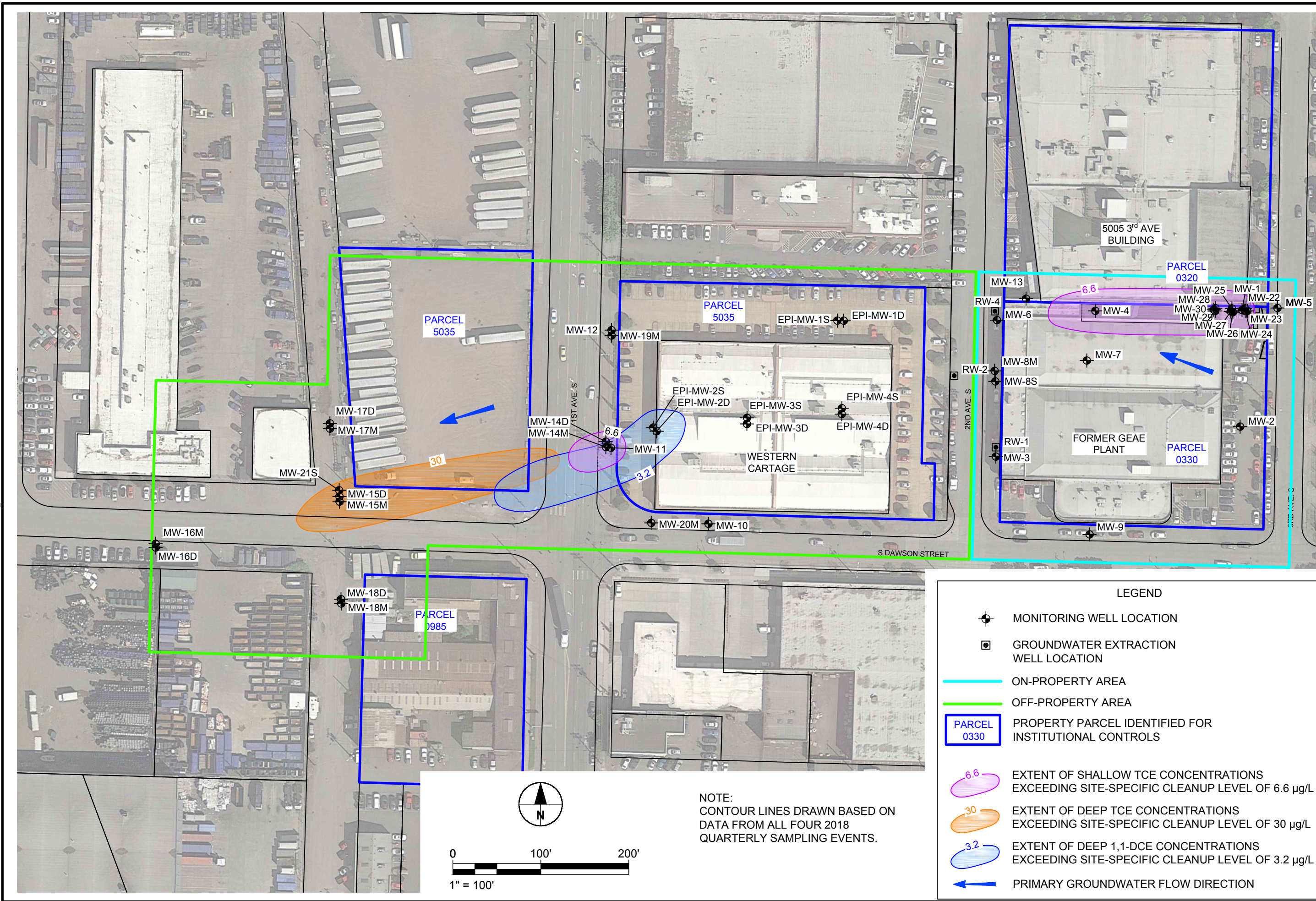
Sincerely,



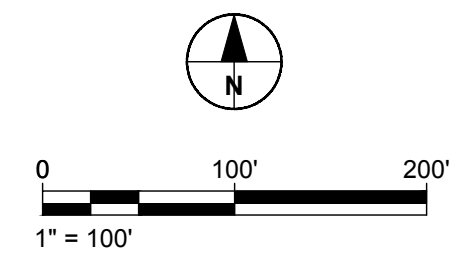
Jason Palmer
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cc: Tong Li, Groundwater Solutions
Tom Antonoff, GE














NOTE:
 CONTOUR LINES DRAWN BASED ON
 DATA FROM ALL FOUR 2018
 QUARTERLY SAMPLING EVENTS.



LEGEND

-  MONITORING WELL LOCATION
-  GROUNDWATER EXTRACTION WELL LOCATION
-  ON-PROPERTY AREA
-  OFF-PROPERTY AREA
-  **PARCEL 0330** PROPERTY PARCEL IDENTIFIED FOR INSTITUTIONAL CONTROLS
-  6.6 EXTENT OF SHALLOW TCE CONCENTRATIONS EXCEEDING SITE-SPECIFIC CLEANUP LEVEL OF 6.6 µg/L
-  30 EXTENT OF DEEP TCE CONCENTRATIONS EXCEEDING SITE-SPECIFIC CLEANUP LEVEL OF 30 µg/L
-  3.2 EXTENT OF DEEP 1,1-DCE CONCENTRATIONS EXCEEDING SITE-SPECIFIC CLEANUP LEVEL OF 3.2 µg/L
-  PRIMARY GROUNDWATER FLOW DIRECTION