Memorandum

To: Eric Rapp, Jeld-Wen Inc.

From: Frank Winslow, LHG, Department of Ecology, Toxics Cleanup Program

Date: February 14, 2024

Re: **Ecology Comments on Pre-Remedial Design Investigation Work Plan, Upland Areas of Jeld Wen Site dated January 24, 2024**

- Site Name: Jeld Wen
- Site Address: 300 W Marine View Dr, Everett, WA 98201-1030
- Facility/Site No.: 2757
- Cleanup Site No.: 4402
- Agreed Order No.: DE 5095

The following are the Department of Ecology's (Ecology's) comments on the above-referenced draft work plan. These comments are divided by the following topics:

A. Woodlife Area Proposed Investigations

B. Creosote Area Proposed Investigations

C. Permitting and Reporting

D. SAP and QAPP

Comments include requested changes to the work plan and advisory comments. Ecology requests that all comments be responded to, although some responses may be appropriately responded to with "Comment acknowledged". For comments that have resulted in edits to the work plan please summarize the change and note the location of the change within the revised work plan document.

Ecology notes that initial comments were provided by Ecology on February 8, 2024 and additional clarification on comment B-10 on February 9, 2024. Comment text that was not included within the February 8, 2024 comments are highlighted below for your convenience. In addition, **bold** font had been added for selected action items and summary points.

Comments – Woodlife Area Proposed Investigations

A1 - Woodlife Area – Section 3.3.1 - Basis for depth of borings

The report refers to Figure 5, which shows estimated depth of contamination, but not boring depths, though the SAP discusses boring depths in greater detail. **Please add reference to the SAP for more detail on this subject in this section**.

Note that Ecology expects that the total depth of the boring should allow for soil samples that clearly demonstrate that all remaining soils following excavation have DF concentrations below the selected cleanup level (CUL). This means that soils should be excavated to a depth where concentrations are below the CUL based on data rather than based on interpolation. Ecology understands that there will apparently be no opportunity to collect confirmation soil samples and conduct additional excavation if

those confirmation soil samples had DF concentrations exceeding CULs. **Hence, interpolation-based excavation total depths are not considered appropriate to demonstrate sufficiency of cleanup.** The collection of sufficient reserve samples (and analyzing them, as needed) is anticipated to address this concern.

A2 - Woodlife Area – Section 3.3.1 - Basis for selection of samples for analysis

Preliminary sampling depths shown on cross sections (Figures 6 a, b, and c). The SAP discusses sampling depths and field screening in greater detail. **Please add reference to the SAP for more detail on the subject in this section.**

To ensure that all locations have a bottom sample that will be below CULs, **Ecology recommends that additional soil samples should be collected and held in reserve pending results from other depths**. This approach is anticipated to reduce laboratory analyses while ensuring that the bottom depth of the excavation is well delineated.

A3 - Woodlife Area – Section 3.3.1 - Anomalous PID Reading Location at GP-501

During previous investigations, anomalous PID readings of 1,620 ppm at 4.5 ft bgs and 1,202 ppm at 5.5 ft bgs were found at location GP-501. The soil exhibited "strong chemical like odor". Soil from this depth was not analyzed for VOCs (a sample from a depth of 3 ft bgs with a PID reading of 2.1 ppm was). The cause of these very high PID readings at 4.5-5.5 ft bgs were not identified, although CPAHs, diesel, and heavy oil range petroleum, and PCP were detected at a depth of 3.0 ft bgs. This is also the location where DFs were detected in groundwater and a very high concentration of DFs was found in soil at 1.0 ft bgs.

Ecology requests that an offset boring close to GP-501 be conducted, and a sample from the 4.5 to 5.5 ft bgs interval be analyzed for VOCs. Understanding this contamination concern is important since a volatile solvent could potentially be a carrying agent for other site contaminants (e.g. DFs).

Ecology requests that the boring offsetting GP-501 be drilled to a sufficient depth to define the maximum vertical extent of contamination. Boring GP-501 was drilled to 7.0 ft bgs, and still had evidence of contamination at 7.0 ft (PID reading of 41.6 ppm). The targeted depth of 10 ft bgs for borings in this area within the work plan may not be sufficient to define the vertical extent of contamination. We suggest that the offset boring at GP-501 be drilled to a greater depth to provide for better understanding of the maximum vertical extent of contamination prior to drilling other locations in the Woodlife Area. Care should be taken during drilling at this location to ensure that a conduit for downward contamination migration is not created.

Ecology notes that PID readings should be taken and recorded at all Wood Life boring locations unless a case can be made that the readings at GP-501 were in error.

A4 - Woodlife Area – Section 3.3 - Water Levels

Please discuss the depth to groundwater data from the Woodlife Area within the work plan. Depth to water data from MW-7 and MW-9A/B data from 2015 to 2019 ranged from 1.6 to 5.7 feet below top of casing (ft btoc) in these monitoring wells. Hence, a significant amount of water could seep into the excavation, planned for up to about 7.0 feet below ground surface [ft bgs] at GP-501, and a significant

amount of dewatering may be needed. Testing may be warranted to assess potential water production in this excavation in this area to appropriately design dewatering measures.

A5 - Woodlife Area – Section 3.3 - Stormwater Management

We understand that currently, stormwater from West Marine View Drive flows into the area of the planned Woodlife excavation. **Please discuss within the workplan this stormwater concern**, and if information will be needed during Step 2 investigations to design appropriate mitigation measures for this concern.

A6 - Woodlife Area – General Comment - Health and Safety

The DFs in soil in this area are a significant health & safety concern. Ecology notes that meticulous adherence to health and safety plan requirements to prevent dermal contact, incidental ingestion, and dust inhalation are critical for these highly carcinogenic substances.

Comments – Creosote Area Proposed Investigations

B1 - Creosote Area – General Comment - Cross Sections

No cross sections were provided for the Creosote Area within the work plan. **A minimum of two cross sections (E-W and N-S) would appear to be warranted** and appropriate to support the work planning. Such cross sections should include lithologies, existing borings and monitoring well screened intervals, and the estimated area of "hot spot" contamination.

B2 - Creosote Area – General Comment - Field Screening

Ecology understands that the Creosote Area excavation is targeting hot spots where contamination is clearly apparent in the field, both during borehole sampling and during excavation work. We understand that such clearly apparent hot spots are based on visual free product and such soils are expected to have very strong odors.

Ecology recommends that recording of field observations including product observations be reported on borehole logs and then compiled in a tabular format since such observational data may be more valuable for defining the excavation than laboratory analytical data. The descriptions of product should include descriptors such as "product saturated", "some product present", "significant grain staining", "some grain staining".

The CAP included RELs for "hot spots" in the Creosote Area as follows:

- Soil - visible NAPL and PID readings > 100 ppm
- Groundwater - mobile NAPL and > 500 ug/L naphthalene in shallow groundwater

It is appropriate to more clearly define what constitutes the presence of visible NAPL in soil and mobile NAPL in groundwater to define a hot spot. Please add discussion within the work plan that includes definitions of free and residual NAPL, and the distinction between product saturation and product staining. **This discussion should propose what constitutes visible NAPL in soil and mobile NAPL in groundwater.**

Ecology notes that previous data suggest that the PID threshold of 100 ppm may only have relevance in selected areas, since high contaminant concentrations were apparently commonly found with PID readings significantly lower than 100 ppm. However, PID reading should be taken and recorded at all boring locations in the creosote area.

B3 - Creosote Area – General Comment - Health and Safety

It will be critical to prevent inhalation exposure to such contamination both during investigations and during excavation work. Use of institutional controls such as large fans and staying upwind are important, as well as appropriate PPE and health and safety monitoring. Keeping non-project personnel out of the work area will also be important. Ecology wishes to emphasize the importance of health and safety to all personnel during this work.

B4 - Creosote Area – Section 2.2.2 - Reference to "CPOC" on Page 12

The text in this section states:

> *Conceptually, excavation of contaminated soil will proceed after completion of the PRDI and engineering design. Site conditions could easily lead to flowing sands that could quickly destabilize a shored excavation and additional data will be collected during the PRDI to support a detailed design of the shoring system necessary for soil removal to the CPOC of 9 beet bgs.*

The reference to 9 ft bgs (the target excavation depth) in this section as a CPOC is not correct and should be corrected. The CAP states:

> *A CPOC for the surface water protection COCs (cPAH is used here as IHS) in the Creosote/Fuel Oil Area of the Site may be allowed at the downgradient edge of the applicable COC plume within the upland area as determined from the RI after active remedy has been completed and the performing PLPs have demonstrated through a study that it would not be practicable to meet CUL throughout the plume area.*

Therefore, the only potential CPOC for the creosote area is for monitoring wells, after completion of the cleanup work.

B5 - Creosote Area – Section 3.4 - Water Levels and Dewatering Assessment

Please discuss depth to groundwater data from the creosote area within the work plan. Depth to water data from MW-8A/B and MW-10A/B data from 2015 to 2019 ranged from 1.2 to 4.2 ft btoc in these monitoring wells. Hence a significant amount of water may seep into the excavation and a significant amount of dewatering may be required.

We understand that free product floating on water within the excavation is not currently anticipated; however, if free product is generated within the excavation, then it should be properly removed and disposed of. Ecology notes that the area of pump testing is to the west of the area where product may be found, hence boring data within the product area are anticipated to be more pertinent to assess the potential for potential product floating on water generation during excavation.

B6 - Creosote Area – Section 3.4.5 - Aquifer Pump Test

Ecology notes that the proposed pumping tests will be performed in part to assess dewatering needs during excavation. **Ecology suggests that the proposed shallow pumping well and monitoring wells be screened interval be consistent with the anticipated depth of excavation to better assess dewatering needs**.

The representativeness of the pumping test on contaminated areas to the east is dependent on how laterally consistent the lithologies are in this area. The inclusion of boring logs from this area within the work plan as well as the cross sections discussed above, would be appropriate to allow for assessing the amount of lateral heterogeneity in subsurface media.

B7 - Creosote Area – Section 3.4 - Resilience to Climate Change

The new MTCA rule includes a requirement that cleanup alternatives be sufficiently resilient to potential climate change. We understand that a portion of the peninsula that the Property is on currently gets flooded under very high tides (i.e. king tides). As previously evaluated for the Site, climate change may bring rising sea levels. Ecology is concerned that if flooded, the proposed remedial system within the creosote area could be damaged or put out of operation. Hence, an assessment of potential flooding with high tides and potential sea level rise within the planned period of operation is warranted. **Please add discussion to the work plan regarding assessing this potential concern**. Elevation of land surface data in the creosote area, historical king tide elevations, and potential elevation rises should be included in this analysis. **This should also include presenting a map of the peninsula showing the extent of current and potential future inundation, based on this analysis.**

B8 - Creosote Area – Section 3.4.6.1 - Bench Scale Study – Soil for Testing

The work plan states:

> *Saturated soil and groundwater samples will be collected from three locations within the Creosote/Fuel Oil Area but outside of the Hot Spot removal footprint as the soil removal component of the remedial action will occur first and therefore conditions within the Hot Spot removal footprint are not representative of what conditions will be at time of implementation of the BIO System. Samples will be collected from the shallow zone in conjunction with the Hot Spot Soil Removal Delineation Assessment (Section 3.4.1), and the Shallow Zone Groundwater Assessment (Section 3.4.2).*

Ecology does not understand why soil samples for this bench scale testing would be collected from the shallow zone, when the bio system will be applied in the deeper zone. It would appear to be more appropriate to used soil from the zone where the treatment will be applied and with contaminant concentrations where the treatment will apply.

B9 - Creosote Area – Section 3.4.6.1 - Bench Scale Study – Use of Sodium azide

The work plan states:

> *Bench scale testing of COC removal / secondary effects will be performed utilizing a combination of soil, groundwater, nitrate, surfactant, and sodium azide in various compositions and sample*

times to determine ideal solution for contaminant destruction (further detailed in the SAP, Appendix A).

A quick online search on sodium azide resulted in the following:

> *Sodium azide is a rapidly acting, potentially deadly chemical that exists as an odorless white solid. When it is mixed with water or an acid, sodium azide changes rapidly to a toxic gas with a pungent (sharp) odor.*

The use of sodium azide for site bench scale testing and site remediation does not appear to be advisable.

B10 - Creosote Area – Section 3.4.6.3 SSD Pilot Testing – Vadose zone lithologies

As discussed above, the vadose zone thickness in the creosote area historically ranged from 1.2 to 4.2 ft btoc. Hence, there appears to be limited thickness available for installing and testing horizontal piping for assessing sub-slab depressurization (SSD)system. Ecology notes that typical building construction would include placing an aggregate layer underneath the slab of a building. Also, due to potential flooding concerns and an expectation that a new structure would likely have additional fill materials brought it, it would appear that an SSD system would likely be constructed within such new materials (as opposed to within the existing vadose zone). Hence, Ecology is not clear on the rationale for installing and testing for SSD within the current vadose zone materials. **Please clarify the specific data needs that are anticipated to results from the proposed SSD testing.**

Ecology notes that a sub-slab depressurization system (SSDS) is typically installed for the purpose of protection of human health within structures by blocking the vapor intrusion pathway. By creating a negative pressure beneath the slab, no pressure gradient exists that could result in vapor intrusion.

Soil vapor extraction (SVE), on the other hand, can have multiple purposes. When coupled with air sparging (AS), SVE can be an effective alternative in removing volatile contaminant mass from groundwater and the vadose zone. An SVE system can also provide for protection of the vapor intrusion pathway, although a SVE system is commonly installed more deeply than a SSDS.

The Cleanup Action Plan (CAP) dated August 2023 includes AS coupled with SVE within the selected alternative (Alternative 7). According to the CAP, the SVE "will reduce potential exposures through vapor intrusion". This coupling of AS with SVE is particularly important in proximity to buildings, since AS systems can result in significant mass transfer of volatile contaminants to the vadose zone. But removal of this contaminant mass within the vadose zone is a significant portion of the effectiveness of AS as a remedy.

Ecology suggests that reference to "SSD" within the work plan should be changed to "SVE", consistent with the CAP. Testing is commonly needed for SVE design, but is not commonly done for SSDS design, since the permeability of the sub-slab aggregate in a new building would be known, and the effectiveness of a SSDS should generally be assured. SVE, on the other hand, can have success limited by insufficient permeability within the vadose zone.

Ecology has not concluded that SVE is not warranted, but rather that an SVE system must be installed within vadose zone soil and there is a significant concern that the depth to groundwater within the creosote area is currently very limited (as shallow as 1.3 ft btoc). Hence, a SVE system may not be

practicable prior to first bringing in additional fill. Another concern would be too shallow a SVE system with no concrete or asphalt "cap" may result in short circuiting to the surface. Hence Ecology is skeptical regarding conducting SVE testing at this time prior to additional fill being brought into this area. A SSD system installed within sub-slab aggregate may have potential to meet the needs of the project for an SVE system (removing vadose zone mass and protection from vapor intrusion) without testing, but of course, such a system would generally be installed as part of a new building slab construction.

Another possibility is to install a SVE system at a depth that may become occasionally saturated– presumably, a SVE system could be shut down if the perforated PVC used for vapor collection was under the water table, and the system brought back online after water levels dropped. I am not aware of any SVE systems operating in this manner, but I would assume that this approach would not be desirable.

B11 - Creosote Area – Section 3.4.6.3 Air Injection Testing – ROI Testing

A key element for the air injection testing is defining the radius of influence (ROI) and thus appropriate design spacing for air sparge wells. In addition to the measurements proposed to define the ROI, **Ecology recommends use of pressure transducer/data loggers during such testing**. Such loggers typically also record temperature, which in addition to pressure can provide valuable data for estimating ROIs.

B12 - Creosote Area – Section 3.4.6 Nutrient Injection – ROI Testing

The work plan stated:

> *If significant data gaps are identified, then additional pilot testing of the components may be performed (testing wells will be installed as permanent fixtures).*

Ecology notes that the ROI testing for air injection will not result in the definition of the injection ROI for the BIO solution (nitrate, nutrients, and surfactant). **Ecology recommends conducting solution injection ROI testing to assess the ROI to support system design**. Please add discussion of this within the work plan. Such testing could be based on injecting potable water. **Use of pressure transducer/data loggers during such testing is advised.** We request consulting with Ecology Water Quality Program's underground injection control (UIC) coordinator to assess the need for authorizations for such testing.

An important concern for the remedial design is ensuring that injection of fluids that include a surfactant(s) do not result in mobilization of contamination to currently uncontaminated areas. For example, if injection of a solution containing a surfactant found a highly permeable lens, then transport of contamination could be significant. Ecology requests consideration of this concern during the design of both testing, and the ultimate remedial design.

B13 - Creosote Area – Section 2.2.3 Remediation Levels

The cleanup levels (CULs) and remediation levels (RELs) presented in the Work Plan Section 2.2.3, including the tables on page 13, are not consistent with the remediation levels presented within the final Cleanup Action Plan (CAP) dated August 2023. **Please revise this section and the tables on page 13 to be consistent with the tables in the CAP (page 23)**. This includes, but is not limited to:

- Addition of the CUL of 0.015 µg/L cPAHs in groundwater which was included within the CAP.

- Deletion of the REL of 4,900 µg/L for naphthalene (4,900 µg/L for naphthalene in shallow groundwater with IC and EC or no structures) which was not included within the CAP.

We suggest copying the text in these tables verbatim from the CAP to avoid potential confusion.

Comments – Permitting and Reporting

C1 - Permitting – Section 3.5.1 Archeology

As discussed in a Site meeting, Ecology's new rule requires development of a Tribal Engagement Plan as well as requirements for consultation with the tribes. Ecology plans to submit a request for a tribal consultation for the proposed work. Other requirements for cultural resource compliance could follows. **Please mention tribal consultation within the work plan**.

C2 - Permitting – Section 3.5.2 Air Emissions

As discussed above, Ecology is questioning the need for SSD testing at this time, although we note that the design and operation of an SSD should including meeting all air emission requirements. **Noting the highly noxious nature of the contamination in the creosote area, treatment of an SSD discharge may be warranted and appropriate**.

C3 - Permitting – Section 3.5.3 Water Quality

Ecology notes that all water discharges must comply with state and local requirements. Pretreatment of dewatering water and pumping test water prior to discharge (e.g. to the sanitary sewer may be necessary) and potentially required. Use of an oil/water separator may be needed if there is sheen or product on top of the excavation water. Ecology requests to be copied on all correspondences related to water discharges. No discharge of investigation-derived waters to the surface, stormwater features, or the marine environment should occur.

C4 - Permitting – Section 3.5.4 Waste Management

Ecology requests documentation of disposal of investigation derived wastes (IDW) within the report to be prepared documenting the PRDI Step 2 Upland work (see following comment regarding reporting).

C5- Reporting – Section 4

As discussed in the Agreed Order, Second Amendment, Task C1 is the preparation and submittal of a draft PRDI data report. **Ecology requests addition of Section 4, Reporting, to the work plan**. We anticipate it may facilitate both preparation and review to separate the uplands from the sediments PRDI work into two separate reports.

The uplands report should include maps showing sampling locations, tables presenting data, and analysis of the data (e.g. delineated excavation lateral extent and depth, and the derived radius of influence for later use in design). Appendices should include, but not be limited to boring logs, laboratory analytical reports, data quality review, field data forms, and disposal documentation for IDW.

When presenting tables with results for soil and groundwater sampling, please include all historical and current results. As discussed above, for the creosote area, please also include tabulation of field observations used to delineate the "hot spot" area(s).

The data quality review appendix should discuss any laboratory qualified data, review field and laboratory quality controls samples (e.g. blanks, duplicates, laboratory control samples [LCS], matrix spikes [MS], and discuss the overall usability of the acquired data.

For the investigations in the Woodlife area, we anticipate that stormwater controls will be needed to prevent runoff from West Marine View Drive. Please include within the report, documentation of the mitigation measures employed to prevent runoff from entering the investigation area during the Step 2 investigations.

For the resiliency to climate change requirement in the new rule, please include in the report an aerial map showing the current inundation area under king tides, and the anticipated future inundation area taking into account anticipated sea level rise from the previously provided sea level rise analyses.

C6 - Professional License Stamp

Please include appropriate professional license stamps and signatures on the revised work plan.

Comments – Appendix A – SAP and QAPP

D1 - General Comment

Please adjust the language within the SAP and QAP, as appropriate, to be consistent with the above work plan comments.

D2 - SAP Section 2.1

Please adjust the language as follows (inserted text in bold):

> *Groundwater and soils will be analyzed by **Washington State-**accredited laboratories using ~~U.S. Environmental Protection Agency (EPA)~~ **Ecology**-approved analytical methods with appropriate detection limits. **Detection limits must be lower than cleanup levels defined in the Cleanup Action Plan (CAP).** Laboratory quality objectives are shown in Table 2.*

D3 - SAP Section 2.1

The document states:

> *Final specifications of soil borings and well constructions will be dependent upon conversations with the drilling subcontractors and field observations.*

Ecology notes that depths are commonly adjusted by field geologists based on field observations. Drilling subcontractors should generally not be adjusting installation specifications outside of ensuring compliance with well construction regulations. Any adjustments beyond those that are typically done by field geologists (e.g. adjustments in monitoring well screened intervals) should be communicated to Ecology prior to implementation.

D4 - SAP Page 5, Sample Procedures (Woodlife)

Please adjust the language as follows (inserted text in bold):

1.Soil borings will be advanced with a direct push (i.e. Geoprobe) drilling rig operated by a Washington-licensed drilling subcontractor to an initial depth of 10 feet bgs. The soil cores are typically completed as 5-foot intervals ***(continuous soil sampling)****. Areas with concrete surface will be cored prior to Geoprobe drilling and areas with asphalt pavement will be driven through the asphalt with the Geoprobe drilling rig.*

D5 - SAP Page 5, Sample Procedures (Woodlife)

The document states:

4.Sample intervals for laboratory analysis will be based on the CSM presented in the Upland PRDI WP, field observations, and previous investigation findings, and per the following procedure as shown on SAP Figure 4a to 4c.

Please note Ecology's above comments A1 and A2. Soil sample results below CULs must define the base of the excavation, not by interpolation. Reserve samples should be collected and run to ensure that the deepest soil sample at each location is below CULs for DFs (noting the anticipated constructability limit of 9 ft bgs stated in the SAP). Note that field screening may be of limited utility for assessing the potential presence of DFs at concentrations above the CUL.

D6 - SAP Page 5, Sample Procedures (Woodlife)

The very high PID readings at GP-501 may drive field screening for excavation and offsite disposal for a separate contaminant release in this area. Please add PID screening to the sample procedures for the Woodlife area borings. If the requested boring offset at GP-501 does not show elevated PID readings (demonstrating that the report PID readings at this location were in error), then there may be potential for discontinuing PID measurements in this area.

D7 - SAP Page 6, Sample Procedures (Woodlife)

The document states:

5.Soil borings will be backfilled with bentonite chips to the approximate ground surface and hydrated and the surrounding surface material will be patched with like material.

Ecology anticipates that the stormwater concern discussed above will be addressed such that no ponding occurs in the Woodlife area. However, if there is any potential for ponding to occur subsequent to drilling and before excavation work, then asphalt patch should be applied to the surface at each boring location.

D8 - SAP Page 9, Sample Procedures, Shallow Zone Groundwater Assessment

The document states:

1. Following completion of the Geoprobe drilling, the soil boring will be overdrilled with an auger using a hollow-stem auger drilling rig (or auger attachment for the Geoprobe rig) to approximately 15' bgs. No split spoons or soil sampling/screening will be performed; however, the soil cuttings will be visually observed for significant field impacts not observed in the Geoprobe cores.

2. A 2-inch diameter 10-foot section of slotted well screen will be installed with blank PVC risers to above the ground surface. The annulus of the well screen interval will be backfilled with a silica sand filter pack to approximately one-foot above the well screen, followed by a hydrated bentonite seal to approximately one-foot bgs. A concrete surface seal and traffic-rated flush mount well box will be installed at the surface and allowed to set for a minimum of 48 hours.

As discussed above, to assess the zone where excavation and dewatering will take place, Ecology recommends that the shallow monitoring wells be installed to a depth no greater than 10 ft bgs. Drilling to 15 feet and backfilling to 10 ft bgs with bentonite would be acceptable such that additional characterization of the soils immediately below the excavation bottom is done. We recognize that the shallow pumping well may need to be screened deeper so that it does not dry up during pumping.

D9 - SAP Page 9, Sample Procedures, Shallow Zone Groundwater Assessment

No well screen slot size was specified in the SAP. In Ecology's experience, a 0.010 slot size can be a barrier to product entering a monitoring well, whereas a 0.020 slot size can more easily allow product to enter. However, minimizing turbidity can be an important, if characterizing dissolved phase contamination is the primary objective. Ecology also notes that the potential presence of LNAPL also necessitates the top of the well screen to extend above the water table. In some cases, it can be challenging to install a shallow enough well screen and meet well construction regulations. Hence, one option, if groundwater is very shallow, is to complete some wells to a depth of less than 10 feet, which is less than the limit required for registration of wells in Washington State (and thus the surface seal minimum thickness requirement is not invoked. If there is any potential for product within in the excavation, the installation of one or more shallower point to assess this concern may be warranted. An added benefit of this would be not needing to file well decommissioning paperwork for wells less than 10 feet deep within the excavation area, as well as not needing to install a surface installation (other than to temporarily protect the PVC point).

D10 - SAP Page 10, Section 2.6 Deep Zone Groundwater Assessment

The document states:

Five deep groundwater monitoring wells will be co-located with soil borings completed as part of the Hot Spot delineation assessment and their location will be based on an estimate of whether they will remain outside of the excavation footprint, but still within the deep groundwater zone area of impacts (see proposed locations on SAP Figure 5). As opposed to the shallow monitoring well installations, it is not feasible to advance every soil boring that is part of the Hot Spot soil delineation to the deep zone.

Ecology notes that in order to characterize worst-case conditions, one of the deep zone monitoring wells may need to be within the anticipated excavation area. Although Ecology concurs with the goals of the preservation of the monitoring wells to the extent possible, this should not be done to the degree that results could be inappropriately biased. If a location is installed within the excavation area, then such a well would need to be properly decommissioned by a licensed well driller prior to excavation.

D11 - SAP Page 10, Section 2.6 Deep Zone Groundwater Assessment

Similar to shallow zone monitoring wells, no proposed well slot size was given in the work plan for deep monitoring wells. A 0.010 slot well screen will likely impede entry of DNAPL into the wells. Even a 0.020 slot could potentially impeded entry of a highly viscous DNAPL product. Hence, proper design of monitoring wells to characterize DNAPL should be closely examined.

If any measurable thickness of LNAPL or DNAPL is found in any site monitoring wells, Ecology recommends collecting a product sample(s) for laboratory analysis for chemical composition as well as density.

Ecology also notes that an interface probe should be used for water level and depth to product measurements if any LNAPL or DNAPL is encountered.

D12 - SAP Page 12, Section 2.7 Geotechnical Assessment

The document states:

> *If very loose sands are encountered, an alternate drilling method (i.e., mud rotary drilling) may be needed.*

Ecology highly recommends sonic drilling in case of heaving sand problems rather than mud rotary drilling. Unlike mud rotary drilling, sonic drilling generally results in excellent and continuous soil sample recovery.

D13 - SAP Page 14, Section 2.8 Aquifer Pumping Test

Please note Ecology's above comments regarding shallow pumping and monitoring well screened intervals. These wells should be designed to provide data targeting the excavation maximum depth of 9.0 ft bgs. Therefore, a shallow pumping well screened from 15 to 20 ft bgs does not make sense to Ecology (a screened interval from 5 to 15 feet would make better sense). Although a permanent water supply well typically has a pump set above the well screen (or installed with shroud), it is not uncommon for pumping tests to be conducted with the pump set within the well screened interval.

For the deep pumping wells, a well screen longer than 5.0 feet may be advisable, since aquifer materials may not have sufficient yield. Ecology recommends a significantly larger screened interval (e.g. 35-50 ft bgs) to ensure that target pumping rates can be achieved.

D14 - SAP Page 15, Aquifer Testing Procedures

The document includes:

> *a. Background data will be collected for approximately two weeks.*
>
> *b. Manual soundings will be made when the pressure transducers are installed and before the aquifer test begins. Data from the pressure transducers will be downloaded before every test to ensure that data is being recorded properly.*
>
> *c. The background data will be used if correcting water levels for tidal or barometric effects is warranted. Tidal fluctuations in the estuary will be monitored by installing a temporary well that extends into the adjacent surface water at the end of the property.*

Manual water level readings should also be taken prior to pulling the pressure transducer/data loggers and are suggested for several points in between. This allows for corrections to be applied to the pressure transducer data, if stray occurs, or even rejection of the data, if failure occurs.

In addition to tidal effects, Ecology requests that the heads in the monitored wells be compared with the marine head measurements in order to assess gradients during the course of the background monitoring. This means that pressure transducer data be transformed to elevation data from all locations, including the temporary well installed in surface water. The top of casing of the temporary surface water well and all new monitoring wells therefore need to be surveyed. This gradient data can be assessed by overlaying the groundwater head data with the marine head data within the report prepared for the Step 2 PRDI. These data are anticipated to allow significantly better understanding of the interconnectivity of the groundwater system with the adjacent marine system.

Monitoring wells MW-4, MW-5, MW-6, MW-7, MW-8A/8B, MW-9A/9B, MW-10A/10B, MW-11A/11B, the new shallow and deep monitoring wells to be installed as part of the Upland PRDI activities, and the new pumping wells are proposed for installation of pressure transducer/data loggers during the background monitoring. Ecology concurs with the selection of these monitoring wells and appreciates that this proposed background monitoring will be a thorough assessment.

D15 - SAP Page 16, Aquifer Testing Procedures

The document includes:

> *6. Groundwater pumped during the testing will be containerized pending disposal or discharge.*

Please add additional discussion regarding the capacity of water container(s) that will be needed, and anticipated pretreatment and discharge requirements.

D16 – SAP Section 2.9.2 Microbiological Community Assessment

Ecology notes that the samples collected for microbiological assessment may not be from samples within the highest concentrations soils and groundwater. In addition to microbial communities that are present, the toxicity of the contamination on the microbial community must be considered. For example, gasoline degrading bacteria are commonly present in aquifer systems but appear to be generally limited or defunct in aquifers with gasoline concentrations greater than 10,000 µg/L in groundwater (based on persistency of gasoline contamination source areas). Whether this is due to toxicity effects or solely due to the system becoming more anaerobic (and thus rendering aerobic bacteria inactive) is not entirely clear. Hence, it is appropriate to consider the effects of high concentrations of contamination at the Site on bacterial communities and potential toxicity effects that could potentially impact the success of the proposed treatment. In Ecology's experience, the success of biodegradation is not generally driven by whether certain microbial communities are present (and thus whether supplemental inoculation is performed), but rather if biodegradation is anticipated to occur within the modified geochemical environment. Inoculation may be warranted to help an aerobic microbial community develop more rapidly as the environment becomes more conducive. However, Ecology is skeptical of the pertinence of identifying the specific microbial communities that are present in soils outside of the highest concentration areas in determining the success of biodegradation.

D17 – SAP Section 2.13 Residuals Management

Ecology highly recommends keeping soils and water potentially contaminated with DFs separate from the creosote area contaminated soil and groundwater. In addition, properly separating potentially contaminated soil, water, and other wastes (e.g. PPE and disposable investigation materials) is advised.