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***Remedial Design/Remedial Action
Work Plan
Willamette Cove Upland Facility
Portland, Oregon***

**Prepared for:
Port of Portland and Metro**

**March 27, 2026
32-23011207**



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Abbreviations/Acronyms

Apex	Apex Companies, LLC
ARARs	Applicable or Relevant and Appropriate Requirements
As	Arsenic
bgs	Below Ground Surface
BODR	Basis of Design Report
BNSF	Burlington Northern Santa Fe
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cu	Copper
COC	Chemical of Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
DEQ	Oregon Department of Environmental Quality
D/F TEQ	Dioxin/Furan Toxic Equivalent Quotient
DU	Decision Unit
ECSI	Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
ESCP	Erosion and Sediment Control Plan
Facility	Willamette Cove Upland Facility
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
GPS	Global Positioning System
Hg	Mercury
HI	Hazard Index
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbons
HQ	Hazard Quotient
ISM	Incremental Sampling Methodology
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbons
McCormick & Baxter	McCormick & Baxter Creosoting Company Superfund Site
MHW	Mean High Water
NAVD88	North American Vertical Datum 88
OLWL	Ordinary Low Water Line
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCBs	Polychlorinated Biphenyls
PHSS	Portland Harbor Superfund Site
Port	Port of Portland

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QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RAOs	Remedial Action Objectives
RBC	Risk-Based Concentrations
RD	Remedial Design
RDI	Remedial Design Investigation
RD/RA	Remedial Design/Remedial Action
RD/RA WP	Remedial Design/Remedial Action Work Plan
RG	Remediation Goal
RM	River Mile
ROD	Record of Decision
Sb	Antimony
SCP	Site Conservation Plan
TOB	Top of Bank
UCL	Upper Confidence Limit
UPRR	Union Pacific Railroad
VCP	Voluntary Cleanup Program

1.0 Introduction

Apex Companies, LLC (Apex) prepared this Remedial Design/Remedial Action Work Plan (RD/RA WP) for the Willamette Cove Upland Facility (the Facility) as part of Voluntary Cleanup Program (VCP) Agreement EC-NWR-00-26 between the Port of Portland (Port), Metro, and the Oregon Department of Environmental Quality (DEQ). The Facility is defined in the DEQ Environmental Cleanup Site Information (ECSI) database as ECSI No. 2066. For the RD/RA WP, the site consists of that portion of the upland Facility landward of the top of the riverbank (referred to as the Site). Investigation and cleanup of the riverbank, beach, and in-water contamination are being conducted separately under the Portland Harbor Superfund Site (PHSS) in-water actions overseen by the U.S. Environmental Protection Agency (EPA).

The purpose of the RD/RA WP is to define the Facility remedial action design and implementation process. The scope of the RD/RA WP includes:

- RD/RA activities;
- Schedule;
- Project team;
- Performance objectives including cleanup levels; design criteria and objectives; performance standards; and applicable or relevant federal, state, or local laws, regulations, or guidance;
- Permitting;
- Disposal facilities;
- Site access;
- Design studies;
- Additional sampling;
- Surveys;
- Special circumstances;
- Construction methods and equipment;
- Quality assurance and quality control; and
- Institutional controls.

2.0 Project Area Description

The Site is located along the northeast bank of the Willamette River in the St. Johns area of Portland, Oregon. Figure 1 shows the location of the Site. It is situated between River Miles 6 and 7 on the Willamette River and is mostly in Section 12 of Township 1 North, Range 1 West, Willamette Meridian. The Facility has been owned by Metro since 1996. Figure 2 provides a current plan of the Facility and the surrounding area. For

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describing the Site, it has been divided into the Richmond, West, Central, and East Parcels as shown on Figure 2.

The Site is approximately 3,300 feet long and varies from 80 to 650 feet in width. The edge of the cove is up to 800 feet from the main river channel; it was historically created primarily because of the placement of the embankment leading up to the Burlington Northern Santa Fe (BNSF) railroad bridge. The Facility as defined in the VCP Agreement covers approximately 24 acres of upland area that is inland from the ordinary low water line (OLWL). However, the scope of work for the VCP Agreement limits the work to areas inland from the mean high water (MHW) line (defined as 13.3 feet, North American vertical datum 88 [NAVD88]) to the property line with the Union Pacific Railroad (UPRR). DEQ and EPA have agreed that the riverbank at the Facility (defined as the area from the waterline to the top of bank [TOB]) will be addressed as part of in-water activity. Although the Feasibility Study (FS, Apex, 2019) included the upper portion of the riverbank, the Record of Decision (ROD) and upland RA work does not include any portion of the Facility below the TOB. The Site for the RA, therefore, is that portion of the Facility from the TOB to the inland property line and covers an area of approximately 19.2 acres, divided as follows: Richmond Parcel (0.57 acres) West Parcel (4.28 acres); Central Parcel (7.76 acres); and East Parcel (6.59 acres).

The Site is bordered on the northeast by the UPRR tracks. Farther to the northeast is a vegetated bluff. A residential area is present on top of the bluff and farther inland. Bordering the northwest side of the Site is an industrial property (Crawford Street site, DEQ Environmental Cleanup Site Information #2363) that is currently being used for storage of vehicles apparently supporting salvage operations. To the southeast is an embankment for the BNSF railroad bridge over the Willamette River. On the opposite side of this embankment is the former McCormick & Baxter Creosoting Company, a federal Superfund Site (McCormick & Baxter). Toward the river, the Site is bordered by the riverbank and the surface water of the cove and Willamette River.

The Site is currently vacant, covered with invasive and native vegetation, and it provides habitat for opportunistic use by wildlife. Remnants of previous structures include a large concrete slab foundation and a paved roadway in the eastern portion of the Site, pavement on the Richmond Parcel, as well as several smaller concrete slabs or foundations. The site is not managed for any human use and is posted to prohibit trespassing. However, trespassers do come on the site (e.g., homeless persons and joggers/walkers).

The Site is situated on a terrace created by historical filling. Based on historical maps and photographs, the fill was placed on lowlands and outward into the Willamette River prior to and concurrent with development. The thickness of the fill across the Site is generally in the range of 20 to 30 feet; however, in places, it could be up to 60 feet (such as in a former log pond on the West Parcel filled in the early 1970s). The West Parcel consists of a mixture of roughly equal amounts of silty sand, sandy silt, and silt with some clean sand. The Central and East Parcels consist mostly of sand or silty sand. The observed soil types are consistent with the known fill history where much of the Central and East Parcels were filled in a few large events, but the West Parcel was filled in multiple small events from a variety of sources (Apex, 2019).

Overall, the topography of the Site is relatively flat, with an elevation ranging between 30 and 45 feet (all elevations in the report refer to NAVD88 unless otherwise noted). The surface elevations generally decrease from the West Parcel (35 to 45 feet) to the Central Parcel (30 to 40 feet) and to the East Parcel (30 to 35 feet). Berms and hummocks are occasionally present on the West Parcel and the edges of the East Parcel.

Adjacent to the Site, the riverbank is generally a steep slope down to the river. The BNSF railroad embankment along the southeast perimeter of the cove rises steeply approximately 30 feet higher than the East Parcel. North of the Site, across the UPRR tracks, is a naturally formed bluff rising 50 to 60 feet above the West Parcel, 60 to 120 feet above the Central Parcel, and 120 feet above the East Parcel. This bluff rises at approximately 5H:4V adjacent to the East and Central Parcels. Near the West Parcel, the slope is approximately 10H:3V.

In 2015, Metro conducted a vegetation survey of the Facility that identified approximately 1,000 native trees on the Site. Native species identified on the Site include Pacific Madrone, Bigleaf Maple, Oregon Ash, Black Cottonwood, Oregon White Oak, Pacific Willow, and Scouler's Willow.

3.0 Proposed RD/RA Tasks

The DEQ selected a final RA for the upland Site in the March 2021 ROD (DEQ, 2021). The Port and Metro conducted a Remedial Design Investigation (RDI) to further define the extent of needed RA (Apex, 2023a and 2023b). The RD/RA tasks to be implemented after the RDI include the following:

- Basis of Design Report (completed) – In June 2025, the Port and Metro submitted a revised Basis of Design Report (BODR) (Apex, 2025). The report presented the methodology to be used to conduct the remedial design (RD), including preliminary proposed excavation depths and cap thicknesses. Based on the preliminary design presented in the BODR, a residual risk evaluation was presented in the report. The DEQ reviewed and commented on the revised report (DEQ, 2025). The DEQ did not require submission of a revised report but requested that updated information be presented in future documents, including updates to residual risk evaluations that are presented in this RD/RA WP.
- Supplemental Remedial Design Investigation (Health and Safety Plan, Sampling and Analysis Plan) – This work plan will be modeled on the RDI work plan. The expected scope of additional sampling will include assessing potential on-site borrow of soil beneath the concrete slabs on the East Parcel, assessing the Richmond Avenue parcel Decision Unit (DU), and refining vertical delineation of contamination on selected DUs.
- 30% RD (completed) – The 30% RD drawings and specification outline were submitted to DEQ on February 2, 2026. The 30% RD was presented to the DEQ in a meeting on February 4, 2026. The presentation covered design objectives, criteria, and standards; description of design elements;

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preliminary drawings; specification outline; description of issues that may delay the project schedule; and a preliminary construction schedule.

- 60% RD – The 60% RD will expand on the 30% RD by addressing DEQ comments on the 30% RD and include the same elements as the 30% RD in a preliminary design report.
- 90% RD – The 90% RD will be prepared to serve as final design in the event the DEQ has no further comments. It will contain a compilation of major design items including the following:
 - Design criteria/standards;
 - Final design/analyses calculations;
 - Drawing index and final drawings;
 - Specifications;
 - Construction schedule;
 - Description of remedial action activities to be performed, including methods and equipment for:
 - Mobilization;
 - Site preparation;
 - Demolition, clearing, and removal of existing pavement and foundations;
 - Excavation:
 - Estimates of soil volumes to be excavated;
 - Detailed site layout drawings, delineating the areas to be excavated;
 - Excavation methods, including area delineation, slope stabilization, characterization and management of excavated materials, runoff management, and incorporation of confirmation sampling;
 - Capping:
 - Grading;
 - Fill placement;
 - Surface drainage;
 - Site restoration planting;
 - Description of permitting requirements to include:
 - Construction/operating permits required;
 - Permitting authorities and specific permit requirements;
 - Permit application processing procedures, schedule, and fees;

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- Monitoring and compliance testing requirements;
- Identification and description of construction quality assurance/quality control (QA/QC) program requirements and procedures for construction QA/QC program implementation;
- Construction controls:
 - Description of proposed control measures to minimize potential releases of hazardous substances to all environmental media during construction;
 - Description of proposed surface water runoff control measures during construction;
 - Identification and description of dust control and noise abatement measures to minimize and monitor environmental impacts of construction or installation activities;
 - Identification and description of any site security measures necessary to minimize exposure to hazardous situations during RA;
 - Identification and description of transportation requirements, including haul route selection, load limits, truck haul schedule, restricted routes, traffic control needs, accident prevention and response, and decontamination;
 - Land disposal requirements to include:
 - Identification and description of off-site land disposal facilities;
 - Specific disposal requirements.
- Final RD – Final RD, if necessary, will include revisions to 90% RD required by DEQ plus the draft bid package for procuring the construction contractor.
- Contractor Procurement – This will include advertising the bid, evaluating bids, and selecting the construction contractor.
- RA Construction Work Plans (Health and Safety Plan, Transportation and Disposal Plan, Construction Quality Assurance and Control Plan, Emergency Response and Reporting) – The contractor will be required to update plans from the final design specific to the planned means and methods.
- RA Construction.
- RA Oversight and Reporting (Construction Completion Report) – A representative of the Performing Parties (see Section 6) will provide full-time oversight of construction and prepare a report documenting compliance with the RD.
- Institutional Controls (Institutional Controls and Implementation and Assurance Plan) – A plan will be prepared identifying the institutional controls and how those controls will be implemented. This will generally include recording a deed restriction or equivalent with the property identifying the nature of contamination, use restrictions (e.g., residential), and necessary long-term controls.

- Long-Term Inspection and Maintenance (Cap Inspection and Maintenance Plan, Contaminated Media Management Plan, Community and Outreach Plan, Monitoring and Performance Evaluation Reports) – These work plans and reports will be developed and implemented to conduct long-term inspection and maintenance of the site cap.

4.0 Updated Residual Risk Screening

In their comments on the BODR, the DEQ requested updated risk evaluations to include the following:

- Tables and figures showing baseline and residual risk for each ecological receptor and human health. Risk values should be evaluated for each DU and depth.
- In evaluating uncertainty based on variability between replicate samples, data adjustments should be evaluated for the following:
 - West Parcel:
 - Polychlorinated biphenyl (PCB) Aroclors and total PCBs
 - Polychlorinated dibenzo-dioxin/furans (D/F) and 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent (D/F TEQ)
 - Polycyclic aromatic hydrocarbons (PAHs), total high molecular weight PAHs (HPAHs), total low molecular weight PAHs (LPAHs), and carcinogenic PAHs (cPAHs)
 - Mercury (Hg)
 - Central Parcel:
 - PCB Aroclors and total PCBs
 - PAHs, HPAHs, LPAHs, and cPAHs
 - D/Fs and D/F TEQ
 - Dibenzofuran
 - East Parcel:
 - PCB Aroclors and total PCBs
 - D/Fs and D/F TEQ
 - Antimony (Sb), arsenic (As), copper (Cu), lead (Pb), and mercury

Appendix A presents the requested tables and figures and provides a discussion of the data and analysis used to generate them.

5.0 Proposed RD/RA Schedule

Figure 4 presents the proposed project schedule to complete the RD/RA. Major milestone target completion dates are summarized as follows:

- 60% RD – Q2 2026
- Supplemental RDI – Q3 2026
- 90% RD/Final RD – Q4 2026
- Remedial Action:¹
 - Phase 1 Excavation – Q3 2027
 - Phase 2 Cap Eastern Portion – Q4 2027
 - Hiatus (In-Water Remedial Action) – Q3 2029
 - Phase 3 Cap Western Portion – Q4 2029
- Construction Completion Report – Q2 2030

6.0 Project Organization

6.1 Project Team

The RD/RA project team consists of the following parties:

- Regulatory Agency – DEQ is the lead agency overseeing the RD/RA.
- Performing Parties – Metro is the property owner, and through a cooperative agreement, Metro and the Port are the performing parties.
- Project Consultant – Apex is the lead engineering consultant responsible for preparing the RD.
- RA Contractor – The RA contractor will be responsible for implementing the RA. The RA contractor has not been selected.

6.2 Key Personnel

Key personnel and their roles/responsibilities are discussed below.

¹ Phase 1 excavation schedule assumes earliest possible start date based on 100% RD by end of 2026. The RA schedule is highly dependent on the in-water RA schedule.

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DEQ Project Manager. DEQ is the regulatory agency responsible for overseeing the RD/RA. In this capacity, DEQ reviews design documents, plans, specifications, and construction reports to confirm that the project is meeting the requirements of the Facility ROD (DEQ, 2021). The DEQ Project Manager is Erin McDonnell, P.E., who will manage DEQ's oversight of the RD/RA.

Performing Parties. The RD/RA is being completed by the Performing Parties. The Performing Parties review the work products prepared by its consultants. The Performing Parties collectively provide direction to the RD/RA Consultant, ensure compliance with VCP Agreement EC-NWR-00-26 and the ROD, and oversee the project budget, schedule, and execution. The Performing Party Project Managers are Dwight Leisle for the Port of Portland and Alison Clements for Metro.

RD/RA Consultant. The RD/RA Consultant, Apex, is responsible for the development of RD documents. Key team members and their responsibilities include:

- Consultant Project Manager – Steve Misner, RG, is the Consultant Project Manager. In this role, Mr. Misner is the direct line of communication between Apex, the Performing Parties, and the Regulatory Agency. He is responsible for production of project deliverables, managing the schedule and budget, and performing the administrative tasks needed to ensure timely and successful completion of the work. He provides the overall programmatic guidance to support staff and subcontractors, ensuring that documents, procedures, and project activities meet the RD/RA objectives. Mr. Misner has 38 years of remedial investigation experience including project management, client program management, remedial investigation report preparation, regulatory interaction and implementation of field activities.
- Engineer of Record – Herb Clough, PE, is the project Engineer of Record. With the support of his engineering and design team, Mr. Clough is responsible for RD plans and specifications and addressing issues related to technical matters. He has 40 years of geotechnical and environmental assessment and remedial experience including design and implementation of upland source control cleanups at multiple sites in Portland Harbor.

7.0 Summary of Selected Remedy

The DEQ selected a final soil RA for the Site in the March 2021 ROD (DEQ, 2021). In summary, the selected RA in the ROD consists of the following elements:

- Excavation and off-site disposal of soil exceeding hot spot levels for human health;
- Excavation and off-site disposal of soil exceeding non-dioxin/furan (e.g., metals including mercury) hot spot levels for ecological health;

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- Consolidation and on-site capping² (using a demarcation layer and minimum 3 feet of clean material) of a) soil posing an excess risk to humans but below hot spot levels; and b) soil with higher risk levels relative to plants and animals, including hot spots;
- Allowance for alternative techniques to save native trees during excavations;
- In-place covering of residual soil contamination posing a lower-level risk to plants and animals following off-site disposal and on-site consolidation³ and capping. Cover thickness would be determined based on the level of residual risk; however, a minimum of 1 foot of clean topsoil will be necessary with 3 feet of clean soil cap in areas with remaining ecological hot spots;
- Long-term monitoring and maintenance of all engineering controls, including caps and soil covers. A cap inspection and maintenance plan, a contaminated media management plan, and a community and outreach plan will be developed;
- Institutional controls, including recording of a deed restriction or equivalent, with the property identifying the nature of contamination, use restrictions (e.g., no residential usage), and necessary long-term controls; and
- A contingency remedy incorporated by DEQ that allows for Metro to elect to perform additional measures during RD and in consultation with DEQ to align with final plans for use of the Site.⁴ Under this framework, Metro can eliminate or greatly reduce the volume of soil to be consolidated on-site and instead transport the excavated soil off-site for disposal at a regulated waste facility.

The planned remedy is consistent with the ROD and generally includes removal and off-site disposal of soil with COCs above hot spot levels or posing an excess risk to humans followed by installation of a cap over remaining soil exceeding ecological risk levels. The ROD does not require off-site disposal of excavated dioxin/furan ecological hot spots, but to the extent practicable, those hot spots were to be excavated and placed into a consolidation cell. With Metro exercising the contingency remedy, materials that were planned for the consolidation cell will be disposed of off-site. However, based on the RDI data, most of the excavation will be driven by ecological hot spots for mercury.

Based on evaluation of the data collected during the RDI, where excavation is needed, depths are anticipated to range from 1 to 3 feet bgs. The thickness and composition of the soil cap will vary depending on the residual contamination. Site restoration will be conducted in coordination with the Metro master plan currently under development and the in-water RA.

² In 2022, the Metro Council elected to implement the contingency remedy in the ROD whereby soil designated for excavation and on-site capping in a consolidation cell will instead be disposed of off-site in a regulated landfill.

³ As indicated in the prior footnote, the Metro Council has elected to implement this contingency remedy.

Implementation of the selected remedy (including the contingency remedy that Metro has elected to perform) will allow for full access to the Site, on and off trails, in accordance with Metro's intended future use as a nature park.

8.0 Performance Standards and Design Criteria

8.1 Remedial Action Objectives

Remedial Action Objectives (RAOs) are the objectives or goals for the RA established in the ROD (DEQ, 2021) to achieve protection for human and ecological receptors. The ROD identified the following RAOs:

1. Prevent exposure of human receptors (recreational/park user, transient trespasser, construction worker) to soil containing COCs at concentrations exceeding individual and cumulative acceptable risk;
2. Prevent exposure of ecological receptors (mammals, birds, invertebrates, plants) to soil containing COCs at concentrations exceeding individual and cumulative acceptable risk levels;
3. Remove or treat soil hot spots of contamination to the extent feasible and practicable; and
4. Prevent further migration of contaminated upland soil to the river, to the extent practicable.

8.2 Remediation Goals

The remediation goal (RG) is defined as the soil concentration corresponding to the acceptable risk level (or the background concentration if the acceptable risk level is less than background) for the corresponding COC, receptor, and exposure area. The RG values and the use of RGs in RD are discussed below.

Receptor-specific risk-based concentrations (RBCs) were developed in the baseline risk assessments (Formation Environmental, 2013 and 2014) and the FS (Apex, 2019). The lowest RBC (or the background concentration, whichever is greater) for each COC was selected as the preliminary remediation goal (PRG) for that COC. PRGs are conservative screening levels used during the RD investigation to ensure that data collected will adequately characterize the nature and extent of contamination for use in RD. The PRGs correspond to the lowest RBC for ecological receptors and the lowest RBC for human receptors. The RBCs and PRGs are presented in Tables 1 and 2 (adopted from the BODR) for human and ecological receptors, respectively. Table 3 presents the RGs.⁴ RGs will be used in RD as follows:

- Immobile receptors (plants, invertebrates): For immobile receptors, soil concentrations representing DUs of approximately 0.5 acres will be compared to RGs. RD will define removal or risk management

⁴ RBCs that are the basis for the RGs were developed prior to EPA's most recent updates to evaluation of lead risk for human health (based on acceptable blood lead concentrations in children). The RD will demonstrate that the remedial action will adequately address lead to meet EPA protective levels.

actions in each DU where a COC concentration equals or exceeds an RG for immobile receptors. The RG for each COC for immobile receptors is the lower of the plant or invertebrate RBC (or the background concentration if greater than the RBC) for that COC.

- Mobile receptors (birds, mammals, humans): For mobile receptors, soil concentrations representing DUs of approximately 0.5 acres will be screened against RGs. If concentrations are lower than RGs then the risks are acceptable. If any concentrations exceed RGs, soil concentrations representing exposure areas (exposure point concentrations) will be compared to RGs for the receptor(s) with screening exceedances. The exposure areas evaluated will be the West, Central, and East Parcels, corresponding to the primary exposure areas used in the baseline risk calculations (Formation Environmental, 2013 and 2014). The exposure point concentration for a parcel will be calculated as the 90 percent upper confidence limit of the mean (90 UCL) of the applicable data from the DUs within that parcel. As a result, for mobile receptors, it is possible for an individual DU COC concentration to exceed the RG but the exposure point concentration for the parcel to be less than the RG. In that event, no risk management would be required for that COC/receptor on that parcel. RD will address removal or risk management actions on each parcel where a COC exposure point concentration equals or exceeds an RG for mobile receptors (generally focusing on addressing the DUs with higher COC concentrations until the risk at the parcel is acceptable). The RG for each COC for mobile ecological receptors is the lesser of the bird or mammal RBC (or the background concentration, whichever is greater) for that COC. For human health, the RG for each COC is the lowest of the human receptor RBCs (or the background concentration if greater than the RBC) for that COC (i.e., the RBCs for the park user receptor).

8.3 Hot Spot Levels

For soil, a hot spot exists if the Site presents an unacceptable risk and if the contamination is highly concentrated, highly mobile, or cannot be reliably contained. Hot spots were evaluated in the feasibility study (Apex, 2019), and only high-concentration hot spots were identified. For all receptors, hot spots are evaluated on a point-by-point basis. Therefore, soil concentrations representing DUs of approximately 0.5 acres will be compared to hot spot levels. The RD will specify removal of human health hot spots and ecological non-dioxin/furan hot spots. Dioxin/furan hot spots for ecological receptors may be managed with a minimum 3-foot cap if removal is not practicable. The hot spot level used in the RD is the lowest of the hot spot levels for any receptor. Table 3 lists the hot spot levels and corresponding receptors that define the hot spot levels.

8.4 Remedial Design Dataset

The RD dataset is discussed in Section 4 and Appendix A.

8.5 Other Design Criteria

Additional design criteria to be used in RD are discussed below.

8.5.1 Native Tree Preservation

During the ROD comment period, DEQ received substantial support from the public to preserve native trees. In the 2015 removal action, special techniques were used to preserve native trees within the removal action area. These special techniques, implemented within the driplines of the trees and intended to preserve tree roots, limited excavation depths and residual soil cover thicknesses to approximately 6 inches. Therefore, given the widespread presence of COCs exceeding RGs and/or hot spot levels to depths greater than 6 inches, tree preservation would have a corresponding increase in residual risk. During RD, native tree preservation will be evaluated on a case-by-case basis in DUs where the ecological HQ is less than 5 and HI is less than 10. Following this criterion will limit evaluation of tree preservation to DU-3, DU-37, DU-38, DU-39, DU-40, DU-43, and DU-44.

8.5.2 Site Clearing

Invasive Species Removal. Invasive species, including roots, will be cleared from the entire Site and composted or disposed of off-site. In areas targeted for excavation, root removal may be conducted in conjunction with excavation.

Woody Debris Salvage. The design will evaluate potential for salvage of large trees cleared from the Site for re-use in habitat enhancement or other site features, if deemed safe. At a minimum, some or all of the native trees cleared from the Site without root balls will be stockpiled for reuse in upland restoration or as in-water large woody debris. (The number needed for salvage will be determined during design, including consultation with the In-Water Remedial Design Group [In-Water Group]) If it is desired to salvage trees with intact root balls, all contaminated soil must be removed from the root ball. The design will evaluate potential for salvage of large trees that include root balls (see discussion of green waste in Section 11).

8.5.3 Cap Criteria

Cap Thickness. Soil caps will be installed at locations that have post-excavation unacceptable ecological residual risk. In general, caps will consist of soil with a thickness of 1 or 3 feet (inclusive of the surface layer that will consist of a minimum of 1 foot of topsoil planted with native grasses, shrubs, and trees). Cap thickness will be established as follows:

- Residual HI less than 1: No cap.
- Residual HQ equal to or less than 5 and residual HI equal to or less than 10: 1-foot-thick cap.
- Residual HQ greater than 5 or residual HI greater than 10: 3-foot-thick cap with demarcation layer defining the boundary between residual soil and the cap.

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Cap and Other Fill Soil. Cap soils will generally consist of topsoil and general fill (e.g., silty sand). These materials will be obtained from on-site borrow or imported from off-site sources. In either case, unless otherwise approved by the DEQ, these soils will have concentrations of Site COCs below the RGs or below DEQ Clean Fill Levels for chemicals without RGs. Prior to use, the soil will be evaluated for compliance with these criteria. Samples of borrow or imported soil will be collected for laboratory analysis and analyzed for dioxin/furans, metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc), PCBs, and PAHs (including dibenzofuran).

Soil may be imported from off-site for use as temporary roadways and staging pads, general fill, or topsoil. Gravel (soil with particle sizes greater than No. 4 sieve size) from a virgin commercial source will be sampled for metals analysis only. The method and frequency of sampling imported fill and topsoil will be submitted to the DEQ for approval and will be determined based on the source of the material. In general, materials imported from a virgin, commercial source would have a lower sampling frequency. Recycled materials or soil imported from private sources would have a greater sampling frequency.

Fill may be obtained from on-site borrow areas if it meets the criteria discussed above. The method and frequency of sampling borrow materials will be submitted to the DEQ for approval.

8.5.4 Surface Drainage

Currently, the Site is relatively flat with no clear drainage channels. Most rainfall infiltrates into the ground surface. The intent with post-remediation finish grades (after excavation/capping) is to maintain these characteristics, emphasizing infiltration of rainfall. Finish grades may vary by several feet from current grades, but overall existing surface drainage will be maintained. Areas where there could be greater change between current and finish grades include where the riverbank is laid back, areas used for on-site borrow, or future park features. The In-Water Group is evaluating layback of portions of the riverbank. The park design team is collaborating with the In-Water Group and the upland remediation design team to minimize grade changes. Areas between the current top of bank and the new top of bank may have larger grade changes, and surface runoff on the riverbank will be directed toward the river (again, riverbank layback, including erosion protection, will be addressed by the In-Water Group). If borrow materials are obtained from an on-site area, finish grade could be lower in that area. Restoration of that area will account for the grade change and include habitat restoration consistent with the final elevations. The future park may include mounded areas to accommodate variable habitats and/or program elements within the park.

8.5.5 Site Restoration

Following site remediation, Metro is planning to construct a nature park at the Facility. Metro has developed a Site Conservation Plan (SCP) and is currently developing a Site Master Plan. Based on the SCP, the conservation targets for the Facility include shallow water habitat along the Willamette River migratory fish pathway, riparian forest, and oak-madrone woodland. Metro is not a partner in the in-water RD; however,

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Metro is collaborating with the In-Water Group to discuss opportunities for improving water quality and restoring fish habitat for salmon and lamprey. Pertinent recommended restoration actions which could apply to the Site include work to:

- Improve riparian buffer density, health, and width and establish high species diversity;
- Maintain and expand Oregon white oak-madrone habitat;
- Restore floodplain function and connectivity; and
- Remove invasive species to reduce habitat stress and create more resilient habitats.

In alignment with the ROD and consistent with Metro's park planning, future land use at the Site is expected to include passive recreation opportunities within a natural area context including a regional trail, water access, nature viewing points, beach access, environmental education programs, cultural elements and interpretation, art, and information signs.

Site restoration will consist of planting finish grade with native grasses, shrubs, and trees to establish vegetation that will prevent surface erosion and support native species. The top 1 foot of the caps will consist of topsoil to support the native vegetation. Areas that will not be capped will also receive 1 foot of topsoil. Site restoration for the RA will be in accordance with City code requirements. In addition, restoration will be consistent with Metro's planned final use (riparian buffer; Oregon white oak/madrone habitat; invasive species removal), but it is not intended to fully implement Metro's SCP.

8.5.6 Geotechnical Considerations

Geotechnical considerations include settlement and riverbank slope stability. Settlement and riverbank slope stability will be evaluated in RD considering net changes in surface loads from excavation and capping. Slope stability will be evaluated by the In-Water Group.

8.5.7 Seismic Evaluation

RD will evaluate seismic hazards resulting from the recommended design earthquake for Portland Harbor (ground motion with a 10% probability of exceedance in 50 years). Associated seismic damage from this hazard level includes liquefaction of riverbanks or destabilization and displacement of riverbanks. These evaluations are being conducted by the In-Water Group. If needed, further evaluation will be conducted for the upland design.

The primary risk associated with seismic hazards is exposure of contaminated soil resulting from failures related to liquefaction/failure of the riverbank slope. The results of the seismic design evaluation will be used to determine mitigating measures against the exposure of contaminated soil. If these measures are

impractical or ineffective, appropriate maintenance and repair measures will be included in the operations and maintenance plan.

8.5.8 Climate Change

Climate change is expected to result in changes to hydrology (both in seasonal patterns of river flow and peak storm event flows) in the Willamette and Columbia Rivers, as well as sea level rise, and thus impact Portland Harbor remedy design (EPA, 2021). The effects of climate change on peak flows, dam operations, typical base flow river stages, and sea level rise on river hydrodynamics in the in-water project area will be considered as part of the flood rise impact evaluation being conducted as part of the In-Water Group RD. Net grade changes resulting from the upland RA will be incorporated into that evaluation.

8.5.9 Green Remediation Practices

Some of the work activities will impose negative environmental impacts that are anticipated and necessary in exchange for the reduction in risk associated with hazardous substances at the Site. Work will be conducted consistent with Green Remediation Best Management Practices: Excavation and Surface Restoration (EPA, 2008) and DEQ's Green Remediation Policy to promote, support, and implement sustainable practices that lessen the overall environmental impact of the cleanup. Green remediation approaches will be incorporated in deliverables throughout the design process. Green remediation strategies to be evaluated in RD include, but are not limited to:

- Use of alternative fuels (e.g. biodiesel) to operate heavy machinery;
- Conserve raw materials such as borrowing clean soil from on-site sources rather than importing soil to the extent practicable;
- Minimize use of potable water;
- Recycle/reuse cleared vegetation (e.g., composting, reuse of woody debris);
- Replant with native vegetation;
- Minimize disturbance of mature native vegetation where possible;
- Control/remove invasive species;
- Sequence work to improve efficiency;
- Consider the carbon footprint associated with travel routes and modes of material transportation for both import and export;
- Use alternative routes and modes of travel where practicable to reduce the impact on the local community;
- Restrict the idling times for heavy equipment and trucks when not being actively operated;

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- Perform routine and on-time maintenance on heavy machinery and trucks to assure fuel efficiency;
- Control and mitigate dust, odors, noise, and light impacts; and
- Identify waste minimization measures and uses of recycled materials.

9.0 Applicable or Relevant and Appropriate Requirements

RA conducted under Oregon cleanup rules must comply with federal, state, and local laws. Table 4 lists applicable or relevant and appropriate requirements (ARARs). The ARARs for the RA generally consist of the following.

- Protection of Surface Water, Wetland, and Drinking Water – Earthwork activities could impact wetlands or water quality. Actions will be identified in RD to minimize or prevent impacts.
- Air Emissions – Potential air emissions include fugitive dusts and engine exhausts. RD will identify methods to prevent or reduce to the extent practicable these emissions.
- Waste Designation, Handling, Transport, and Disposal – The primary protective component of the RA is off-site disposal of contaminated soil. The RD and associated plans will address requirements for activities related to waste disposal.
- Impacts to Endangered or Protected Species or Migratory Birds – The RA activities will include impacts to upland habitat. The RD will evaluate potential impacts and identify actions to reduce impacts and/or restore habitat.
- Protection of Trees – RD will include actions to address local rules for protection of existing trees if possible, or replacement of existing trees if not.
- Protection of Archeological or Historically Sensitive Areas – Archeological and historically sensitive resources have been assessed (Archaeological Investigations Northwest, Inc., 2003). Remaining remnant structures are not historically significant and archeological resources are not expected to be encountered within the planned excavation. However, an Inadvertent Discovery Plan will be included in 60% RD.
- Floodplain Impacts – A portion of the Site in the East and Central Parcels is located within the Federal Emergency Management Agency (FEMA) mapped Special Flood Hazard Area of the Willamette River. Planned changes to finish grade will be incorporated into the flood-rise analysis being conducted by the In-Water Group to verify the RA will not cause a rise in future floods.

10.0 Permitting

RA conducted under Oregon cleanup rules must obtain required permits except to the extent that state and local permits may be exempted pursuant to ORS 465.315(3) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This section identifies applicable permit requirements.

Site Development Permit. The selected upland RA consists primarily of earthwork activities. The work will include tree removal, where necessary, and excavation and/or filling. Earthwork activities will impact an area of greater than one acre. Permits (or permit exemptions associated with earthwork activities) include a site development permit from the City of Portland and a construction stormwater permit (1200-C) to address runoff of stormwater during implementation of the RA in accordance with Portland City Code Title 10. The 1200-C permit requires an erosion and sediment control plan (ESCP) and a contaminated media management plan. No other permits are anticipated associated with the earthwork activities. Requirements for tree preservation and/or replacement under city code Title 11 may also be applicable.

Because a portion of the work will be conducted adjacent to the top of bank, city permitting includes requirements associated with Greenway review in accordance with Chapter 33.440 of the Portland Zoning Code. The Greenway review addresses issues of public access, flood protection, transportation connections, and potential impacts to recreational users. These requirements may include tree/shrub preservation or replacement as part of a mitigation plan.

11.0 Potential Off-Site Disposal Facilities and Disposal Requirements

This section describes the types of waste materials and potential off-site facilities for disposal, composting, or recycling during the RA. A Transportation and Disposal Plan will be developed during RD.

Contaminated Soil. Soil with concentrations of COCs above hot spot levels will be excavated from depths up to 3 feet. Approximately 50,000 cubic yards of soil will be excavated for off-site disposal. The soil generally consists of silty sand and sand but will also contain debris such as brick, glass, and wood. It is anticipated that the soil will be classified as Subtitle D non-hazardous waste. The nearest Subtitle D disposal facilities suitable to accept this waste include the following:

- Waste Connections, Wasco County Landfill in The Dalles, Oregon
- Waste Management, Columbia Ridge Landfill in Arlington, Oregon
- Republic Services, Roosevelt Regional Landfill in Bickleton, Washington

Remnant Structures. Remnant structures associated with historical industrial operations are present on the East and Central Parcels. The remnant structures include structural concrete and concrete pads (including

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rebar) associated with former buildings, asphalt concrete pavement, and potentially wooden pilings. Remnant structures within the planned depth of contaminated soil excavation will be removed and sized for transport. Concrete debris may be crushed and beneficially re-used on-site as temporary haul road aggregate. Material removed from the Site free of staining or treatment chemicals will be disposed of off-site at an approved recycling facility or demolition debris landfill.

Green Waste. Vegetation within the planned area of contaminated soil excavation will be cleared down to the ground surface. This green waste includes trees, shrubs, and groundcover (mainly invasive English ivy, Scotch broom, and Himalayan blackberry). Roots associated with shrubs and ground cover will be removed with contaminated soil. All vegetation above the soil line is anticipated to be either incorporated into the RA restoration, used at another restoration site, sold for commercial value, or disposed of off-site as green waste at an approved recycling site. The Site covers an area of approximately 17.5 acres. Approximately one-third of the Site is forested. The remainder is covered with grass/groundcover or pavement/slabs or is bare soil. It is anticipated that green waste will be sized and removed from the Project Area using local trucking.

Trees may be salvaged for woody debris to be used in site restoration. Root wads on trees will be evaluated during RD for salvage with the trees. Soil adhering to root wads will be removed by scraping and shaking or with water spray. Water will infiltrate and the soil will be removed with other contaminated soil. If soil removal from root wads is not practical, root wads and root balls will be disposed of with the contaminated soil.

12.0 Site Access

The Site is accessible by vehicle from public roadways: North Edgewater Street at the east end and North Richmond Avenue on the west end. Richmond Avenue will be the primary access point from upland. A gravel roadway is present on the Central and East Parcels.

The Site and the riverbank down to the OLWL are owned by Metro, and the submerged lands below the OLWL are owned by the State of Oregon and managed by the Department of State Lands. An access agreement is in place between Metro and the Port to provide access to the Site for RD/RA activities.

To the extent that access to the Site is needed from the river, access will be coordinated with the State of Oregon and coordinated with the In-Water Group.

13.0 Proposed Additional Investigation or Studies

Additional investigation is proposed to address data gaps in the lateral and vertical extent of contaminated soil. No bench scale or pilot scale studies, treatability studies, or unit process evaluations are needed to complete RD.

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Based on the results of the RDI, the remaining data gaps for understanding the extent of contaminated soil include the following:

- Lateral and vertical delineation of COCs on the Richmond Avenue Parcel adjacent to the West Parcel;
- Refinement of vertical delineation in select DUs that may be targeted for partial layer excavation;
- Vertical delineation of COCs in the potential borrow area beneath concrete slabs and along the riverbank;
- Vertical delineation of COCs beyond 3 feet in areas proposed for 3 feet of excavation; and
- Vertical delineation of COCs beneath the soil berm on DU-41.

A supplemental RDI is planned to sample the Richmond Avenue Parcel, select DUs to refine vertical delineation, and delineate clean soil in the potential borrow area. Delineation beyond a depth of 3 feet and beneath the DU-41 soil berm will be addressed during construction.

A work plan for the supplemental RDI will be prepared separately, including a sampling and analysis plan and a health and safety plan.

14.0 Proposed Property, Utility, Right-of-Way, or Topographic Site Surveys

A topographic survey was conducted in February 2021 providing detailed ground surface elevations that will be used in RD. Additional surveys will be conducted including a boundary survey and a survey of manmade Site features. The boundary survey will identify/establish benchmarks to define the Site boundary and ensure that no work is conducted on adjacent properties without access authorization. Manmade features, including a large concrete slab foundation, several smaller concrete slabs, a portion of paved roadway, manholes associated with a city storm sewer that crosses the Site, and other remnant concrete foundations are present on the Site. These features will be surveyed to assist design of demolition needs during RA. In addition, a tree survey will be conducted on the upland and riverbank to provide a basis for restoration and tree replacement.

15.0 Special Design/Implementation Issues

This section describes other design/implementation issues anticipated and how they will be addressed.

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- **Quantity and Size of Debris to be Removed.** Surface and subsurface debris will impact the ability to perform excavation and place capping effectively. Debris will be removed wherever practicable. The survey described in Section 14 will be used to identify demolition needs in RD.
- **Potential Utilities.** Based on prior Site work, the only active utility on the Site is a city-owned storm sewer that crosses the Site. Except for two manholes, the stormwater line is below the depth of excavation. The manholes will be identified by survey during RD and will be protected during RA. City records⁵ show two water lines entering the Site – one near the northwest corner of the West Parcel and one on the east side of the Central Parcel. Utility locating will be conducted to verify presence/location of these water lines. Additional utilities are located in the adjacent railroad right-of-way. These adjacent utilities will be identified in RD/RA but are not expected to be impacted by RA.
- **Construction Materials.** The project will require on the order of 70,000 cubic yards of soil to construct the caps. A supplemental RDI will be conducted, including evaluating areas of potential clean fill for use in constructing caps. It is anticipated that up to 20,000 cubic yards of clean fill may be obtained on-Site. Therefore, the project will require 50,000 to 70,000 cubic yards of imported fill materials. The RA will be conducted at the same time as other RA throughout Portland Harbor. These simultaneous activities may place stress on available materials from vendors who will be supplying other remediation projects in the area. Materials in high demand may include sand and gravel. To mitigate some of those risks, acquiring materials early and outside of potential seasonal price increases should be considered. This could include negotiating a preferred pricing structure or considering an early downpayment for securing minimum volumes of material. Materials could be acquired directly from the supplier or suppliers, perhaps through a separate procurement process. The suppliers could potentially be charged with generating, storing, and maintaining materials for contractor use at appropriate times during construction.
- **Material Transport.** Between export of contaminated soil and import of clean fill, combined import/export is approximately 100,000 to 120,000 cubic yards of soil. Material transportation options include truck, rail, and barge (see further discussion in Section 17). Each of these options will be evaluated during RD considering such factors as availability, impacts to community, coordination with in-water work, and costs.
- **Coordination with In-Water/Riverbank RD/RA.** The Site is located upland of the Willamette Cove In-Water Project Area that is the portion of the Portland Harbor Superfund Site approximately between river miles (RMs) 6.1 and 6.9 along the east bank of the Willamette River. The Site RD process will require ongoing coordination with the In-Water Group to check that the selected remedy satisfies the RAOs of the Site and the in-water project within the transition area, primarily the riverbank. To achieve this, both parties are engaged in ongoing regularly scheduled coordination

⁵ See Portland Maps at https://www.portlandmaps.com/detail/water/SEC-RICHMOND-N-BRADFORD-ST/R324112_did/ and https://www.portlandmaps.com/detail/water/S-N-PIERCE-AVE/R324110_did/.

meetings and shared design document review, and opportunities for realizing efficiencies in RA are being discussed. In addition, Metro property ownership extends from the upland area to the ordinary low water line (OLWL) on the riverbank, and Metro and the Port will continue to coordinate with the In-Water Group on future land-use planning goals, long term maintenance requirements and community priorities. Additionally, the in-water RA intends to use the upland facility for staging and water treatment, and the in-water construction will likely include layback of the riverbank (as identified in the In-Water Group 30% design submitted to EPA October 14, 2025). Both the upland and in-water construction may include material transport via barge. These activities require careful coordination between the upland team and the In-Water Group to avoid delays and additional costs.

- **Stability of Riverbank Slope.** The In-Water Group is responsible for design and construction on the riverbank slopes. Upland activities could influence the stability of the riverbank. Therefore, proposed cuts/fill associated with the upland RA will be provided to the In-Water Group to include in the evaluation of riverbank slope stability.
- **Flood Rise.** Portions of the Site are within the 100-year floodplain. Filling within these areas could influence future flood elevations. Approximately one-third of the Site will have no net change in elevation and other areas will have up to three feet of fill. These changes are small compared to the large cuts expected as part of the riverbank layback, so the upland RA is not expected to result in a future rise in flood elevations. The In-Water Group is conducting hydraulic analysis to analyze potential flood rise. Proposed cuts/fills associated with the upland RA will be provided to the In-Water Group to include in the evaluation of potential flood rise.

16.0 Institutional Controls

Upon completion of the RA, residual soil containing COCs will remain on the Site, and these soils will be capped with 1 to 3 feet of clean soil. The presence of residual soils and the soil cap require restrictions on future site use. These restrictions will be addressed by the following institutional controls.

- **Deed Restriction.** Metro (the property owner) will place the following notifications/restrictions on property deeds:
 - Identify the location of contaminated soil;
 - Identify the presence and thickness of the soil cap and the location of the demarcation layer identifying the transition between the soil cap and underlying contaminated soil;
 - Limit site uses to passive recreation activities (for example, trails, nature viewing points, beach access, water access, environmental education programs, cultural elements and interpretation, art, and information signs);

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- Identify the existence of the Long-Term Inspection and Maintenance Plan and the Contaminated Media Management Plan, both of which must be implemented in perpetuity.
- **Long-Term Inspection and Maintenance Plan.** A Long-Term Inspection and Maintenance Plan will be prepared to identify inspection frequency, inspection methods and locations, typical maintenance activities, and reporting. The plan will identify restrictions on site use related to maintaining the integrity of the cap. The plan will address anticipated potential impacts to the cap to include development work (e.g., planting, utility installation, trail construction), surface erosion, vandalism, animal burrowing, tree fall, floods, earthquakes, and riverbank slope failure. The plan will refer to the Contaminated Media Management Plan as appropriate. The plan will include as-built drawings of the cap.
- **Contaminated Media Management Plan.** A Contaminated Media Management Plan will be prepared to address the safe handling of contaminated media in the event of disturbance of the cap or underlying media. The plan will address soil handling and stockpiling, soil re-use/disposal, dust control, decontamination, and site restoration. The plan will include as-built drawings of the cap and figures and tables providing residual soil data to be used in preparing health and safety plans or planning for disposal of contaminated soil.

17.0 Description of Construction Methods and Means

The RA will be conducted using conventional construction equipment as discussed below.

Vegetation Clearing. Vegetation will be cleared using a combination of tractor mounted brush mowers, chain saws, excavators, and dozers with rake attachments. Trees targeted for salvage will be removed and stockpiled separately. Other vegetation will be mown or dozed. Trash rakes will be used to consolidate vegetation without soil for removal. Root balls that can be cleaned of soil will be salvaged for use as woody debris or disposed of with other vegetation. Root balls containing soil will be removed to be disposed of with contaminated soil.

Debris Removal. Debris will be removed and sized using an excavator with a hammer attachment or a bucket with an articulating thumb. Soil will be removed from debris by shaking, brooming, or water spray. Water will infiltrate and generated soil will be disposed of with contaminated soil.

Excavation and Capping. Excavation and capping will be conducted using earthmovers, dozers, excavators, and/or front-end loaders. Finish grading may be conducted using a grader. The machines may use a GPS grading system for real-time elevation control.

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Material Transport. Materials to be hauled include vegetation, debris, and soil to off-site disposal or recycling facilities and fill soil to be imported to the Site. Potential material transport methods to be evaluated in RD include truck, rail, and barge and these are briefly described below.

- **Truck** – A standard on-road dump truck has a capacity of approximately 10 cubic yards. Combining a truck and trailer or use of a long-bed truck can increase capacity to 20 cubic yards. Off-road truck capacities can be greater. Even if other methods such as barge transport are used for contaminated soil or import fill, trucks will be used for some material hauling. If rail or barge transport are used, soil will be hauled with trucks to the transload point. Materials with smaller quantities and/or local destinations (such as rock for temporary roads or green waste) will be hauled to/from the Site via truck.
- **Rail** – Rail gondolas have a capacity of approximately 70 cubic yards. Loading of rail cars at the Site will require improvements to the adjacent rail system or a nearby transload facility. This will be further evaluated in RD, but rail transport is not expected to be feasible unless developed as part of a larger Portland Harbor transport system.
- **Barge** – Barge transport is feasible given the waterfront location of the Site. Barge transport is expected to be used for the in-water RA. Tugboats would position the barge for loading/unloading. Loaders/excavators and belt systems would be used to transload to/from the barge. Tugboats would move the barge up the Columbia River to a transload facility. The waste material would be loaded onto trucks for the final haul to the landfill. Similar operations in reverse would be used to bring clean soil to the Site. Barge capacity is generally on the order of 2,000 cubic yards.

18.0 Documentation/Validation of RA Activities

18.1 Construction Inspection and Sampling Reports

Monitoring will be performed during RA activities to confirm that the construction engineering controls are maintained and in working order and that the RA is conducted in accordance with RD. Construction engineering controls will include but not be limited to dust control, stormwater best management practices, and activities designed to limit off-site discharge of contaminated soil (e.g., brushing off trucks, containment of material conveyance to barge, etc.). Management of excavation depths and lateral extent will be monitored through global positioning system instrumentation either attached to construction equipment or with periodic surveys.

Soil sampling and chemical analysis will be conducted during RA to verify removal of soil to the extent required by the RA objectives and design standards. The type and frequency of verification sampling will be detailed in the Construction Quality Assurance and Quality Control Plan but will generally follow the same protocol that was used for the RDI sampling including the same DU boundaries, 30-point ISM samples (including DUs that were previously sampled with composite samples), 1-foot depth intervals, and the same analyte list as used

in the RDI. The verification sampling data will be used to adjust cap thicknesses, as appropriate, and update residual concentrations and residual risk estimates.

The Construction Quality Assurance and Quality Control Plan will be developed during RD (see Section 3). Inspection and sampling reports will be submitted in accordance with the scope and schedules set forth in that plan.

18.2 Project Completion Report

A Project Completion Report will be prepared at the completion of the RA construction. The report will be submitted as a draft for DEQ review and comment. A final Project Completion Report addressing DEQ's comments on the draft report will be submitted for DEQ approval. The Project Completion Report will include the following:

- Results of a final inspection, including a brief description of any problems discovered during the final inspection and the resolution of those problems, as necessary;
- A detailed description of all work conducted in accordance with the approved final design plans and specifications, and certification by an Oregon-Registered Professional Engineer and Performing Party's Project Manager that the work was performed in accordance with approved plans and specifications;
- Explanation of any modifications to the approved plans and specifications and why these modifications were necessary;
- Final, as-built drawings;
- Copy of final permits, as applicable;
- Results of verification sampling, including data validation, and certification that the required RA criteria have been attained; and
- Explanation of any additional inspections, operation, and maintenance activities (including monitoring) to be undertaken at the site.

18.3 Monitoring and Performance Evaluation Reports

The Long-Term Inspection and Maintenance Plan and Contaminated Media Management Plan (described in Section 16) require long-term inspection and maintenance for capped areas. Inspection reports, performance evaluation reports, and periodic land use review reports will be submitted in accordance with the scope and schedules set forth in those plans.

19.0 References

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Table 1

Receptor Specific Risk-Based Concentrations, Remediation Goals, and Hot Spot Values for Soil – Human Health

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Willamette Cove Upland Facility

Analyte	Regional Background Concentrations - Portland Basin		Receptor Specific RBCs												Human Health Remediation Goals (RGs)	
			Recreational Trespasser/Park User				Transient Trespasser				Construction Worker					
			Cancer		Non-Cancer		Cancer		Non-Cancer		Cancer		Non-Cancer		Remediation Goal	Hot Spot
	Mean	95% UPL	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot		
Concentration in mg/kg																
Antimony	0.29	0.56	--	--	24	243	--	--	98	980	--	--	31	310	24	240
Arsenic	4.4	8.8	1.4	140	74	740	29	2,900	370	3,700	15	1,500	97	970	8.8	140
Chromium	39	76	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	24	34	--	--	11,000	110,000	--	--	56,000	560,000	--	--	14,000	140,000	11,000	110,000
Lead	27	79	--	--	400	4,000	--	--	800	8,000	--	--	800	8,000	400	4,000
Mercury	0.073	0.23	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	23	47	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	0.33	0.71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	105	180	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cPAHs	--	--	0.55	55	60	600	32	3,200	270	2,700	17	1,700	74	740	0.55	55
Total PCBs	--	--	0.74	74	4	40	14	1,400	18	180	8.4	840	4.9	49	0.74	40
Dioxin/Furan TEQ	--	--	1.50E-05	1.50E-03	1.70E-04	1.70E-03	3.20E-04	3.20E-02	1.10E-02	1.10E-01	1.70E-04	1.70E-02	2.30E-04	2.30E-03	1.50E-05	1.50E-03

Notes:Background concentrations from *Development of Oregon Background Metals Concentrations in Soil*, Oregon DEQ, March 2013

95% UPL = Upper Prediction Limit (95% confidence)

RBC = Risk Based Concentration

mg/kg = milligrams per kilogram

cPAHs= carcinogenic polycyclic aromatic hydrocarbons

HPAH = high molecular weight polycyclic aromatic hydrocarbons

LPAH = low molecular weight polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent

Receptor Specific RBC Concentrations from the Record of Decision for Willamette Cove Upland Site, Oregon Department of Environmental Quality, March 2021 with the exception of arsenic:

arsenic concentration is from the Residual Human Health Risk Assessment Willamette Cove Upland Facility, December 2013

Table 2

Receptor Specific Risk-Based Concentrations, Remediation Goals, and Hot Spot Values for Soil – Ecological Receptors
Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility

Analyte	Regional Background Concentrations - Portland Basin		Receptor Specific Cleanup Levels and RBCs								Ecological Remediation Goals (RGs) and Hot Spots			
			Plant		Invertebrate		Birds		Mammal		Sample Type			
	Mean	95% UPL	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	Discrete/Composite		ISM	
											RG	Hot Spot	RG	Hot Spot
Concentration in mg/kg														
Antimony	0.29	0.56	5	50	78	780	--	--	2.7	27	2.7	27	2.7	27
Arsenic	4.4	8.8	18	180	--	--	575	5,750	83	830	18	180	18	180
Chromium	39	76	39	39	39	39	87	870	342	3,420	76	76	39	39
Copper	24	34	70	700	80	800	87.7	877	82	820	70	700	70	700
Lead	27	79	120	1,200	1,700	17,000	33	330	122	1,220	79	330	33	330
Mercury	0.073	0.23	0.3	3	0.1	1	0.015	0.15	3.53	35.3	0.23	0.23	0.073	0.15
Nickel	23	47	38	380	280	2,800	139	1,390	20	200	47	200	23	200
Selenium	0.33	0.71	0.52	5.2	4.1	41	3.42	34.2	1.1	11	0.71	5.2	0.52	5.2
Zinc	105	180	160	1,600	120	1,200	673	6,730	201	2,010	180	1,200	120	1,200
Dibenzofuran	--	--	--	--	--	--	--	--	0.01	0.10	0.01	0.1	0.01	0.1
Total HPAH	--	--	--	--	18	180	--	--	5.6	56	5.6	56	5.6	56
Total LPAH	--	--	--	--	29	290	--	--	100	1,000	29	290	29	290
Total PCBs	--	--	40	400	--	--	0.734	7.34	0.098	0.98	0.098	0.98	0.098	0.98
Dioxin/Furan TEQ	--	--	--	--	--	--	8.90E-05	8.90E-04	6.10E-06	6.10E-05	6.10E-06	6.10E-05	6.10E-06	6.10E-05

Notes:

Background concentrations from *Development of Oregon Background Metals Concentrations in Soil*, Oregon DEQ, March 2013

95% UPL = Upper Prediction Limit (95% confidence)

RBC = Risk Based Concentration

mg/kg = milligrams per kilogram

HPAH = high molecular weight polycyclic aromatic hydrocarbons

LPAH = low molecular weight polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent

Receptor Specific Screening Level and RBC Concentrations from the Record of Decision for Willamette Cove Upland Site, Oregon Department of Environmental Quality, March 2021 except chromium:

chromium RBC and Hot Spot levels are set to mean regional background levels per DEQ comments on draft BODR (Letter to Port of Portland, February 18, 2025).

Table 3
Remediation Goals and Hot Spot Values for Soil
Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility

Analyte	Human Health		Ecological					
	Remediation Goal	Hot Spot	Immobile			Mobile		
			Remediation Goal	Hot Spot	Basis	Remediation Goal	Hot Spot	Basis
	Concentration in mg/kg							
Antimony	24	240	5	50	Plant	2.7	27	Mamm
Arsenic	8.8	140	18	180	Plant	83	830	Mamm
Chromium	--	--	39	39	Bkgd	87	870	Bird
Copper	11,000	110,000	70	700	Plant	82	820	Mamm
Lead	400	4,000	120	1200	Plant	33	330	Bird
Mercury	--	--	0.1	1	Invert	0.073	0.15	Bird
Nickel	--	--	38	380	Plant	23	200	Bkgd/Mamm
Selenium	--	--	0.52	5.2	Plant	1.1	11	Mamm
Zinc	--	--	120	1,200	Invert	201	2,010	Mamm
cPAHs	0.55	55	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	0.01	0.1	Mamm
Total HPAH	--	--	18	180	Invert	5.6	56	Mamm
Total LPAH	--	--	29	290	Invert	100	1,000	Mamm
Total PCBs	0.74	40	40	400	Plant	0.098	0.98	Mamm
Dioxin/Furan TEQ	1.50E-05	1.50E-03	--	--	--	6.10E-06	6.10E-05	Mamm

Notes:

mg/kg = milligrams per kilogram

cPAHs= carcinogenic polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent

Receptor Specific Remediation Goals from the Record of Decision for Willamette Cove Upland Site, Oregon Department of Environmental Quality, March 2021 with the exception of arsenic: arsenic concentration is from the Residual Human Health Risk Assessment Willamette Cove Upland Facility, December 2013.

Immobile ecological endpoints include plants and invertebrates

Mobile ecological endpoints include birds and mammals

Table 4
Applicable or Relevant and Appropriate Requirements
Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility

Medium	Regulation/Citation	Applicability	Documents that Address Compliance with ARARs	Compliance Measures
Action-Specific ARARs				
Actions that discharge pollutants to Waters of the United States	CWA, Section 402, 33 USC 1342	Relevant and Appropriate	60%/90%/Final RD Report	Specify stormwater BMPs in RD.
Actions that discharge pollutants to Waters of the United States	CWA, 33 USC 1341, (Section 401), 40 CFR Section, 121.2(a)(3), (4) and (5). Also see OAR 340 048 0015 "When Certification Required" pursuant to Oregon state law.	Relevant and Appropriate		
Actions resulting in discharges to Waters of the State of Oregon, including removal and fill activities	ORS 468B.025 and State water quality standards established by rule: OAR 340 041 0002 through 0059, and Willamette Basin Designated Uses and Basin specific water quality standards at OAR 340 041 340 and OAR 340 041 345.	Relevant and Appropriate	60%/90%/Final RD Report; ERP	Specify stormwater BMPs in RD.
Actions resulting in discharges from removal and fill activities	ORS 196.825(5) Statutory requirement to mitigate for expected adverse effects of removal and fill activities. Applicable substantive mitigation rules are: OAR 141 085 510, 141 085 680, 141 085 0685, 141 085 0690, 141 085 0710, and 141 085 715.	Applicable		
Actions handling PCB remediation wastes and PCB containing material	Toxic Substances Control Act, 15 USC §2601 et seq., 40 CFR Part 761, Subpart D and OAR 340 110 0065 (1) and (2)	Applicable	60%/90%/Final RD Report; TODP; ERP	Develop action-specific standards for handling PCB contaminated materials and remediation wastes consistent with guidelines. Include standards in Waste Designation and TODP.
Risk based limits protective of human health for air emissions associated with soil or sediment removal	Clean Air Act, 40 CFR Parts 50 and 52	Relevant and Appropriate	60%/90%/Final RD Report; TODP	Develop and incorporate green remediation and emission control considerations for inclusion in RD and TODP.
Actions generating air emissions	Oregon Air Pollution Control ORS 468A et seq., General Emissions Standards OAR 340 226	Applicable		
Actions generating air emissions	Fugitive Emission Requirements OAR 340 208 0205, 0208, and 0209	Applicable	60%/90%/Final RD Report; TODP	Develop and incorporate green remediation and emission control considerations for inclusion in RD.
Actions that may affect Endangered Species Act listed and State protected fish and wildlife species	Oregon Department of Fish and Wildlife Fish Management Plans for the Willamette River. OAR 635, div 500	Applicable	60%/90%/Final RD Report	Assess potential impacts and incorporate avoidance strategies in RD.
Actions that may affect migratory birds	Migratory Bird Treaty Act. 16 USC §703 50 CFR §10.12	Applicable	60%/90%/Final RD Report	Assess potential impacts and incorporate avoidance strategies in RD.
On-site actions that involve generating, handling, and disposal of hazardous waste	OAR 340 100 0001(3) and OAR 340 100 0002(1)	Applicable	60%/90%/Final RD Report; TODP; ERP	Complete waste designation in RD and prepare TODP.

Table 4
Applicable or Relevant and Appropriate Requirements
Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility

Medium	Regulation/Citation	Applicability	Documents that Address Compliance with ARARs	Compliance Measures
Actions generating solid wastes or hazardous wastes for off-site disposal	Solid waste defined in 40 CFR 261.2. Determining if solid waste is hazardous per 40 CFR § 262.11(a c) and OAR 340 102 0011 Hazardous Waste Determination	Applicable	60%/90%/Final RD Report; TODP; ERP	Complete waste designation in RD and TODP; include action-specific handling considerations.
Actions generating RCRA hazardous waste that will be disposed of in a permitted off- site disposal facility	40 CFR § 264.13(a)(1)	Applicable		
Actions generating RCRA hazardous waste	40 CFR § 268.7(a)(1) 40 CFR § 268.9(a)	Applicable Applicable		
Actions requiring temporary storage of hazardous waste	OAR 340 102 0034 40 CFR § 262.34(a); 40 CFR § 262.34(a)(1)(i); 40 CFR § 262.34(a)(2) and (3) 40 CFR § 262.34(c)(1)	Applicable	60%/90%/Final RD Report; TODP; ERP	Complete waste designation Memorandum and TODP; include action-specific handling considerations.
Actions resulting in the storage of solid waste	OAR 340 093 0210 and 0220 OAR 340 095 0010, 0020, 0030, 0050(1) & (2), 0070(2)	Applicable Applicable		
Actions transporting hazardous materials	49 CFR § 171.1(b)	Applicable	TODP; ERP	Identify handling requirements in TODP.
Actions that involve storage and treatment of hazardous waste at the transloading facility	40 CFR Part 264, Subparts B, C, F, G, I, J, K, L, M, AA, BB, CC, and DD	Applicable	TODP; ERP	Identify storage requirements and include in TODP.
Actions in the City of Portland involving earthwork impacting greater than one acre	Portland City Code Title 10	Applicable	60%/90%/Final RD Report	Specify stormwater BMPs in RD.
Actions in the City of Portland impacting existing trees	Portland City Code Title 11	Applicable	60%/90%/Final RD Report	Specify tree preservation/replacement requirements in RD.
Location-Specific ARARs				
Presence of archeologically or historically sensitive area	Native American Graves Protection and Reparation Act, 25 USC 3001 3013, 43 CFR 10	Applicable	AIDP to be included in 60%/90%/Final RD Report	Provide AIDP example as a guide for the RA contractor that will be responsible for preparing the AIDP in advance of RA construction.
	Indian Graves and Protected Objects ORS 97.740 760	Relevant and Appropriate		
	Archaeological Objects and Sites ORS 358.905 955 ORS 390.235	Relevant and Appropriate		
Presence of archeologically or historically sensitive area	National Historic Preservation Act. 16 USC 470 et seq. 36 CFR Part 800	Applicable		
Presence of floodplain as designated on FEMA Flood Insurance map	Archaeological and Historic Preservation Act. 16 USC 469a 1	Applicable	60%/90%/Final RD Report	Define FEMA regulated floodplain at Site. Conduct flood impact evaluation to demonstrate that RA will not result in unacceptable flood rise.
Presence of floodplain as designated on map	44 CFR 60.3(d)(2) and (3)	Relevant and Appropriate		
Presence of floodplain as designated on map	FEMA regulations at 44 CFR 9 (which sets forth the policy, procedure and responsibilities to implement and enforce Executive Orders 11988 (Management of Floodplain) as amended by Executive Order 13690 and 11990 (Protection of Wetlands)	Regulations: Relevant and Appropriate Executive Order: TBC		

Table 4
Applicable or Relevant and Appropriate Requirements
Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility

Medium	Regulation/Citation	Applicability	Documents that Address Compliance with ARARs	Compliance Measures
Presence of wetlands	Executive Order for Wetlands Protection. Executive Order 11990 (1977)	Relevant and Appropriate	60%/90%/Final RD Report	Review and evaluate Site for wetlands and incorporate into RD if present.
Presence of state listed threatened or endangered wildlife species	Protection and Conservation Programs ORS. 496.171 to 496.182. Survival Guidelines OAR 635 100 0135	Relevant and Appropriate	60%/90%/Final RD Report	Identify state and federally protected species. Identify preferred habitats and the presence or absence thereof. Incorporate into RD.
Presence of federally endangered or threatened species	Endangered Species Act. 16 USC 1536 (a)(2), Listing of endangered or threatened species per 50 CFR 17.11 and 17.12 or designation of critical habitat of such species listed in 50 CFR 17.95	Applicable		

Notes:

AIDP - Archeological Inadvertent Discovery Plan

BMPs - Best Management Practices

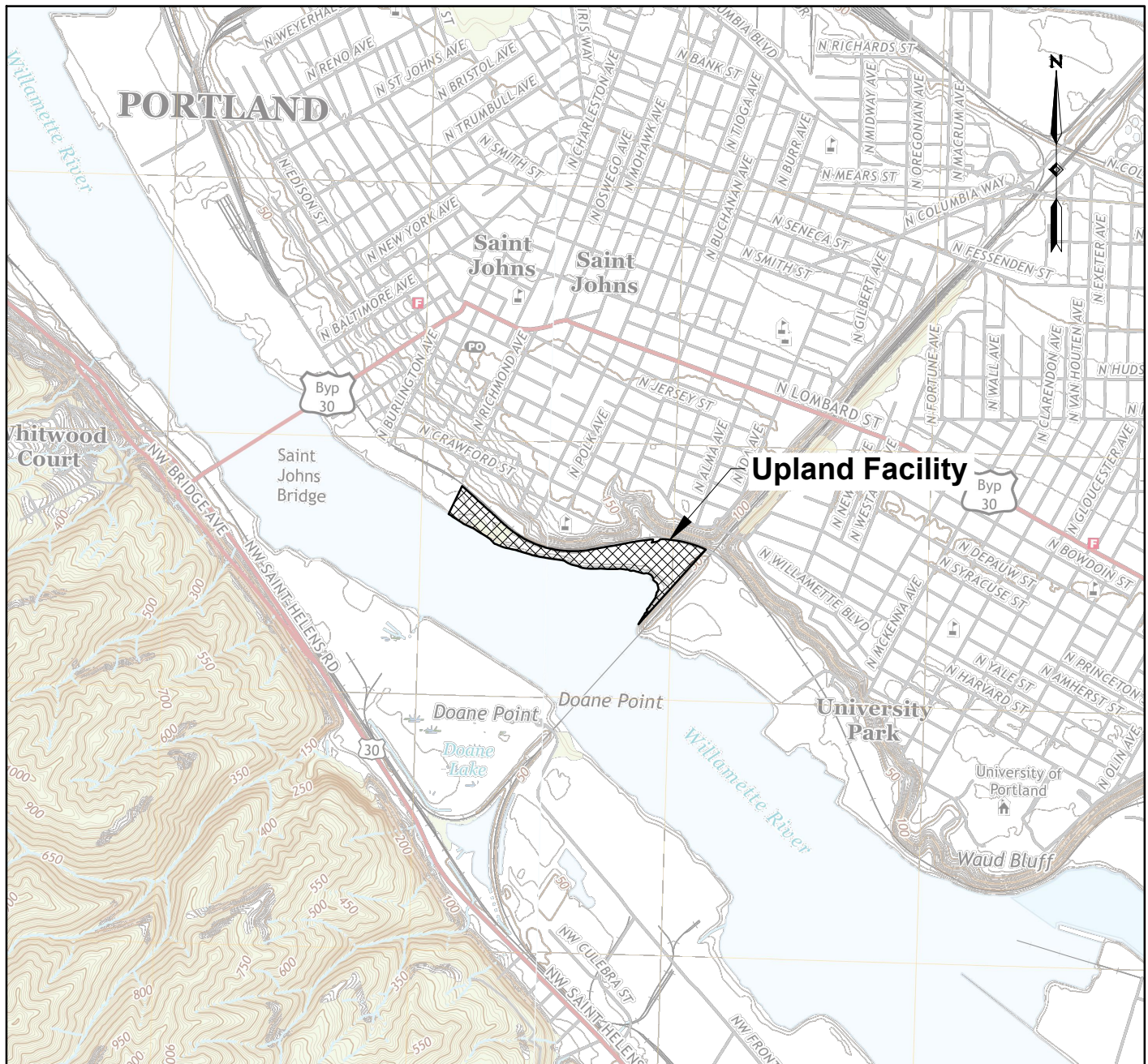
ERP - Emergency Response Plan

RA - Remedial Action

RD - Remedial Design

TODP - Transportation and Disposal Plan

I:\Client\Port of Portland\00-PH905\05 WC01 Repts and Wk Plans\31 Remedial Design Work Plan 32-23011207 01 (Site Location Map).dwg Modified 12/31/2025 by JPoore



Linnton and Portland, Oregon
United States Geological Survey
7.5 Minute Series Topographic Map
Contour Interval: 10 feet
Scale: 1 inch = 24,000 feet
Date: 2020

DRAFT

0 2,000 4,000
Scale in Feet



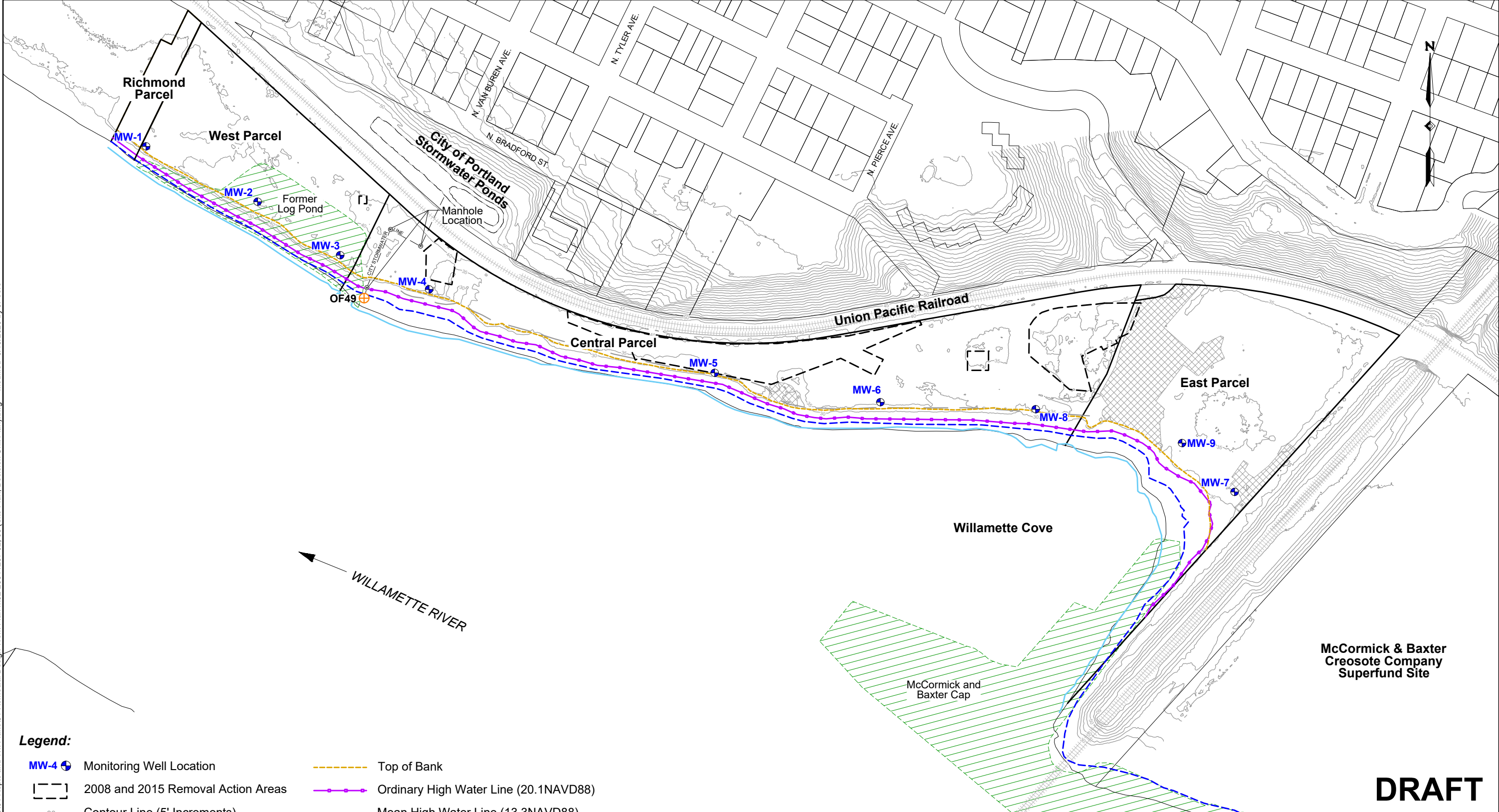
Site Location Map

Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility
Portland, Oregon

 Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 1
March 2026			

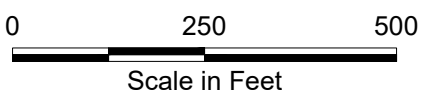
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Legend:

- MW-4 Monitoring Well Location
- 2008 and 2015 Removal Action Areas
- Contour Line (5' Increments)
- Approximate Area Covered by Concrete Slab
- OF49 City Outfall Location
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

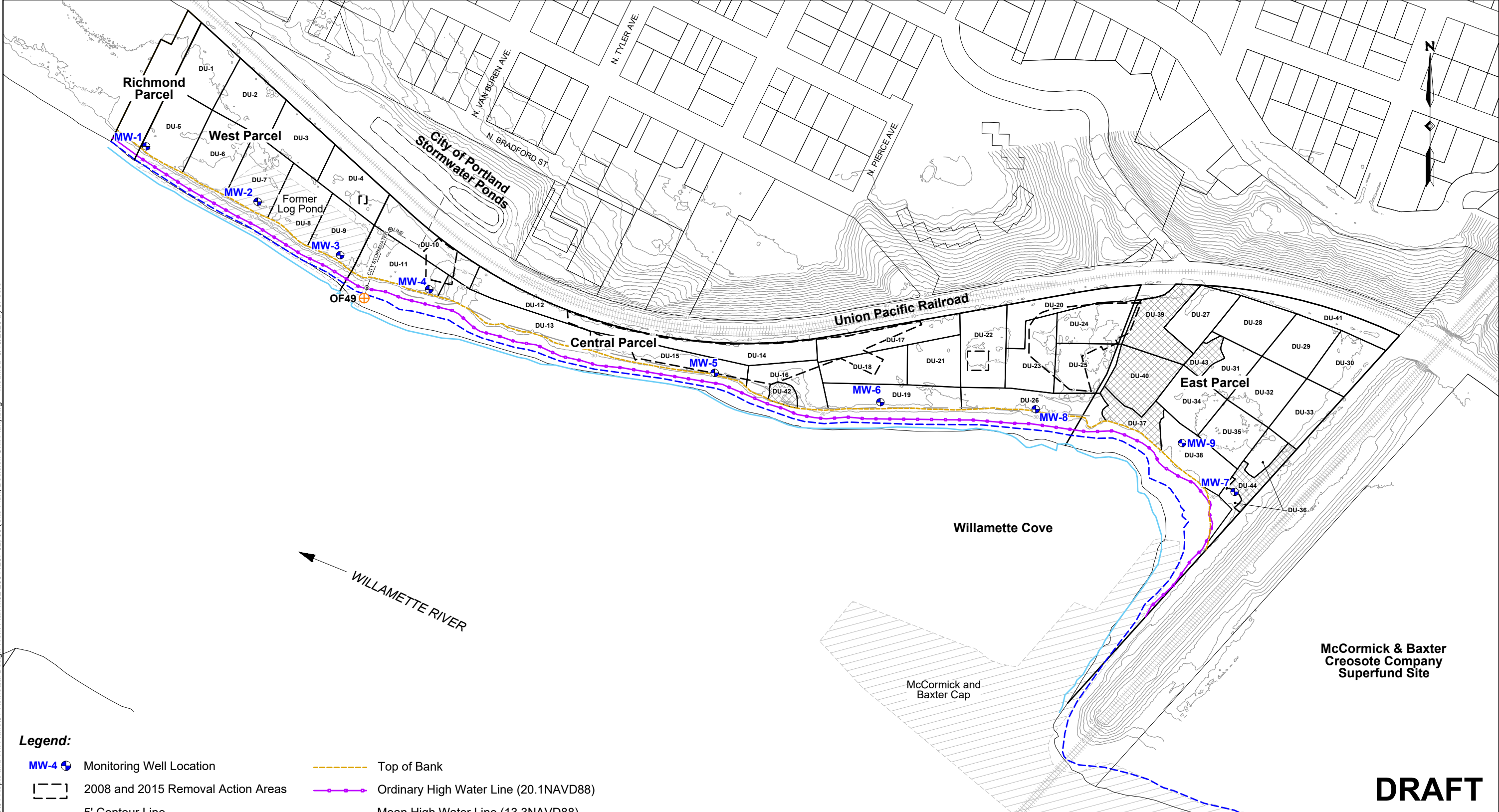
NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rliis (2023). Historical base layer information from an electronic file provided by Hart Crowser.



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Site Plan				
Remedial Design/Remedial Action Work Plan Willamette Cove Upland Facility Portland, Oregon				
 Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 2
	March 2026			

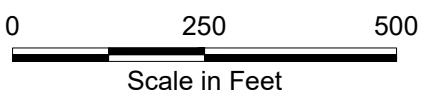
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Legend:

- MW-4 Monitoring Well Location
- 2008 and 2015 Removal Action Areas
- 5' Contour Line
- Approximate Area Covered by Concrete Slab
- OF49 City Outfall Location
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- DU-1 Decision Unit

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rliis (2023). Historical base layer information from an electronic file provided by Hart Crowser.



DRAFT

Decision Unit Plan

Remedial Design/Remedial Action Work Plan
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 3
	March 2026			

Task Name	2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
BODR																								
Supplemental RDI																								
Work Plan																								
Field/Lab																								
Evaluation and Reporting																								
Remedial Design																								
30% RD																								
60% RD																								
90% RD																								
Final RD																								
Contractor Procurement																								
RA Construction																								
Phase I - Excavation																								
Riverbank/In-Water Work (by Others)																								
Phase II - Cap and Restoration - East																								
Hiatus - Await Completion of In-Water Work																								
Phase III - Cap and Restoration - West																								
Construction Completion Report																								

Notes:

1. Phase I Excavation assumes earliest possible start date based on 100% RD by end of 2026.
2. Schedule highly dependent on In-Water RA schedule.

Project Schedule

Remedial Design/Remedial Action Work Plan
 Willamette Cove Upland Facility
 Portland, Oregon



Apex Companies, LLC
 15618 SW 72nd Avenue
 Tigard, Oregon 97224

Project Number:
 32-23011207

Drawn:
 JP

Approved:
 HFC

March 2026

Figure

4

Appendix A

Baseline and Residual Risk Analysis, Tables and Figures

Appendix A – Baseline and Residual Risk Screening Analysis

Remedial Design Input Data

The Port and Metro conducted an RDI in 2022 in accordance with the DEQ-approved *RDI Work Plan* (Apex, 2022). The results of the RDI were presented in the *Draft RDI Evaluation Report* (Apex, 2023a). The DEQ provided written comments on the *Draft RDI Evaluation Report* in a letter dated July 31, 2023 (DEQ, 2023) that requested a response from the Port and Metro to DEQ's comments in lieu of a revised report. The Port and Metro provided responses to DEQ's July 2023 comments in a letter dated October 4, 2023 (Apex, 2023b). Data were collected from 44 decision units (DUs) at three depths designated Layer 1, Layer 2, and Layer 3. Layer 1 is the 0- to 1-foot depth; Layer 2 is the 1- to 2-foot depth; and Layer 3 is the 2- to 3-foot depth. Risks were evaluated for 15 COCs for a total of 1,980 input data points.¹ The DUs sampled during the RDI are shown on Figure 3 of the RD/RA Work Plan. The analytical data are presented in Tables 2a through 5b in the RDI report (Apex, 2023a).

The following input data sets were used for the risk evaluation, and these data sets are discussed further below².

- Baseline
- Residual
- Exposure Area Baseline
- Exposure Area Residual
- Uncertainty Evaluation:
 - Adjusted Residual
 - Exposure Area Top One Foot Residual

Baseline Soil Data. Baseline risk input data are presented in Table A-1. Baseline data are taken directly from the RDI data tables except that for samples with replicate data, the baseline value is the maximum of the replicates. Two primary data types were collected during the RDI: incremental sampling methodology (ISM) samples were collected at 38 of the DUs, and 5-point composite samples were collected at six of the DUs. The ISM and composite samples are not directly comparable for risk evaluation purposes, but the composite results were assumed for the risk evaluation to be representative of the soil concentrations in those DUs. For the DUs that have only composite sample results, ISM sampling will be conducted in supplemental RDI work or during construction to verify final residual risks.

¹ In some cases, COCs for risk evaluation are combinations of individual chemical analytical results (for example, cPAHs are a toxicity-based combination of seven individual PAHs), so there were many more analytical data points than the number of data used in the risk calculations.

² Riverbank layback is planned as part of the In-Water Group remedial action and it is likely that portions of several DUs will be removed. This screening analysis was performed using all of the RDI data and does not account for DU soil that may be removed as part of the riverbank layback.

Appendix A – Baseline and Residual Risk Screening Analysis

Residual Soil Data. Residual risk input data are presented in Table A-2. In general, the residual soil data are the baseline data except the data for soil layers planned for excavation are removed. Specifically, the residual soil data set was developed as follows. The sixth column of Table A-2 (labeled as “30% Design Excavation”) summarizes the planned excavation as determined in the 30% RD. For layers with no planned excavation, the residual data are equal to the baseline data. Where the entire layer is planned for excavation, the data are excluded from the risk evaluation (the values in Table A-2 are shown as zero, but zero values are excluded from the subsequent residual risk calculations). In five DUs, only a portion of the final layer is planned for excavation. In each case, the risk driver is mercury hot spots (for ecological receptors) and the excavation depth is based on interpolation of the depth to the mercury hot spot value. Therefore, for partial excavation layers, the residual concentration of mercury was assumed to be 99 percent of the hot spot concentration (or 0.1485 mg/kg). For all other COCs, the residual concentrations in the partial excavation layer were assumed to be equal to the baseline concentrations.

Exposure Area Baseline Soil Data. Risks for mobile receptors (birds, mammals, humans) were also evaluated over larger exposure areas. Consistent with the baseline risk calculations (Formation Environmental, 2013 and 2014), exposure areas evaluated are the West, Central, and East Parcels. The exposure point concentration for a parcel was calculated as the 90 percent upper confidence limit of the mean (90 UCL) of the applicable data from the DUs within that parcel. Tables A-3 through A-5 present the input data for the baseline exposure area risk evaluation. The data in these tables are equal to the baseline soil data, segregated into the West, Central, and East Parcels. These data were used to calculate 90 UCL values for each parcel over the depth range of 0-3 feet. The input and output files are presented in Appendix B. Calculations were initially run for the 95 UCL to obtain the best-fit data distribution recommendation from the software output. The same recommended data distribution was used to select the best value from the 90 UCL calculations. The baseline 90 UCL output results are presented in Table A-6.

Exposure Area Residual Soil Data. Exposure area residual soil data were calculated in the same manner as the baseline exposure area data. Tables A-7 through A-9 present the input data for the residual exposure area risk evaluation. The data in these tables are equal to the residual soil data for the West and East Parcels. For the Central Parcel, most of the DUs will be excavated to 3 feet, so there is insufficient data to calculate a meaningful 90 UCL. Therefore, for those DUs that will be excavated to 3 feet, the data from Layer 3 were used as surrogate data for the residual risk calculations. The surrogate data are highlighted in Table A-8. The input and output files are presented in Appendix B. The residual 90 UCL output results are presented in Table A-6.

Uncertainty Evaluation Input Data – Data Variability. Uncertainty related to data variability was evaluated using the replicate sample results from the RDI. Uncertainty was assessed for the residual risks by comparing adjusted residual risks to the residual risks calculated from the residual data set. Adjusted residual risks were estimated using adjusted data as discussed below.

- DUs with replicate samples
 - Adjusted value is the maximum value of the three replicate samples.

Appendix A – Baseline and Residual Risk Screening Analysis

- No change from the residual data set.
- DUs without replicate samples
 - Metals – Metals were adjusted for each metal where at least one replicate on the Parcel had a replicate standard deviation (RSD) greater than 45 percent.
 - D/Fs – D/F values were adjusted if two or more congeners in at least one replicate on the Parcel had an RSD greater than 45 percent. Each congener and D/F TEQ in each sample were adjusted. The adjusted D/F TEQ value was the greater of the adjusted D/F TEQ or the summation of the toxic equivalents of the adjusted congeners.
 - PAHs – PAHs were adjusted if two or more individual PAHs in at least one replicate on the Parcel had an RSD greater than 45 percent. Each individual PAH and the combined values (HPAHs, LPAHs, and cPAHs) in each sample were adjusted. The combined PAH values are the greater of the adjusted combined values or the combination of the adjusted individual PAHs.
 - PCBs – PCBs were adjusted if at least one Aroclor in at least one replicate on the Parcel had an RSD greater than 45 percent. Each Aroclor and total PCBs were adjusted. The adjusted total PCBs value was the greater of the adjusted total PCBs or the summation of the adjusted Aroclors.
 - The adjusted values are the residual soil concentrations adjusted upward by the maximum RSD for the corresponding COC on the Parcel.³

Table A-10 lists the adjustment factors determined from the rules above. Adjusted residual risk input data are presented in Table A-11. The adjusted residual soil data are the residual data from Table A-2 adjusted by the factors in Table A-10. Like Table A-2, values in Table A-11 for layers planned for excavation are shown as zero, but the zero values are excluded from the subsequent residual risk calculations.

Uncertainty Evaluation Input Data – Exposure Area Variability. Exposure area variability was evaluated considering both the size of the exposure area and variation in depth of exposure.

Exposure area size was evaluated by comparing the risks in individual DUs to the exposure area risks. Input data for these comparisons are included in Tables A-1 (baseline data by DU), A-2 (residual data by DU), and A-6 (baseline and residual data for exposure areas).

Depth of exposure variation was evaluated by comparing residual risks for the exposure areas over the depth of 0-3 feet to the residual risks for the exposure area over the depth range of 0-1 foot. The input data for the 0-3 feet depth

³ For example, if the residual COC concentration is Cx, the adjusted residual COC concentration is $Cx * (1 + \text{Max RSD})$, where Max RSD is the maximum RSD for that COC on the Parcel where the DU is located. The quantity in parentheses is the adjustment factor.

Appendix A – Baseline and Residual Risk Screening Analysis

range were discussed above for exposure area residual soil data (Tables A-7 through A-9). The input data for the 0-1 foot depth range are listed in Tables A-12 through A-14. The 90 UCL output results are presented in Table A-6.

Baseline Risks

Baseline risks for each receptor, DU, and depth are listed in Tables A-15 through A-20. Ecological baseline hazard quotients (HQs) and hazard indexes (HIs) are presented in Tables A-15 through A-18 for plants, invertebrates, birds, and mammals. Table A-19 presents human health baseline non-carcinogenic risk ratios for individual COCs and cumulative risk. Table A-20 presents human health baseline excess lifetime cancer risk for individual COCs and cumulative risk.

Exposure area baseline risks for birds, mammals, human health non-carcinogens, and human health carcinogens are presented in Tables A-21 through A-24, respectively.

Risks were calculated using the following protocols.

- No rounding occurred until the final value. Intermediate values may be shown in tables to limited significant digits (e.g., HQs to nearest 0.1), but the cumulative HIs were calculated from unrounded values.
- Values less than one-tenth of the acceptable risk level (e.g., HQ less than 0.1) were not calculated and were not included in the cumulative risk calculation.
- HQs and risk ratios are reported to two significant figures (except values less than one are shown to the nearest tenth).
- Carcinogenic risks are shown to one significant figure.

Baseline risks for DUs are summarized on Figures A-1 through A-6, organized as follows:

- Plants – Figures A-1a through A-1f
- Invertebrates – Figures A-2a through A-2f
- Birds – Figures A-3a through A-3f
- Mammals – Figures A-4a through A-4f
- Human health non-carcinogens – Figures A-5a through A-5f
- Human health carcinogens – Figures A-6a through A-6f

Residual Risks

Residual risks for each receptor, DU, and depth are listed in Tables A-25 through A-30. Ecological residual HQs and HIs are presented in Tables A-25 through A-28 for plants, invertebrates, birds, and mammals. Table A-29 presents

Appendix A – Baseline and Residual Risk Screening Analysis

human health residual non-carcinogenic risk ratios for individual COCs and cumulative risk. Table A-30 presents human health residual excess lifetime cancer risk for individual COCs and cumulative risk.

Exposure area residual risks for birds, mammals, human health non-carcinogens, and human health carcinogens are presented in Tables A-21 through A-24, respectively.

Residual risks for DUs are summarized in Figures A-7 through A-12, organized as follows:

- Plants – Figures A-7a through A-7f
- Invertebrates – Figures A-8a through A-8f
- Birds – Figures A-9a through A-9f
- Mammals – Figures A-10a through A-10f
- Human health non-carcinogens – Figures A-11a through A-11f
- Human health carcinogens – Figures A-12a through A-12f

Residual Risk Uncertainty Evaluation

Uncertainty Evaluation – Data Variability. Adjusted residual risks (adjusted considering variability of replicate data) for each receptor, DU, and depth are listed in Tables A-31 through A-36. Ecological adjusted residual HQs and HIs are presented in Tables A-31 through A-34 for plants, invertebrates, birds, and mammals. Table A-35 presents human health adjusted residual non-carcinogenic risk ratios for individual COCs and cumulative risk. Table A-30 presents human health adjusted residual excess lifetime cancer risk for individual COCs and cumulative risk.

Adjusted exposure area residual risks for birds, mammals, human health non-carcinogens, and human health carcinogens are presented in Tables A-21 through A-24, respectively.

Uncertainty Evaluation – Exposure Area Size Variability. Exposure area size was evaluated by comparing the risks in individual DUs to the exposure area risks. Baseline and residual risks by DU are listed in Tables A-15 through A-20 and A-25 through A-30. Baseline and residual risks by exposure area are listed in Tables A-21 through A-24. Table A-37 summarizes for comparison human health residual risks by parcel exposure area and DU.

Depth of exposure variation was evaluated by comparing human health residual risks for the exposure areas over the depth of 0-3 feet to the residual risks for the exposure area over the depth range of 0-1 foot. Residual risks for these exposure area depths are listed in Tables A-21 through A-24. Table A-38 summarizes for comparison human health residual risks by parcel exposure area for 0-3 feet and 0-1 foot.

Appendix A – Baseline and Residual Risk Screening Analysis

Risk Summary Conclusions

This section summarizes baseline and residual risk conclusions.

Baseline Risks. Baseline risks by DU are presented in Tables A-15 through A-20 and by exposure area (Parcel) in Tables A-21 through A-24. Baseline risk results and conclusions are summarized in the embedded tables and bullets below.

- Ecological:
 - Baseline risks exceed acceptable risk levels (HQ and HI of 1.0) for each ecological receptor, with greater relative risk to birds and mammals. Maximum HIs range from 25 for plants to 360 for birds.
 - The primary baseline ecological risk drivers are mercury (birds, invertebrates, and plants) and D/F TEQ, total PCBs, and dibenzofuran (mammals).
 - Ecological hot spots (HQ of 10 or greater) are present on all three parcels for the baseline with most hot spot exceedances being either mercury or D/F TEQ.
- Human health:
 - Exposure area baseline non-carcinogenic risks are acceptable (risk ratio of 1.0 or less) and there are only slight exceedances in 10 of 44 DUs.
 - Exposure area baseline carcinogenic risks are acceptable⁴ on the West Parcel and exceed acceptable risk levels by factors of 5 and 3 on the Central and East Parcels, respectively. The primary risk driver is D/F TEQ. Acceptable risk levels are exceeded in individual DUs by factors of 6 (arsenic), 30 (D/F TEQ), and 40 (arsenic) on the West, Central, and East Parcels, respectively.
 - There are no human health hot spots.⁵

⁴ Acceptable risk levels are 1E-06 for individual COCs and 1E-05 for cumulative risk.

⁵ High concentration hot spots are defined by a non-carcinogenic risk ratio greater than 10 or an excess cancer risk for individual COCs greater than 1E-04.

Appendix A – Baseline and Residual Risk Screening Analysis

Baseline Ecological

Receptor	COCs Exceeding RBCs at Least Once	Primary Risk Driver COCs	Max. HQ	Max. HI	Hot Spots
Plants	Sb, As, Cr, Cu, Pb, Ni, Se, Zn	Hg	17	25	Hg in 2 samples on Central Parcel
		Cu	4.9		
Invertebrates	Cr, Cu, Hg, Zn, HPAHs	Hg	51	56	Hg in 9 DUs on Central Parcel
		Cu	4.3		
Birds	Cu, Pb, Hg, D/F TEQ, total PCBs	Hg	340	360	Hg in 5 DUs on West Parcel, 16 DUs on Central Parcel, and 4 DUs on East Parcel; Pb in 1 sample on Central Parcel
		Pb	10		
		D/F TEQ	4.0		
Mammals	Sb, Cu, Pb, Hg, Ni, Zn, D/F TEQ, dibenzofuran, HPAHs, total PCBs	D/F TEQ	65	70	D/F TEQ in 9 DUs on the Central Parcel and 3 DUs on East Parcel; total PCBs in 1 sample on West Parcel; dibenzofuran in 1 sample on Central Parcel
		total PCBs	28		
		dibenzofuran	11		
		HPAHs	5.6		

Baseline Human Health Non-Carcinogen

Exposure Area	COCs Exceeding RBCs at Least Once	Max. DU Risk Ratio	Max. DU Cumulative Risk Ratio	Parcel Max. Ind. COC Risk Ratio	Parcel Cumulative Risk Ratio
West Parcel	none	0.8	1.6	0.2	0.3
Central Parcel	D/F TEQ	2.3	2.8	0.4	0.7
East Parcel	D/F TEQ	1.5	2.5	0.2	0.4

Baseline Human Health Carcinogen

Exposure Area	COCs Exceeding RBCs at Least Once	Primary Risk Driver COCs	Max. DU Cancer Risk	Max. DU Cumulative Cancer Risk	Parcel Cancer Risk	Parcel Cumulative Cancer Risk
West Parcel	As, D/F TEQ, cPAHs, total PCBs	D/F TEQ	6.E-06	8.E-06	1.E-06	2.E-06

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Central Parcel	As, D/F TEQ, cPAHs, total PCBs	D/F TEQ, cPAHs	3.E-05	3.E-05	5.E-06	6.E-06
East Parcel	As, D/F TEQ	D/F TEQ	4.E-05	5.E-05	3.E-06	3.E-06

Residual Risks. Residual risks by DU are presented in Tables A-25 through A-30 and by exposure area (Parcel) in Tables A-21 through A-24. Residual risk that are above the acceptable risk levels will be managed with caps to prevent exposure. Residual risk results and conclusions are summarized in the embedded tables and bullets below.

- Ecological:
 - Residual risks exceed acceptable risk levels for each ecological receptor, with greater relative risk to birds and mammals. Maximum HIs range from 7 for plants and invertebrates to 17 for birds, a 95 percent reduction in maximum HI compared to baseline conditions.
 - The primary residual ecological risk drivers are mercury and lead (birds), D/F TEQ total PCBs (mammals), and copper and zinc (plants and invertebrates).
 - There are no ecological hot spots for the residual conditions.
- Human health:
 - Residual non-carcinogenic risks are acceptable.
 - Exposure area residual carcinogenic risks are acceptable. The Central Parcel residual risk for individual COCs exceeded the acceptable risk level by a factor of 2. However, as noted above, there is insufficient residual data to calculate a meaningful 90 UCL in the Central Parcel. Therefore, for those DUs that will be excavated to 3 feet, the data from Layer 3 were used as surrogate data for the residual risk calculations, so the residual risk for the Central Parcel is likely biased high. Residual risks will be updated based on verification samples collected during construction. Acceptable risk levels are exceeded individual DUs by factors of 3 (cPAHs), 3 (D/F TEQ), and 10 (arsenic) on the West, Central, and East Parcels, respectively.
 - There are no human health hot spots.

Residual Ecological

Receptor	COCs Exceeding RBCs at Least Once	Primary Risk Driver COCs	Max. HQ	Max. HI	Hot Spots
Plants	Sb, Cu, Pb, Se, Zn	Cu	3.3	7.4	None
		Zn	2.2		
Invertebrates	Cu, Hg, Zn	Zn	3.0	6.7	None
		Cu	2.9		

Appendix A – Baseline and Residual Risk Screening Analysis

Birds	Cu, Pb, Hg	Hg	9.9	17	None
		Pb	6.1		
Mammals	Sb, Cu, Pb, Ni, Zn, D/F TEQ, dibenzofuran, HPAHs, total PCBs	D/F TEQ	9.6	14	None
		total PCBs	5.7		

Residual Human Health Non-Carcinogen

Exposure Area	COCs Exceeding RBCs at Least Once	Max. DU Risk Ratio	Max. DU Cumulative Risk Ratio	Parcel Risk Ratio	Parcel Cumulative Risk Ratio
West Parcel	none	0.3	0.4	0.1	0.1
Central Parcel	none	0.3	0.5	0.2	0.4
East Parcel	none	0.5	0.7	0.1	0.2

Residual Human Health Carcinogen

Exposure Area	COCs Exceeding RBCs at Least Once	Primary Risk Driver COCs	Max. DU Ind. COC Cancer Risk	Max. DU Cumulative Cancer Risk	Parcel Max. Ind. COC Risk Ratio	Parcel Cumulative Cancer Risk
West Parcel	D/F TEQ, cPAHs	D/F TEQ, cPAHs	3.E-06	4.E-06	9.E-07	2.E-06
Central Parcel	D/F TEQ	D/F TEQ, cPAHs	3.E-06	3.E-06	2.E-06	3.E-06
East Parcel	As, D/F TEQ	D/F TEQ	1.E-05	1.E-05	1.E-06	2.E-06

Residual Risk Uncertainty. Uncertainty in residual risks were evaluated for data variability for all receptors and for spatial variability for human receptors (ecological receptors were already evaluated on a DU/sample basis, the smallest exposure area evaluated). Residual risk uncertainty results are summarized below.

- Ecological Receptors – Based on variability of replicate samples, residual risks for ecological receptors could be marginally greater for birds (60%) and mammals (30% to 110%) on the West Parcel, mammals (30% to 60%) on the Central Parcel, and all receptors (30% to 60%) on the East Parcel. These risks would be managed by caps to prevent exposure.

Appendix A – Baseline and Residual Risk Screening Analysis

- Non-Carcinogen Human Health – Considering data variability (Table A-35), exposure at the DU level (Table A-37), and exposure to just the top 1 foot of soil (Table A-38), non-carcinogenic risks are acceptable. The cumulative risk ratio exceeded 1 (maximum of 1.1) in only 2 of 44 DUs and the exposure area risk is acceptable. This very minor uncertainty in risk would be managed with a cap that prevents exposure.
- Carcinogen Human Health – Considering data variability (Table A-36), exposure at the DU level (Table A-37), and exposure to just the top 1 foot of soil (Table A-38), carcinogenic risks could slightly exceed acceptable risk levels for cPAHs and D/F TEQ (3E-06 to 4E-06 for individual DUs and 2E-06 to 3E-06 for exposure areas). Arsenic could have risk levels up to 1E-05 for individual DUs (exposure area concentrations are below background), but that risk level corresponds to a concentration only slightly greater than twice background. These risks would be managed with a cap that prevents exposure.

Table A-1
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														Total HPAH	Total LPAH	cPAHs	Total PCBs
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran							
ISM Background					0.29	8.8	39	24	27	0.073	23.4	0.33	105									
Composite Background					0.56	8.8	76	34	79	0.23	47	0.71	180									
Plant RBC					5	18	39	70	120	0.30	38	0.52	160					40				
Invertebrate RBC					78		39	80	1700	0.10	280	4.1	120			18	29					
Bird RBC						575	87	88	33	0.015	139	3.42	673	8.90E-05				0.734				
Mammal RBC					2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100	0.098				
Human Health Non-Carcinogenic RBC					24	74		11,000	400					1.70E-04			60	4				
Human Health Carcinogenic RBC						1.4								1.50E-05			0.55	0.74				
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.801	6.24	37.4	180	74.8	0.0696	27.1	0.514	151	2.21E-05	0.0078	2.6600	0.3370	0.4460	0.4270			
			1-2	DU-1 (1-2)	0.712	5.41	41.3	64.6	321	0.0863	30.9	0.516	140	2.56E-05	0.0102	2.6200	0.4240	0.4000	2.7500			
			2-3	DU-1 (2-3)	0.529	5.79	29.5	69.5	57.5	0.0813	25.0	0.529	179	1.07E-05	0.0048	2.1100	0.2860	0.3280	0.1100			
	DU-2	ISM	0-1	DU-2 (0-1)	0.603	5.41	21.5	119	96.2	0.0731	18.9	0.505	99.4	6.95E-06	0.0051	1.0200	0.1270	0.1650	0.1860			
			1-2	DU-2 (1-2)	0.515	5.36	22	170	118	0.124	16.4	0.515	88.8	3.44E-06	0.0047	0.7920	0.1230	0.1080	0.5580			
			2-3	DU-2 (2-3)	0.495	5.21	15.5	41.9	24.4	0.0607	14.7	0.495	78	2.42E-06	0.0050	0.2230	0.0275	0.0319	0.0299			
	DU-3	ISM	0-1	DU-3 (0-1)	0.547	6.87	16.2	26.8	20.1	0.0438	16.3	0.547	80.4	2.63E-05	0.0048	0.9760	0.1210	0.1530	0.0250			
			1-2	DU-3 (1-2)	0.497	6.65	16.5	25.8	15.8	0.0455	17.1	0.497	72.2	7.82E-06	0.0051	0.9840	0.1210	0.1290	0.0050			
			2-3	DU-3 (2-3)	0.536	6.65	15.7	21.6	13.5	0.0497	16.0	0.536	64.7	4.57E-06	0.0050	0.7450	0.1140	0.1030	0.0048			
	DU-4	ISM	0-1	DU-4 (0-1)	0.565	6.57	16.3	29.1	23.7	0.0746	23.9	0.565	89.4	2.09E-05	0.0057	2.5200	0.3290	0.4280	0.0317			
			1-2	DU-4 (1-2)	0.515	6.87	16.3	26.6	23.9	0.0596	24.6	0.515	79.4	1.66E-05	0.0334	11.9000	3.5400	1.7500	0.0245			
			2-3	DU-4 (2-3)	0.502	7.63	18.4	34	45.1	0.076	22.4	0.502	115	1.47E-05	0.0094	4.6500	0.6340	0.7670	0.0351			
	DU-5	ISM	0-1	DU-5 (0-1)	0.992	8.98	52.3	344	62.1	0.352	32.6	0.369	211	1.71E-05	0.0073	1.4000	0.1860	0.2420	0.1770			
			1-2	DU-5 (1-2)	0.832	8.09	42.9	237	70.5	0.369	58.9	0.335	179	1.53E-05	0.0061	1.1600	0.1550	0.1990	0.1430			
			2-3	DU-5 (2-3)	0.596	6.73	47.1	214	118	0.273	31.3	0.309	224	2.33E-05	0.0099	2.8800	0.5470	0.4080	0.3870			
	DU-6	ISM	0-1	DU-6 (0-1)	0.539	4.93	22.1	67.6	28.2	0.128	19.6	0.539	135	1.04E-05	0.0052	1.1000	0.1200	0.1880	0.0625			
			1-2	DU-6 (1-2)	0.56	4.89	25.2	91.6	40	0.156	21.8	0.56	124	2.51E-05	0.0090	1.2900	0.1910	0.2040	0.1110			
			2-3	DU-6 (2-3)	0.526	4.67	23.2	100	37.8	0.141	22.0	0.526	112	1.14E-05	0.0110	1.4300	0.2160	0.2260	0.1670			
	DU-7	ISM	0-1	DU-7 (0-1)	0.537	4.37	19.2	36	23.3	0.304	19.3	0.537	126	1.74E-05	0.0051	0.7510	0.0885	0.1270	0.0527			
			1-2	DU-7 (1-2)	0.547	3.98	18.6	30.1	18.7	0.13	19.7	0.547	92.7	1.24E-05	0.0050	0.4400	0.0705	0.0711	0.0567			
			2-3	DU-7 (2-3)	0.536	3.07	16.2	24.2	14.9	0.0927	19.1	0.536	75.1	8.17E-06	0.0050	0.3160	0.0497	0.0478	0.0502			
	DU-8	ISM	0-1	DU-8 (0-1)	0.56	4.33	21.7	32.5	39.1	0.154	19.6	0.56	144	2.36E-05	0.0055	0.7550	0.1140	0.1210	0.0989			
			1-2	DU-8 (1-2)	0.501	4.13	24.6	32.9	31.4	0.164	19.7	0.501	130	2.46E-05	0.0055	0.4940	0.1010	0.0731	0.0678			
			2-3	DU-8 (2-3)	0.545	4.13	21.9	32	31	0.156	20.7	0.545	126	2.34E-05	0.0062	0.5890	0.1200	0.0847	0.0984			
	DU-9	ISM	0-1	DU-9 (0-1)	0.623	5.25	30.6	40.6	28.2	0.16	26.5	0.506	154	1.78E-05	0.0057	1.1200	0.1600	0.1890	0.0640			
			1-2	DU-9 (1-2)	0.555	4.81	27.8	34.6	40.7	0.141	24.4	0.555	115	1.28E-05	0.0048	0.4770	0.0753	0.0771	0.0353			
			2-3	DU-9 (2-3)	0.512	5.12	31	37.4	21.5	0.141	26.2	0.512	122	1.23E-05	0.0080	1.1600	0.1990	0.1800	0.0478			

Please see notes at the end of the table.

Table A-1
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)	0.541	4.5	14.8	33.3	86.5	1.07	29.9	0.541	106	1.73E-05	0.0235	29.4000	3.8500	5.1900	0.0337
			1-2	DU-10 (1-2)	0.531	5.56	15.3	33.6	54.8	0.829	27.5	0.513	94.9	5.46E-06	0.0494	28.3000	6.5900	4.7000	0.0262
			2-3	DU-10 (2-3)	0.514	5.16	14.5	32.2	73.3	0.609	22.6	0.491	117	4.52E-06	0.0244	16.9000	3.3700	2.6000	0.0051
	DU-11	ISM	0-1	DU-11 (0-1)	0.545	4.6	23.6	38.5	56.1	0.726	29.3	0.545	116	1.17E-05	0.0819	31.3000	9.3600	5.4000	0.0369
			1-2	DU-11 (1-2)	0.535	4.15	22	37.3	49	0.633	28.2	0.535	99.5	5.21E-06	0.0486	15.1000	2.9800	2.6500	0.0372
			2-3	DU-11 (2-3)	0.526	4.23	22	35.2	43.3	0.604	26.4	0.526	95	5.89E-06	0.0613	30.2000	7.3500	5.1300	0.0389
	DU-12	ISM	0-1	DU-12 (0-1)	0.83	4.95	14.8	78.9	165	0.292	19.8	0.504	166	2.54E-05	0.0070	2.4700	0.3520	0.3930	0.0532
			1-2	DU-12 (1-2)	0.493	4.26	14	55.7	131	0.275	19	0.493	104	4.21E-06	0.0059	0.9970	0.1900	0.1430	0.0317
			2-3	DU-12 (2-3)	0.551	3.62	13.7	41	70.8	0.207	17.8	0.551	79.7	2.60E-06	0.0050	0.5840	0.1030	0.0900	0.0050
	DU-13	ISM	0-1	DU-13 (0-1)	0.923	6.04	14.2	94.3	241	1.15	21.4	0.563	204	2.77E-04	0.0084	7.9300	0.4760	1.1700	0.0701
			1-2	DU-13 (1-2)	0.54	4.79	13.8	53	154	0.785	18.6	0.54	128	3.62E-05	0.0155	3.0600	0.6760	0.4500	0.0272
			2-3	DU-13 (2-3)	0.562	4.04	12.6	54.2	175	0.769	18.4	0.562	127	2.66E-05	0.0052	1.6700	0.2480	0.2630	0.0330
	DU-14	ISM	0-1	DU-14 (0-1)	2.81	6.14	22.9	73.5	134	1.33	24.3	0.514	147	7.87E-05	0.0229	0.9920	0.3010	0.1490	0.0283
			1-2	DU-14 (1-2)	7.38	6.87	21.6	122	240	3.1	23.7	0.519	204	3.43E-05	0.0224	1.7000	0.4070	0.2570	0.0048
			2-3	DU-14 (2-3)	3.04	5.66	20.6	185	162	2.5	24.8	0.493	164	1.43E-05	0.0143	1.3200	0.2860	0.1950	0.0048
	DU-15	ISM	0-1	DU-15 (0-1)	2.81	5.04	16	95.4	131	0.75	21.7	0.506	131	3.96E-04	0.0081	0.9590	0.1440	0.1380	0.0268
			1-2	DU-15 (1-2)	0.576	3.75	14	57.7	68.6	1.28	19.3	0.517	120	2.00E-04	0.0049	0.3280	0.0668	0.0499	0.0048
			2-3	DU-15 (2-3)	0.492	2.91	11.2	36.2	63.6	0.563	17.6	0.492	76.8	1.50E-04	0.0049	0.6910	0.0868	0.1010	0.0048
	DU-16	ISM	0-1	DU-16 (0-1)	4.29	8.31	26.6	131	306	5.12	28.1	0.543	371	2.44E-04	0.0776	3.2200	0.9680	0.4960	0.0346
			1-2	DU-16 (1-2)	2.29	6.92	13.6	71.8	151	1.69	18.5	0.521	139	1.75E-05	0.0075	1.6300	0.2070	0.2460	0.0049
			2-3	DU-16 (2-3)	0.499	3.72	12.9	29.1	37.5	0.429	16.8	0.539	71.3	7.62E-06	0.0050	0.4170	0.0624	0.0569	0.0050
	DU-17	ISM	0-1	DU-17 (0-1)	1.06	4.95	12.4	59.2	81.4	0.575	16.4	0.499	156	4.04E-05	0.0050	0.4280	0.0851	0.0634	0.0257
			1-2	DU-17 (1-2)	0.511	3.72	11.8	34.3	62.5	0.356	16.3	0.511	70.6	3.43E-06	0.0050	0.3630	0.0859	0.0513	0.0050
			2-3	DU-17 (2-3)	0.504	3.16	11.1	26.8	35.1	0.121	14.6	0.504	58.4	7.81E-06	0.0050	0.2220	0.0348	0.0309	0.0049
	DU-18	ISM	0-1	DU-18 (0-1)	1.41	10.9	22.8	111	280	1.72	23.5	0.531	204	6.68E-05	0.0069	1.8100	0.2630	0.2710	0.0584
			1-2	DU-18 (1-2)	0.495	6.22	15.3	79.5	179	1.06	21.8	0.495	158	2.16E-05	0.0050	0.8940	0.1380	0.1380	0.0336
			2-3	DU-18 (2-3)	0.502	5.63	13.9	59.9	92.3	0.681	18.3	0.497	118	1.29E-05	0.0051	0.5870	0.0841	0.0862	0.0316
	DU-19	ISM	0-1	DU-19 (0-1)	1.39	7.67	13.2	107	257	0.666	16.5	0.541	215	1.34E-04	0.0121	2.3700	0.3430	0.4030	0.1440
			1-2	DU-19 (1-2)	0.957	11.2	12	110	161	1.08	15.5	0.555	198	8.48E-05	0.0174	1.8200	0.3840	0.2700	0.0311
			2-3	DU-19 (2-3)	0.926	5.68	11.2	44.9	70.8	0.327	15.5	0.522	113	4.66E-05	0.0051	0.5140	0.0627	0.0790	0.0568
	DU-20	ISM	0-1	DU-20 (0-1)	1.69	5.69	19.6	58.4	76.2	0.314	22.7	0.517	117	3.49E-05	0.0048	0.8920	0.0970	0.1450	0.0390
			1-2	DU-20 (1-2)	0.536	4.08	19.5	25.8	17.7	0.136	28.4	0.536	87.3	4.30E-06	0.0049	0.0881	0.0236	0.0132	0.0050
			2-3	DU-20 (2-3)	0.511	3.68	16.7	23	14.3	0.101	21.1	0.511	90.4	3.97E-06	0.0047	0.1350	0.0247	0.0193	0.0050
	DU-21	ISM	0-1	DU-21 (0-1)	2.73	10.5	14.8	128	295	0.776	20.3	0.493	242	7.03E-05	0.0187	2.0900	0.4640	0.3140	0.0492
			1-2	DU-21 (1-2)	1.01	4.93	11.8	56.2	116	0.276	17.7	0.5	180	2.06E-05	0.0074	1.0500	0.1510	0.1640	0.0364
			2-3	DU-21 (2-3)	0.497	4.48	11.6	45.9	89.7	0.154	18	0.497	109	1.01E-05	0.0052	0.6240	0.1480	0.0879	0.0050

Please see notes at the end of the table.

Table A-1
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg															Total HPAH	Total LPAH	cPAHs	Total PCBs
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran								
Central Parcel	DU-22	ISM	0-1	DU-22 (0-1)	2.89	6.48	19.6	96.6	190	0.602	23.2	0.538	178	3.25E-05	0.1120	2.6500	1.9500	0.1310	0.0438				
			1-2	DU-22 (1-2)	2.63	4.53	18.8	47.4	72.3	0.349	22.6	0.512	164	1.23E-05	0.0051	0.2350	0.0463	0.0289	0.0258				
			2-3	DU-22 (2-3)	1.09	4.45	18	54	57.5	0.376	21.4	0.557	123	7.93E-06	0.0051	0.2250	0.0652	0.0292	0.0050				
	DU-23	ISM	0-1	DU-23 (0-1)	1.62	5.99	22.1	150	276	1.02	22.9	0.497	184	4.00E-05	0.0061	0.7550	0.1410	0.1060	0.0591				
			1-2	DU-23 (1-2)	0.61	4.63	18.4	69.5	70.9	0.545	20.5	0.518	127	1.05E-05	0.0050	0.5370	0.0638	0.1040	0.0265				
			2-3	DU-23 (2-3)	0.498	3.82	15.6	41.9	82.2	0.426	18.8	0.488	99	5.92E-06	0.0051	0.2310	0.0313	0.0362	0.0050				
	DU-24	ISM	0-1	DU-24 (0-1)	0.546	4.16	15.5	39.9	48.8	0.276	19.2	0.546	117	2.33E-05	0.0050	0.6300	0.0812	0.0907	0.0326				
			1-2	DU-24 (1-2)	0.496	3.56	15	31.1	23.2	0.175	20.6	0.496	124	6.44E-06	0.0050	0.5000	0.0548	0.0740	0.0049				
			2-3	DU-24 (2-3)	0.501	2.84	10.9	17.6	13.8	0.0928	18.5	0.501	83.1	8.88E-06	0.0050	0.0883	0.0202	0.0145	0.0048				
	DU-25	ISM	0-1	DU-25 (0-1)	0.822	5.24	20.2	226	144	0.762	21.3	0.491	242	4.69E-05	0.0123	2.7700	0.4270	0.3860	0.0653				
			1-2	DU-25 (1-2)	0.493	3.29	14.5	48.5	113	0.213	19.6	0.493	202	2.60E-06	0.0050	0.6430	0.1010	0.0905	0.0050				
			2-3	DU-25 (2-3)	0.496	3.17	12.6	30	43.2	0.116	18.7	0.496	138	1.94E-06	0.0048	0.6130	0.0873	0.0873	0.0050				
	DU-26	ISM	0-1	DU-26 (0-1)	4.79	9.5	19.1	152	330	1.95	20.7	0.605	260	9.33E-05	0.0246	4.8900	0.7790	0.7230	0.1850				
			1-2	DU-26 (1-2)	1.4	11.6	15.5	80.7	151	1.25	19.9	0.558	206	4.27E-05	0.0050	1.6600	0.1580	0.2810	0.0705				
			2-3	DU-26 (2-3)	0.529	4.75	14.6	41.6	76.1	0.82	18.3	0.521	138	2.36E-05	0.0050	0.9930	0.1240	0.1480	0.1890				
	DU-42	Composite	0-1	DU-42 (0-1)	0.512	4.38	17.8	36.3	53.3	0.226	23.3	0.531	126	6.07E-05	0.0050	0.3470	0.0678	0.0507	0.0050				
			1-2	DU-42 (1-2)	0.667	4.11	18.4	25.4	30.3	0.186	22.6	0.549	109	2.27E-05	0.0048	0.2200	0.0429	0.0309	0.0050				
			2-3	DU-42 (2-3)	0.531	3.76	17.4	21.1	20.1	0.125	20.7	0.531	87	8.27E-06	0.0050	0.1580	0.0297	0.0229	0.0049				
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	1.3	14.5	19.8	204	46.1	0.184	21.1	0.583	173	1.03E-04	0.0050	1.4000	0.1590	0.2130	0.1860				
			1-2	DU-27 (1-2)	0.488	8.72	16.9	81.2	39.1	0.0555	21.3	0.488	130	6.99E-05	0.0101	1.7800	0.3630	0.2420	0.1680				
			2-3	DU-27 (2-3)	1.15	15.8	15.5	45.6	55.4	0.0643	18.4	0.512	139	2.40E-05	0.0050	0.6570	0.1030	0.0973	0.1780				
	DU-28	ISM	0-1	DU-28 (0-1)	2.32	10.5	16.4	184	78.1	0.649	17.9	0.513	267	1.91E-05	0.0070	2.3600	0.2610	0.4330	0.1000				
			1-2	DU-28 (1-2)	2.87	13.3	17.3	327	74.1	0.706	17.2	0.493	231	3.27E-05	0.0085	3.1400	0.3090	0.5280	0.0718				
			2-3	DU-28 (2-3)	4.79	7.4	16.9	229	113	0.207	19.6	0.522	275	1.49E-05	0.0084	1.8900	0.2380	0.3530	0.0370				
	DU-29	ISM	0-1	DU-29 (0-1)	1.08	6.95	12.1	69.3	103	0.0595	18.1	0.518	164	4.97E-05	0.0085	0.9880	0.1570	0.1540	0.0250				
			1-2	DU-29 (1-2)	1.02	5.08	10.4	44.3	41.1	0.0436	15.3	0.545	100	1.53E-05	0.0051	0.4780	0.0641	0.0697	0.0047				
			2-3	DU-29 (2-3)	0.511	3.6	10	27.8	45.7	0.0409	15.2	0.511	92.7	1.53E-05	0.0050	0.3800	0.0562	0.0588	0.0049				
	DU-30	ISM	0-1	DU-30 (0-1)	1.66	4.22	14.5	63.4	131	0.0829	18.3	0.5	179	5.05E-05	0.0072	2.1500	0.2030	0.3980	0.0325				
			1-2	DU-30 (1-2)	2.09	3.72	13.9	79.8	202	0.05	17.7	0.512	228	2.24E-05	0.0050	1.0000	0.1200	0.1690	0.0050				
			2-3	DU-30 (2-3)	6.81	4.14	11.6	86.6	220	0.159	15.7	0.501	152	1.44E-05	0.0050	0.4650	0.0681	0.0709	0.0456				
	DU-31	ISM	0-1	DU-31 (0-1)	1.85	6.09	14.5	35.4	44.8	0.0479	16.5	0.491	116	5.84E-05	0.0050	0.8540	0.1160	0.1240	0.0257				
			1-2	DU-31 (1-2)	0.743	4.98	12.6	49.2	34.1	0.067	17	0.516	140	1.90E-05	0.0054	0.7680	0.1270	0.1190	0.0298				
			2-3	DU-31 (2-3)	0.735	5.96	12.9	68.2	25	0.0415	16.7	0.519	109	1.09E-05	0.0050	0.6490	0.1100	0.0919	0.0270				
	DU-32	ISM	0-1	DU-32 (0-1)	0.879	8.99	12.4	31.6	28.9	0.0428	15.7	0.535	118	3.48E-05	0.0063	0.7760	0.1220	0.1150	0.0048				
			1-2	DU-32 (1-2)	0.535	7.1	11.1	23.4	20.9	0.0428	15.3	0.535	104	7.54E-06	0.0047	0.4910	0.0684	0.0754	0.0048				
			2-3	DU-32 (2-3)	0.492	3.56	9.91	20.1	34.1	0.0394	14.2	0.492	90.2	7.59E-06	0.0405	3.5300	0.7460	0.5660	0.0047				
DU-33	ISM	0-1	DU-33 (0-1)	2.31	6.62	9.85	79.8	88.8	0.0435	14.9	0.491	290	3.69E-05	0.0081	0.4140	0.1040	0.0542	0.0852					
		1-2	DU-33 (1-2)	1.84	9.6	12.3	96.6	66.2	0.0413	17.8	0.516	354	1.67E-05	0.0066	0.4510	0.1280	0.0519	0.0501					
		2-3	DU-33 (2-3)	0.666	5.35	10.3	52.6	42.8	0.0423	16.4	0.529	234	1.21E-05	0.0049	0.4010	0.0650	0.0555	0.0579					

Please see notes at the end of the table.

Table A-1
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
East Parcel	DU-34	ISM	0-1	DU-34 (0-1)	1.05	5.13	14	32.6	41.4	0.044	22	0.523	182	6.03E-05	0.0178	1.7200	0.3960	0.2530	0.0330
			1-2	DU-34 (1-2)	0.557	4.95	14.6	33.2	31.9	0.0447	24.3	0.498	177	2.82E-05	0.0098	1.1900	0.2100	0.1840	0.0476
			2-3	DU-34 (2-3)	0.537	3.69	12.1	33.1	25.9	0.043	20.1	0.537	222	3.02E-05	0.0051	0.6510	0.1160	0.0973	0.0050
	DU-35	ISM	0-1	DU-35 (0-1)	0.512	4.4	14.5	52.9	22.6	0.0415	17.8	0.512	174	4.05E-05	0.0053	0.6160	0.1040	0.0931	0.0284
			1-2	DU-35 (1-2)	0.531	3.81	12.3	29.1	19	0.0425	15.3	0.531	168	1.31E-05	0.0050	0.7040	0.1060	0.1190	0.0396
			2-3	DU-35 (2-3)	0.524	3.37	9.45	27.8	12.4	0.042	14.2	0.524	141	1.02E-05	0.0049	0.2500	0.0334	0.0355	0.0050
	DU-36	ISM	0-1	DU-36 (0-1)	3.77	5.03	20.1	57.9	73.2	0.0398	22.6	0.498	266	4.21E-05	0.0060	0.6170	0.0892	0.0823	0.0279
			1-2	DU-36 (1-2)	3.44	4.23	17.3	56.7	130	0.0606	19	0.52	222	3.70E-05	0.0082	0.7770	0.1290	0.1030	0.0050
			2-3	DU-36 (2-3)	3.62	4.12	14.4	46.3	63.3	0.0449	18.3	0.526	190	2.80E-05	0.0050	0.2950	0.0564	0.0379	0.0284
	DU-38	ISM	0-1	DU-38 (0-1)	1.31	3.71	13.1	27.7	30.5	0.0454	16.5	0.536	110	2.94E-05	0.0056	0.5940	0.0920	0.0828	0.0412
			1-2	DU-38 (1-2)	4.88	3.76	12.3	56	76.7	0.0415	16	0.519	102	1.90E-05	0.0051	0.4550	0.0853	0.0635	0.0444
			2-3	DU-38 (2-3)	3.71	4.06	13.6	51.4	51.3	0.0421	17.1	0.527	108	1.05E-05	0.0051	0.5190	0.0738	0.0442	0.0300
	DU-37	Composite	0-1	DU-37 (0-1)	0.495	3.72	17.4	26.1	39.3	0.0396	18.6	0.572	74.4	6.78E-07	0.0050	0.0834	0.0210	0.0124	0.0049
			1-2	DU-37 (1-2)	0.495	3.00	14.9	21.4	12.6	0.043	18.8	0.537	61.5	6.32E-07	0.0050	0.1050	0.0213	0.0114	0.0050
			2-3	DU-37 (2-3)	0.513	2.85	13.4	16.9	8.96	0.0411	17.1	0.513	52.2	5.69E-07	0.0115	0.8510	0.2540	0.0970	0.0051
	DU-39	Composite	0-1	DU-39 (0-1)	0.534	2.69	13.4	21.3	6.09	0.0427	16	0.534	62.8	3.68E-06	0.0049	0.0270	0.0172	0.0057	0.0049
			1-2	DU-39 (1-2)	0.56	3.24	15.1	17.9	5.11	0.0448	18.3	0.615	57.4	1.38E-06	0.0049	0.0247	0.1750	0.0057	0.0049
			2-3	DU-39 (2-3)	0.525	3.44	16	18.4	6.88	0.042	19.2	0.525	54.3	1.36E-06	0.0049	0.0955	0.1290	0.0124	0.0049
	DU-40	Composite	0-1	DU-40 (0-1)	0.509	2.88	12.9	16.2	3.75	0.0407	16.3	0.509	44.3	7.34E-07	0.0050	0.0249	0.0174	0.0057	0.0049
			1-2	DU-40 (1-2)	0.513	3.4	13.4	15.4	3.47	0.0411	17.7	0.513	44.7	5.18E-07	0.0050	0.0281	0.0175	0.0061	0.0050
			2-3	DU-40 (2-3)	0.525	3.13	13.7	16.6	3.1	0.042	18.2	0.525	45.1	5.52E-07	0.0051	0.0279	0.0177	0.0061	0.0050
	DU-43	Composite	0-1	DU-43 (0-1)	0.503	2.92	13.8	18.8	5.42	0.0402	16.9	0.522	53.9	3.00E-06	0.0049	0.1200	0.0236	0.0163	0.0051
			1-2	DU-43 (1-2)	0.536	2.89	14	18.7	9.65	0.0429	18.5	0.536	56.4	1.26E-06	0.0051	0.1220	0.0813	0.0106	0.0051
			2-3	DU-43 (2-3)	0.523	3.06	13.8	16.3	4.35	0.0418	18.4	0.523	46	6.63E-07	0.0050	0.0616	0.0174	0.0097	0.0050
	DU-44	Composite	0-1	DU-44 (0-1)	0.619	3.12	14	17.9	13	0.0394	17.7	0.492	83.7	1.38E-06	0.0050	0.1430	0.0294	0.0180	0.0049
			1-2	DU-44 (1-2)	0.486	3.24	14.3	15.7	6.23	0.0389	17.2	0.486	51.3	8.37E-07	0.0050	0.0910	0.0206	0.0127	0.0049
			2-3	DU-44 (2-3)	0.505	3.06	13.2	15	5.94	0.0404	16.0	0.505	45.9	7.25E-07	0.0049	0.0840	0.0171	0.0129	0.0048
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	2.81	50.1	16.9	78.6	83.8	0.262	16.5	0.531	139	2.55E-04	0.0184	2.1100	0.3120	0.3360	0.0691
			1-2	DU-41 (1-2)	2.39	14.1	20.7	71.1	129	0.108	18.4	0.514	165	2.42E-04	0.0427	1.9400	0.5590	0.2760	0.0926
			2-3	DU-41 (2-3)	1.69	19.6	21.7	45.2	109	0.0732	21.7	0.511	182	1.55E-04	0.0129	1.0800	0.2310	0.1490	0.0438

Notes:

1. Definition of table shading:

COC was not detected. Value shown is the detection limit.

2. Where replicate samples collected, value shown is maximum value among replicate results.

Table A-2
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
ISM Background						0.29	8.8	39	24	27	0.073	23.4	0.33	105						
Composite Background						0.56	8.8	76	34	79	0.23	47	0.71	180						
Plant RBC						5	18	39	70	120	0.30	38	0.52	160						40
Invertebrate RBC						78		39	80	1700	0.10	280	4.1	120			18	29		
Bird RBC							575	87	88	33	0.015	139	3.42	673	8.90E-05					0.734
Mammal RBC						2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
Human Health Non-Carcinogenic RBC						24	74		11,000	400					1.70E-04				60	4
Human Health Carcinogenic RBC							1.4								1.50E-05				0.55	0.74
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0	0.801	6.24	37.4	180	74.8	0.0696	27.1	0.514	151	2.21E-05	0.0078	2.6600	0.3370	0.4460	0.4270
			1-2	DU-1 (1-2)	1	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000		
			2-3	DU-1 (2-3)	0	0.529	5.79	29.5	69.5	57.5	0.0813	25.0	0.529	179	1.07E-05	0.0048	2.1100	0.2860	0.3280	0.1100
	DU-2	ISM	0-1	DU-2 (0-1)	0	0.603	5.41	21.5	119	96.2	0.0731	18.9	0.505	99.4	6.95E-06	0.0051	1.0200	0.1270	0.1650	0.1860
			1-2	DU-2 (1-2)	0	0.515	5.36	22	170	118	0.124	16.4	0.515	88.8	3.44E-06	0.0047	0.7920	0.1230	0.1080	0.5580
			2-3	DU-2 (2-3)	0	0.495	5.21	15.5	41.9	24.4	0.0607	14.7	0.495	78	2.42E-06	0.0050	0.2230	0.0275	0.0319	0.0299
	DU-3	ISM	0-1	DU-3 (0-1)	0	0.547	6.87	16.2	26.8	20.1	0.0438	16.3	0.547	80.4	2.63E-05	0.0048	0.9760	0.1210	0.1530	0.0250
			1-2	DU-3 (1-2)	0	0.497	6.65	16.5	25.8	15.8	0.0455	17.1	0.497	72.2	7.82E-06	0.0051	0.9840	0.1210	0.1290	0.0050
			2-3	DU-3 (2-3)	0	0.536	6.65	15.7	21.6	13.5	0.0497	16.0	0.536	64.7	4.57E-06	0.0050	0.7450	0.1140	0.1030	0.0048
	DU-4	ISM	0-1	DU-4 (0-1)	0	0.565	6.57	16.3	29.1	23.7	0.0746	23.9	0.565	89.4	2.09E-05	0.0057	2.5200	0.3290	0.4280	0.0317
			1-2	DU-4 (1-2)	0	0.515	6.87	16.3	26.6	23.9	0.0596	24.6	0.515	79.4	1.66E-05	0.0334	11.9000	3.5400	1.7500	0.0245
			2-3	DU-4 (2-3)	0	0.502	7.63	18.4	34	45.1	0.076	22.4	0.502	115	1.47E-05	0.0094	4.6500	0.6340	0.7670	0.0351
	DU-5	ISM	0-1	DU-5 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-5 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-5 (2-3)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-6	ISM	0-1	DU-6 (0-1)	0	0.539	4.93	22.1	67.6	28.2	0.128	19.6	0.539	135	1.04E-05	0.0052	1.1000	0.1200	0.1880	0.0625
			1-2	DU-6 (1-2)	1	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000	
			2-3	DU-6 (2-3)	0	0.526	4.67	23.2	100	37.8	0.141	22.0	0.526	112	1.14E-05	0.0110	1.4300	0.2160	0.2260	0.1670
	DU-7	ISM	0-1	DU-7 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-7 (1-2)	0	0.547	3.98	18.6	30.1	18.7	0.13	19.7	0.547	92.7	1.24E-05	0.0050	0.4400	0.0705	0.0711	0.0567
			2-3	DU-7 (2-3)	0	0.536	3.07	16.2	24.2	14.9	0.0927	19.1	0.536	75.1	8.17E-06	0.0050	0.3160	0.0497	0.0478	0.0502
	DU-8	ISM	0-1	DU-8 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-8 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-8 (2-3)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-9	ISM	0-1	DU-9 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-9 (1-2)	0	0.555	4.81	27.8	34.6	40.7	0.141	24.4	0.555	115	1.28E-05	0.0048	0.4770	0.0753	0.0771	0.0353
			2-3	DU-9 (2-3)	0	0.512	5.12	31	37.4	21.5	0.141	26.2	0.512	122	1.23E-05	0.0080	1.1600	0.1990	0.1800	0.0478
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-10 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-10 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-11	ISM	0-1	DU-11 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-11 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-11 (2-3)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-12	ISM	0-1	DU-12 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-12 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-12 (2-3)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000

Please see notes at the end of the table.

Table A-2
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-13 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-13 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-14	ISM	0-1	DU-14 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-14 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-14 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-15	ISM	0-1	DU-15 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-15 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-15 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-16	ISM	0-1	DU-16 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-16 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-16 (2-3)	2	0.499	3.72	12.9	29.1	37.5	0.1485	16.8	0.539	71.3	7.62E-06	0.0050	0.4170	0.0624	0.0569	0.0050
	DU-17	ISM	0-1	DU-17 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-17 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-17 (2-3)	0	0.504	3.16	11.1	26.8	35.1	0.121	14.6	0.504	58.4	7.81E-06	0.0050	0.2220	0.0348	0.0309	0.0049
	DU-18	ISM	0-1	DU-18 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-18 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-18 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-19	ISM	0-1	DU-19 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-19 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-19 (2-3)	2	0.926	5.68	11.2	44.9	70.8	0.1485	15.5	0.522	113	4.66E-05	0.0051	0.5140	0.0627	0.0790	0.0568
	DU-20	ISM	0-1	DU-20 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-20 (1-2)	0	0.536	4.08	19.5	25.8	17.7	0.136	28.4	0.536	87.3	4.30E-06	0.0049	0.0881	0.0236	0.0132	0.0050
			2-3	DU-20 (2-3)	0	0.511	3.68	16.7	23	14.3	0.101	21.1	0.511	90.4	3.97E-06	0.0047	0.1350	0.0247	0.0193	0.0050
	DU-21	ISM	0-1	DU-21 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-21 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-21 (2-3)	2	0.497	4.48	11.6	45.9	89.7	0.1485	18	0.497	109	1.01E-05	0.0052	0.6240	0.1480	0.0879	0.0050
	DU-22	ISM	0-1	DU-22 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-22 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-22 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-23	ISM	0-1	DU-23 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-23 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-23 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-24	ISM	0-1	DU-24 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-24 (1-2)	2	0.496	3.56	15	31.1	23.2	0.1485	20.6	0.496	124	6.44E-06	0.0050	0.5000	0.0548	0.0740	0.0049
			2-3	DU-24 (2-3)	0	0.501	2.84	10.9	17.6	13.8	0.0928	18.5	0.501	83.1	8.88E-06	0.0050	0.0883	0.0202	0.0145	0.0048
	DU-25	ISM	0-1	DU-25 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-25 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-25 (2-3)	0	0.496	3.17	12.6	30	43.2	0.116	18.7	0.496	138	1.94E-06	0.0048	0.6130	0.0873	0.0873	0.0050
	DU-26	ISM	0-1	DU-26 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-26 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-26 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000

Please see notes at the end of the table.

Table A-2
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-42 (1-2)	0	0.667	4.11	18.4	25.4	30.3	0.186	22.6	0.549	109	2.27E-05	0.0048	0.2200	0.0429	0.0309	0.0050
			2-3	DU-42 (2-3)	0	0.531	3.76	17.4	21.1	20.1	0.125	20.7	0.531	87	8.27E-06	0.0050	0.1580	0.0297	0.0229	0.0049
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-27 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-27 (2-3)	0	1.15	15.8	15.5	45.6	55.4	0.0643	18.4	0.512	139	2.40E-05	0.0050	0.6570	0.1030	0.0973	0.1780
	DU-28	ISM	0-1	DU-28 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-28 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-28 (2-3)	2	4.79	7.4	16.9	229	113	0.1485	19.6	0.522	275	1.49E-05	0.0084	1.8900	0.2380	0.3530	0.0370
	DU-29	ISM	0-1	DU-29 (0-1)	0	1.08	6.95	12.1	69.3	103	0.0595	18.1	0.518	164	4.97E-05	0.0085	0.9880	0.1570	0.1540	0.0250
			1-2	DU-29 (1-2)	0	1.02	5.08	10.4	44.3	41.1	0.0436	15.3	0.545	100	1.53E-05	0.0051	0.4780	0.0641	0.0697	0.0047
			2-3	DU-29 (2-3)	0	0.511	3.6	10	27.8	45.7	0.0409	15.2	0.511	92.7	1.53E-05	0.0050	0.3800	0.0562	0.0588	0.0049
	DU-30	ISM	0-1	DU-30 (0-1)	0	1.66	4.22	14.5	63.4	131	0.0829	18.3	0.5	179	5.05E-05	0.0072	2.1500	0.2030	0.3980	0.0325
			1-2	DU-30 (1-2)	0	2.09	3.72	13.9	79.8	202	0.05	17.7	0.512	228	2.24E-05	0.0050	1.0000	0.1200	0.1690	0.0050
			2-3	DU-30 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-31	ISM	0-1	DU-31 (0-1)	0	1.85	6.09	14.5	35.4	44.8	0.0479	16.5	0.491	116	5.84E-05	0.0050	0.8540	0.1160	0.1240	0.0257
			1-2	DU-31 (1-2)	0	0.743	4.98	12.6	49.2	34.1	0.067	17	0.516	140	1.90E-05	0.0054	0.7680	0.1270	0.1190	0.0298
			2-3	DU-31 (2-3)	0	0.735	5.96	12.9	68.2	25	0.0415	16.7	0.519	109	1.09E-05	0.0050	0.6490	0.1100	0.0919	0.0270
	DU-32	ISM	0-1	DU-32 (0-1)	0	0.879	8.99	12.4	31.6	28.9	0.0428	15.7	0.535	118	3.48E-05	0.0063	0.7760	0.1220	0.1150	0.0048
			1-2	DU-32 (1-2)	0	0.535	7.1	11.1	23.4	20.9	0.0428	15.3	0.535	104	7.54E-06	0.0047	0.4910	0.0684	0.0754	0.0048
			2-3	DU-32 (2-3)	0	0.492	3.56	9.91	20.1	34.1	0.0394	14.2	0.492	90.2	7.59E-06	0.0405	3.5300	0.7460	0.5660	0.0047
	DU-33	ISM	0-1	DU-33 (0-1)	0	2.31	6.62	9.85	79.8	88.8	0.0435	14.9	0.491	290	3.69E-05	0.0081	0.4140	0.1040	0.0542	0.0852
			1-2	DU-33 (1-2)	0	1.84	9.6	12.3	96.6	66.2	0.0413	17.8	0.516	354	1.67E-05	0.0066	0.4510	0.1280	0.0519	0.0501
			2-3	DU-33 (2-3)	0	0.666	5.35	10.3	52.6	42.8	0.0423	16.4	0.529	234	1.21E-05	0.0049	0.4010	0.0650	0.0555	0.0579
	DU-34	ISM	0-1	DU-34 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-34 (1-2)	0	0.557	4.95	14.6	33.2	31.9	0.0447	24.3	0.498	177	2.82E-05	0.0098	1.1900	0.2100	0.1840	0.0476
			2-3	DU-34 (2-3)	0	0.537	3.69	12.1	33.1	25.9	0.043	20.1	0.537	222	3.02E-05	0.0051	0.6510	0.1160	0.0973	0.0050
	DU-35	ISM	0-1	DU-35 (0-1)	0	0.512	4.4	14.5	52.9	22.6	0.0415	17.8	0.512	174	4.05E-05	0.0053	0.6160	0.1040	0.0931	0.0284
			1-2	DU-35 (1-2)	0	0.531	3.81	12.3	29.1	19	0.0425	15.3	0.531	168	1.31E-05	0.0050	0.7040	0.1060	0.1190	0.0396
			2-3	DU-35 (2-3)	0	0.524	3.37	9.45	27.8	12.4	0.042	14.2	0.524	141	1.02E-05	0.0049	0.2500	0.0334	0.0355	0.0050
	DU-36	ISM	0-1	DU-36 (0-1)	0	3.77	5.03	20.1	57.9	73.2	0.0398	22.6	0.498	266	4.21E-05	0.0060	0.6170	0.0892	0.0823	0.0279
			1-2	DU-36 (1-2)	0	3.44	4.23	17.3	56.7	130	0.0606	19	0.52	222	3.70E-05	0.0082	0.7770	0.1290	0.1030	0.0050
			2-3	DU-36 (2-3)	0	3.62	4.12	14.4	46.3	63.3	0.0449	18.3	0.526	190	2.80E-05	0.0050	0.2950	0.0564	0.0379	0.0284
	DU-38	ISM	0-1	DU-38 (0-1)	0	1.31	3.71	13.1	27.7	30.5	0.0454	16.5	0.536	110	2.94E-05	0.0056	0.5940	0.0920	0.0828	0.0412
			1-2	DU-38 (1-2)	0	4.88	3.76	12.3	56	76.7	0.0415	16	0.519	102	1.90E-05	0.0051	0.4550	0.0853	0.0635	0.0444
			2-3	DU-38 (2-3)	0	3.71	4.06	13.6	51.4	51.3	0.0421	17.1	0.527	108	1.05E-05	0.0051	0.5190	0.0738	0.0442	0.0300
	DU-37	Composite	0-1	DU-37 (0-1)	0	0.495	3.72	17.4	26.1	39.3	0.0396	18.6	0.572	74.4	6.78E-07	0.0050	0.0834	0.0210	0.0124	0.0049
			1-2	DU-37 (1-2)	0	0.495	3.00	14.9	21.4	12.6	0.043	18.8	0.537	61.5	6.32E-07	0.0050	0.1050	0.0213	0.0114	0.0050
			2-3	DU-37 (2-3)	0	0.513	2.85	13.4	16.9	8.96	0.0411	17.1	0.513	52.2	5.69E-07	0.0115	0.8510	0.2540	0.0970	0.0051
	DU-39	Composite	0-1	DU-39 (0-1)	0	0.534	2.69	13.4	21.3	6.09	0.0427	16	0.534	62.8	3.68E-06	0.0049	0.0270	0.0172	0.0057	0.0049
			1-2	DU-39 (1-2)	0	0.56	3.24	15.1	17.9	5.11	0.0448	18.3	0.615	57.4	1.38E-06	0.0049	0.0247	0.1750	0.0057	0.0049
			2-3	DU-39 (2-3)	0	0.525	3.44	16	18.4	6.88	0.042	19.2	0.525	54.3	1.36E-06	0.0049	0.0955	0.1290	0.0124	0.0049

Please see notes at the end of the table.

Table A-2
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)	0	0.509	2.88	12.9	16.2	3.75	0.0407	16.3	0.509	44.3	7.34E-07	0.0050	0.0249	0.0174	0.0057	0.0049
			1-2	DU-40 (1-2)	0	0.513	3.4	13.4	15.4	3.47	0.0411	17.7	0.513	44.7	5.18E-07	0.0050	0.0281	0.0175	0.0061	0.0050
			2-3	DU-40 (2-3)	0	0.525	3.13	13.7	16.6	3.1	0.042	18.2	0.525	45.1	5.52E-07	0.0051	0.0279	0.0177	0.0061	0.0050
	DU-43	Composite	0-1	DU-43 (0-1)	0	0.503	2.92	13.8	18.8	5.42	0.0402	16.9	0.522	53.9	3.00E-06	0.0049	0.1200	0.0236	0.0163	0.0051
			1-2	DU-43 (1-2)	0	0.536	2.89	14	18.7	9.65	0.0429	18.5	0.536	56.4	1.26E-06	0.0051	0.1220	0.0813	0.0106	0.0051
			2-3	DU-43 (2-3)	0	0.523	3.06	13.8	16.3	4.35	0.0418	18.4	0.523	46	6.63E-07	0.0050	0.0616	0.0174	0.0097	0.0050
	DU-44	Composite	0-1	DU-44 (0-1)	0	0.619	3.12	14	17.9	13	0.0394	17.7	0.492	83.7	1.38E-06	0.0050	0.1430	0.0294	0.0180	0.0049
			1-2	DU-44 (1-2)	0	0.486	3.24	14.3	15.7	6.23	0.0389	17.2	0.486	51.3	8.37E-07	0.0050	0.0910	0.0206	0.0127	0.0049
			2-3	DU-44 (2-3)	0	0.505	3.06	13.2	15	5.94	0.0404	16.0	0.505	45.9	7.25E-07	0.0049	0.0840	0.0171	0.0129	0.0048
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-41 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-41 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000

Notes:

1. Definition of table shading:

COC was not detected. Value shown is the detection limit.

2. Where replicate samples collected, value shown is maximum value among replicate results.

Table A-3
West Parcel
ProUCL Input
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-1 (0-1)	0.801	6.24	37.4	180	74.8	0.0696	27.1	151	2.21E-05	0.0078	2.6600	0.4460	0.4270
DU-1 (1-2)	0.712	5.41	41.3	64.6	321	0.0863	30.9	140	2.56E-05	0.0102	2.6200	0.4000	2.7500
DU-1 (2-3)	0.529	5.79	29.5	69.5	57.5	0.0813	25.0	179	1.07E-05	0.0048	2.1100	0.3280	0.1100
DU-2 (0-1)	0.603	5.41	21.5	119	96.2	0.0731	18.9	99.4	6.95E-06	0.0051	1.0200	0.1650	0.1860
DU-2 (1-2)	0.515	5.36	22	170	118	0.124	16.4	88.8	3.44E-06	0.0047	0.7920	0.1080	0.5580
DU-2 (2-3)	0.495	5.21	15.5	41.9	24.4	0.0607	14.7	78	2.42E-06	0.0050	0.2230	0.0319	0.0299
DU-3 (0-1)	0.547	6.87	16.2	26.8	20.1	0.0438	16.3	80.4	2.63E-05	0.0048	0.9760	0.1530	0.0250
DU-3 (1-2)	0.497	6.65	16.5	25.8	15.8	0.0455	17.1	72.2	7.82E-06	0.0051	0.9840	0.1290	0.0050
DU-3 (2-3)	0.536	6.65	15.7	21.6	13.5	0.0497	16.0	64.7	4.57E-06	0.0050	0.7450	0.1030	0.0048
DU-4 (0-1)	0.565	6.57	16.3	29.1	23.7	0.0746	23.9	89.4	2.09E-05	0.0057	2.5200	0.4280	0.0317
DU-4 (1-2)	0.515	6.87	16.3	26.6	23.9	0.0596	24.6	79.4	1.66E-05	0.0334	11.9000	1.7500	0.0245
DU-4 (2-3)	0.502	7.63	18.4	34	45.1	0.076	22.4	115	1.47E-05	0.0094	4.6500	0.7670	0.0351
DU-5 (0-1)	0.992	8.98	52.3	344	62.1	0.352	32.6	211	1.71E-05	0.0073	1.4000	0.2420	0.1770
DU-5 (1-2)	0.832	8.09	42.9	237	70.5	0.369	58.9	179	1.53E-05	0.0061	1.1600	0.1990	0.1430
DU-5 (2-3)	0.596	6.73	47.1	214	118	0.273	31.3	224	2.33E-05	0.0099	2.8800	0.4080	0.3870
DU-6 (0-1)	0.539	4.93	22.1	67.6	28.2	0.128	19.6	135	1.04E-05	0.0052	1.1000	0.1880	0.0625
DU-6 (1-2)	0.56	4.89	25.2	91.6	40	0.156	21.8	124	2.51E-05	0.0090	1.2900	0.2040	0.1110
DU-6 (2-3)	0.526	4.67	23.2	100	37.8	0.141	22.0	112	1.14E-05	0.0110	1.4300	0.2260	0.1670
DU-7 (0-1)	0.537	4.37	19.2	36	23.3	0.304	19.3	126	1.74E-05	0.0051	0.7510	0.1270	0.0527
DU-7 (1-2)	0.547	3.98	18.6	30.1	18.7	0.13	19.7	92.7	1.24E-05	0.0050	0.4400	0.0711	0.0567
DU-7 (2-3)	0.536	3.07	16.2	24.2	14.9	0.0927	19.1	75.1	8.17E-06	0.0050	0.3160	0.0478	0.0502
DU-8 (0-1)	0.56	4.33	21.7	32.5	39.1	0.154	19.6	144	2.36E-05	0.0055	0.7550	0.1210	0.0989
DU-8 (1-2)	0.501	4.13	24.6	32.9	31.4	0.164	19.7	130	2.46E-05	0.0055	0.4940	0.0731	0.0678
DU-8 (2-3)	0.545	4.13	21.9	32	31	0.156	20.7	126	2.34E-05	0.0062	0.5890	0.0847	0.0984
DU-9 (0-1)	0.623	5.25	30.6	40.6	28.2	0.16	26.5	154	1.78E-05	0.0057	1.1200	0.1890	0.0640
DU-9 (1-2)	0.555	4.81	27.8	34.6	40.7	0.141	24.4	115	1.28E-05	0.0048	0.4770	0.0771	0.0353
DU-9 (2-3)	0.512	5.12	31	37.4	21.5	0.141	26.2	122	1.23E-05	0.0080	1.1600	0.1800	0.0478

Notes:

1. Definition of table shading:

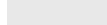
 COC was not detected. Value shown is the detection limit.

Table A-4
Central Parcel
ProUCL Input
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-10 (0-1)	0.541	4.5	14.8	33.3	86.5	1.07	29.9	106	1.73E-05	0.0235	29.4000	5.1900	0.0337
DU-10 (1-2)	0.531	5.56	15.3	33.6	54.8	0.829	27.5	94.9	5.46E-06	0.0494	28.3000	4.7000	0.0262
DU-10 (2-3)	0.514	5.16	14.5	32.2	73.3	0.609	22.6	117	4.52E-06	0.0244	16.9000	2.6000	0.0051
DU-11 (0-1)	0.545	4.6	23.6	38.5	56.1	0.726	29.3	116	1.17E-05	0.0819	31.3000	5.4000	0.0369
DU-11 (1-2)	0.535	4.15	22	37.3	49	0.633	28.2	99.5	5.21E-06	0.0486	15.1000	2.6500	0.0372
DU-11 (2-3)	0.526	4.23	22	35.2	43.3	0.604	26.4	95	5.89E-06	0.0613	30.2000	5.1300	0.0389
DU-12 (0-1)	0.83	4.95	14.8	78.9	165	0.292	19.8	166	2.54E-05	0.0070	2.4700	0.3930	0.0532
DU-12 (1-2)	0.493	4.26	14	55.7	131	0.275	19	104	4.21E-06	0.0059	0.9970	0.1430	0.0317
DU-12 (2-3)	0.551	3.62	13.7	41	70.8	0.207	17.8	79.7	2.60E-06	0.0050	0.5840	0.0900	0.0050
DU-13 (0-1)	0.923	6.04	14.2	94.3	241	1.15	21.4	204	2.77E-04	0.0084	7.9300	1.1700	0.0701
DU-13 (1-2)	0.54	4.79	13.8	53	154	0.785	18.6	128	3.62E-05	0.0155	3.0600	0.4500	0.0272
DU-13 (2-3)	0.562	4.04	12.6	54.2	175	0.769	18.4	127	2.66E-05	0.0052	1.6700	0.2630	0.0330
DU-14 (0-1)	2.81	6.14	22.9	73.5	134	1.33	24.3	147	7.87E-05	0.0229	0.9920	0.1490	0.0283
DU-14 (1-2)	7.38	6.87	21.6	122	240	3.1	23.7	204	3.43E-05	0.0224	1.7000	0.2570	0.0048
DU-14 (2-3)	3.04	5.66	20.6	185	162	2.5	24.8	164	1.43E-05	0.0143	1.3200	0.1950	0.0048
DU-15 (0-1)	2.81	5.04	16	95.4	131	0.75	21.7	131	3.96E-04	0.0081	0.9590	0.1380	0.0268
DU-15 (1-2)	0.576	3.75	14	57.7	68.6	1.28	19.3	120	2.00E-04	0.0049	0.3280	0.0499	0.0048
DU-15 (2-3)	0.492	2.91	11.2	36.2	63.6	0.563	17.6	76.8	1.50E-04	0.0049	0.6910	0.1010	0.0048
DU-16 (0-1)	4.29	8.31	26.6	131	306	5.12	28.1	371	2.44E-04	0.0776	3.2200	0.4960	0.0346
DU-16 (1-2)	2.29	6.92	13.6	71.8	151	1.69	18.5	139	1.75E-05	0.0075	1.6300	0.2460	0.0049
DU-16 (2-3)	0.499	3.72	12.9	29.1	37.5	0.429	16.8	71.3	7.62E-06	0.0050	0.4170	0.0569	0.0050
DU-17 (0-1)	1.06	4.95	12.4	59.2	81.4	0.575	16.4	156	4.04E-05	0.0050	0.4280	0.0634	0.0257
DU-17 (1-2)	0.511	3.72	11.8	34.3	62.5	0.356	16.3	70.6	3.43E-06	0.0050	0.3630	0.0513	0.0050
DU-17 (2-3)	0.504	3.16	11.1	26.8	35.1	0.121	14.6	58.4	7.81E-06	0.0050	0.2220	0.0309	0.0049
DU-18 (0-1)	1.41	10.9	22.8	111	280	1.72	23.5	204	6.68E-05	0.0069	1.8100	0.2710	0.0584
DU-18 (1-2)	0.495	6.22	15.3	79.5	179	1.06	21.8	158	2.16E-05	0.0050	0.8940	0.1380	0.0336
DU-18 (2-3)	0.502	5.63	13.9	59.9	92.3	0.681	18.3	118	1.29E-05	0.0051	0.5870	0.0862	0.0316
DU-19 (0-1)	1.39	7.67	13.2	107	257	0.666	16.5	215	1.34E-04	0.0121	2.3700	0.4030	0.1440
DU-19 (1-2)	0.957	11.2	12	110	161	1.08	15.5	198	8.48E-05	0.0174	1.8200	0.2700	0.0311
DU-19 (2-3)	0.926	5.68	11.2	44.9	70.8	0.327	15.5	113	4.66E-05	0.0051	0.5140	0.0790	0.0568
DU-20 (0-1)	1.69	5.69	19.6	58.4	76.2	0.314	22.7	117	3.49E-05	0.0048	0.8920	0.1450	0.0390
DU-20 (1-2)	0.536	4.08	19.5	25.8	17.7	0.136	28.4	87.3	4.30E-06	0.0049	0.0881	0.0132	0.0050
DU-20 (2-3)	0.511	3.68	16.7	23	14.3	0.101	21.1	90.4	3.97E-06	0.0047	0.1350	0.0193	0.0050
DU-21 (0-1)	2.73	10.5	14.8	128	295	0.776	20.3	242	7.03E-05	0.0187	2.0900	0.3140	0.0492
DU-21 (1-2)	1.01	4.93	11.8	56.2	116	0.276	17.7	180	2.06E-05	0.0074	1.0500	0.1640	0.0364
DU-21 (2-3)	0.497	4.48	11.6	45.9	89.7	0.154	18	109	1.01E-05	0.0052	0.6240	0.0879	0.0050
DU-22 (0-1)	2.89	6.48	19.6	96.6	190	0.602	23.2	178	3.25E-05	0.1120	2.6500	0.1310	0.0438
DU-22 (1-2)	2.63	4.53	18.8	47.4	72.3	0.349	22.6	164	1.23E-05	0.0051	0.2350	0.0289	0.0258
DU-22 (2-3)	1.09	4.45	18	54	57.5	0.376	21.4	123	7.93E-06	0.0051	0.2250	0.0292	0.0050
DU-23 (0-1)	1.62	5.99	22.1	150	276	1.02	22.9	184	4.00E-05	0.0061	0.7550	0.1060	0.0591
DU-23 (1-2)	0.61	4.63	18.4	69.5	70.9	0.545	20.5	127	1.05E-05	0.0050	0.5370	0.1040	0.0265
DU-23 (2-3)	0.498	3.82	15.6	41.9	82.2	0.426	18.8	99	5.92E-06	0.0051	0.2310	0.0362	0.0050
DU-24 (0-1)	0.546	4.16	15.5	39.9	48.8	0.276	19.2	117	2.33E-05	0.0050	0.6300	0.0907	0.0326
DU-24 (1-2)	0.496	3.56	15	31.1	23.2	0.175	20.6	124	6.44E-06	0.0050	0.5000	0.0740	0.0049
DU-24 (2-3)	0.501	2.84	10.9	17.6	13.8	0.0928	18.5	83.1	8.88E-06	0.0050	0.0883	0.0145	0.0048
DU-25 (0-1)	0.822	5.24	20.2	226	144	0.762	21.3	242	4.69E-05	0.0123	2.7700	0.3860	0.0653
DU-25 (1-2)	0.493	3.29	14.5	48.5	113	0.213	19.6	202	2.60E-06	0.0050	0.6430	0.0905	0.0050
DU-25 (2-3)	0.496	3.17	12.6	30	43.2	0.116	18.7	138	1.94E-06	0.0048	0.6130	0.0873	0.0050
DU-26 (0-1)	4.79	9.5	19.1	152	330	1.95	20.7	260	9.33E-05	0.0246	4.8900	0.7230	0.1850
DU-26 (1-2)	1.4	11.6	15.5	80.7	151	1.25	19.9	206	4.27E-05	0.0050	1.6600	0.2810	0.0705
DU-26 (2-3)	0.529	4.75	14.6	41.6	76.1	0.82	18.3	138	2.36E-05	0.0050	0.9930	0.1480	0.1890
DU-42 (0-1)	0.512	4.38	17.8	36.3	53.3	0.226	23.3	126	6.07E-05	0.0050	0.3470	0.0507	0.0050
DU-42 (1-2)	0.667	4.11	18.4	25.4	30.3	0.186	22.6	109	2.27E-05	0.0048	0.2200	0.0309	0.0050
DU-42 (2-3)	0.531	3.76	17.4	21.1	20.1	0.125	20.7	87	8.27E-06	0.0050	0.1580	0.0229	0.0049

Notes:

1. Definition of table shading:

COC was not detected. Value shown is the detection limit.

Table A-5
East Parcel
ProUCL Input
Baseline Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-27 (0-1)	1.3	14.5	19.8	204	46.1	0.184	21.1	173	1.03E-04	0.0050	1.4000	0.2130	0.1860
DU-27 (1-2)	0.488	8.72	16.9	81.2	39.1	0.0555	21.3	130	6.99E-05	0.0101	1.7800	0.2420	0.1680
DU-27 (2-3)	1.15	15.8	15.5	45.6	55.4	0.0643	18.4	139	2.40E-05	0.0050	0.6570	0.0973	0.1780
DU-28 (0-1)	2.32	10.5	16.4	184	78.1	0.649	17.9	267	1.91E-05	0.0070	2.3600	0.4330	0.1000
DU-28 (1-2)	2.87	13.3	17.3	327	74.1	0.706	17.2	231	3.27E-05	0.0085	3.1400	0.5280	0.0718
DU-28 (2-3)	4.79	7.4	16.9	229	113	0.207	19.6	275	1.49E-05	0.0084	1.8900	0.3530	0.0370
DU-29 (0-1)	1.08	6.95	12.1	69.3	103	0.0595	18.1	164	4.97E-05	0.0085	0.9880	0.1540	0.0250
DU-29 (1-2)	1.02	5.08	10.4	44.3	41.1	0.0436	15.3	100	1.53E-05	0.0051	0.4780	0.0697	0.0047
DU-29 (2-3)	0.511	3.6	10	27.8	45.7	0.0409	15.2	92.7	1.53E-05	0.0050	0.3800	0.0588	0.0049
DU-30 (0-1)	1.66	4.22	14.5	63.4	131	0.0829	18.3	179	5.05E-05	0.0072	2.1500	0.3980	0.0325
DU-30 (1-2)	2.09	3.72	13.9	79.8	202	0.05	17.7	228	2.24E-05	0.0050	1.0000	0.1690	0.0050
DU-30 (2-3)	6.81	4.14	11.6	86.6	220	0.159	15.7	152	1.44E-05	0.0050	0.4650	0.0709	0.0456
DU-31 (0-1)	1.85	6.09	14.5	35.4	44.8	0.0479	16.5	116	5.84E-05	0.0050	0.8540	0.1240	0.0257
DU-31 (1-2)	0.743	4.98	12.6	49.2	34.1	0.067	17	140	1.90E-05	0.0054	0.7680	0.1190	0.0298
DU-31 (2-3)	0.735	5.96	12.9	68.2	25	0.0415	16.7	109	1.09E-05	0.0050	0.6490	0.0919	0.0270
DU-32 (0-1)	0.879	8.99	12.4	31.6	28.9	0.0428	15.7	118	3.48E-05	0.0063	0.7760	0.1150	0.0048
DU-32 (1-2)	0.535	7.1	11.1	23.4	20.9	0.0428	15.3	104	7.54E-06	0.0047	0.4910	0.0754	0.0048
DU-32 (2-3)	0.492	3.56	9.91	20.1	34.1	0.0394	14.2	90.2	7.59E-06	0.0405	3.5300	0.5660	0.0047
DU-33 (0-1)	2.31	6.62	9.85	79.8	88.8	0.0435	14.9	290	3.69E-05	0.0081	0.4140	0.0542	0.0852
DU-33 (1-2)	1.84	9.6	12.3	96.6	66.2	0.0413	17.8	354	1.67E-05	0.0066	0.4510	0.0519	0.0501
DU-33 (2-3)	0.666	5.35	10.3	52.6	42.8	0.0423	16.4	234	1.21E-05	0.0049	0.4010	0.0555	0.0579
DU-34 (0-1)	1.05	5.13	14	32.6	41.4	0.044	22	182	6.03E-05	0.0178	1.7200	0.2530	0.0330
DU-34 (1-2)	0.557	4.95	14.6	33.2	31.9	0.0447	24.3	177	2.82E-05	0.0098	1.1900	0.1840	0.0476
DU-34 (2-3)	0.537	3.69	12.1	33.1	25.9	0.043	20.1	222	3.02E-05	0.0051	0.6510	0.0973	0.0050
DU-35 (0-1)	0.512	4.4	14.5	52.9	22.6	0.0415	17.8	174	4.05E-05	0.0053	0.6160	0.0931	0.0284
DU-35 (1-2)	0.531	3.81	12.3	29.1	19	0.0425	15.3	168	1.31E-05	0.0050	0.7040	0.1190	0.0396
DU-35 (2-3)	0.524	3.37	9.45	27.8	12.4	0.042	14.2	141	1.02E-05	0.0049	0.2500	0.0355	0.0050
DU-36 (0-1)	3.77	5.03	20.1	57.9	73.2	0.0398	22.6	266	4.21E-05	0.0060	0.6170	0.0823	0.0279
DU-36 (1-2)	3.44	4.23	17.3	56.7	130	0.0606	19	222	3.70E-05	0.0082	0.7770	0.1030	0.0050
DU-36 (2-3)	3.62	4.12	14.4	46.3	63.3	0.0449	18.3	190	2.80E-05	0.0050	0.2950	0.0379	0.0284
DU-38 (0-1)	1.31	3.71	13.1	27.7	30.5	0.0454	16.5	110	2.94E-05	0.0056	0.5940	0.0828	0.0412
DU-38 (1-2)	4.88	3.76	12.3	56	76.7	0.0415	16	102	1.90E-05	0.0051	0.4550	0.0635	0.0444
DU-38 (2-3)	3.71	4.06	13.6	51.4	51.3	0.0421	17.1	108	1.05E-05	0.0051	0.5190	0.0442	0.0300
DU-37 (0-1)	0.495	3.72	17.4	26.1	39.3	0.0396	18.6	74.4	6.78E-07	0.0050	0.0834	0.0124	0.0049
DU-37 (1-2)	0.495	3.00	14.9	21.4	12.6	0.043	18.8	61.5	6.32E-07	0.0050	0.1050	0.0114	0.0050
DU-37 (2-3)	0.513	2.85	13.4	16.9	8.96	0.0411	17.1	52.2	5.69E-07	0.0115	0.8510	0.0970	0.0051
DU-39 (0-1)	0.534	2.69	13.4	21.3	6.09	0.0427	16	62.8	3.68E-06	0.0049	0.0270	0.0057	0.0049
DU-39 (1-2)	0.56	3.24	15.1	17.9	5.11	0.0448	18.3	57.4	1.38E-06	0.0049	0.0247	0.0057	0.0049
DU-39 (2-3)	0.525	3.44	16	18.4	6.88	0.042	19.2	54.3	1.36E-06	0.0049	0.0955	0.0124	0.0049
DU-40 (0-1)	0.509	2.88	12.9	16.2	3.75	0.0407	16.3	44.3	7.34E-07	0.0050	0.0249	0.0057	0.0049
DU-40 (1-2)	0.513	3.4	13.4	15.4	3.47	0.0411	17.7	44.7	5.18E-07	0.0050	0.0281	0.0061	0.0050
DU-40 (2-3)	0.525	3.13	13.7	16.6	3.1	0.042	18.2	45.1	5.52E-07	0.0051	0.0279	0.0061	0.0050
DU-43 (0-1)	0.503	2.92	13.8	18.8	5.42	0.0402	16.9	53.9	3.00E-06	0.0049	0.1200	0.0163	0.0051
DU-43 (1-2)	0.536	2.89	14	18.7	9.65	0.0429	18.5	56.4	1.26E-06	0.0051	0.1220	0.0106	0.0051
DU-43 (2-3)	0.523	3.06	13.8	16.3	4.35	0.0418	18.4	46	6.63E-07	0.0050	0.0616	0.0097	0.0050
DU-44 (0-1)	0.619	3.12	14	17.9	13	0.0394	17.7	83.7	1.38E-06	0.0050	0.1430	0.0180	0.0049
DU-44 (1-2)	0.486	3.24	14.3	15.7	6.23	0.0389	17.2	51.3	8.37E-07	0.0050	0.0910	0.0127	0.0049
DU-44 (2-3)	0.505	3.06	13.2	15	5.94	0.0404	16.0	45.9	7.25E-07	0.0049	0.0840	0.0129	0.0048
DU-41 (0-1)	2.81	50.1	16.9	78.6	83.8	0.262	16.5	139	2.55E-04	0.0184	2.1100	0.3360	0.0691
DU-41 (1-2)	2.39	14.1	20.7	71.1	129	0.108	18.4	165	2.42E-04	0.0427	1.9400	0.2760	0.0926
DU-41 (2-3)	1.69	19.6	21.7	45.2	109	0.0732	21.7	182	1.55E-04	0.0129	1.0800	0.1490	0.0438

Notes:

1. Definition of table shading:

COC was not detected. Value shown is the detection limit.

Table A-6 Baseline and Residual 90% Upper Confidence Limit of the Mean Output Results
RD/RA Work Plan
Willamette Cove Upland Facility

Exposure Condition	Depth Range (feet bgs)	Sample Location	90%UCL Concentration in mg/kg														
			Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
		ISM Background	0.29	8.8	39	24	27	0.073	23.4	0.33	105						
		Bird RBC		575	87	88	33	0.015	139	3.42	673	8.90E-05					0.734
		Mammal RBC	2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
		Human Health Non-Carcinogenic RBC	24	74		11,000	400					1.70E-04				60	4
		Human Health Carcinogenic RBC		1.4							1.50E-05				0.55	0.74	
Baseline	0-3	West Parcel	0.59	6.0	28	101	64	0.165	26		133	1.73E-05	0.0080	2.18		0.35	0.319
		Central Parcel	1.51	5.7	17	74	132	0.927	22		152	7.05E-05	0.0165	5.33		0.88	0.040
		East Parcel	1.73	7.9	15	64	61	0.107	18		153	4.23E-05	0.0092	0.97		0.15	0.049
Residual	0-3	West Parcel	0.55	6.0	78		50	0.102	22		113	1.41E-05	0.0123	2.93		0.46	0.160
		Central Parcel	0.83	4.4	48		73	0.568	21		113	2.87E-05	0.0126	4.61		0.75	0.032
		East Parcel	1.52	5.2	48		52	0.050	18		146	2.00E-05	0.0076	0.75		0.11	0.030
Residual Uncertainty	0-1	West Parcel	0.66	6.1	102		60	0.115	23		123	1.98E-05	0.0061	1.81		0.30	0.198
		Central Parcel	0.90	4.5	59		84	0.678	21		118	3.61E-05	0.0143	5.60		0.92	0.038
		East Parcel	1.83	6.7	69		63	0.0631	19		172	3.28E-05	0.0068	0.91		0.15	0.068

Table A-7
West Parcel
ProUCL Input
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-1 (0-1)	0.801	6.24	180	74.8	0.0696	27.1	151	2.21E-05	0.0078	2.6600	0.4460	0.4270
DU-1 (2-3)	0.529	5.79	69.5	57.5	0.0813	25.0	179	1.07E-05	0.0048	2.1100	0.3280	0.1100
DU-2 (0-1)	0.603	5.41	119	96.2	0.0731	18.9	99.4	6.95E-06	0.0051	1.0200	0.1650	0.1860
DU-2 (1-2)	0.515	5.36	170	118	0.124	16.4	88.8	3.44E-06	0.0047	0.7920	0.1080	0.5580
DU-2 (2-3)	0.495	5.21	41.9	24.4	0.0607	14.7	78	2.42E-06	0.0050	0.2230	0.0319	0.0299
DU-3 (0-1)	0.547	6.87	26.8	20.1	0.0438	16.3	80.4	2.63E-05	0.0048	0.9760	0.1530	0.0250
DU-3 (1-2)	0.497	6.65	25.8	15.8	0.0455	17.1	72.2	7.82E-06	0.0051	0.9840	0.1290	0.0050
DU-3 (2-3)	0.536	6.65	21.6	13.5	0.0497	16.0	64.7	4.57E-06	0.0050	0.7450	0.1030	0.0048
DU-4 (0-1)	0.565	6.57	29.1	23.7	0.0746	23.9	89.4	2.09E-05	0.0057	2.5200	0.4280	0.0317
DU-4 (1-2)	0.515	6.87	26.6	23.9	0.0596	24.6	79.4	1.66E-05	0.0334	11.9000	1.7500	0.0245
DU-4 (2-3)	0.502	7.63	34	45.1	0.076	22.4	115	1.47E-05	0.0094	4.6500	0.7670	0.0351
DU-6 (0-1)	0.539	4.93	67.6	28.2	0.128	19.6	135	1.04E-05	0.0052	1.1000	0.1880	0.0625
DU-6 (2-3)	0.526	4.67	100	37.8	0.141	22.0	112	1.14E-05	0.0110	1.4300	0.2260	0.1670
DU-7 (1-2)	0.547	3.98	30.1	18.7	0.13	19.7	92.7	1.24E-05	0.0050	0.4400	0.0711	0.0567
DU-7 (2-3)	0.536	3.07	24.2	14.9	0.0927	19.1	75.1	8.17E-06	0.0050	0.3160	0.0478	0.0502
DU-9 (1-2)	0.555	4.81	34.6	40.7	0.141	24.4	115	1.28E-05	0.0048	0.4770	0.0771	0.0353
DU-9 (2-3)	0.512	5.12	37.4	21.5	0.141	26.2	122	1.23E-05	0.0080	1.1600	0.1800	0.0478

Notes:

1. Definition of table shading:

COC was not detected. Value shown is the detection limit.

Table A-8
Central Parcel
ProUCL Input
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-10 (2-3)	0.514	5.16	32.2	73.3	0.609	22.6	117	4.52E-06	0.0244	16.9000	2.6000	0.0051
DU-11 (2-3)	0.526	4.23	35.2	43.3	0.604	26.4	95	5.89E-06	0.0613	30.2000	5.1300	0.0389
DU-12 (2-3)	0.551	3.62	41	70.8	0.207	17.8	79.7	2.60E-06	0.0050	0.5840	0.0900	0.0050
DU-13 (2-3)	0.562	4.04	54.2	175	0.769	18.4	127	2.66E-05	0.0052	1.6700	0.2630	0.0330
DU-14 (2-3)	3.04	5.66	185	162	2.5	24.8	164	1.43E-05	0.0143	1.3200	0.1950	0.0048
DU-15 (2-3)	0.492	2.91	36.2	63.6	0.563	17.6	76.8	1.50E-04	0.0049	0.6910	0.1010	0.0048
DU-16 (2-3)	0.499	3.72	29.1	37.5	0.1485	16.8	71.3	7.62E-06	0.0050	0.4170	0.0569	0.0050
DU-17 (2-3)	0.504	3.16	26.8	35.1	0.121	14.6	58.4	7.81E-06	0.0050	0.2220	0.0309	0.0049
DU-18 (2-3)	0.502	5.63	59.9	92.3	0.681	18.3	118	1.29E-05	0.0051	0.5870	0.0862	0.0316
DU-19 (2-3)	0.926	5.68	44.9	70.8	0.1485	15.5	113	4.66E-05	0.0051	0.5140	0.0790	0.0568
DU-20 (1-2)	0.536	4.08	25.8	17.7	0.136	28.4	87.3	4.30E-06	0.0049	0.0881	0.0132	0.0050
DU-20 (2-3)	0.511	3.68	23	14.3	0.101	21.1	90.4	3.97E-06	0.0047	0.1350	0.0193	0.0050
DU-21 (2-3)	0.497	4.48	45.9	89.7	0.1485	18	109	1.01E-05	0.0052	0.6240	0.0879	0.0050
DU-22 (2-3)	1.09	4.45	54	57.5	0.376	21.4	123	7.93E-06	0.0051	0.2250	0.0292	0.0050
DU-23 (2-3)	0.498	3.82	41.9	82.2	0.426	18.8	99	5.92E-06	0.0051	0.2310	0.0362	0.0050
DU-24 (1-2)	0.496	3.56	31.1	23.2	0.1485	20.6	124	6.44E-06	0.0050	0.5000	0.0740	0.0049
DU-24 (2-3)	0.501	2.84	17.6	13.8	0.0928	18.5	83.1	8.88E-06	0.0050	0.0883	0.0145	0.0048
DU-25 (2-3)	0.496	3.17	30	43.2	0.116	18.7	138	1.94E-06	0.0048	0.6130	0.0873	0.0050
DU-26 (2-3)	0.529	4.75	41.6	76.1	0.82	18.3	138	2.36E-05	0.0050	0.9930	0.1480	0.1890
DU-42 (0-1)	0.512	4.38	36.3	53.3	0.226	23.3	126	6.07E-05	0.0050	0.3470	0.0507	0.0050
DU-42 (1-2)	0.667	4.11	25.4	30.3	0.186	22.6	109	2.27E-05	0.0048	0.2200	0.0309	0.0050
DU-42 (2-3)	0.531	3.76	21.1	20.1	0.125	20.7	87	8.27E-06	0.0050	0.1580	0.0229	0.0049

Notes:

1. Definition of table shading:

	COC was not detected. Value shown is the detection limit.
	Excavated Layer 3 data used as surrogate post-excavation residual concentration

Table A-9
East Parcel
ProUCL Input
Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-27 (2-3)	1.15	15.8	45.6	55.4	0.0643	18.4	139	2.40E-05	0.0050	0.6570	0.0973	0.1780
DU-28 (2-3)	4.79	7.4	229	113	0.1485	19.6	275	1.49E-05	0.0084	1.8900	0.3530	0.0370
DU-29 (0-1)	1.08	6.95	69.3	103	0.0595	18.1	164	4.97E-05	0.0085	0.9880	0.1540	0.0250
DU-29 (1-2)	1.02	5.08	44.3	41.1	0.0436	15.3	100	1.53E-05	0.0051	0.4780	0.0697	0.0047
DU-29 (2-3)	0.511	3.6	27.8	45.7	0.0409	15.2	92.7	1.53E-05	0.0050	0.3800	0.0588	0.0049
DU-30 (0-1)	1.66	4.22	63.4	131	0.0829	18.3	179	5.05E-05	0.0072	2.1500	0.3980	0.0325
DU-30 (1-2)	2.09	3.72	79.8	202	0.05	17.7	228	2.24E-05	0.0050	1.0000	0.1690	0.0050
DU-31 (0-1)	1.85	6.09	35.4	44.8	0.0479	16.5	116	5.84E-05	0.0050	0.8540	0.1240	0.0257
DU-31 (1-2)	0.743	4.98	49.2	34.1	0.067	17	140	1.90E-05	0.0054	0.7680	0.1190	0.0298
DU-31 (2-3)	0.735	5.96	68.2	25	0.0415	16.7	109	1.09E-05	0.0050	0.6490	0.0919	0.0270
DU-32 (0-1)	0.879	8.99	31.6	28.9	0.0428	15.7	118	3.48E-05	0.0063	0.7760	0.1150	0.0048
DU-32 (1-2)	0.535	7.1	23.4	20.9	0.0428	15.3	104	7.54E-06	0.0047	0.4910	0.0754	0.0048
DU-32 (2-3)	0.492	3.56	20.1	34.1	0.0394	14.2	90.2	7.59E-06	0.0405	3.5300	0.5660	0.0047
DU-33 (0-1)	2.31	6.62	79.8	88.8	0.0435	14.9	290	3.69E-05	0.0081	0.4140	0.0542	0.0852
DU-33 (1-2)	1.84	9.6	96.6	66.2	0.0413	17.8	354	1.67E-05	0.0066	0.4510	0.0519	0.0501
DU-33 (2-3)	0.666	5.35	52.6	42.8	0.0423	16.4	234	1.21E-05	0.0049	0.4010	0.0555	0.0579
DU-34 (1-2)	0.557	4.95	33.2	31.9	0.0447	24.3	177	2.82E-05	0.0098	1.1900	0.1840	0.0476
DU-34 (2-3)	0.537	3.69	33.1	25.9	0.043	20.1	222	3.02E-05	0.0051	0.6510	0.0973	0.0050
DU-35 (0-1)	0.512	4.4	52.9	22.6	0.0415	17.8	174	4.05E-05	0.0053	0.6160	0.0931	0.0284
DU-35 (1-2)	0.531	3.81	29.1	19	0.0425	15.3	168	1.31E-05	0.0050	0.7040	0.1190	0.0396
DU-35 (2-3)	0.524	3.37	27.8	12.4	0.042	14.2	141	1.02E-05	0.0049	0.2500	0.0355	0.0050
DU-36 (0-1)	3.77	5.03	57.9	73.2	0.0398	22.6	266	4.21E-05	0.0060	0.6170	0.0823	0.0279
DU-36 (1-2)	3.44	4.23	56.7	130	0.0606	19	222	3.70E-05	0.0082	0.7770	0.1030	0.0050
DU-36 (2-3)	3.62	4.12	46.3	63.3	0.0449	18.3	190	2.80E-05	0.0050	0.2950	0.0379	0.0284
DU-38 (0-1)	1.31	3.71	27.7	30.5	0.0454	16.5	110	2.94E-05	0.0056	0.5940	0.0828	0.0412
DU-38 (1-2)	4.88	3.76	56	76.7	0.0415	16	102	1.90E-05	0.0051	0.4550	0.0635	0.0444
DU-38 (2-3)	3.71	4.06	51.4	51.3	0.0421	17.1	108	1.05E-05	0.0051	0.5190	0.0442	0.0300
DU-37 (0-1)	0.495	3.72	26.1	39.3	0.0396	18.6	74.4	6.78E-07	0.0050	0.0834	0.0124	0.0049
DU-37 (1-2)	0.495	3.00	21.4	12.6	0.043	18.8	61.5	6.32E-07	0.0050	0.1050	0.0114	0.0050
DU-37 (2-3)	0.513	2.85	16.9	8.96	0.0411	17.1	52.2	5.69E-07	0.0115	0.8510	0.0970	0.0051
DU-39 (0-1)	0.534	2.69	21.3	6.09	0.0427	16	62.8	3.68E-06	0.0049	0.0270	0.0057	0.0049
DU-39 (1-2)	0.56	3.24	17.9	5.11	0.0448	18.3	57.4	1.38E-06	0.0049	0.0247	0.0057	0.0049
DU-39 (2-3)	0.525	3.44	18.4	6.88	0.042	19.2	54.3	1.36E-06	0.0049	0.0955	0.0124	0.0049
DU-40 (0-1)	0.509	2.88	16.2	3.75	0.0407	16.3	44.3	7.34E-07	0.0050	0.0249	0.0057	0.0049
DU-40 (1-2)	0.513	3.4	15.4	3.47	0.0411	17.7	44.7	5.18E-07	0.0050	0.0281	0.0061	0.0050
DU-40 (2-3)	0.525	3.13	16.6	3.1	0.042	18.2	45.1	5.52E-07	0.0051	0.0279	0.0061	0.0050
DU-43 (0-1)	0.503	2.92	18.8	5.42	0.0402	16.9	53.9	3.00E-06	0.0049	0.1200	0.0163	0.0051
DU-43 (1-2)	0.536	2.89	18.7	9.65	0.0429	18.5	56.4	1.26E-06	0.0051	0.1220	0.0106	0.0051
DU-43 (2-3)	0.523	3.06	16.3	4.35	0.0418	18.4	46	6.63E-07	0.0050	0.0616	0.0097	0.0050
DU-44 (0-1)	0.619	3.12	17.9	13	0.0394	17.7	83.7	1.38E-06	0.0050	0.1430	0.0180	0.0049
DU-44 (1-2)	0.486	3.24	15.7	6.23	0.0389	17.2	51.3	8.37E-07	0.0050	0.0910	0.0127	0.0049
DU-44 (2-3)	0.505	3.06	15	5.94	0.0404	16.0	45.9	7.25E-07	0.0049	0.0840	0.0129	0.0048

Notes:

1. Definition of table shading:

 COC was not detected. Value shown is the detection limit.

Table A-10
Replicate Adjustment Factors
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Adjustment Factor Based on Replicate Results														
		Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
West Parcel	DU-1 thru DU-4, DU-6 thru DU-9	100%	100%	100%	100%	100%	161%	100%	100%	100%	127%	100%	131%	150%	124%	172%
	DU-5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Central Parcel	DU-10, DU-12, DU-14, DU-15, DU-16 (1-3), DU-17, DU-19 thru DU-21, DU-23 thru DU-25, DU-42	100%	100%	100%	100%	100%	100%	100%	100%	100%	141%	223%	186%	218%	165%	183%
	DU-11, DU-13, DU-16 (0-1), DU-18, DU-22, DU-26	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
East Parcel	DU-27 thru DU37, DU39, DU-40, DU-43, DU-44	172%	187%	100%	152%	158%	165%	100%	100%	100%	125%	100%	100%	100%	100%	131%
	DU-38 and DU-41	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Sample Location	Decision Unit	Adjustment Factor Based on Replicate Results																
		2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF
West Parcel	DU-1 thru DU-4, DU-6 thru DU-9	146%	131%	137%	125%	126%	110%	113%	121%	127%	121%	126%	164%	126%	138%	200%	120%	145%
	DU-5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Central Parcel	DU-10, DU-12, DU-14, DU-15, DU-16 (1-3), DU-17, DU-19 thru DU-21, DU-23 thru DU-25, DU-42	139%	162%	169%	162%	152%	155%	160%	178%	148%	173%	167%	166%	152%	173%	173%	150%	171%
	DU-11, DU-13, DU-16 (0-1), DU-18, DU-22, DU-26	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
East Parcel	DU-27 thru DU37, DU39, DU-40, DU-43, DU-44	138%	129%	125%	128%	131%	130%	129%	151%	114%	117%	130%	126%	123%	132%	130%	125%	129%
	DU-38 and DU-41	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Sample Location	Decision Unit	Adjustment Factor Based on Replicate Results																	
		Acenaph-thene	Acenaph-thylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	1-Methyl naphthalene	2-Methyl naphthalene	Naphthalene	Phenanthrene	Pyrene
West Parcel	DU-1 thru DU-4, DU-6 thru DU-9	160%	135%	163%	150%	142%	141%	147%	129%	139%	147%	157%	157%	132%	123%	113%	124%	176%	157%
	DU-5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Central Parcel	DU-10, DU-12, DU-14, DU-15, DU-16 (1-3), DU-17, DU-19 thru DU-21, DU-23 thru DU-25, DU-42	230%	173%	222%	190%	167%	160%	169%	160%	159%	165%	221%	233%	161%	181%	179%	165%	225%	184%
	DU-11, DU-13, DU-16 (0-1), DU-18, DU-22, DU-26	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
East Parcel	All DUs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table A-10
Replicate Adjustment Factors
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Adjustment Factor Based on Replicate Results								
		Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268
West Parcel	DU-1 thru DU-4, DU-6 thru DU-9	100%	100%	100%	108%	100%	168%	214%	100%	100%
	DU-5	100%	100%	100%	100%	100%	100%	100%	100%	100%
Central Parcel	DU-10, DU-12, DU-14, DU-15, DU-16 (1-3), DU-17, DU-19 thru DU-21, DU-23 thru DU-25, DU-42	100%	100%	100%	100%	100%	165%	204%	100%	205%
	DU-11, DU-13, DU-16 (0-1), DU-18, DU-22, DU-26	100%	100%	100%	100%	100%	100%	100%	100%	100%
East Parcel	DU-27 thru DU37, DU39, DU-40, DU-43, DU-44	100%	100%	100%	100%	100%	149%	153%	100%	100%
	DU-38 and DU-41	100%	100%	100%	100%	100%	100%	100%	100%	100%

- Notes:
1. Basis for Adjustment Factors:
- a. Samples with replicates (DU-5, -11, -16(0-1), -13, -18, -22, -26, -38, and -41) are shaded in table. Adjusted value is the maximum value from the three replicate results used in baseline data so factor is 100%.
 - b. Samples without replicates:
 - i. Metals: values adjusted if at least one replicate in the Parcel had a replicate standard deviation (RSD) greater than 45 %
 - ii. Dioxins/Furans: values adjusted if two or more congeners in at least one replicate in the Parcel had an RSD greater than 45 %
 - 1. Each congener and the TEQ in each sample adjusted
 - 2. The adjusted TEQ value is the greater of the adjusted TEQ or the summation of the adjusted congeners x TEF
 - iii. PCBs: values adjusted if at least one Aroclor in at least one replicate in the Parcel had an RSD greater than 45 %
 - 1. Each Aroclor and total PCBs in each sample adjusted
 - 2. The adjusted total PCB value is the greater of the adjusted total PCBs or the summation of the adjusted Aroclors
 - iv. PAHs: values adjusted if two or more individual PAHs in at least one replicate in the Parcel had an RSD greater than 45 %
 - 1. Each individual PAH and the summed values (HPAHs, LPAHs, cPAHs) in each sample adjusted
 - 2. The summed PAH values are the greater of the adjusted summed values or the summation of the adjusted individual PAHs
 - v. COCs adjusted:
 - 1. West Parcel: mercury, dioxin/furan congeners, dioxin/furan TEQ, individual PAHs, HPAHs, LPAHs, cPAHs, PCB Aroclors, total PCBs
 - 2. Central Parcel: dioxin/furan congeners, dioxin/furan TEQ, individual PAHs, dibenzofuran, HPAHs, LPAHs, cPAHs, PCB Aroclors, total PCBs
 - 3. East Parcel: antimony, arsenic, copper, lead, mercury, dioxin/furan congeners, dioxin/furan TEQ,PCB Aroclors, total PCBs
 - vi. Adjustment factor is 1 plus the maximum RSD for that COC on the same parcel -- i.e., 1 + Max RSD stated as a percentage.

Table A-11
Adjusted Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
ISM Background Composite Background Plant RBC Invertebrate RBC Bird RBC Mammal RBC Human Health Non-Carcinogenic RBC Human Health Carcinogenic RBC						0.29	8.8	39	24	27	0.073	23.4	0.33	105	8.90E-05 6.10E-06 1.70E-04 1.50E-05	0.01	18	29	0.734 0.098 60 0.55	40
						0.56	8.8	76	34	79	0.23	47	0.71	180						
						5	18	39	70	120	0.30	38	0.52	160						
						78		39	80	1700	0.10	280	4.1	120						
							575	87	88	33	0.015	139	3.42	673						
						2.7	83	342	82	122	3.53	20	1.1	201						
						24	74		11,000	400										
						1.4														
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0	0.801	6.24	37.4	180	74.8	0.112056	27.1	0.514	151	2.85E-05	0.0078	3.8568	0.5433	0.6337	0.7344
			1-2	DU-1 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-1 (2-3)	0	0.529	5.79	29.5	69.5	57.5	0.130893	25.0	0.529	179	1.41E-05	0.0048	3.0647	0.4681	0.4654	0.1985
	DU-2	ISM	0-1	DU-2 (0-1)	0	0.603	5.41	21.5	119	96.2	0.117691	18.9	0.505	99.4	8.83E-06	0.0051	1.4735	0.2098	0.2341	0.3775
			1-2	DU-2 (1-2)	0	0.515	5.36	22	170	118	0.19964	16.4	0.515	88.8	4.37E-06	0.0047	1.1641	0.2092	0.1544	1.1733
			2-3	DU-2 (2-3)	0	0.495	5.21	15.5	41.9	24.4	0.097727	14.7	0.495	78	3.14E-06	0.0050	0.3207	0.0433	0.0452	0.0514
	DU-3	ISM	0-1	DU-3 (0-1)	0	0.547	6.87	16.2	26.8	20.1	0.070518	16.3	0.547	80.4	3.34E-05	0.0048	1.4113	0.1975	0.2169	0.0430
			1-2	DU-3 (1-2)	0	0.497	6.65	16.5	25.8	15.8	0.073255	17.1	0.497	72.2	9.93E-06	0.0051	1.4358	0.2006	0.1831	0.0108
			2-3	DU-3 (2-3)	0	0.536	6.65	15.7	21.6	13.5	0.080017	16.0	0.536	64.7	7.88E-06	0.0050	1.0813	0.1784	0.1463	0.0103
	DU-4	ISM	0-1	DU-4 (0-1)	0	0.565	6.57	16.3	29.1	23.7	0.120106	23.9	0.565	89.4	2.66E-05	0.0057	3.6334	0.5162	0.6067	0.0545
			1-2	DU-4 (1-2)	0	0.515	6.87	16.3	26.6	23.9	0.095956	24.6	0.515	79.4	2.12E-05	0.0334	17.4643	6.0683	2.4979	0.0422
			2-3	DU-4 (2-3)	0	0.502	7.63	18.4	34	45.1	0.12236	22.4	0.502	115	1.87E-05	0.0094	6.7224	1.0287	1.0865	0.0603
	DU-5	ISM	0-1	DU-5 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-5 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-5 (2-3)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-6	ISM	0-1	DU-6 (0-1)	0	0.539	4.93	22.1	67.6	28.2	0.20608	19.6	0.539	135	1.36E-05	0.0052	1.5896	0.1933	0.2671	0.1076
			1-2	DU-6 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-6 (2-3)	0	0.526	4.67	23.2	100	37.8	0.22701	22.0	0.526	112	1.46E-05	0.0110	2.0727	0.3483	0.3207	0.3367
	DU-7	ISM	0-1	DU-7 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-7 (1-2)	0	0.547	3.98	18.6	30.1	18.7	0.2093	19.7	0.547	92.7	1.61E-05	0.0050	0.6334	0.1094	0.1009	0.0976
			2-3	DU-7 (2-3)	0	0.536	3.07	16.2	24.2	14.9	0.149247	19.1	0.536	75.1	1.05E-05	0.0050	0.4543	0.0785	0.0677	0.0864
	DU-8	ISM	0-1	DU-8 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-8 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-8 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-9	ISM	0-1	DU-9 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-9 (1-2)	0	0.555	4.81	27.8	34.6	40.7	0.22701	24.4	0.555	115	1.65E-05	0.0048	0.6886	0.1159	0.1093	0.0608
			2-3	DU-9 (2-3)	0	0.512	5.12	31	37.4	21.5	0.22701	26.2	0.512	122	1.59E-05	0.0080	1.6843	0.3177	0.2547	0.0822
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-10 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-10 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-11	ISM	0-1	DU-11 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-11 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-11 (2-3)	1	0	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000
	DU-12	ISM	0-1	DU-12 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-12 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-12 (2-3)	1	0	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000

Please see notes at the end of the table.

Table A-11
Adjusted Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-13 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-13 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-14	ISM	0-1	DU-14 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-14 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-14 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-15	ISM	0-1	DU-15 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-15 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-15 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-16	ISM	0-1	DU-16 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-16 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-16 (2-3)	2	0.499	3.72	12.9	29.1	37.5	0.1485	16.8	0.539	71.3	1.22E-05	0.0112	0.7756	0.1360	0.0954	0.0103
	DU-17	ISM	0-1	DU-17 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-17 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-17 (2-3)	0	0.504	3.16	11.1	26.8	35.1	0.121	14.6	0.504	58.4	1.27E-05	0.0110	0.4129	0.0759	0.0517	0.0100
	DU-18	ISM	0-1	DU-18 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-18 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-18 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-19	ISM	0-1	DU-19 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-19 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-19 (2-3)	2	0.926	5.68	11.2	44.9	70.8	0.1485	15.5	0.522	113	7.84E-05	0.0113	0.9560	0.1367	0.1319	0.1039
	DU-20	ISM	0-1	DU-20 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-20 (1-2)	0	0.536	4.08	19.5	25.8	17.7	0.136	28.4	0.536	87.3	6.88E-06	0.0110	0.1639	0.0514	0.0220	0.0102
			2-3	DU-20 (2-3)	0	0.511	3.68	16.7	23	14.3	0.101	21.1	0.511	90.4	6.43E-06	0.0105	0.2511	0.0538	0.0323	0.0103
	DU-21	ISM	0-1	DU-21 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-21 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-21 (2-3)	2	0.497	4.48	11.6	45.9	89.7	0.1485	18	0.497	109	1.65E-05	0.0117	1.1606	0.3226	0.1467	0.0103
	DU-22	ISM	0-1	DU-22 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-22 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-22 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-23	ISM	0-1	DU-23 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-23 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-23 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
	DU-24	ISM	0-1	DU-24 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-24 (1-2)	2	0.496	3.56	15	31.1	23.2	0.1485	20.6	0.496	124	9.08E-06	0.0111	0.9300	0.1195	0.1238	0.0101
			2-3	DU-24 (2-3)	0	0.501	2.84	10.9	17.6	13.8	0.0928	18.5	0.501	83.1	1.25E-05	0.0111	0.1642	0.0440	0.0242	0.0099
	DU-25	ISM	0-1	DU-25 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-25 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-25 (2-3)	0	0.496	3.17	12.6	30	43.2	0.116	18.7	0.496	138	2.73E-06	0.0108	1.1402	0.1903	0.1460	0.0102
	DU-26	ISM	0-1	DU-26 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-26 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-26 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000

Please see notes at the end of the table.

Table A-11
Adjusted Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg																Total HPAH	Total LPAH	cPAHs	Total PCBs
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran									
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
			1-2	DU-42 (1-2)	0	0.667	4.11	18.4	25.4	30.3	0.186	22.6	0.549	109	3.64E-05	0.0106	0.4092	0.0935	0.0517	0.0103					
			2-3	DU-42 (2-3)	0	0.531	3.76	17.4	21.1	20.1	0.125	20.7	0.531	87	1.33E-05	0.0111	0.2939	0.0647	0.0384	0.0101					
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
			1-2	DU-27 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
			2-3	DU-27 (2-3)	0	1.978	29.546	15.5	69.312	87.532	0.106095	18.4	0.512	139	3.05E-05	0.0050	0.6570	0.1030	0.0973	0.2564					
	DU-28	ISM	0-1	DU-28 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
			1-2	DU-28 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
			2-3	DU-28 (2-3)	2	8.2388	13.838	16.9	348.08	178.54	0.245025	19.6	0.522	275	1.93E-05	0.0084	1.8900	0.2380	0.3530	0.0485					
	DU-29	ISM	0-1	DU-29 (0-1)	0	1.8576	12.9965	12.1	105.336	162.74	0.098175	18.1	0.518	164	6.40E-05	0.0085	0.9880	0.1570	0.1540	0.0327					
			1-2	DU-29 (1-2)	0	1.7544	9.4996	10.4	67.336	64.938	0.07194	15.3	0.545	100	1.96E-05	0.0051	0.4780	0.0641	0.0697	0.0072					
			2-3	DU-29 (2-3)	0	0.87892	6.732	10	42.256	72.206	0.067485	15.2	0.511	92.7	1.95E-05	0.0050	0.3800	0.0562	0.0588	0.0075					
	DU-30	ISM	0-1	DU-30 (0-1)	0	2.8552	7.8914	14.5	96.368	206.98	0.136785	18.3	0.5	179	6.48E-05	0.0072	2.1500	0.2030	0.3980	0.0425					
			1-2	DU-30 (1-2)	0	3.5948	6.9564	13.9	121.296	319.16	0.0825	17.7	0.512	228	2.87E-05	0.0050	1.0000	0.1200	0.1690	0.0077					
			2-3	DU-30 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
	DU-31	ISM	0-1	DU-31 (0-1)	0	3.182	11.3883	14.5	53.808	70.784	0.079035	16.5	0.491	116	7.50E-05	0.0050	0.8540	0.1160	0.1240	0.0336					
			1-2	DU-31 (1-2)	0	1.27796	9.3126	12.6	74.784	53.878	0.11055	17	0.516	140	2.44E-05	0.0054	0.7680	0.1270	0.1190	0.0391					
			2-3	DU-31 (2-3)	0	1.2642	11.1452	12.9	103.664	39.5	0.068475	16.7	0.519	109	1.41E-05	0.0050	0.6490	0.1100	0.0919	0.0354					
	DU-32	ISM	0-1	DU-32 (0-1)	0	1.51188	16.8113	12.4	48.032	45.662	0.07062	15.7	0.535	118	4.47E-05	0.0063	0.7760	0.1220	0.1150	0.0074					
			1-2	DU-32 (1-2)	0	0.9202	13.277	11.1	35.568	33.022	0.07062	15.3	0.535	104	9.70E-06	0.0047	0.4910	0.0684	0.0754	0.0073					
			2-3	DU-32 (2-3)	0	0.84624	6.6572	9.91	30.552	53.878	0.06501	14.2	0.492	90.2	9.76E-06	0.0405	3.5300	0.7460	0.5660	0.0071					
	DU-33	ISM	0-1	DU-33 (0-1)	0	3.9732	12.3794	9.85	121.296	140.304	0.071775	14.9	0.491	290	4.72E-05	0.0081	0.4140	0.1040	0.0542	0.1185					
			1-2	DU-33 (1-2)	0	3.1648	17.952	12.3	146.832	104.596	0.068145	17.8	0.516	354	2.15E-05	0.0066	0.4510	0.1280	0.0519	0.0665					
			2-3	DU-33 (2-3)	0	1.14552	10.0045	10.3	79.952	67.624	0.069795	16.4	0.529	234	1.56E-05	0.0049	0.4010	0.0650	0.0555	0.0784					
	DU-34	ISM	0-1	DU-34 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000					
			1-2	DU-34 (1-2)	0	0.95804	9.2565	14.6	50.464	50.402	0.073755	24.3	0.498	177	3.63E-05	0.0098	1.1900	0.2100	0.1840	0.0624					
			2-3	DU-34 (2-3)	0	0.92364	6.9003	12.1	50.312	40.922	0.07095	20.1	0.537	222	3.96E-05	0.0051	0.6510	0.1160	0.0973	0.0076					
	DU-35	ISM	0-1	DU-35 (0-1)	0	0.88064	8.228	14.5	80.408	35.708	0.068475	17.8	0.512	174	5.20E-05	0.0053	0.6160	0.1040	0.0931	0.0371					
			1-2	DU-35 (1-2)	0	0.91332	7.1247	12.3	44.232	30.02	0.070125	15.3	0.531	168	1.70E-05	0.0050	0.7040	0.1060	0.1190	0.0519					
			2-3	DU-35 (2-3)	0	0.90128	6.3019	9.45	42.256	19.592	0.0693	14.2	0.524	141	1.32E-05	0.0049	0.2500	0.0334	0.0355	0.0077					
	DU-36	ISM	0-1	DU-36 (0-1)	0	6.4844	9.4061	20.1	88.008	115.656	0.06567	22.6	0.498	266	5.42E-05	0.0060	0.6170	0.0892	0.0823	0.0365					
			1-2	DU-36 (1-2)	0	5.9168	7.9101	17.3	86.184	205.4	0.09999	19	0.52	222	4.76E-05	0.0082	0.7770	0.1290	0.1030	0.0076					
			2-3	DU-36 (2-3)	0	6.2264	7.7044	14.4	70.376	100.014	0.074085	18.3	0.526	190	3.61E-05	0.0050	0.2950	0.0564	0.0379	0.0372					
	DU-38	ISM	0-1	DU-38 (0-1)	0	1.31	3.71	13.1	27.7	30.5	0.0454	16.5	0.536	110	2.94E-05	0.0056	0.5940	0.0920	0.0828	0.0412					
			1-2	DU-38 (1-2)	0	4.88	3.76	12.3	56	76.7	0.0415	16	0.519	102	1.90E-05	0.0051	0.4550	0.0853	0.0635	0.0444					
			2-3	DU-38 (2-3)	0	3.71	4.06	13.6	51.4	51.3	0.0421	17.1	0.527	108	1.05E-05	0.0051	0.5190	0.0738	0.0442	0.0300					
	DU-37	Composite	0-1	DU-37 (0-1)	0	0.8514	6.9564	17.4	39.672	62.094	0.06534	18.6	0.572	74.4	8.91E-07	0.0050	0.0834	0.0210	0.0124	0.0075					
			1-2	DU-37 (1-2)	0	0.8514	5.61	14.9	32.528	19.908	0.07095	18.8	0.537	61.5	8.23E-07	0.0050	0.1050	0.0213	0.0114	0.0076					
			2-3	DU-37 (2-3)	0	0.88236	5.3295	13.4	25.688	14.1568	0.067815	17.1	0.513	52.2	7.47E-07	0.0115	0.8510	0.2540	0.0970	0.0077					
	DU-39	Composite	0-1	DU-39 (0-1)	0	0.91848	5.0303	13.4	32.376	9.6222	0.070455	16	0.534	62.8	4.74E-06	0.0049	0.0270	0.0172	0.0057	0.0074					
			1-2	DU-39 (1-2)	0	0.9632	6.0588	15.1	27.208	8.0738	0.07392	18.3	0.615	57.4	1.80E-06	0.0049	0.0247	0.1750	0.0057	0.0074					
			2-3	DU-39 (2-3)	0	0.903	6.4328	16	27.968	10.8704	0.0693	19.2	0.525	54.3	1.77E-06	0.0049	0.0955	0.1290	0.0124	0.0075					
	DU-40	Composite	0-1	DU-40 (0-1)	0	0.87548	5.3856	12.9	24.624	5.925	0.067155	16.3	0.509	44.3	9.59E-07	0.0050	0.0249	0.0174	0.0057	0.0075					
			1-2	DU-40 (1-2)	0	0.88236	6.358	13.4	23.408	5.4826	0.067815	17.7	0.513	44.7	6.78E-07	0.0050	0.0281	0.0175	0.0061	0.0077					
			2-3	DU-40 (2-3)	0	0.903	5.8531	13.7	25.232	4.898	0.0693	18.2	0.525	45.1	7.22E-07	0.0051	0.0279	0.0177	0.0061	0.0077					

Please see notes at the end of the table.

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Adjusted Residual Soil Data
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	30% Design Excavation (0=None, 1=Full, 2=Partial)	Concentration in mg/kg														
						Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)	0	0.86516	5.4604	13.8	28.576	8.5636	0.06633	16.9	0.522	53.9	3.75E-06	0.0049	0.1200	0.0236	0.0163	0.0078
			1-2	DU-43 (1-2)	0	0.92192	5.4043	14	28.424	15.247	0.070785	18.5	0.536	56.4	1.63E-06	0.0051	0.1220	0.0813	0.0106	0.0078
			2-3	DU-43 (2-3)	0	0.89956	5.7222	13.8	24.776	6.873	0.06897	18.4	0.523	46	8.66E-07	0.0050	0.0616	0.0174	0.0097	0.0077
	DU-44	Composite	0-1	DU-44 (0-1)	0	1.06468	5.8344	14	27.208	20.54	0.06501	17.7	0.492	83.7	1.86E-06	0.0050	0.1430	0.0294	0.0180	0.0075
			1-2	DU-44 (1-2)	0	0.83592	6.0588	14.3	23.864	9.8434	0.064185	17.2	0.486	51.3	1.09E-06	0.0050	0.0910	0.0206	0.0127	0.0075
			2-3	DU-44 (2-3)	0	0.8686	5.7222	13.2	22.8	9.3852	0.06666	16.0	0.505	45.9	9.51E-07	0.0049	0.0840	0.0171	0.0129	0.0074
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			1-2	DU-41 (1-2)	1	0	0	0	0	0	0	0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000
			2-3	DU-41 (2-3)	1	0	0	0	0	0	0	0.0	0	0	0.00E+00	0.0000	0.0000	0.0000	0.0000	0.0000

Notes:

1. Definition of table shading:

COC was not detected. Value shown is the detection limit.

2. Basis for Adjusted Values:

a. Samples with replicates -- DU-5, -11, -16(0-1), -13, -18, -22, -26, -38, and -41 -- adjusted value is the maximum value from the three replicate results.

b. Samples without replicates:

i. Metals: values adjusted if at least one replicate in the Parcel had a replicate standard deviation (RSD) greater than 45 %

ii. Dioxins/Furans: values adjusted if two or more congeners in at least one replicate in the Parcel had an RSD greater than 45 %

1. Each congener and the TEQ in each sample adjusted

2. The adjusted TEQ value is the greater of the adjusted TEQ or the summation of the adjusted congeners x TEF

iii. PCBs: values adjusted if at least one Aroclor in at least one replicate in the Parcel had an RSD greater than 45 %

1. Each Aroclor and total PCBs in each sample adjusted

2. The adjusted total PCB value is the greater of the adjusted total PCBs or the summation of the adjusted Aroclors

iv. PAHs: values adjusted if two or more individual PAHs in at least one replicate in the Parcel had an RSD greater than 45 %

1. Each individual PAH and the summed values (HPAHs, LPAHs, cPAHs) in each sample adjusted

2. The summed PAH values are the greater of the adjusted summed values or the summation of the adjusted individual PAHs

v. COCs adjusted:

1. West Parcel: mercury, dioxin/furan congeners, dioxin/furan TEQ, individual PAHs, HPAHs, LPAHs, cPAHs, PCB Aroclors, total PCBs

2. Central Parcel: dioxin/furan congeners, dioxin/furan TEQ, individual PAHs, dibenzofuran, HPAHs, LPAHs, cPAHs, PCB Aroclors, total PCBs

3. East Parcel: antimony, arsenic, copper, lead, mercury, dioxin/furan congeners, dioxin/furan TEQ, PCB Aroclors, total PCBs

vi. Adjusted value is the base value increased by the maximum RSD for that COC on the same parcel. For example, if the base value is C, the adjusted value is C*(1 + Max RSD).

Table A-12
West Parcel
ProUCL Input
Residual Soil Data - Top Foot Only
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-1 (0-1)	0.801	6.24	180	74.8	0.0696	27.1	151	2.21E-05	0.0078	2.6600	0.4460	0.4270
DU-2 (0-1)	0.603	5.41	119	96.2	0.0731	18.9	99.4	6.95E-06	0.0051	1.0200	0.1650	0.1860
DU-3 (0-1)	0.547	6.87	26.8	20.1	0.0438	16.3	80.4	2.63E-05	0.0048	0.9760	0.1530	0.0250
DU-4 (0-1)	0.565	6.57	29.1	23.7	0.0746	23.9	89.4	2.09E-05	0.0057	2.5200	0.4280	0.0317
DU-6 (0-1)	0.539	4.93	67.6	28.2	0.128	19.6	135	1.04E-05	0.0052	1.1000	0.1880	0.0625
DU-7 (1-2)	0.547	3.98	30.1	18.7	0.13	19.7	92.7	1.24E-05	0.0050	0.4400	0.0711	0.0567
DU-9 (1-2)	0.555	4.81	34.6	40.7	0.141	24.4	115	1.28E-05	0.0048	0.4770	0.0771	0.0353

Notes:

1. Definition of table shading:

 COC was not detected. Value shown is the detection limit.

Table A-13
Central Parcel
ProUCL Input
Residual Soil Data - Top Foot Only
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-10 (2-3)	0.514	5.16	32.2	73.3	0.609	22.6	117	4.52E-06	0.0244	16.9000	2.6000	0.0051
DU-11 (2-3)	0.526	4.23	35.2	43.3	0.604	26.4	95	5.89E-06	0.0613	30.2000	5.1300	0.0389
DU-12 (2-3)	0.551	3.62	41	70.8	0.207	17.8	79.7	2.60E-06	0.0050	0.5840	0.0900	0.0050
DU-13 (2-3)	0.562	4.04	54.2	175	0.769	18.4	127	2.66E-05	0.0052	1.6700	0.2630	0.0330
DU-14 (2-3)	3.04	5.66	185	162	2.5	24.8	164	1.43E-05	0.0143	1.3200	0.1950	0.0048
DU-15 (2-3)	0.492	2.91	36.2	63.6	0.563	17.6	76.8	1.50E-04	0.0049	0.6910	0.1010	0.0048
DU-16 (2-3)	0.499	3.72	29.1	37.5	0.1485	16.8	71.3	7.62E-06	0.0050	0.4170	0.0569	0.0050
DU-17 (2-3)	0.504	3.16	26.8	35.1	0.121	14.6	58.4	7.81E-06	0.0050	0.2220	0.0309	0.0049
DU-18 (2-3)	0.502	5.63	59.9	92.3	0.681	18.3	118	1.29E-05	0.0051	0.5870	0.0862	0.0316
DU-19 (2-3)	0.926	5.68	44.9	70.8	0.1485	15.5	113	4.66E-05	0.0051	0.5140	0.0790	0.0568
DU-20 (1-2)	0.536	4.08	25.8	17.7	0.136	28.4	87.3	4.30E-06	0.0049	0.0881	0.0132	0.0050
DU-21 (2-3)	0.497	4.48	45.9	89.7	0.1485	18	109	1.01E-05	0.0052	0.6240	0.0879	0.0050
DU-22 (2-3)	1.09	4.45	54	57.5	0.376	21.4	123	7.93E-06	0.0051	0.2250	0.0292	0.0050
DU-23 (2-3)	0.498	3.82	41.9	82.2	0.426	18.8	99	5.92E-06	0.0051	0.2310	0.0362	0.0050
DU-24 (1-2)	0.496	3.56	31.1	23.2	0.1485	20.6	124	6.44E-06	0.0050	0.5000	0.0740	0.0049
DU-25 (2-3)	0.496	3.17	30	43.2	0.116	18.7	138	1.94E-06	0.0048	0.6130	0.0873	0.0050
DU-26 (2-3)	0.529	4.75	41.6	76.1	0.82	18.3	138	2.36E-05	0.0050	0.9930	0.1480	0.1890
DU-42 (0-1)	0.512	4.38	36.3	53.3	0.226	23.3	126	6.07E-05	0.0050	0.3470	0.0507	0.0050

Notes:

1. Definition of table shading:

	COC was not detected. Value shown is the detection limit.
	Excavated Layer 3 data used as surrogate post-excavation residual concentration

Table A-14
East Parcel
ProUCL Input
Residual Soil Data - Top Foot Only
RD/RA Work Plan
Willamette Cove Upland Facility

Sample ID	Antimony (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)	Dioxin/Furan TEQ (mg/kg)	Dibenzofuran (mg/kg)	Total HPAH (mg/kg)	cPAHs (mg/kg)	Total PCBs (mg/kg)
DU-27 (2-3)	1.15	15.8	45.6	55.4	0.0643	18.4	139	2.40E-05	0.0050	0.6570	0.0973	0.1780
DU-28 (2-3)	4.79	7.4	229	113	0.1485	19.6	275	1.49E-05	0.0084	1.8900	0.3530	0.0370
DU-29 (0-1)	1.08	6.95	69.3	103	0.0595	18.1	164	4.97E-05	0.0085	0.9880	0.1540	0.0250
DU-30 (0-1)	1.66	4.22	63.4	131	0.0829	18.3	179	5.05E-05	0.0072	2.1500	0.3980	0.0325
DU-31 (0-1)	1.85	6.09	35.4	44.8	0.0479	16.5	116	5.84E-05	0.0050	0.8540	0.1240	0.0257
DU-32 (0-1)	0.879	8.99	31.6	28.9	0.0428	15.7	118	3.48E-05	0.0063	0.7760	0.1150	0.0048
DU-33 (0-1)	2.31	6.62	79.8	88.8	0.0435	14.9	290	3.69E-05	0.0081	0.4140	0.0542	0.0852
DU-34 (1-2)	0.557	4.95	33.2	31.9	0.0447	24.3	177	2.82E-05	0.0098	1.1900	0.1840	0.0476
DU-35 (0-1)	0.512	4.4	52.9	22.6	0.0415	17.8	174	4.05E-05	0.0053	0.6160	0.0931	0.0284
DU-36 (0-1)	3.77	5.03	57.9	73.2	0.0398	22.6	266	4.21E-05	0.0060	0.6170	0.0823	0.0279
DU-38 (0-1)	1.31	3.71	27.7	30.5	0.0454	16.5	110	2.94E-05	0.0056	0.5940	0.0828	0.0412
DU-37 (0-1)	0.495	3.72	26.1	39.3	0.0396	18.6	74.4	6.78E-07	0.0050	0.0834	0.0124	0.0049
DU-39 (0-1)	0.534	2.69	21.3	6.09	0.0427	16	62.8	3.68E-06	0.0049	0.0270	0.0057	0.0049
DU-40 (0-1)	0.509	2.88	16.2	3.75	0.0407	16.3	44.3	7.34E-07	0.0050	0.0249	0.0057	0.0049
DU-43 (0-1)	0.503	2.92	18.8	5.42	0.0402	16.9	53.9	3.00E-06	0.0049	0.1200	0.0163	0.0051
DU-44 (0-1)	0.619	3.12	17.9	13	0.0394	17.7	83.7	1.38E-06	0.0050	0.1430	0.0180	0.0049

Notes:

1. Definition of table shading:

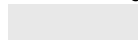
 COC was not detected. Value shown is the detection limit.

Table A-15

Plant Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Plant RBC (mg/kg)					5	18	39	70	120	0.30	38	0.52	160						40	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.2			2.6	0.6		0.7		0.9						5.0	
			1-2	DU-1 (1-2)	0.1		1.1	0.9	2.7	0.3	0.8		0.9				6.8			
			2-3	DU-1 (2-3)				1.0	0.5	0.3	0.7		1.1				3.5			
	DU-2	ISM	0-1	DU-2 (0-1)	0.1			1.7	0.8	0.2								2.9		
			1-2	DU-2 (1-2)				2.4	1.0	0.4							3.8			
			2-3	DU-2 (2-3)				0.6								0.6				
	DU-3	ISM	0-1	DU-3 (0-1)				0.4										0.4		
			1-2	DU-3 (1-2)				0.4								0.4				
			2-3	DU-3 (2-3)												0.0				
	DU-4	ISM	0-1	DU-4 (0-1)				0.4		0.2	0.6								1.3	
			1-2	DU-4 (1-2)				0.4			0.6						1.0			
			2-3	DU-4 (2-3)				0.5	0.4	0.3		0.7				1.8				
	DU-5	ISM	0-1	DU-5 (0-1)	0.2	0.5	1.3	4.9	0.5	1.2	0.9	0.7	1.3						12	
			1-2	DU-5 (1-2)	0.2		1.1	3.4	0.6	1.2	1.6	0.6	1.1					10		
			2-3	DU-5 (2-3)	0.1		1.2	3.1	1.0	0.9	0.8		1.4				8.5			
	DU-6	ISM	0-1	DU-6 (0-1)				1.0	0.2	0.4			0.8						2.5	
			1-2	DU-6 (1-2)				1.3	0.3	0.5			0.8				2.9			
			2-3	DU-6 (2-3)				1.4	0.3	0.5			0.7			2.9				
	DU-7	ISM	0-1	DU-7 (0-1)				0.5		1.0			0.8						2.3	
			1-2	DU-7 (1-2)				0.4		0.4						0.9				
			2-3	DU-7 (2-3)				0.3		0.3						0.7				
	DU-8	ISM	0-1	DU-8 (0-1)				0.5	0.3	0.5			0.9						2.2	
			1-2	DU-8 (1-2)				0.5	0.3	0.5			0.8				2.1			
			2-3	DU-8 (2-3)				0.5	0.3	0.5			0.8			2.0				
	DU-9	ISM	0-1	DU-9 (0-1)	0.1			0.6	0.2	0.5	0.7		1.0						3.1	
			1-2	DU-9 (1-2)				0.5	0.3	0.5	0.6		0.7				2.7			
			2-3	DU-9 (2-3)				0.5		0.5	0.7		0.8				2.5			
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)				0.5	0.7	3.6	0.8		0.7						6.2	
			1-2	DU-10 (1-2)	0.1			0.5	0.5	2.8	0.7						4.5			
			2-3	DU-10 (2-3)	0.1			0.5	0.6	2.0			0.7				3.9			
	DU-11	ISM	0-1	DU-11 (0-1)				0.6	0.5	2.4	0.8		0.7						4.9	
			1-2	DU-11 (1-2)				0.5	0.4	2.1	0.7						3.8			
			2-3	DU-11 (2-3)				0.5	0.4	2.0	0.7						3.6			
	DU-12	ISM	0-1	DU-12 (0-1)	0.2			1.1	1.4	1.0			1.0						4.7	
			1-2	DU-12 (1-2)				0.8	1.1	0.9							2.8			
			2-3	DU-12 (2-3)				0.6	0.6	0.7							1.9			

Please see notes at the end of the table.

Table A-15

Plant Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)	0.2			1.3	2.0	3.8			1.3							8.6
			1-2	DU-13 (1-2)				0.8	1.3	2.6			0.8							5.5
			2-3	DU-13 (2-3)				0.8	1.5	2.6			0.8							5.6
	DU-14	ISM	0-1	DU-14 (0-1)	0.6			1.1	1.1	4.4	0.6		0.9							8.7
			1-2	DU-14 (1-2)	1.5			1.7	2.0	10	0.6		1.3							17
			2-3	DU-14 (2-3)	0.6			2.6	1.4	8.3	0.7		1.0							15
	DU-15	ISM	0-1	DU-15 (0-1)	0.6			1.4	1.1	2.5			0.8							6.3
			1-2	DU-15 (1-2)	0.1			0.8	0.6	4.3			0.8							6.5
			2-3	DU-15 (2-3)				0.5	0.5	1.9										2.9
	DU-16	ISM	0-1	DU-16 (0-1)	0.9			1.9	2.6	17	0.7		2.3							25
			1-2	DU-16 (1-2)	0.5			1.0	1.3	5.6			0.9							9.2
			2-3	DU-16 (2-3)				0.4	0.3	1.4		1.0								3.2
	DU-17	ISM	0-1	DU-17 (0-1)	0.2			0.8	0.7	1.9			1.0							4.6
			1-2	DU-17 (1-2)				0.5	0.5	1.2										2.2
			2-3	DU-17 (2-3)				0.4	0.3	0.4										1.1
	DU-18	ISM	0-1	DU-18 (0-1)	0.3	0.6		1.6	2.3	5.7	0.6		1.3							12
			1-2	DU-18 (1-2)				1.1	1.5	3.5			1.0							7.1
			2-3	DU-18 (2-3)				0.9	0.8	2.3		1.0	0.7							5.6
	DU-19	ISM	0-1	DU-19 (0-1)	0.3			1.5	2.1	2.2			1.3							7.5
			1-2	DU-19 (1-2)	0.2	0.6		1.6	1.3	3.6			1.2							8.6
			2-3	DU-19 (2-3)	0.2			0.6	0.6	1.1			0.7							3.2
	DU-20	ISM	0-1	DU-20 (0-1)	0.3			0.8	0.6	1.0			0.7							3.6
			1-2	DU-20 (1-2)				0.4		0.5	0.7									1.6
			2-3	DU-20 (2-3)						0.3										0.3
	DU-21	ISM	0-1	DU-21 (0-1)	0.5	0.6		1.8	2.5	2.6			1.5							9.5
			1-2	DU-21 (1-2)	0.2			0.8	1.0	0.9			1.1							4.0
			2-3	DU-21 (2-3)				0.7	0.7	0.5			0.7							2.6
	DU-22	ISM	0-1	DU-22 (0-1)	0.6			1.4	1.6	2.0			1.1							6.7
			1-2	DU-22 (1-2)	0.5			0.7	0.6	1.2			1.0							4.0
			2-3	DU-22 (2-3)	0.2			0.8	0.5	1.3			0.8							3.5
	DU-23	ISM	0-1	DU-23 (0-1)	0.3			2.1	2.3	3.4			1.2							9.3
			1-2	DU-23 (1-2)	0.1			1.0	0.6	1.8			0.8							4.3
			2-3	DU-23 (2-3)				0.6	0.7	1.4										2.7
	DU-24	ISM	0-1	DU-24 (0-1)				0.6	0.4	0.9			0.7							2.6
			1-2	DU-24 (1-2)				0.4		0.6			0.8							1.8
			2-3	DU-24 (2-3)						0.3										0.3
	DU-25	ISM	0-1	DU-25 (0-1)	0.2			3.2	1.2	2.5			1.5							8.6
			1-2	DU-25 (1-2)				0.7	0.9	0.7			1.3							3.6
			2-3	DU-25 (2-3)				0.4	0.4	0.4			0.9							2.0

Please see notes at the end of the table.

Table A-15

Plant Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-26	ISM	0-1	DU-26 (0-1)	1.0	0.5		2.2	2.8	6.5		1.2	1.6							16
			1-2	DU-26 (1-2)	0.3	0.6		1.2	1.3	4.2		1.1	1.3							9.9
			2-3	DU-26 (2-3)	0.1			0.6	0.6	2.7			0.9							4.9
	DU-42	Composite	0-1	DU-42 (0-1)				0.5												0.5
			1-2	DU-42 (1-2)	0.1															0.1
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	0.3	0.8		2.9	0.4	0.6		1.1	1.1							7.2
			1-2	DU-27 (1-2)				1.2	0.3				0.8							2.3
			2-3	DU-27 (2-3)	0.2	0.9		0.7	0.5				0.9							3.1
	DU-28	ISM	0-1	DU-28 (0-1)	0.5	0.6		2.6	0.7	2.2			1.7							8.2
			1-2	DU-28 (1-2)	0.6	0.7		4.7	0.6	2.4			1.4							10
			2-3	DU-28 (2-3)	1.0			3.3	0.9	0.7			1.7							7.6
	DU-29	ISM	0-1	DU-29 (0-1)	0.2			1.0	0.9				1.0							3.1
			1-2	DU-29 (1-2)	0.2			0.6	0.3											1.2
			2-3	DU-29 (2-3)				0.4	0.4											0.8
	DU-30	ISM	0-1	DU-30 (0-1)	0.3			0.9	1.1	0.3			1.1							3.7
			1-2	DU-30 (1-2)	0.4			1.1	1.7				1.4							4.7
			2-3	DU-30 (2-3)	1.4			1.2	1.8	0.5			1.0							5.9
	DU-31	ISM	0-1	DU-31 (0-1)	0.4			0.5	0.4				0.7							2.0
			1-2	DU-31 (1-2)	0.1			0.7	0.3				0.9							2.0
			2-3	DU-31 (2-3)	0.1			1.0					0.7							1.8
	DU-32	ISM	0-1	DU-32 (0-1)	0.2	0.5		0.5	0.2				0.7							2.1
			1-2	DU-32 (1-2)																0.0
			2-3	DU-32 (2-3)					0.3											0.3
	DU-33	ISM	0-1	DU-33 (0-1)	0.5			1.1	0.7				1.8							4.2
			1-2	DU-33 (1-2)	0.4	0.5		1.4	0.6				2.2							5.0
			2-3	DU-33 (2-3)	0.1			0.8	0.4				1.5							2.7
	DU-34	ISM	0-1	DU-34 (0-1)	0.2			0.5	0.3				1.1							2.2
			1-2	DU-34 (1-2)	0.1			0.5	0.3		0.6		1.1							2.6
			2-3	DU-34 (2-3)				0.5					1.4							1.9
	DU-35	ISM	0-1	DU-35 (0-1)				0.8					1.1							1.8
			1-2	DU-35 (1-2)				0.4					1.1							1.5
			2-3	DU-35 (2-3)				0.4					0.9							1.3
	DU-36	ISM	0-1	DU-36 (0-1)	0.8			0.8	0.6				1.7							3.9
			1-2	DU-36 (1-2)	0.7			0.8	1.1				1.4							4.0
			2-3	DU-36 (2-3)	0.7			0.7	0.5				1.2							3.1
	DU-38	ISM	0-1	DU-38 (0-1)	0.3			0.4	0.3				0.7							1.6
			1-2	DU-38 (1-2)	1.0			0.8	0.6											2.4
			2-3	DU-38 (2-3)	0.7			0.7	0.4				0.7							2.6

Please see notes at the end of the table.

Table A-15

Plant Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	
East Parcel	DU-37	Composite	0-1	DU-37 (0-1)															0.0
			1-2	DU-37 (1-2)														0.0	
			2-3	DU-37 (2-3)														0.0	
	DU-39	Composite	0-1	DU-39 (0-1)															0.0
			1-2	DU-39 (1-2)														0.0	
			2-3	DU-39 (2-3)														0.0	
	DU-40	Composite	0-1	DU-40 (0-1)															0.0
			1-2	DU-40 (1-2)														0.0	
			2-3	DU-40 (2-3)														0.0	
	DU-43	Composite	0-1	DU-43 (0-1)															0.0
			1-2	DU-43 (1-2)														0.0	
			2-3	DU-43 (2-3)														0.0	
	DU-44	Composite	0-1	DU-44 (0-1)	0.1														0.1
			1-2	DU-44 (1-2)															0.0
			2-3	DU-44 (2-3)															0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	0.6	2.8		1.1	0.7	0.9			0.9						6.9
			1-2	DU-41 (1-2)	0.5	0.8		1.0	1.1	0.4			1.0						4.7
			2-3	DU-41 (2-3)	0.3	1.1		0.6	0.9	0.2			1.1						4.4

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-16

Invertebrate Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Invertebrate RBC					78		39.0	80	1700	0.10	280	4.1	120			18	29			
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)				2.3					1.3			0.1			3.7	
			1-2	DU-1 (1-2)			1.1	0.8	0.2	0.9	0.1		1.2			0.1		4.3		
			2-3	DU-1 (2-3)				0.9		0.8			1.5			0.1		3.3		
	DU-2	ISM	0-1	DU-2 (0-1)				1.5		0.7								2.2		
			1-2	DU-2 (1-2)				2.1		1.2							3.4			
			2-3	DU-2 (2-3)				0.5								0.5				
	DU-3	ISM	0-1	DU-3 (0-1)				0.3										0.3		
			1-2	DU-3 (1-2)				0.3									0.3			
			2-3	DU-3 (2-3)												0.0				
	DU-4	ISM	0-1	DU-4 (0-1)				0.4		0.7						0.1	0.1		1.2	
			1-2	DU-4 (1-2)				0.3							0.7	1.1				
			2-3	DU-4 (2-3)				0.4		0.8		1.0		0.3	2.4					
	DU-5	ISM	0-1	DU-5 (0-1)			1.3	4.3		3.5	0.1		1.8						11	
			1-2	DU-5 (1-2)			1.1	3.0		3.7	0.2		1.5					9.5		
			2-3	DU-5 (2-3)			1.2	2.7		2.7	0.1		1.9		0.2		8.8			
	DU-6	ISM	0-1	DU-6 (0-1)				0.8		1.3			1.1						3.3	
			1-2	DU-6 (1-2)				1.1		1.6			1.0					3.7		
			2-3	DU-6 (2-3)				1.3		1.4			0.9				3.6			
	DU-7	ISM	0-1	DU-7 (0-1)				0.5		3.0			1.1						4.5	
			1-2	DU-7 (1-2)				0.4		1.3								1.7		
			2-3	DU-7 (2-3)				0.3		0.9							1.2			
	DU-8	ISM	0-1	DU-8 (0-1)				0.4		1.5			1.2						3.1	
			1-2	DU-8 (1-2)				0.4		1.6			1.1					3.1		
			2-3	DU-8 (2-3)				0.4		1.6			1.1				3.0			
	DU-9	ISM	0-1	DU-9 (0-1)				0.5		1.6			1.3						3.4	
			1-2	DU-9 (1-2)				0.4		1.4			1.0					2.8		
			2-3	DU-9 (2-3)				0.5		1.4			1.0				2.9			
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)				0.4		11	0.1		0.9			1.6	0.1		14	
			1-2	DU-10 (1-2)				0.4		8.3					1.6	0.2		11		
			2-3	DU-10 (2-3)				0.4		6.1			1.0		0.9	0.1		8.5		
	DU-11	ISM	0-1	DU-11 (0-1)				0.5		7.3	0.1		1.0			1.7	0.3		11	
			1-2	DU-11 (1-2)				0.5		6.3	0.1				0.8	0.1		7.8		
			2-3	DU-11 (2-3)				0.4		6.0					1.7	0.3		8.4		
	DU-12	ISM	0-1	DU-12 (0-1)				1.0		2.9			1.4			0.1			5.4	
			1-2	DU-12 (1-2)				0.7		2.8								3.4		
			2-3	DU-12 (2-3)				0.5		2.1								2.6		

Please see notes at the end of the table.

Table A-16

Invertebrate Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)				1.2	0.1	12			1.7			0.4				15
			1-2	DU-13 (1-2)				0.7		7.9			1.1			0.2				9.7
			2-3	DU-13 (2-3)				0.7	0.1	7.7			1.1							9.5
	DU-14	ISM	0-1	DU-14 (0-1)				0.9		13			1.2							15
			1-2	DU-14 (1-2)				1.5	0.1	31			1.7							34
			2-3	DU-14 (2-3)				2.3		25			1.4							29
	DU-15	ISM	0-1	DU-15 (0-1)				1.2		7.5			1.1							9.8
			1-2	DU-15 (1-2)				0.7		13			1.0							15
			2-3	DU-15 (2-3)				0.5		5.6										6.1
	DU-16	ISM	0-1	DU-16 (0-1)				1.6	0.2	51	0.1		3.1			0.2				56
			1-2	DU-16 (1-2)				0.9		17			1.2							19
			2-3	DU-16 (2-3)				0.4		4.3	0.1									4.8
	DU-17	ISM	0-1	DU-17 (0-1)				0.7		5.8			1.3							7.8
			1-2	DU-17 (1-2)				0.4		3.6										4.0
			2-3	DU-17 (2-3)				0.3		1.2										1.5
	DU-18	ISM	0-1	DU-18 (0-1)				1.4	0.2	17			1.7			0.1				21
			1-2	DU-18 (1-2)				1.0	0.1	11			1.3							13
			2-3	DU-18 (2-3)				0.7		6.8	0.1		1.0							8.7
	DU-19	ISM	0-1	DU-19 (0-1)				1.3	0.2	6.7			1.8			0.1				10
			1-2	DU-19 (1-2)				1.4		11			1.7			0.1				14
			2-3	DU-19 (2-3)				0.6		3.3			0.9							4.8
	DU-20	ISM	0-1	DU-20 (0-1)				0.7		3.1	0.1		1.0							4.8
			1-2	DU-20 (1-2)				0.3		1.4										1.8
			2-3	DU-20 (2-3)				1.0		1.0										1.0
	DU-21	ISM	0-1	DU-21 (0-1)				1.6	0.2	7.8			2.0			0.1				12
			1-2	DU-21 (1-2)				0.7		2.8			1.5							5.0
			2-3	DU-21 (2-3)				0.6		1.5			0.9							3.0
	DU-22	ISM	0-1	DU-22 (0-1)				1.2	0.1	6.0			1.5			0.1				9.0
			1-2	DU-22 (1-2)				0.6		3.5			1.4							5.4
			2-3	DU-22 (2-3)				0.7		3.8			1.0							5.5
	DU-23	ISM	0-1	DU-23 (0-1)				1.9	0.2	10			1.5							14
			1-2	DU-23 (1-2)				0.9		5.5			1.1							7.4
			2-3	DU-23 (2-3)				0.5		4.3										4.8
	DU-24	ISM	0-1	DU-24 (0-1)				0.5		2.8			1.0							4.2
			1-2	DU-24 (1-2)				0.4		1.8			1.0							3.2
			2-3	DU-24 (2-3)						0.9										0.9
	DU-25	ISM	0-1	DU-25 (0-1)				2.8		7.6			2.0			0.2				13
			1-2	DU-25 (1-2)				0.6		2.1			1.7							4.4
			2-3	DU-25 (2-3)				0.4		1.2			1.2							2.7

Please see notes at the end of the table.

Table A-16

Invertebrate Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-26	ISM	0-1	DU-26 (0-1)				1.9	0.2	20		0.1	2.2			0.3				24
			1-2	DU-26 (1-2)				1.0		13		0.1	1.7							15
			2-3	DU-26 (2-3)				0.5		8.2			1.2							9.9
	DU-42	Composite	0-1	DU-42 (0-1)				0.5												0.5
			1-2	DU-42 (1-2)																0.0
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)				2.6		1.8		0.1	1.4							6.0
			1-2	DU-27 (1-2)				1.0					1.1							2.1
			2-3	DU-27 (2-3)				0.6					1.2							1.7
	DU-28	ISM	0-1	DU-28 (0-1)				2.3		6.5			2.2			0.1				11.1
			1-2	DU-28 (1-2)				4.1		7.1			1.9			0.2				13.2
			2-3	DU-28 (2-3)				2.9		2.1			2.3			0.1				7.3
	DU-29	ISM	0-1	DU-29 (0-1)				0.9					1.4							2.2
			1-2	DU-29 (1-2)				0.6												0.6
			2-3	DU-29 (2-3)				0.3												0.3
	DU-30	ISM	0-1	DU-30 (0-1)				0.8		0.8			1.5			0.1				3.2
			1-2	DU-30 (1-2)				1.0	0.1				1.9							3.0
			2-3	DU-30 (2-3)				1.1	0.1	1.6			1.3							4.1
	DU-31	ISM	0-1	DU-31 (0-1)				0.4					1.0							1.4
			1-2	DU-31 (1-2)				0.6					1.2							1.8
			2-3	DU-31 (2-3)				0.9					0.9							1.8
	DU-32	ISM	0-1	DU-32 (0-1)				0.4					1.0							1.4
			1-2	DU-32 (1-2)												0.2				0.0
			2-3	DU-32 (2-3)																0.2
	DU-33	ISM	0-1	DU-33 (0-1)				1.0					2.4							3.4
			1-2	DU-33 (1-2)				1.2					3.0							4.2
			2-3	DU-33 (2-3)				0.7					2.0							2.6
	DU-34	ISM	0-1	DU-34 (0-1)				0.4					1.5							1.9
			1-2	DU-34 (1-2)				0.4					1.5							1.9
			2-3	DU-34 (2-3)				0.4					1.9							2.3
	DU-35	ISM	0-1	DU-35 (0-1)				0.7					1.5							2.1
			1-2	DU-35 (1-2)				0.4					1.4							1.8
			2-3	DU-35 (2-3)				0.3					1.2							1.5
	DU-36	ISM	0-1	DU-36 (0-1)				0.7					2.2							2.9
			1-2	DU-36 (1-2)				0.7					1.9							2.6
			2-3	DU-36 (2-3)				0.6					1.6							2.2
	DU-38	ISM	0-1	DU-38 (0-1)				0.3					0.9							1.3
			1-2	DU-38 (1-2)				0.7												0.7
			2-3	DU-38 (2-3)				0.6					0.9							1.5

Please see notes at the end of the table.

Table A-16

Invertebrate Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
East Parcel	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0
	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)				1.0		2.6			1.2			0.1				4.9
			1-2	DU-41 (1-2)				0.9		1.1			1.4			0.1				3.5
			2-3	DU-41 (2-3)				0.6		0.7			1.5							2.8

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-17

Bird Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Bird RBC						575	87	88	33	0.015	139	3.42	673	8.90E-05				0.734		
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)				2.0	2.3		0.2		0.2	0.2				0.6	5.6	
			1-2	DU-1 (1-2)			0.5	0.7	9.7	5.8	0.2		0.2	0.3				3.7	21	
			2-3	DU-1 (2-3)				0.8	1.7	5.4	0.2		0.3	0.1				0.1	8.7	
	DU-2	ISM	0-1	DU-2 (0-1)				1.4	2.9	4.9								0.3	9.4	
			1-2	DU-2 (1-2)				1.9	3.6	8.3							0.8	15		
			2-3	DU-2 (2-3)				0.5										0.5		
	DU-3	ISM	0-1	DU-3 (0-1)				0.3						0.3					0.6	
			1-2	DU-3 (1-2)				0.3										0.3		
			2-3	DU-3 (2-3)														0.0		
	DU-4	ISM	0-1	DU-4 (0-1)				0.3		5.0	0.2			0.2					5.7	
			1-2	DU-4 (1-2)				0.3			0.2			0.2					0.7	
			2-3	DU-4 (2-3)				0.4	1.4	5.1			0.2	0.2					7.2	
	DU-5	ISM	0-1	DU-5 (0-1)			0.6	3.9	1.9	23	0.2	0.1	0.3	0.2				0.2	31	
			1-2	DU-5 (1-2)			0.5	2.7	2.1	25	0.4		0.3	0.2				0.2	31	
			2-3	DU-5 (2-3)			0.5	2.4	3.6	18	0.2		0.3	0.3				0.5	26	
	DU-6	ISM	0-1	DU-6 (0-1)				0.8	0.9	8.5			0.2	0.1					10	
			1-2	DU-6 (1-2)				1.0	1.2	10			0.2	0.3				0.2	13	
			2-3	DU-6 (2-3)				1.1	1.1	9.4			0.2	0.1				0.2	12	
	DU-7	ISM	0-1	DU-7 (0-1)				0.4		20			0.2	0.2					21	
			1-2	DU-7 (1-2)				0.3		8.7				0.1					9.1	
			2-3	DU-7 (2-3)				0.3		6.2									6.5	
	DU-8	ISM	0-1	DU-8 (0-1)				0.4	1.2	10			0.2	0.3					12	
			1-2	DU-8 (1-2)				0.4	1.0	11			0.2	0.3					13	
			2-3	DU-8 (2-3)				0.4	0.9	10			0.2	0.3				0.1	12	
	DU-9	ISM	0-1	DU-9 (0-1)				0.5	0.9	11	0.2		0.2	0.2					13	
			1-2	DU-9 (1-2)				0.4	1.2	9.4	0.2		0.2	0.1					12	
			2-3	DU-9 (2-3)				0.4		9.4	0.2		0.2	0.1					10	
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)				0.4	2.6	71	0.2		0.2	0.2					75	
			1-2	DU-10 (1-2)				0.4	1.7	55	0.2								58	
			2-3	DU-10 (2-3)				0.4	2.2	41			0.2						43	
	DU-11	ISM	0-1	DU-11 (0-1)				0.4	1.7	48	0.2		0.2	0.1					51	
			1-2	DU-11 (1-2)				0.4	1.5	42	0.2								44	
			2-3	DU-11 (2-3)				0.4	1.3	40	0.2								42	
	DU-12	ISM	0-1	DU-12 (0-1)				0.9	5.0	19			0.2	0.3					26	
			1-2	DU-12 (1-2)				0.6	4.0	18									23	
			2-3	DU-12 (2-3)				0.5	2.1	14									16	

Please see notes at the end of the table.

Table A-17

Bird Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)				1.1	7.3	77			0.3	3.1						88
			1-2	DU-13 (1-2)				0.6	4.7	52			0.2	0.4						58
			2-3	DU-13 (2-3)				0.6	5.3	51			0.2	0.3						58
	DU-14	ISM	0-1	DU-14 (0-1)				0.8	4.1	89	0.2		0.2	0.9						95
			1-2	DU-14 (1-2)				1.4	7.3	207	0.2		0.3	0.4						216
			2-3	DU-14 (2-3)				2.1	4.9	167	0.2		0.2	0.2						174
	DU-15	ISM	0-1	DU-15 (0-1)				1.1	4.0	50			0.2	4.5						60
			1-2	DU-15 (1-2)				0.7	2.1	85			0.2	2.3						90
			2-3	DU-15 (2-3)				0.4	1.9	38				1.7						42
	DU-16	ISM	0-1	DU-16 (0-1)				1.5	9.3	341	0.2		0.6	2.7						356
			1-2	DU-16 (1-2)				0.8	4.6	113			0.2	0.2						118
			2-3	DU-16 (2-3)				0.3	1.1	29		0.2								30
	DU-17	ISM	0-1	DU-17 (0-1)				0.7	2.5	38			0.2	0.5						42
			1-2	DU-17 (1-2)				0.4	1.9	24										26
			2-3	DU-17 (2-3)				0.3	1.1	8.1										9.4
	DU-18	ISM	0-1	DU-18 (0-1)				1.3	8.5	115	0.2		0.3	0.8						126
			1-2	DU-18 (1-2)				0.9	5.4	71			0.2	0.2						77
			2-3	DU-18 (2-3)				0.7	2.8	45		0.1	0.2	0.1						49
	DU-19	ISM	0-1	DU-19 (0-1)				1.2	7.8	44			0.3	1.5					0.2	55
			1-2	DU-19 (1-2)				1.3	4.9	72			0.3	1.0						79
			2-3	DU-19 (2-3)				0.5	2.1	22			0.2	0.5						25
	DU-20	ISM	0-1	DU-20 (0-1)				0.7	2.3	21			0.2	0.4						24
			1-2	DU-20 (1-2)				0.3		9.1	0.2									9.6
			2-3	DU-20 (2-3)						6.7										6.7
	DU-21	ISM	0-1	DU-21 (0-1)				1.5	8.9	52			0.4	0.8						63
			1-2	DU-21 (1-2)				0.6	3.5	18			0.3	0.2						23
			2-3	DU-21 (2-3)				0.5	2.7	10			0.2	0.1						14
	DU-22	ISM	0-1	DU-22 (0-1)				1.1	5.8	40			0.3	0.4						48
			1-2	DU-22 (1-2)				0.5	2.2	23			0.2	0.1						26
			2-3	DU-22 (2-3)				0.6	1.7	25			0.2							28
	DU-23	ISM	0-1	DU-23 (0-1)				1.7	8.4	68			0.3	0.4						79
			1-2	DU-23 (1-2)				0.8	2.1	36			0.2	0.1						40
			2-3	DU-23 (2-3)				0.5	2.5	28										31
	DU-24	ISM	0-1	DU-24 (0-1)				0.5	1.5	18			0.2	0.3						21
			1-2	DU-24 (1-2)				0.4		12			0.2							12
			2-3	DU-24 (2-3)						6.2										6.2
	DU-25	ISM	0-1	DU-25 (0-1)				2.6	4.4	51			0.4	0.5						59
			1-2	DU-25 (1-2)				0.6	3.4	14			0.3							18
			2-3	DU-25 (2-3)				0.3	1.3	7.7			0.2							9.6

Please see notes at the end of the table.

Table A-17

Bird Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-26	ISM	0-1	DU-26 (0-1)				1.7	10	130		0.2	0.4	1.0					0.3	144
			1-2	DU-26 (1-2)				0.9	4.6	83		0.2	0.3	0.5					90	
			2-3	DU-26 (2-3)				0.5	2.3	55			0.2	0.3					0.3	58
	DU-42	Composite	0-1	DU-42 (0-1)				0.4						0.7					1.1	
			1-2	DU-42 (1-2)									0.3						0.3	
			2-3	DU-42 (2-3)															0.0	
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)				2.3	1.4	12		0.2	0.3	1.2					0.3	18
			1-2	DU-27 (1-2)				0.9	1.2			0.2	0.8					0.2	3.3	
			2-3	DU-27 (2-3)				0.5	1.7			0.2	0.3					0.2	2.9	
	DU-28	ISM	0-1	DU-28 (0-1)				2.1	2.4	43			0.4	0.2					0.1	48
			1-2	DU-28 (1-2)				3.7	2.2	47			0.3	0.4					54	
			2-3	DU-28 (2-3)				2.6	3.4	14			0.4	0.2					20	
	DU-29	ISM	0-1	DU-29 (0-1)				0.8	3.1				0.2	0.6					4.7	
			1-2	DU-29 (1-2)				0.5	1.2				0.2					1.9		
			2-3	DU-29 (2-3)				0.3	1.4				0.2					1.9		
	DU-30	ISM	0-1	DU-30 (0-1)				0.7	4.0	5.5			0.3	0.6					11	
			1-2	DU-30 (1-2)				0.9	6.1			0.3	0.3					7.6		
			2-3	DU-30 (2-3)				1.0	6.7	11			0.2	0.2				19		
	DU-31	ISM	0-1	DU-31 (0-1)				0.4	1.4				0.2	0.7					2.6	
			1-2	DU-31 (1-2)				0.6	1.0			0.2	0.2					2.0		
			2-3	DU-31 (2-3)				0.8				0.2	0.1					1.1		
	DU-32	ISM	0-1	DU-32 (0-1)				0.4	0.9				0.2	0.4					1.8	
			1-2	DU-32 (1-2)														0.0		
			2-3	DU-32 (2-3)					1.0									1.0		
	DU-33	ISM	0-1	DU-33 (0-1)				0.9	2.7				0.4	0.4					0.1	4.6
			1-2	DU-33 (1-2)				1.1	2.0				0.5	0.2					3.8	
			2-3	DU-33 (2-3)				0.6	1.3				0.3	0.1					2.4	
	DU-34	ISM	0-1	DU-34 (0-1)				0.4	1.3				0.3	0.7					2.6	
			1-2	DU-34 (1-2)				0.4	1.0		0.2		0.3	0.3					2.1	
			2-3	DU-34 (2-3)				0.4					0.3	0.3					1.0	
DU-35	ISM	0-1	DU-35 (0-1)				0.6					0.3	0.5					1.3		
		1-2	DU-35 (1-2)				0.3					0.2	0.1					0.7		
		2-3	DU-35 (2-3)				0.3					0.2	0.1					0.6		
DU-36	ISM	0-1	DU-36 (0-1)				0.7	2.2				0.4	0.5					3.7		
		1-2	DU-36 (1-2)				0.6	3.9				0.3	0.4					5.3		
		2-3	DU-36 (2-3)				0.5	1.9				0.3	0.3					3.0		
DU-38	ISM	0-1	DU-38 (0-1)				0.3	0.9				0.2	0.3					1.7		
		1-2	DU-38 (1-2)				0.6	2.3					0.2					3.2		
		2-3	DU-38 (2-3)				0.6	1.6				0.2	0.1					2.4		

Please see notes at the end of the table.

Table A-17

Bird Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
East Parcel	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0
	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)				0.9	2.5	17			0.2	2.9						24
			1-2	DU-41 (1-2)				0.8	3.9	7.2			0.2	2.7					0.1	15
			2-3	DU-41 (2-3)				0.5	3.3	4.9			0.3	1.7						11

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-18

Mammal Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Mammal RBC					2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.3			2.2	0.6		1.4		0.8	3.6	0.8	0.5			4.4	14
			1-2	DU-1 (1-2)	0.3		0.1	0.8	2.6		1.5		0.7	4.2	1.0	0.5			28	40
			2-3	DU-1 (2-3)				0.8	0.5		1.3		0.9	1.8		0.4			1.1	6.7
	DU-2	ISM	0-1	DU-2 (0-1)	0.2			1.5	0.8				1.1	0.5	0.2			1.9	6.2	
			1-2	DU-2 (1-2)				2.1	1.0				0.6		0.1			5.7	9.4	
			2-3	DU-2 (2-3)				0.5					0.4					0.3	1.2	
	DU-3	ISM	0-1	DU-3 (0-1)				0.3					4.3		0.2			0.3	5.1	
			1-2	DU-3 (1-2)				0.3					1.3		0.2				1.8	
			2-3	DU-3 (2-3)									0.7		0.1				0.9	
	DU-4	ISM	0-1	DU-4 (0-1)				0.4			1.2			3.4	0.6	0.5			0.3	6.3
			1-2	DU-4 (1-2)				0.3			1.2			2.7	3.3	2.1			0.3	10
			2-3	DU-4 (2-3)				0.4	0.4			0.6	2.4	0.9	0.8			0.4	5.9	
	DU-5	ISM	0-1	DU-5 (0-1)	0.4	0.1	0.2	4.2	0.5		1.6	0.3	1.0	2.8	0.7	0.3			1.8	14
			1-2	DU-5 (1-2)	0.3		0.1	2.9	0.6	0.1	2.9	0.3	0.9	2.5	0.6	0.2			1.5	13
			2-3	DU-5 (2-3)	0.2		0.1	2.6	1.0		1.6		1.1	3.8	1.0	0.5			3.9	16
	DU-6	ISM	0-1	DU-6 (0-1)				0.8	0.2				0.7	1.7	0.5	0.2			0.6	4.8
			1-2	DU-6 (1-2)				1.1	0.3				0.6	4.1	0.9	0.2			1.1	8.4
			2-3	DU-6 (2-3)				1.2	0.3				0.6	1.9	1.1	0.3			1.7	7.0
	DU-7	ISM	0-1	DU-7 (0-1)				0.4					0.6	2.9		0.1			0.5	4.6
			1-2	DU-7 (1-2)				0.4						2.0					0.6	3.0
			2-3	DU-7 (2-3)				0.3						1.3					0.5	2.1
	DU-8	ISM	0-1	DU-8 (0-1)				0.4	0.3				0.7	3.9	0.5	0.1			1.0	7.0
			1-2	DU-8 (1-2)				0.4	0.3				0.6	4.0	0.6				0.7	6.6
			2-3	DU-8 (2-3)				0.4	0.3				0.6	3.8	0.6	0.1			1.0	6.8
	DU-9	ISM	0-1	DU-9 (0-1)	0.2			0.5	0.2		1.3		0.8	2.9	0.6	0.2			0.7	7.4
			1-2	DU-9 (1-2)				0.4	0.3		1.2		0.6	2.1					0.4	5.0
			2-3	DU-9 (2-3)				0.5			1.3		0.6	2.0	0.8	0.2			0.5	5.9
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)				0.4	0.7	0.3	1.5		0.5	2.8	2.4	5.3			0.3	14
			1-2	DU-10 (1-2)	0.2			0.4	0.4	0.2	1.4			0.9	4.9	5.1			0.3	14
			2-3	DU-10 (2-3)	0.2			0.4	0.6	0.2			0.6	0.7	2.4	3.0				8.1
	DU-11	ISM	0-1	DU-11 (0-1)				0.5	0.5	0.2	1.5		0.6	1.9	8.2	5.6			0.4	19
			1-2	DU-11 (1-2)				0.5	0.4	0.2	1.4			0.9	4.9	2.7			0.4	11
			2-3	DU-11 (2-3)				0.4	0.4	0.2	1.3			1.0	6.1	5.4			0.4	15
	DU-12	ISM	0-1	DU-12 (0-1)	0.3			1.0	1.4				0.8	4.2	0.7	0.4			0.5	9.3
			1-2	DU-12 (1-2)				0.7	1.1					0.7	0.6	0.2			0.3	3.5
			2-3	DU-12 (2-3)				0.5	0.6					0.4		0.1				1.6

Please see notes at the end of the table.

Table A-18

Mammal Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)	0.3			1.2	2.0	0.3			1.0	45	0.8	1.4			0.7	53
			1-2	DU-13 (1-2)				0.6	1.3	0.2			0.6	5.9	1.6	0.5			0.3	11
			2-3	DU-13 (2-3)				0.7	1.4	0.2			0.6	4.4	0.5	0.3			0.3	8.5
	DU-14	ISM	0-1	DU-14 (0-1)	1.0			0.9	1.1	0.4	1.2		0.7	13	2.3	0.2			0.3	21
			1-2	DU-14 (1-2)	2.7			1.5	2.0	0.9	1.2		1.0	5.6	2.2	0.3				17
			2-3	DU-14 (2-3)	1.1			2.3	1.3	0.7	1.2		0.8	2.4	1.4	0.2				11
	DU-15	ISM	0-1	DU-15 (0-1)	1.0			1.2	1.1	0.2			0.7	65	0.8	0.2			0.3	70
			1-2	DU-15 (1-2)	0.2			0.7	0.6	0.4			0.6	33						35
			2-3	DU-15 (2-3)				0.4	0.5	0.2				25		0.1				26
	DU-16	ISM	0-1	DU-16 (0-1)	1.6			1.6	2.5	1.5	1.4		1.8	40	7.8	0.6			0.4	59
			1-2	DU-16 (1-2)	0.8			0.9	1.2	0.5			0.7	2.9	0.8	0.3				8.0
			2-3	DU-16 (2-3)				0.4	0.3	0.1		0.5		1.2						2.5
	DU-17	ISM	0-1	DU-17 (0-1)	0.4			0.7	0.7	0.2			0.8	6.6					0.3	9.6
			1-2	DU-17 (1-2)				0.4	0.5	0.1				0.6						1.6
			2-3	DU-17 (2-3)				0.3	0.3					1.3						1.9
	DU-18	ISM	0-1	DU-18 (0-1)	0.5	0.1		1.4	2.3	0.5	1.2		1.0	11	0.7	0.3			0.6	20
			1-2	DU-18 (1-2)				1.0	1.5	0.3			0.8	3.5		0.2			0.3	7.6
			2-3	DU-18 (2-3)				0.7	0.8	0.2		0.5	0.6	2.1		0.1			0.3	5.3
	DU-19	ISM	0-1	DU-19 (0-1)	0.5			1.3	2.1	0.2			1.1	22	1.2	0.4			1.5	30
			1-2	DU-19 (1-2)	0.4	0.1		1.3	1.3	0.3			1.0	14	1.7	0.3			0.3	21
			2-3	DU-19 (2-3)	0.3			0.5	0.6				0.6	7.6					0.6	10
	DU-20	ISM	0-1	DU-20 (0-1)	0.6			0.7	0.6				0.6	5.7		0.2			0.4	8.8
			1-2	DU-20 (1-2)				0.3			1.4			0.7						2.4
			2-3	DU-20 (2-3)										0.7						0.7
	DU-21	ISM	0-1	DU-21 (0-1)	1.0	0.1		1.6	2.4	0.2			1.2	12	1.9	0.4			0.5	21
			1-2	DU-21 (1-2)	0.4			0.7	1.0				0.9	3.4	0.7	0.2			0.4	7.6
			2-3	DU-21 (2-3)				0.6	0.7				0.5	1.6	0.5	0.1				4.1
	DU-22	ISM	0-1	DU-22 (0-1)	1.1			1.2	1.6	0.2			0.9	5.3	11	0.5			0.4	22
			1-2	DU-22 (1-2)	1.0			0.6	0.6				0.8	2.0					0.3	5.2
			2-3	DU-22 (2-3)	0.4			0.7	0.5	0.1			0.6	1.3						3.6
	DU-23	ISM	0-1	DU-23 (0-1)	0.6			1.8	2.3	0.3			0.9	6.6	0.6	0.1			0.6	14
			1-2	DU-23 (1-2)	0.2			0.8	0.6	0.2			0.6	1.7					0.3	4.4
			2-3	DU-23 (2-3)	0.2			0.5	0.7	0.1				1.0						2.5
	DU-24	ISM	0-1	DU-24 (0-1)				0.5	0.4				0.6	3.8		0.1			0.3	5.7
			1-2	DU-24 (1-2)				0.4					0.6	1.1						2.1
			2-3	DU-24 (2-3)										1.5						1.5
	DU-25	ISM	0-1	DU-25 (0-1)	0.3			2.8	1.2	0.2			1.2	7.7	1.2	0.5			0.7	16
			1-2	DU-25 (1-2)				0.6	0.9				1.0	0.4		0.1				3.1
			2-3	DU-25 (2-3)				0.4	0.4				0.7	0.3		0.1				1.8

Please see notes at the end of the table.

Table A-18

Mammal Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-26	ISM	0-1	DU-26 (0-1)	1.8	0.1		1.9	2.7	0.6		0.6	1.3	15	2.5	0.9			1.9	29
			1-2	DU-26 (1-2)	0.5	0.1		1.0	1.2	0.4		0.5	1.0	7.0		0.3			0.7	13
			2-3	DU-26 (2-3)	0.2			0.5	0.6	0.2			0.7	3.9		0.2			1.9	8.2
	DU-42	Composite	0-1	DU-42 (0-1)				0.4						10						10
			1-2	DU-42 (1-2)	0.2									3.7						4.0
			2-3	DU-42 (2-3)										1.4						1.4
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	0.5	0.2		2.5	0.4			0.5	0.9	17		0.3			1.9	24
			1-2	DU-27 (1-2)				1.0	0.3				0.6	11	1.0	0.3			1.7	16
			2-3	DU-27 (2-3)	0.4	0.2		0.6	0.5				0.7	3.9		0.1			1.8	8.2
	DU-28	ISM	0-1	DU-28 (0-1)	0.9	0.1		2.2	0.6	0.2			1.3	3.1	0.7	0.4			1.0	11
			1-2	DU-28 (1-2)	1.1	0.2		4.0	0.6	0.2			1.1	5.4	0.9	0.6			0.7	15
			2-3	DU-28 (2-3)	1.8			2.8	0.9				1.4	2.4	0.8	0.3			0.4	11
	DU-29	ISM	0-1	DU-29 (0-1)	0.4			0.8	0.8				0.8	8.2	0.8	0.2			0.3	12
			1-2	DU-29 (1-2)	0.4			0.5	0.3					2.5						3.8
			2-3	DU-29 (2-3)				0.3	0.4					2.5						3.2
	DU-30	ISM	0-1	DU-30 (0-1)	0.6			0.8	1.1				0.9	8.3	0.7	0.4			0.3	13
			1-2	DU-30 (1-2)	0.8			1.0	1.7				1.1	3.7		0.2				8.4
			2-3	DU-30 (2-3)	2.5			1.1	1.8				0.8	2.4						8.5
	DU-31	ISM	0-1	DU-31 (0-1)	0.7			0.4	0.4				0.6	9.6	0.5	0.2			0.3	13
			1-2	DU-31 (1-2)	0.3			0.6	0.3				0.7	3.1	0.5	0.1			0.3	5.9
			2-3	DU-31 (2-3)	0.3			0.8	0.3				0.5	1.8		0.1			0.3	3.8
	DU-32	ISM	0-1	DU-32 (0-1)	0.3	0.1		0.4	0.2				0.6	5.7	0.6	0.1				8.1
			1-2	DU-32 (1-2)										1.2						1.2
			2-3	DU-32 (2-3)					0.3					1.2	4.1	0.6				6.2
	DU-33	ISM	0-1	DU-33 (0-1)	0.9			1.0	0.7				1.4	6.1	0.8				0.9	12
			1-2	DU-33 (1-2)	0.7	0.1		1.2	0.5				1.8	2.7	0.7				0.5	8.2
			2-3	DU-33 (2-3)	0.2			0.6	0.4				1.2	2.0					0.6	5.0
	DU-34	ISM	0-1	DU-34 (0-1)	0.4			0.4	0.3				0.9	10	1.8	0.3			0.3	14
			1-2	DU-34 (1-2)	0.2			0.4	0.3		1.2		0.9	4.6	1.0	0.2			0.5	9.3
			2-3	DU-34 (2-3)				0.4					1.1	4.9	0.5	0.1				7.1
	DU-35	ISM	0-1	DU-35 (0-1)				0.6					0.9	6.6	0.5	0.1			0.3	9.1
			1-2	DU-35 (1-2)				0.4					0.8	2.1		0.1			0.4	3.9
			2-3	DU-35 (2-3)				0.3					0.7	1.7						2.7
	DU-36	ISM	0-1	DU-36 (0-1)	1.4			0.7	0.6				1.3	6.9	0.6	0.1			0.3	12
			1-2	DU-36 (1-2)	1.3			0.7	1.1				1.1	6.1	0.8	0.1				11
			2-3	DU-36 (2-3)	1.3			0.6	0.5				0.9	4.6					0.3	8.2
	DU-38	ISM	0-1	DU-38 (0-1)	0.5			0.3	0.3				0.5	4.8	0.6	0.1			0.4	7.5
			1-2	DU-38 (1-2)	1.8			0.7	0.6					3.1					0.5	6.7
			2-3	DU-38 (2-3)	1.4			0.6	0.4				0.5	1.7					0.3	5.0

Please see notes at the end of the table.

Table A-18

Mammal Hazard Quotient and Hazard Index - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-37	Composite	0-1	DU-37 (0-1)										0.1						0.1
			1-2	DU-37 (1-2)										0.1						0.1
			2-3	DU-37 (2-3)											1.2	0.2				1.3
	DU-39	Composite	0-1	DU-39 (0-1)										0.6						0.6
			1-2	DU-39 (1-2)										0.2						0.2
			2-3	DU-39 (2-3)										0.2						0.2
	DU-40	Composite	0-1	DU-40 (0-1)										0.1						0.1
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)										0.5						0.5
			1-2	DU-43 (1-2)										0.2						0.2
			2-3	DU-43 (2-3)										0.1						0.1
	DU-44	Composite	0-1	DU-44 (0-1)	0.2									0.2						0.5
			1-2	DU-44 (1-2)										0.1						0.1
			2-3	DU-44 (2-3)										0.1						0.1
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	1.0	0.6		1.0	0.7				0.7	42	1.8	0.4			0.7	49
			1-2	DU-41 (1-2)	0.9	0.2		0.9	1.1				0.8	40	4.3	0.3			0.9	49
			2-3	DU-41 (2-3)	0.6	0.2		0.6	0.9				0.9	25	1.3	0.2			0.4	30

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-19

Human Health Non-Carcinogenic Risk - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio														Cumulative Non-Cancer Risk Ratio	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Human Health Non-Carcinogenic RBC					24	74		11,000	400					1.70E-04				60	4	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)					0.2					0.1				0.1	0.4	
			1-2	DU-1 (1-2)					0.8				0.2				0.7	1.6		
			2-3	DU-1 (2-3)					0.1									0.1		
	DU-2	ISM	0-1	DU-2 (0-1)					0.2									0.1	0.2	
			1-2	DU-2 (1-2)					0.3								0.1	0.4		
			2-3	DU-2 (2-3)													0.0			
	DU-3	ISM	0-1	DU-3 (0-1)									0.2					0.2		
			1-2	DU-3 (1-2)													0.0			
			2-3	DU-3 (2-3)													0.0			
	DU-4	ISM	0-1	DU-4 (0-1)									0.1					0.1		
			1-2	DU-4 (1-2)													0.0			
			2-3	DU-4 (2-3)					0.1								0.1			
	DU-5	ISM	0-1	DU-5 (0-1)		0.1			0.2					0.1					0.4	
			1-2	DU-5 (1-2)					0.2									0.2		
			2-3	DU-5 (2-3)					0.3					0.1				0.4		
	DU-6	ISM	0-1	DU-6 (0-1)															0.0	
			1-2	DU-6 (1-2)					0.1					0.1				0.2		
			2-3	DU-6 (2-3)														0.0		
DU-7	ISM	0-1	DU-7 (0-1)										0.1					0.1		
		1-2	DU-7 (1-2)														0.0			
		2-3	DU-7 (2-3)														0.0			
DU-8	ISM	0-1	DU-8 (0-1)										0.1					0.1		
		1-2	DU-8 (1-2)										0.1				0.1			
		2-3	DU-8 (2-3)										0.1				0.1			
DU-9	ISM	0-1	DU-9 (0-1)										0.1					0.1		
		1-2	DU-9 (1-2)					0.1									0.1			
		2-3	DU-9 (2-3)														0.0			
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)					0.2				0.1						0.3	
			1-2	DU-10 (1-2)					0.1									0.1		
			2-3	DU-10 (2-3)					0.2									0.2		
	DU-11	ISM	0-1	DU-11 (0-1)					0.1										0.1	
			1-2	DU-11 (1-2)					0.1									0.1		
			2-3	DU-11 (2-3)					0.1									0.1		
	DU-12	ISM	0-1	DU-12 (0-1)					0.4				0.1						0.6	
			1-2	DU-12 (1-2)					0.3									0.3		
			2-3	DU-12 (2-3)					0.2									0.2		
	DU-13	ISM	0-1	DU-13 (0-1)					0.6					1.6					2.2	
			1-2	DU-13 (1-2)					0.4					0.2				0.6		
			2-3	DU-13 (2-3)					0.4					0.2				0.6		

Please see notes at the end of the table.

Table A-19

Human Health Non-Carcinogenic Risk - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-14	ISM	0-1	DU-14 (0-1)	0.1				0.3					0.5						0.9
			1-2	DU-14 (1-2)	0.3				0.6					0.2						1.1
			2-3	DU-14 (2-3)	0.1				0.4											0.5
	DU-15	ISM	0-1	DU-15 (0-1)	0.1				0.3					2.3						2.8
			1-2	DU-15 (1-2)					0.2					1.2						1.4
			2-3	DU-15 (2-3)					0.2					0.9						1.0
	DU-16	ISM	0-1	DU-16 (0-1)	0.2				0.8					1.4						2.4
			1-2	DU-16 (1-2)					0.4					0.1						0.5
			2-3	DU-16 (2-3)																0.0
	DU-17	ISM	0-1	DU-17 (0-1)					0.2					0.2						0.4
			1-2	DU-17 (1-2)					0.2											0.2
			2-3	DU-17 (2-3)																0.0
	DU-18	ISM	0-1	DU-18 (0-1)		0.1			0.7					0.4						1.2
			1-2	DU-18 (1-2)					0.4					0.1						0.6
			2-3	DU-18 (2-3)					0.2											0.2
	DU-19	ISM	0-1	DU-19 (0-1)		0.2			0.6					0.8						1.4
			1-2	DU-19 (1-2)					0.4					0.5						1.1
			2-3	DU-19 (2-3)					0.2					0.3						0.5
	DU-20	ISM	0-1	DU-20 (0-1)					0.2					0.2						0.4
			1-2	DU-20 (1-2)																0.0
			2-3	DU-20 (2-3)																0.0
	DU-21	ISM	0-1	DU-21 (0-1)	0.1	0.1			0.7					0.4						1.4
			1-2	DU-21 (1-2)					0.3					0.1						0.4
			2-3	DU-21 (2-3)					0.2											0.2
	DU-22	ISM	0-1	DU-22 (0-1)	0.1				0.5					0.2						0.8
			1-2	DU-22 (1-2)	0.1				0.2											0.3
			2-3	DU-22 (2-3)					0.1											0.1
	DU-23	ISM	0-1	DU-23 (0-1)					0.7					0.2						0.9
			1-2	DU-23 (1-2)					0.2											0.2
			2-3	DU-23 (2-3)					0.2											0.2
	DU-24	ISM	0-1	DU-24 (0-1)					0.1					0.1						0.3
			1-2	DU-24 (1-2)																0.0
			2-3	DU-24 (2-3)																0.0
	DU-25	ISM	0-1	DU-25 (0-1)					0.4					0.3						0.6
			1-2	DU-25 (1-2)					0.3											0.3
			2-3	DU-25 (2-3)					0.1											0.1
	DU-26	ISM	0-1	DU-26 (0-1)	0.2	0.1			0.8					0.5						1.7
			1-2	DU-26 (1-2)		0.2			0.4					0.3						0.8
			2-3	DU-26 (2-3)					0.2					0.1						0.3
	DU-42	Composite	0-1	DU-42 (0-1)										0.4						0.4
			1-2	DU-42 (1-2)										0.1						0.1
			2-3	DU-42 (2-3)																0.0

Please see notes at the end of the table.

Table A-19

Human Health Non-Carcinogenic Risk - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)		0.2			0.1					0.6						0.9
			1-2	DU-27 (1-2)										0.4						0.4
			2-3	DU-27 (2-3)		0.2			0.1					0.1						0.5
	DU-28	ISM	0-1	DU-28 (0-1)		0.1			0.2					0.1						0.4
			1-2	DU-28 (1-2)	0.1	0.2			0.2					0.2						0.7
			2-3	DU-28 (2-3)	0.2				0.3											0.5
	DU-29	ISM	0-1	DU-29 (0-1)					0.3					0.3						0.6
			1-2	DU-29 (1-2)					0.1											0.1
			2-3	DU-29 (2-3)					0.1											0.1
	DU-30	ISM	0-1	DU-30 (0-1)					0.3					0.3						0.6
			1-2	DU-30 (1-2)					0.5					0.1						0.6
			2-3	DU-30 (2-3)	0.3				0.6											0.8
	DU-31	ISM	0-1	DU-31 (0-1)					0.1					0.3						0.5
			1-2	DU-31 (1-2)										0.1						0.1
			2-3	DU-31 (2-3)																0.0
	DU-32	ISM	0-1	DU-32 (0-1)		0.1								0.2						0.3
			1-2	DU-32 (1-2)																0.0
			2-3	DU-32 (2-3)																0.0
	DU-33	ISM	0-1	DU-33 (0-1)					0.2					0.2						0.4
			1-2	DU-33 (1-2)		0.1			0.2											0.3
			2-3	DU-33 (2-3)					0.1											0.1
	DU-34	ISM	0-1	DU-34 (0-1)					0.1					0.4						0.5
			1-2	DU-34 (1-2)										0.2						0.2
			2-3	DU-34 (2-3)										0.2						0.2
	DU-35	ISM	0-1	DU-35 (0-1)										0.2						0.2
			1-2	DU-35 (1-2)																0.0
			2-3	DU-35 (2-3)																0.0
	DU-36	ISM	0-1	DU-36 (0-1)	0.2				0.2					0.2						0.6
			1-2	DU-36 (1-2)	0.1				0.3					0.2						0.7
			2-3	DU-36 (2-3)	0.2				0.2					0.2						0.5
	DU-38	ISM	0-1	DU-38 (0-1)										0.2						0.2
			1-2	DU-38 (1-2)	0.2				0.2					0.1						0.5
			2-3	DU-38 (2-3)	0.2				0.1											0.3
	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0
	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0

Please see notes at the end of the table.

Table A-19

Human Health Non-Carcinogenic Risk - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	0.1	0.7			0.2					1.5						2.5
			1-2	DU-41 (1-2)		0.2			0.3					1.4						1.9
			2-3	DU-41 (2-3)		0.3			0.3					0.9						1.4

Notes:

1. Definition of table shading:

-  COC was not detected. Hazard Quotient not calculated.
-  Non-Cancer Hazard Quotient or Cumulative Risk Greater than or Equal to 1.0 (Unacceptable Risk)
-  Non-Cancer Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-20

Human Health Carcinogenic Risk - Baseline

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)														Cumulative Excess Lifetime Cancer Risk (x 1E-05)	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Human Health Carcinogenic RBC						1.4								1.50E-05				0.55	0.74	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)										1				0.8	0.6	0.3
			1-2	DU-1 (1-2)									2				0.7	4	0.6	
			2-3	DU-1 (2-3)										0.7				0.6	0.1	0.1
	DU-2	ISM	0-1	DU-2 (0-1)										0.5				0.3	0.3	0.1
			1-2	DU-2 (1-2)									0.2				0.2	0.8	0.1	
			2-3	DU-2 (2-3)									0.2						0.02	
	DU-3	ISM	0-1	DU-3 (0-1)									2				0.3		0.2	
			1-2	DU-3 (1-2)								0.5				0.2		0.1		
			2-3	DU-3 (2-3)								0.3				0.2		0.05		
	DU-4	ISM	0-1	DU-4 (0-1)									1				0.8		0.2	
			1-2	DU-4 (1-2)								1				3		0.4		
			2-3	DU-4 (2-3)								1				1		0.2		
	DU-5	ISM	0-1	DU-5 (0-1)		6							1				0.4	0.2	0.8	
			1-2	DU-5 (1-2)								1				0.4	0.2	0.2		
			2-3	DU-5 (2-3)								2				0.7	0.5	0.3		
	DU-6	ISM	0-1	DU-6 (0-1)										0.7				0.3		0.1
			1-2	DU-6 (1-2)										2				0.4	0.2	0.2
			2-3	DU-6 (2-3)									0.8				0.4	0.2	0.1	
	DU-7	ISM	0-1	DU-7 (0-1)										1				0.2		0.1
			1-2	DU-7 (1-2)									0.8				0.1		0.1	
			2-3	DU-7 (2-3)									0.5						0.1	
	DU-8	ISM	0-1	DU-8 (0-1)										2				0.2	0.1	0.2
			1-2	DU-8 (1-2)									2				0.1		0.2	
			2-3	DU-8 (2-3)									2				0.2	0.1	0.2	
	DU-9	ISM	0-1	DU-9 (0-1)										1				0.3		0.2
			1-2	DU-9 (1-2)									0.9				0.1		0.1	
			2-3	DU-9 (2-3)									0.8				0.3		0.1	
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)									1				9		1	
			1-2	DU-10 (1-2)								0.4				9		0.9		
			2-3	DU-10 (2-3)								0.3				5		0.5		
	DU-11	ISM	0-1	DU-11 (0-1)									0.8				10		1	
			1-2	DU-11 (1-2)								0.3				5		0.5		
			2-3	DU-11 (2-3)								0.4				9		1		
	DU-12	ISM	0-1	DU-12 (0-1)									2				0.7		0.2	
			1-2	DU-12 (1-2)								0.3				0.3		0.1		
			2-3	DU-12 (2-3)								0.2				0.2		0.0		
	DU-13	ISM	0-1	DU-13 (0-1)									18				2		2	
			1-2	DU-13 (1-2)								2				0.8		0.3		
			2-3	DU-13 (2-3)								2				0.5		0.2		

Please see notes at the end of the table.

Table A-20
Human Health Carcinogenic Risk - Baseline
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-14	ISM	0-1	DU-14 (0-1)										5				0.3		0.6
			1-2	DU-14 (1-2)										2				0.5		0.3
			2-3	DU-14 (2-3)										1				0.4		0.1
	DU-15	ISM	0-1	DU-15 (0-1)										26				0.3		3
			1-2	DU-15 (1-2)										13						1
			2-3	DU-15 (2-3)										10				0.2		1
	DU-16	ISM	0-1	DU-16 (0-1)										16				0.9		2
			1-2	DU-16 (1-2)										1				0.4		0.2
			2-3	DU-16 (2-3)										0.5				0.1		0.1
	DU-17	ISM	0-1	DU-17 (0-1)										3				0.1		0.3
			1-2	DU-17 (1-2)										0.2						0.02
			2-3	DU-17 (2-3)										0.5						0.1
	DU-18	ISM	0-1	DU-18 (0-1)		8								4				0.5		1
			1-2	DU-18 (1-2)										1				0.3		0.2
			2-3	DU-18 (2-3)										0.9				0.2		0.1
	DU-19	ISM	0-1	DU-19 (0-1)										9				0.7	0.2	1
			1-2	DU-19 (1-2)		8								6				0.5		1
			2-3	DU-19 (2-3)										3				0.1		0.3
	DU-20	ISM	0-1	DU-20 (0-1)										2				0.3		0.3
			1-2	DU-20 (1-2)										0.3						0.0
			2-3	DU-20 (2-3)										0.3						0.0
	DU-21	ISM	0-1	DU-21 (0-1)		8								5				0.6		1
			1-2	DU-21 (1-2)										1				0.3		0.2
			2-3	DU-21 (2-3)										0.7				0.2		0.1
	DU-22	ISM	0-1	DU-22 (0-1)										2				0.2		0.2
			1-2	DU-22 (1-2)										0.8						0.1
			2-3	DU-22 (2-3)										0.5						0.1
	DU-23	ISM	0-1	DU-23 (0-1)										3				0.2		0.3
			1-2	DU-23 (1-2)										0.7				0.2		0.1
			2-3	DU-23 (2-3)										0.4						0.0
	DU-24	ISM	0-1	DU-24 (0-1)										2				0.2		0.2
			1-2	DU-24 (1-2)										0.4				0.1		0.1
			2-3	DU-24 (2-3)										0.6						0.1
	DU-25	ISM	0-1	DU-25 (0-1)										3				0.7		0.4
			1-2	DU-25 (1-2)										0.2				0.2		0.03
			2-3	DU-25 (2-3)										0.1				0.2		0.03
	DU-26	ISM	0-1	DU-26 (0-1)		7								6				1	0.3	1
			1-2	DU-26 (1-2)		8								3				0.5		1
			2-3	DU-26 (2-3)										2				0.3	0.3	0.2
	DU-42	Composite	0-1	DU-42 (0-1)										4						0.4
			1-2	DU-42 (1-2)										2						0.2
			2-3	DU-42 (2-3)										0.6						0.1

Please see notes at the end of the table.

Table A-20
Human Health Carcinogenic Risk - Baseline
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)		10								7				0.4	0.3	2
			1-2	DU-27 (1-2)										5				0.4	0.2	0.5
			2-3	DU-27 (2-3)		11								2				0.2	0.2	1
	DU-28	ISM	0-1	DU-28 (0-1)		8								1				0.8	0.1	1
			1-2	DU-28 (1-2)		10								2				1		1
			2-3	DU-28 (2-3)										1				0.6		0.2
	DU-29	ISM	0-1	DU-29 (0-1)										3				0.3		0.4
			1-2	DU-29 (1-2)										1				0.1		0.1
			2-3	DU-29 (2-3)										1				0.1		0.1
	DU-30	ISM	0-1	DU-30 (0-1)										3				0.7		0.4
			1-2	DU-30 (1-2)										1				0.3		0.2
			2-3	DU-30 (2-3)										1				0.1		0.1
	DU-31	ISM	0-1	DU-31 (0-1)										4				0.2		0.4
			1-2	DU-31 (1-2)										1				0.2		0.1
			2-3	DU-31 (2-3)										0.7				0.2		0.1
	DU-32	ISM	0-1	DU-32 (0-1)		6								2				0.2		0.9
			1-2	DU-32 (1-2)										0.5				0.1		0.1
			2-3	DU-32 (2-3)										0.5				1.0		0.2
	DU-33	ISM	0-1	DU-33 (0-1)										2					0.1	0.3
			1-2	DU-33 (1-2)		7								1						0.8
			2-3	DU-33 (2-3)										0.8				0.1		0.1
	DU-34	ISM	0-1	DU-34 (0-1)										4				0.5		0.4
			1-2	DU-34 (1-2)										2				0.3		0.2
			2-3	DU-34 (2-3)										2				0.2		0.2
	DU-35	ISM	0-1	DU-35 (0-1)										3				0.2		0.3
			1-2	DU-35 (1-2)										0.9				0.2		0.1
			2-3	DU-35 (2-3)										0.7						0.1
	DU-36	ISM	0-1	DU-36 (0-1)										3				0.1		0.3
			1-2	DU-36 (1-2)										2				0.2		0.3
			2-3	DU-36 (2-3)										2						0.2
	DU-38	ISM	0-1	DU-38 (0-1)										2				0.2		0.2
			1-2	DU-38 (1-2)										1				0.1		0.1
			2-3	DU-38 (2-3)										0.7						0.1
	DU-37	Composite	0-1	DU-37 (0-1)																0
			1-2	DU-37 (1-2)																0
			2-3	DU-37 (2-3)														0.2		0.02
	DU-39	Composite	0-1	DU-39 (0-1)										0.2						0.02
			1-2	DU-39 (1-2)																0
			2-3	DU-39 (2-3)																0
	DU-40	Composite	0-1	DU-40 (0-1)																0
			1-2	DU-40 (1-2)																0
			2-3	DU-40 (2-3)																0

Please see notes at the end of the table.

Table A-20
Human Health Carcinogenic Risk - Baseline
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)										0.2						0.02
			1-2	DU-43 (1-2)																0
			2-3	DU-43 (2-3)																0
	DU-44	Composite	0-1	DU-44 (0-1)																0
			1-2	DU-44 (1-2)																0
			2-3	DU-44 (2-3)																0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)		36								17				0.6		5
			1-2	DU-41 (1-2)		10								16				0.5	0.1	3
			2-3	DU-41 (2-3)		14								10				0.3		2

Notes:

1. Definition of table shading:

-  COC was not detected. Risk not calculated.
-  Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-06 or Cumulative Excess Lifetime Cancer Risk Greater than 1E-05 (Unacceptable Risk)
-  Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-04 (Hot Spot)

2. Only Risk Quotients equal to or greater than 1E-07 are shown.

3. Risks not calculated for results below background.

Table A-21
Bird Exposure Area Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Exposure Condition	Depth Range (feet bgs)	Sample Location	Hazard Quotient															Hazard Index
			Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg Bird RBC)			0.29	8.8 575	39 87	24 88	27 33	0.073 0.015	23.4 139	0.33 3.42	105 673	8.90E-05					0.734	
Baseline	0-3	West Parcel				1.1	1.9	11	0.2		0.2	0.2					0.4	15
		Central Parcel				0.8	4.0	62			0.2	0.8						68
		East Parcel				0.7	1.8	7.1			0.2	0.5						10
Residual	0-3	West Parcel			0.9		1.5	6.8			0.2	0.2					0.2	10
		Central Parcel			0.6		2.2	38			0.2	0.3						41
		East Parcel			0.6		1.6				0.2	0.2						2.6
Residual Uncertainty	0-1	West Parcel			1.2		1.8	7.7	0.2		0.2	0.2					0.3	11
		Central Parcel			0.7		2.5	45			0.2	0.4						49
		East Parcel			0.8		1.9				0.3	0.4						3.3

Notes:

1. Definition of table shading:

Exceeds acceptable risk level

Table A-22
Mammal Exposure Area Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Exposure Condition	Depth Range (feet bgs)	Sample Location	Hazard Quotient															Hazard Index
			Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg)			0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Mammal RBC			2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098	
Baseline	0-3	West Parcel	0.2			1.2	0.5		1.3		0.7	2.8	0.8	0.4			3.3	11
		Central Parcel	0.6			0.9	1.1	0.3			0.8	12	1.7	1.0			0.4	18
		East Parcel	0.6			0.8	0.5				0.8	6.9	0.9	0.2			0.5	11
Residual	0-3	West Parcel	0.2		0.2		0.4				0.6	2.3	1.2	0.5			1.6	7
		Central Parcel	0.3		0.1		0.6	0.2			0.6	4.7	1.3	0.8			0.3	8.9
		East Parcel	0.6		0.1		0.4				0.7	3.3	0.8	0.1			0.3	6.3
Residual Uncertainty	0-1	West Parcel	0.2		0.3		0.5		1.2		0.6	3.3	0.6	0.3			2.0	9.0
		Central Parcel	0.3		0.2		0.7	0.2			0.6	5.9	1.4	1.0			0.4	11
		East Parcel	0.7		0.2		0.5				0.9	5.4	0.7	0.2			0.7	9.2

Notes:

1. Definition of table shading:

 Exceeds acceptable risk level

Table A-23
Human Health Non-Carcinogenic Exposure Area Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Exposure Condition	Depth Range (feet bgs)	Sample Location	Non-Cancer Risk Ratio															Cumulative Risk Ratio
			Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg)			0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Human Health Non-Carcinogenic RBC			24	74		11,000	400				1.70E-04				60	4		
Baseline	0-3	West Parcel					0.2				0.1						0.3	
		Central Parcel				0.3				0.4							0.7	
		East Parcel				0.2				0.2							0.4	
Residual	0-3	West Parcel					0.1										0.1	
		Central Parcel				0.2				0.2							0.4	
		East Parcel				0.1				0.1							0.2	
Residual Uncertainty	0-1	West Parcel					0.1				0.1						0.3	
		Central Parcel				0.2				0.2							0.4	
		East Parcel				0.2				0.2							0.4	

Notes:

1. Definition of table shading:

 Exceeds acceptable risk level

Table A-24
Human Health Carcinogenic Exposure Area Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Exposure Condition	Depth Range (feet bgs)	Sample Location	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
			Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg)			0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Human Health Carcinogenic RBC				1.4							1.50E-05					0.55	0.74	
Baseline	0-3	West Parcel									1					0.6	0.4	0.2
		Central Parcel									5					2		0.6
		East Parcel									3					0.3		0.3
Residual	0-3	West Parcel									0.9					0.8	0.2	0.2
		Central Parcel									2					1		0.3
		East Parcel									1					0.2		0.2
Residual Uncertainty	0-1	West Parcel									1					0.6	0.3	0.2
		Central Parcel									2					2		0.4
		East Parcel									2					0.3		0.2

Notes:

1. Definition of table shading:

 Exceeds acceptable risk level

Table A-25

Plant Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Plant RBC (mg/kg)					5	18	39	70	120	0.30	38	0.52	160						40	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.2			2.6	0.6		0.7		0.9							5.0
			1-2	DU-1 (1-2)														0.0		
			2-3	DU-1 (2-3)			1.0	0.5	0.3	0.7		1.1						3.5		
	DU-2	ISM	0-1	DU-2 (0-1)	0.1			1.7	0.8	0.2									2.9	
			1-2	DU-2 (1-2)			2.4	1.0	0.4								3.8			
			2-3	DU-2 (2-3)			0.6									0.6				
	DU-3	ISM	0-1	DU-3 (0-1)				0.4										0.4		
			1-2	DU-3 (1-2)			0.4									0.4				
			2-3	DU-3 (2-3)												0.0				
	DU-4	ISM	0-1	DU-4 (0-1)				0.4		0.2	0.6								1.3	
			1-2	DU-4 (1-2)			0.4			0.6							1.0			
			2-3	DU-4 (2-3)			0.5	0.4	0.3		0.7					1.8				
	DU-5	ISM	0-1	DU-5 (0-1)															0	
			1-2	DU-5 (1-2)													0			
			2-3	DU-5 (2-3)												0.0				
	DU-6	ISM	0-1	DU-6 (0-1)				1.0	0.2	0.4			0.8						2.5	
			1-2	DU-6 (1-2)													0.0			
			2-3	DU-6 (2-3)			1.4	0.3	0.5		0.7					2.9				
	DU-7	ISM	0-1	DU-7 (0-1)															0.0	
			1-2	DU-7 (1-2)				0.4		0.4							0.9			
			2-3	DU-7 (2-3)				0.3		0.3						0.7				
	DU-8	ISM	0-1	DU-8 (0-1)															0.0	
			1-2	DU-8 (1-2)													0.0			
			2-3	DU-8 (2-3)												0.0				
	DU-9	ISM	0-1	DU-9 (0-1)															0.0	
			1-2	DU-9 (1-2)				0.5	0.3	0.5	0.6		0.7					2.7		
			2-3	DU-9 (2-3)				0.5		0.5	0.7		0.8				2.5			
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0.0	
			1-2	DU-10 (1-2)													0.0			
			2-3	DU-10 (2-3)												0.0				
	DU-11	ISM	0-1	DU-11 (0-1)														0.0		
			1-2	DU-11 (1-2)												0.0				
			2-3	DU-11 (2-3)												0.0				
DU-12	ISM	0-1	DU-12 (0-1)															0.0		
		1-2	DU-12 (1-2)												0.0					
		2-3	DU-12 (2-3)												0.0					

Please see notes at the end of the table.

Table A-25

Plant Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0.0
			1-2	DU-13 (1-2)																0.0
			2-3	DU-13 (2-3)																0.0
	DU-14	ISM	0-1	DU-14 (0-1)																0.0
			1-2	DU-14 (1-2)																0
			2-3	DU-14 (2-3)																0
	DU-15	ISM	0-1	DU-15 (0-1)																0.0
			1-2	DU-15 (1-2)																0.0
			2-3	DU-15 (2-3)																0.0
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)																0.0
			2-3	DU-16 (2-3)				0.4	0.3	0.5		1.0								2.3
	DU-17	ISM	0-1	DU-17 (0-1)																0.0
			1-2	DU-17 (1-2)																0.0
			2-3	DU-17 (2-3)				0.4	0.3	0.4										1.1
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)																0.0
			2-3	DU-18 (2-3)																0.0
	DU-19	ISM	0-1	DU-19 (0-1)																0.0
			1-2	DU-19 (1-2)																0.0
			2-3	DU-19 (2-3)	0.2			0.6	0.6	0.5			0.7							2.6
	DU-20	ISM	0-1	DU-20 (0-1)																0.0
			1-2	DU-20 (1-2)				0.4		0.5	0.7									1.6
			2-3	DU-20 (2-3)						0.3										0.3
	DU-21	ISM	0-1	DU-21 (0-1)																0.0
			1-2	DU-21 (1-2)																0.0
			2-3	DU-21 (2-3)				0.7	0.7	0.5			0.7							2.6
	DU-22	ISM	0-1	DU-22 (0-1)																0.0
			1-2	DU-22 (1-2)																0.0
			2-3	DU-22 (2-3)																0.0
	DU-23	ISM	0-1	DU-23 (0-1)																0.0
			1-2	DU-23 (1-2)																0.0
			2-3	DU-23 (2-3)																0.0
	DU-24	ISM	0-1	DU-24 (0-1)																0.0
			1-2	DU-24 (1-2)				0.4		0.5			0.8							1.7
			2-3	DU-24 (2-3)						0.3										0.3
	DU-25	ISM	0-1	DU-25 (0-1)																0.0
			1-2	DU-25 (1-2)																0.0
			2-3	DU-25 (2-3)				0.4	0.4	0.4			0.9							2.0
	DU-26	ISM	0-1	DU-26 (0-1)																0
			1-2	DU-26 (1-2)																0.0
			2-3	DU-26 (2-3)																0.0

Please see notes at the end of the table.

Table A-25

Plant Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0
			1-2	DU-42 (1-2)	0.1															0.1
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0.0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)	0.2	0.9		0.7	0.5				0.9							3.1
	DU-28	ISM	0-1	DU-28 (0-1)																0.0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)	1.0			3.3	0.9	0.5			1.7							7.4
	DU-29	ISM	0-1	DU-29 (0-1)	0.2			1.0	0.9				1.0							3.1
			1-2	DU-29 (1-2)	0.2			0.6	0.3											1.2
			2-3	DU-29 (2-3)				0.4	0.4											0.8
	DU-30	ISM	0-1	DU-30 (0-1)	0.3			0.9	1.1	0.3			1.1							3.7
			1-2	DU-30 (1-2)	0.4			1.1	1.7				1.4							4.7
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)	0.4			0.5	0.4				0.7							2.0
			1-2	DU-31 (1-2)	0.1			0.7	0.3				0.9							2.0
			2-3	DU-31 (2-3)	0.1			1.0					0.7							1.8
	DU-32	ISM	0-1	DU-32 (0-1)	0.2	0.5		0.5	0.2				0.7							2.1
			1-2	DU-32 (1-2)																0.0
			2-3	DU-32 (2-3)					0.3											0.3
	DU-33	ISM	0-1	DU-33 (0-1)	0.5			1.1	0.7				1.8							4.2
			1-2	DU-33 (1-2)	0.4	0.5		1.4	0.6				2.2							5.0
			2-3	DU-33 (2-3)	0.1			0.8	0.4				1.5							2.7
	DU-34	ISM	0-1	DU-34 (0-1)																0.0
			1-2	DU-34 (1-2)	0.1			0.5	0.3		0.6		1.1							2.6
			2-3	DU-34 (2-3)				0.5					1.4							1.9
	DU-35	ISM	0-1	DU-35 (0-1)				0.8					1.1							1.8
			1-2	DU-35 (1-2)				0.4					1.1							1.5
			2-3	DU-35 (2-3)				0.4					0.9							1.3
	DU-36	ISM	0-1	DU-36 (0-1)	0.8			0.8	0.6				1.7							3.9
			1-2	DU-36 (1-2)	0.7			0.8	1.1				1.4							4.0
			2-3	DU-36 (2-3)	0.7			0.7	0.5				1.2							3.1
	DU-38	ISM	0-1	DU-38 (0-1)	0.3			0.4	0.3				0.7							1.6
			1-2	DU-38 (1-2)	1.0			0.8	0.6											2.4
			2-3	DU-38 (2-3)	0.7			0.7	0.4				0.7							2.6
	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0

Please see notes at the end of the table.

Table A-25

Plant Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)	0.1															0.1
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0.0
			1-2	DU-41 (1-2)																0.0
			2-3	DU-41 (2-3)																0.0

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-26

Invertebrate Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105								
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180								
Invertebrate RBC					78		39.0	80	1700	0.10	280	4.1	120			18	29				
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)				2.3					1.3			0.1				3.7	
			1-2	DU-1 (1-2)														0.0			
			2-3	DU-1 (2-3)				0.9		0.8			1.5			0.1			3.3		
	DU-2	ISM	0-1	DU-2 (0-1)				1.5		0.7									2.2		
			1-2	DU-2 (1-2)				2.1		1.2								3.4			
			2-3	DU-2 (2-3)				0.5									0.5				
	DU-3	ISM	0-1	DU-3 (0-1)				0.3											0.3		
			1-2	DU-3 (1-2)				0.3									0.3				
			2-3	DU-3 (2-3)													0.0				
	DU-4	ISM	0-1	DU-4 (0-1)				0.4		0.7						0.1			1.2		
			1-2	DU-4 (1-2)				0.3							0.7	0.1		1.1			
			2-3	DU-4 (2-3)				0.4		0.8		1.0			0.3			2.4			
	DU-5	ISM	0-1	DU-5 (0-1)															0		
			1-2	DU-5 (1-2)														0.0			
			2-3	DU-5 (2-3)														0.0			
	DU-6	ISM	0-1	DU-6 (0-1)				0.8		1.3			1.1						3.3		
			1-2	DU-6 (1-2)														0.0			
			2-3	DU-6 (2-3)				1.3		1.4		0.9						3.6			
	DU-7	ISM	0-1	DU-7 (0-1)															0.0		
			1-2	DU-7 (1-2)				0.4		1.3								1.7			
			2-3	DU-7 (2-3)				0.3		0.9								1.2			
	DU-8	ISM	0-1	DU-8 (0-1)															0.0		
			1-2	DU-8 (1-2)														0.0			
			2-3	DU-8 (2-3)														0.0			
	DU-9	ISM	0-1	DU-9 (0-1)															0.0		
			1-2	DU-9 (1-2)				0.4		1.4		1.0						2.8			
			2-3	DU-9 (2-3)				0.5		1.4		1.0						2.9			
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0		
			1-2	DU-10 (1-2)														0			
			2-3	DU-10 (2-3)													0.0				
	DU-11	ISM	0-1	DU-11 (0-1)															0		
			1-2	DU-11 (1-2)														0.0			
			2-3	DU-11 (2-3)													0.0				
	DU-12	ISM	0-1	DU-12 (0-1)															0.0		
			1-2	DU-12 (1-2)														0.0			
			2-3	DU-12 (2-3)													0.0				

Please see notes at the end of the table.

Table A-26
Invertebrate Hazard Quotient and Hazard Index - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0
			1-2	DU-13 (1-2)																0.0
			2-3	DU-13 (2-3)																0.0
	DU-14	ISM	0-1	DU-14 (0-1)																0
			1-2	DU-14 (1-2)																0
			2-3	DU-14 (2-3)																0
	DU-15	ISM	0-1	DU-15 (0-1)																0.0
			1-2	DU-15 (1-2)																0
			2-3	DU-15 (2-3)																0.0
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)																0
			2-3	DU-16 (2-3)				0.4		1.5		0.1								2.0
	DU-17	ISM	0-1	DU-17 (0-1)																0.0
			1-2	DU-17 (1-2)																0.0
			2-3	DU-17 (2-3)				0.3		1.2										1.5
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)																0
			2-3	DU-18 (2-3)																0.0
	DU-19	ISM	0-1	DU-19 (0-1)																0
			1-2	DU-19 (1-2)																0
			2-3	DU-19 (2-3)				0.6		1.5			0.9							3.0
	DU-20	ISM	0-1	DU-20 (0-1)																0.0
			1-2	DU-20 (1-2)				0.3		1.4	0.1									1.8
			2-3	DU-20 (2-3)						1.0										1.0
	DU-21	ISM	0-1	DU-21 (0-1)																0
			1-2	DU-21 (1-2)																0.0
			2-3	DU-21 (2-3)				0.6		1.5			0.9							3.0
	DU-22	ISM	0-1	DU-22 (0-1)																0.0
			1-2	DU-22 (1-2)																0.0
			2-3	DU-22 (2-3)																0.0
	DU-23	ISM	0-1	DU-23 (0-1)																0
			1-2	DU-23 (1-2)																0.0
			2-3	DU-23 (2-3)																0.0
	DU-24	ISM	0-1	DU-24 (0-1)																0.0
			1-2	DU-24 (1-2)				0.4		1.5			1.0							2.9
			2-3	DU-24 (2-3)						0.9										0.9
	DU-25	ISM	0-1	DU-25 (0-1)																0
			1-2	DU-25 (1-2)																0.0
			2-3	DU-25 (2-3)				0.4		1.2			1.2							2.7
	DU-26	ISM	0-1	DU-26 (0-1)																0
			1-2	DU-26 (1-2)																0
			2-3	DU-26 (2-3)																0.0

Please see notes at the end of the table.

Table A-26

Invertebrate Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0
			1-2	DU-42 (1-2)																0.0
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0.0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)				0.6					1.2							1.7
	DU-28	ISM	0-1	DU-28 (0-1)																0.0
			1-2	DU-28 (1-2)																0.0
			2-3	DU-28 (2-3)				2.9		1.5			2.3			0.1				6.7
	DU-29	ISM	0-1	DU-29 (0-1)				0.9					1.4							2.2
			1-2	DU-29 (1-2)				0.6												0.6
			2-3	DU-29 (2-3)				0.3												0.3
	DU-30	ISM	0-1	DU-30 (0-1)				0.8		0.8			1.5			0.1				3.2
			1-2	DU-30 (1-2)				1.0	0.1				1.9							3.0
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)				0.4					1.0							1.4
			1-2	DU-31 (1-2)				0.6					1.2							1.8
			2-3	DU-31 (2-3)				0.9					0.9							1.8
	DU-32	ISM	0-1	DU-32 (0-1)				0.4					1.0							1.4
			1-2	DU-32 (1-2)																0.0
			2-3	DU-32 (2-3)												0.2				0.2
	DU-33	ISM	0-1	DU-33 (0-1)				1.0					2.4							3.4
			1-2	DU-33 (1-2)				1.2					3.0							4.2
			2-3	DU-33 (2-3)				0.7					2.0							2.6
	DU-34	ISM	0-1	DU-34 (0-1)																0.0
			1-2	DU-34 (1-2)				0.4					1.5							1.9
			2-3	DU-34 (2-3)				0.4					1.9							2.3
	DU-35	ISM	0-1	DU-35 (0-1)				0.7					1.5							2.1
			1-2	DU-35 (1-2)				0.4					1.4							1.8
			2-3	DU-35 (2-3)				0.3					1.2							1.5
	DU-36	ISM	0-1	DU-36 (0-1)				0.7					2.2							2.9
			1-2	DU-36 (1-2)				0.7					1.9							2.6
			2-3	DU-36 (2-3)				0.6					1.6							2.2
	DU-38	ISM	0-1	DU-38 (0-1)				0.3					0.9							1.3
			1-2	DU-38 (1-2)				0.7												0.7
			2-3	DU-38 (2-3)				0.6					0.9							1.5
	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0

Please see notes at the end of the table.

Table A-26

Invertebrate Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0.0
			1-2	DU-41 (1-2)																0.0
			2-3	DU-41 (2-3)																0.0

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-27

Bird Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105								
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180								
Bird RBC						575	87	88	33	0.015	139	3.42	673	8.90E-05					0.734		
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)				2.0	2.3		0.2		0.2	0.2					0.6	5.6	
			1-2	DU-1 (1-2)														0			
			2-3	DU-1 (2-3)				0.8	1.7	5.4	0.2		0.3	0.1					0.1	8.7	
	DU-2	ISM	0-1	DU-2 (0-1)				1.4	2.9	4.9									0.3	9.4	
			1-2	DU-2 (1-2)				1.9	3.6	8.3								0.8	15		
			2-3	DU-2 (2-3)				0.5											0.5		
	DU-3	ISM	0-1	DU-3 (0-1)				0.3						0.3					0.6		
			1-2	DU-3 (1-2)				0.3											0.3		
			2-3	DU-3 (2-3)															0.0		
	DU-4	ISM	0-1	DU-4 (0-1)				0.3		5.0	0.2			0.2					5.7		
			1-2	DU-4 (1-2)				0.3			0.2			0.2					0.7		
			2-3	DU-4 (2-3)				0.4	1.4	5.1			0.2	0.2					7.2		
	DU-5	ISM	0-1	DU-5 (0-1)															0		
			1-2	DU-5 (1-2)															0		
			2-3	DU-5 (2-3)															0		
	DU-6	ISM	0-1	DU-6 (0-1)				0.8	0.9	8.5			0.2	0.1					10		
			1-2	DU-6 (1-2)															0		
			2-3	DU-6 (2-3)				1.1	1.1	9.4			0.2	0.1				0.2	12		
	DU-7	ISM	0-1	DU-7 (0-1)															0		
			1-2	DU-7 (1-2)				0.3		8.7				0.1					9.1		
			2-3	DU-7 (2-3)				0.3		6.2									6.5		
	DU-8	ISM	0-1	DU-8 (0-1)															0		
			1-2	DU-8 (1-2)															0		
			2-3	DU-8 (2-3)															0		
	DU-9	ISM	0-1	DU-9 (0-1)															0		
			1-2	DU-9 (1-2)				0.4	1.2	9.4	0.2		0.2	0.1					12		
			2-3	DU-9 (2-3)				0.4		9.4	0.2		0.2	0.1					10		
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0		
			1-2	DU-10 (1-2)														0			
			2-3	DU-10 (2-3)														0			
	DU-11	ISM	0-1	DU-11 (0-1)															0		
			1-2	DU-11 (1-2)														0			
			2-3	DU-11 (2-3)														0			
	DU-12	ISM	0-1	DU-12 (0-1)															0		
			1-2	DU-12 (1-2)														0			
			2-3	DU-12 (2-3)														0			

Please see notes at the end of the table.

Table A-27

Bird Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0
			1-2	DU-13 (1-2)																0
			2-3	DU-13 (2-3)																0
	DU-14	ISM	0-1	DU-14 (0-1)																0
			1-2	DU-14 (1-2)																0
			2-3	DU-14 (2-3)																0
	DU-15	ISM	0-1	DU-15 (0-1)																0
			1-2	DU-15 (1-2)																0
			2-3	DU-15 (2-3)																0
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)																0
			2-3	DU-16 (2-3)				0.3	1.1	9.9		0.2								12
	DU-17	ISM	0-1	DU-17 (0-1)																0
			1-2	DU-17 (1-2)																0
			2-3	DU-17 (2-3)				0.3	1.1	8.1										9.4
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)																0
			2-3	DU-18 (2-3)																0
	DU-19	ISM	0-1	DU-19 (0-1)																0
			1-2	DU-19 (1-2)																0
			2-3	DU-19 (2-3)				0.5	2.1	9.9			0.2	0.5						13
	DU-20	ISM	0-1	DU-20 (0-1)																0
			1-2	DU-20 (1-2)				0.3		9.1	0.2									9.6
			2-3	DU-20 (2-3)						6.7										6.7
	DU-21	ISM	0-1	DU-21 (0-1)																0
			1-2	DU-21 (1-2)																0
			2-3	DU-21 (2-3)				0.5	2.7	9.9			0.2	0.1						13
	DU-22	ISM	0-1	DU-22 (0-1)																0
			1-2	DU-22 (1-2)																0
			2-3	DU-22 (2-3)																0
	DU-23	ISM	0-1	DU-23 (0-1)																0
			1-2	DU-23 (1-2)																0
			2-3	DU-23 (2-3)																0
	DU-24	ISM	0-1	DU-24 (0-1)																0
			1-2	DU-24 (1-2)				0.4		9.9			0.2							10
			2-3	DU-24 (2-3)						6.2										6.2
	DU-25	ISM	0-1	DU-25 (0-1)																0
			1-2	DU-25 (1-2)																0
			2-3	DU-25 (2-3)				0.3	1.3	7.7			0.2							9.6
	DU-26	ISM	0-1	DU-26 (0-1)																0
			1-2	DU-26 (1-2)																0
			2-3	DU-26 (2-3)																0

Please see notes at the end of the table.

Table A-27

Bird Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0
			1-2	DU-42 (1-2)										0.3						0.3
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)				0.5	1.7				0.2	0.3					0.2	2.9
	DU-28	ISM	0-1	DU-28 (0-1)																0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)				2.6	3.4	9.9			0.4	0.2						17
	DU-29	ISM	0-1	DU-29 (0-1)				0.8	3.1				0.2	0.6						4.7
			1-2	DU-29 (1-2)				0.5	1.2					0.2						1.9
			2-3	DU-29 (2-3)				0.3	1.4					0.2						1.9
	DU-30	ISM	0-1	DU-30 (0-1)				0.7	4.0	5.5			0.3	0.6						11
			1-2	DU-30 (1-2)				0.9	6.1				0.3	0.3						7.6
			2-3	DU-30 (2-3)																0
	DU-31	ISM	0-1	DU-31 (0-1)				0.4	1.4				0.2	0.7						2.6
			1-2	DU-31 (1-2)				0.6	1.0				0.2	0.2						2.0
			2-3	DU-31 (2-3)				0.8					0.2	0.1						1.1
	DU-32	ISM	0-1	DU-32 (0-1)				0.4	0.9				0.2	0.4						1.8
			1-2	DU-32 (1-2)																0.0
			2-3	DU-32 (2-3)					1.0											1.0
	DU-33	ISM	0-1	DU-33 (0-1)				0.9	2.7				0.4	0.4					0.1	4.6
			1-2	DU-33 (1-2)				1.1	2.0				0.5	0.2						3.8
			2-3	DU-33 (2-3)				0.6	1.3				0.3	0.1						2.4
	DU-34	ISM	0-1	DU-34 (0-1)																0.0
			1-2	DU-34 (1-2)				0.4	1.0		0.2		0.3	0.3						2.1
			2-3	DU-34 (2-3)				0.4					0.3	0.3						1.0
	DU-35	ISM	0-1	DU-35 (0-1)				0.6					0.3	0.5						1.3
			1-2	DU-35 (1-2)				0.3					0.2	0.1						0.7
			2-3	DU-35 (2-3)				0.3					0.2	0.1						0.6
	DU-36	ISM	0-1	DU-36 (0-1)				0.7	2.2				0.4	0.5						3.7
			1-2	DU-36 (1-2)				0.6	3.9				0.3	0.4						5.3
			2-3	DU-36 (2-3)				0.5	1.9				0.3	0.3						3.0
	DU-38	ISM	0-1	DU-38 (0-1)				0.3	0.9				0.2	0.3						1.7
			1-2	DU-38 (1-2)				0.6	2.3					0.2						3.2
			2-3	DU-38 (2-3)				0.6	1.6				0.2	0.1						2.4
	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0

Please see notes at the end of the table.

Table A-27

Bird Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0
			1-2	DU-41 (1-2)																0
			2-3	DU-41 (2-3)																0

Notes:

1. Definition of table shading:

-  COC was not detected. Hazard Quotient not calculated.
-  Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
-  Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-28

Mammal Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Mammal RBC					2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.3			2.2	0.6		1.4		0.8	3.6	0.8	0.5			4.4	14
			1-2	DU-1 (1-2)															0	
			2-3	DU-1 (2-3)			0.8	0.5		1.3		0.9	1.8		0.4				1.1	6.7
	DU-2	ISM	0-1	DU-2 (0-1)	0.2			1.5	0.8				1.1	0.5	0.2			1.9	6.2	
			1-2	DU-2 (1-2)			2.1	1.0			0.6		0.1			5.7	9.4			
			2-3	DU-2 (2-3)			0.5			0.4		0.3	1.2							
	DU-3	ISM	0-1	DU-3 (0-1)				0.3					4.3		0.2			0.3	5.1	
			1-2	DU-3 (1-2)		0.3			1.3		0.2						1.8			
			2-3	DU-3 (2-3)					0.7	0.1			0.9							
	DU-4	ISM	0-1	DU-4 (0-1)				0.4			1.2		3.4	0.6	0.5			0.3	6.3	
			1-2	DU-4 (1-2)		0.3		1.2		2.7	3.3	2.1		0.3	10					
			2-3	DU-4 (2-3)		0.4	0.4		0.6	2.4	0.9	0.8		0.4	5.9					
	DU-5	ISM	0-1	DU-5 (0-1)															0	
			1-2	DU-5 (1-2)														0		
			2-3	DU-5 (2-3)														0		
	DU-6	ISM	0-1	DU-6 (0-1)				0.8	0.2				0.7	1.7	0.5	0.2			0.6	4.8
			1-2	DU-6 (1-2)														0.0		
			2-3	DU-6 (2-3)			1.2	0.3			0.6	1.9	1.1	0.3		1.7	7.0			
	DU-7	ISM	0-1	DU-7 (0-1)															0.0	
			1-2	DU-7 (1-2)			0.4					2.0					0.6	3.0		
			2-3	DU-7 (2-3)		0.3				1.3					0.5	2.1				
	DU-8	ISM	0-1	DU-8 (0-1)															0.0	
			1-2	DU-8 (1-2)														0.0		
			2-3	DU-8 (2-3)													0.0			
	DU-9	ISM	0-1	DU-9 (0-1)															0.0	
			1-2	DU-9 (1-2)			0.4	0.3		1.2		0.6	2.1					0.4	5.0	
			2-3	DU-9 (2-3)			0.5			1.3		0.6	2.0	0.8	0.2			0.5	5.9	
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0	
			1-2	DU-10 (1-2)														0		
			2-3	DU-10 (2-3)														0.0		
	DU-11	ISM	0-1	DU-11 (0-1)															0	
			1-2	DU-11 (1-2)														0		
			2-3	DU-11 (2-3)														0		
	DU-12	ISM	0-1	DU-12 (0-1)															0.0	
			1-2	DU-12 (1-2)														0.0		
			2-3	DU-12 (2-3)														0.0		

Please see notes at the end of the table.

Table A-28

Mammal Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0
			1-2	DU-13 (1-2)																0
			2-3	DU-13 (2-3)																0.0
	DU-14	ISM	0-1	DU-14 (0-1)																0
			1-2	DU-14 (1-2)																0
			2-3	DU-14 (2-3)																0
	DU-15	ISM	0-1	DU-15 (0-1)																0
			1-2	DU-15 (1-2)																0
			2-3	DU-15 (2-3)																0
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)																0.0
			2-3	DU-16 (2-3)				0.4	0.3			0.5		1.2						2.4
	DU-17	ISM	0-1	DU-17 (0-1)																0.0
			1-2	DU-17 (1-2)																0.0
			2-3	DU-17 (2-3)				0.3	0.3					1.3						1.9
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)																0.0
			2-3	DU-18 (2-3)																0.0
	DU-19	ISM	0-1	DU-19 (0-1)																0
			1-2	DU-19 (1-2)																0
			2-3	DU-19 (2-3)	0.3			0.5	0.6				0.6	7.6					0.6	10
	DU-20	ISM	0-1	DU-20 (0-1)																0.0
			1-2	DU-20 (1-2)				0.3			1.4			0.7						2.4
			2-3	DU-20 (2-3)										0.7						0.7
	DU-21	ISM	0-1	DU-21 (0-1)																0
			1-2	DU-21 (1-2)																0.0
			2-3	DU-21 (2-3)				0.6	0.7				0.5	1.6	0.5	0.1				4.1
	DU-22	ISM	0-1	DU-22 (0-1)																0
			1-2	DU-22 (1-2)																0.0
			2-3	DU-22 (2-3)																0.0
	DU-23	ISM	0-1	DU-23 (0-1)																0
			1-2	DU-23 (1-2)																0.0
			2-3	DU-23 (2-3)																0.0
	DU-24	ISM	0-1	DU-24 (0-1)																0.0
			1-2	DU-24 (1-2)				0.4					0.6	1.1						2.1
			2-3	DU-24 (2-3)										1.5						1.5
	DU-25	ISM	0-1	DU-25 (0-1)																0
			1-2	DU-25 (1-2)																0.0
			2-3	DU-25 (2-3)				0.4	0.4				0.7	0.3		0.1				1.8
	DU-26	ISM	0-1	DU-26 (0-1)																0
			1-2	DU-26 (1-2)																0
			2-3	DU-26 (2-3)																0.0

Please see notes at the end of the table.

Table A-28

Mammal Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0
			1-2	DU-42 (1-2)	0.2									3.7						4.0
			2-3	DU-42 (2-3)										1.4						1.4
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0
			1-2	DU-27 (1-2)																0
			2-3	DU-27 (2-3)	0.4	0.2		0.6	0.5				0.7	3.9		0.1			1.8	8.2
	DU-28	ISM	0-1	DU-28 (0-1)																0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)	1.8			2.8	0.9				1.4	2.4	0.8	0.3			0.4	11
	DU-29	ISM	0-1	DU-29 (0-1)	0.4			0.8	0.8				0.8	8.2	0.8	0.2			0.3	12
			1-2	DU-29 (1-2)	0.4			0.5	0.3					2.5						3.8
			2-3	DU-29 (2-3)				0.3	0.4					2.5						3.2
	DU-30	ISM	0-1	DU-30 (0-1)	0.6			0.8	1.1				0.9	8.3	0.7	0.4			0.3	13
			1-2	DU-30 (1-2)	0.8			1.0	1.7				1.1	3.7		0.2				8.4
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)	0.7			0.4	0.4				0.6	9.6	0.5	0.2			0.3	13
			1-2	DU-31 (1-2)	0.3			0.6	0.3				0.7	3.1	0.5	0.1			0.3	5.9
			2-3	DU-31 (2-3)	0.3			0.8					0.5	1.8		0.1			0.3	3.8
	DU-32	ISM	0-1	DU-32 (0-1)	0.3	0.1		0.4	0.2				0.6	5.7	0.6	0.1				8.1
			1-2	DU-32 (1-2)										1.2						1.2
			2-3	DU-32 (2-3)					0.3					1.2	4.1	0.6				6.2
	DU-33	ISM	0-1	DU-33 (0-1)	0.9			1.0	0.7				1.4	6.1	0.8				0.9	12
			1-2	DU-33 (1-2)	0.7	0.1		1.2	0.5				1.8	2.7	0.7				0.5	8.2
			2-3	DU-33 (2-3)	0.2			0.6	0.4				1.2	2.0					0.6	5.0
	DU-34	ISM	0-1	DU-34 (0-1)																0
			1-2	DU-34 (1-2)	0.2			0.4	0.3		1.2		0.9	4.6	1.0	0.2			0.5	9.3
			2-3	DU-34 (2-3)				0.4					1.1	4.9	0.5	0.1				7.1
	DU-35	ISM	0-1	DU-35 (0-1)				0.6					0.9	6.6	0.5	0.1			0.3	9.1
			1-2	DU-35 (1-2)				0.4					0.8	2.1		0.1			0.4	3.9
			2-3	DU-35 (2-3)				0.3					0.7	1.7						2.7
	DU-36	ISM	0-1	DU-36 (0-1)	1.4			0.7	0.6				1.3	6.9	0.6	0.1			0.3	12
			1-2	DU-36 (1-2)	1.3			0.7	1.1				1.1	6.1	0.8	0.1				11
			2-3	DU-36 (2-3)	1.3			0.6	0.5				0.9	4.6					0.3	8.2
	DU-38	ISM	0-1	DU-38 (0-1)	0.5			0.3	0.3				0.5	4.8	0.6	0.1			0.4	7.5
			1-2	DU-38 (1-2)	1.8			0.7	0.6					3.1					0.5	6.7
			2-3	DU-38 (2-3)	1.4			0.6	0.4				0.5	1.7					0.3	5.0
	DU-37	Composite	0-1	DU-37 (0-1)										0.1						0.1
			1-2	DU-37 (1-2)										0.1						0.1
			2-3	DU-37 (2-3)											1.2	0.2				1.3
	DU-39	Composite	0-1	DU-39 (0-1)										0.6						0.6
			1-2	DU-39 (1-2)										0.2						0.2
			2-3	DU-39 (2-3)										0.2						0.2

Please see notes at the end of the table.

Table A-28

Mammal Hazard Quotient and Hazard Index - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)										0.1						0.1
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)										0.5						0.5
			1-2	DU-43 (1-2)										0.2						0.2
			2-3	DU-43 (2-3)										0.1						0.1
	DU-44	Composite	0-1	DU-44 (0-1)	0.2									0.2						0.5
			1-2	DU-44 (1-2)										0.1						0.1
			2-3	DU-44 (2-3)										0.1						0.1
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0
			1-2	DU-41 (1-2)																0
			2-3	DU-41 (2-3)																0

Notes:

1. Definition of table shading:

-  COC was not detected. Hazard Quotient not calculated.
-  Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
-  Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-29
Human Health Non-Carcinogenic Risk - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio														Cumulative Non-Cancer Risk Ratio	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Human Health Non-Carcinogenic RBC					24	74		11,000	400					1.70E-04				60	4	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)					0.2					0.1					0.1	0.4
			1-2	DU-1 (1-2)															0.0	
			2-3	DU-1 (2-3)					0.1											0.1
	DU-2	ISM	0-1	DU-2 (0-1)					0.2											0.2
			1-2	DU-2 (1-2)					0.3										0.4	
			2-3	DU-2 (2-3)														0.1	0.0	
	DU-3	ISM	0-1	DU-3 (0-1)										0.2						0.2
			1-2	DU-3 (1-2)															0.0	
			2-3	DU-3 (2-3)															0.0	
	DU-4	ISM	0-1	DU-4 (0-1)										0.1						0.1
			1-2	DU-4 (1-2)															0.0	
			2-3	DU-4 (2-3)					0.1										0.1	
	DU-5	ISM	0-1	DU-5 (0-1)																0.0
			1-2	DU-5 (1-2)															0.0	
			2-3	DU-5 (2-3)															0.0	
	DU-6	ISM	0-1	DU-6 (0-1)																0.0
			1-2	DU-6 (1-2)															0.0	
			2-3	DU-6 (2-3)															0.0	
	DU-7	ISM	0-1	DU-7 (0-1)																0.0
			1-2	DU-7 (1-2)															0.0	
			2-3	DU-7 (2-3)															0.0	
	DU-8	ISM	0-1	DU-8 (0-1)																0.0
			1-2	DU-8 (1-2)															0.0	
			2-3	DU-8 (2-3)															0.0	
	DU-9	ISM	0-1	DU-9 (0-1)																0.0
			1-2	DU-9 (1-2)					0.1										0.1	
			2-3	DU-9 (2-3)															0.0	
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0.0	
			1-2	DU-10 (1-2)														0.0		
			2-3	DU-10 (2-3)														0.0		
	DU-11	ISM	0-1	DU-11 (0-1)															0.0	
			1-2	DU-11 (1-2)														0.0		
			2-3	DU-11 (2-3)														0.0		
	DU-12	ISM	0-1	DU-12 (0-1)															0.0	
			1-2	DU-12 (1-2)														0.0		
			2-3	DU-12 (2-3)														0.0		

Please see notes at the end of the table.

Table A-29

Human Health Non-Carcinogenic Risk - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0.0
			1-2	DU-13 (1-2)																0.0
			2-3	DU-13 (2-3)																0.0
	DU-14	ISM	0-1	DU-14 (0-1)																0.0
			1-2	DU-14 (1-2)																0.0
			2-3	DU-14 (2-3)																0.0
	DU-15	ISM	0-1	DU-15 (0-1)																0.0
			1-2	DU-15 (1-2)																0.0
			2-3	DU-15 (2-3)																0.0
	DU-16	ISM	0-1	DU-16 (0-1)																0.0
			1-2	DU-16 (1-2)																0.0
			2-3	DU-16 (2-3)																0.0
	DU-17	ISM	0-1	DU-17 (0-1)																0.0
			1-2	DU-17 (1-2)																0.0
			2-3	DU-17 (2-3)																0.0
	DU-18	ISM	0-1	DU-18 (0-1)																0.0
			1-2	DU-18 (1-2)																0.0
			2-3	DU-18 (2-3)																0.0
	DU-19	ISM	0-1	DU-19 (0-1)																0.0
			1-2	DU-19 (1-2)																0.0
			2-3	DU-19 (2-3)					0.2					0.3						0.5
	DU-20	ISM	0-1	DU-20 (0-1)																0.0
			1-2	DU-20 (1-2)																0.0
			2-3	DU-20 (2-3)																0.0
	DU-21	ISM	0-1	DU-21 (0-1)																0.0
			1-2	DU-21 (1-2)																0.0
			2-3	DU-21 (2-3)					0.2											0.2
	DU-22	ISM	0-1	DU-22 (0-1)																0.0
			1-2	DU-22 (1-2)																0.0
			2-3	DU-22 (2-3)																0.0
	DU-23	ISM	0-1	DU-23 (0-1)																0.0
			1-2	DU-23 (1-2)																0.0
			2-3	DU-23 (2-3)																0.0
	DU-24	ISM	0-1	DU-24 (0-1)																0.0
			1-2	DU-24 (1-2)																0.0
			2-3	DU-24 (2-3)																0.0
	DU-25	ISM	0-1	DU-25 (0-1)																0.0
			1-2	DU-25 (1-2)																0.0
			2-3	DU-25 (2-3)					0.1											0.1
	DU-26	ISM	0-1	DU-26 (0-1)																0.0
			1-2	DU-26 (1-2)																0.0
			2-3	DU-26 (2-3)																0.0

Please see notes at the end of the table.

Table A-29

Human Health Non-Carcinogenic Risk - Residual Risk

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0
			1-2	DU-42 (1-2)										0.1						0.1
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0.0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)		0.2			0.1					0.1						0.5
	DU-28	ISM	0-1	DU-28 (0-1)																0.0
			1-2	DU-28 (1-2)																0.0
			2-3	DU-28 (2-3)	0.2				0.3											0.5
	DU-29	ISM	0-1	DU-29 (0-1)					0.3					0.3						0.6
			1-2	DU-29 (1-2)					0.1											0.1
			2-3	DU-29 (2-3)					0.1											0.1
	DU-30	ISM	0-1	DU-30 (0-1)					0.3					0.3						0.6
			1-2	DU-30 (1-2)					0.5					0.1						0.6
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)					0.1					0.3						0.5
			1-2	DU-31 (1-2)										0.1						0.1
			2-3	DU-31 (2-3)																0.0
	DU-32	ISM	0-1	DU-32 (0-1)		0.1								0.2						0.3
			1-2	DU-32 (1-2)																0.0
			2-3	DU-32 (2-3)																0.0
	DU-33	ISM	0-1	DU-33 (0-1)					0.2					0.2						0.4
			1-2	DU-33 (1-2)		0.1			0.2											0.3
			2-3	DU-33 (2-3)					0.1											0.1
	DU-34	ISM	0-1	DU-34 (0-1)																0.0
			1-2	DU-34 (1-2)										0.2						0.2
			2-3	DU-34 (2-3)										0.2						0.2
	DU-35	ISM	0-1	DU-35 (0-1)										0.2						0.2
			1-2	DU-35 (1-2)																0.0
			2-3	DU-35 (2-3)																0.0
	DU-36	ISM	0-1	DU-36 (0-1)	0.2				0.2					0.2						0.6
			1-2	DU-36 (1-2)	0.1				0.3					0.2						0.7
			2-3	DU-36 (2-3)	0.2				0.2					0.2						0.5
	DU-38	ISM	0-1	DU-38 (0-1)										0.2						0.2
			1-2	DU-38 (1-2)	0.2				0.2					0.1						0.5
			2-3	DU-38 (2-3)	0.2				0.1											0.3
	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0

Please see notes at the end of the table.

Table A-29
Human Health Non-Carcinogenic Risk - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0
	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0.0
			1-2	DU-41 (1-2)																0.0
			2-3	DU-41 (2-3)																0.0

Notes:

1. Definition of table shading:

-  COC was not detected. Hazard Quotient not calculated.
-  Non-Cancer Hazard Quotient or Cumulative Risk Greater than or Equal to 1.0 (Unacceptable Risk)
-  Non-Cancer Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-30
Human Health Carcinogenic Risk - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)														Cumulative Excess Lifetime Cancer Risk (x 1E-05)	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Human Health Carcinogenic RBC						1.4								1.50E-05				0.55	0.74	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)										1				0.8	0.6	0.3
			1-2	DU-1 (1-2)															0	
			2-3	DU-1 (2-3)										0.7				0.6	0.1	0.1
	DU-2	ISM	0-1	DU-2 (0-1)										0.5				0.3	0.3	0.1
			1-2	DU-2 (1-2)										0.2				0.2	0.8	0.1
			2-3	DU-2 (2-3)										0.2						0
	DU-3	ISM	0-1	DU-3 (0-1)										2				0.3		0.2
			1-2	DU-3 (1-2)										0.5				0.2		0.1
			2-3	DU-3 (2-3)										0.3				0.2		0.05
	DU-4	ISM	0-1	DU-4 (0-1)										1				0.8		0.2
			1-2	DU-4 (1-2)										1				3		0.4
			2-3	DU-4 (2-3)										1				1		0.2
	DU-5	ISM	0-1	DU-5 (0-1)																0
			1-2	DU-5 (1-2)																0
			2-3	DU-5 (2-3)																0
	DU-6	ISM	0-1	DU-6 (0-1)										0.7				0.3		0.1
			1-2	DU-6 (1-2)																0
			2-3	DU-6 (2-3)										0.8				0.4	0.2	0.1
	DU-7	ISM	0-1	DU-7 (0-1)																0
			1-2	DU-7 (1-2)										0.8				0.1		0.1
			2-3	DU-7 (2-3)										0.5						0.1
	DU-8	ISM	0-1	DU-8 (0-1)																0
			1-2	DU-8 (1-2)																0
			2-3	DU-8 (2-3)																0
	DU-9	ISM	0-1	DU-9 (0-1)																0
			1-2	DU-9 (1-2)										0.9				0.1		0.1
			2-3	DU-9 (2-3)										0.8				0.3		0.1
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0	
			1-2	DU-10 (1-2)															0	
			2-3	DU-10 (2-3)															0	
	DU-11	ISM	0-1	DU-11 (0-1)															0	
			1-2	DU-11 (1-2)															0	
			2-3	DU-11 (2-3)															0	
	DU-12	ISM	0-1	DU-12 (0-1)															0	
			1-2	DU-12 (1-2)															0	
			2-3	DU-12 (2-3)															0	

Please see notes at the end of the table.

Table A-30
Human Health Carcinogenic Risk - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0
			1-2	DU-13 (1-2)																0
			2-3	DU-13 (2-3)																0
	DU-14	ISM	0-1	DU-14 (0-1)																0
			1-2	DU-14 (1-2)																0
			2-3	DU-14 (2-3)																0
	DU-15	ISM	0-1	DU-15 (0-1)																0
			1-2	DU-15 (1-2)																0
			2-3	DU-15 (2-3)																0
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)																0
			2-3	DU-16 (2-3)										0.5				0.1		0.1
	DU-17	ISM	0-1	DU-17 (0-1)																0
			1-2	DU-17 (1-2)																0
			2-3	DU-17 (2-3)										0.5						0.1
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)																0
			2-3	DU-18 (2-3)																0
	DU-19	ISM	0-1	DU-19 (0-1)																0
			1-2	DU-19 (1-2)																0
			2-3	DU-19 (2-3)										3				0.1		0.3
	DU-20	ISM	0-1	DU-20 (0-1)																0
			1-2	DU-20 (1-2)										0.3						0.03
			2-3	DU-20 (2-3)										0.3						0.03
	DU-21	ISM	0-1	DU-21 (0-1)																0
			1-2	DU-21 (1-2)																0
			2-3	DU-21 (2-3)										0.7				0.2		0.1
	DU-22	ISM	0-1	DU-22 (0-1)																0
			1-2	DU-22 (1-2)																0
			2-3	DU-22 (2-3)																0
	DU-23	ISM	0-1	DU-23 (0-1)																0
			1-2	DU-23 (1-2)																0
			2-3	DU-23 (2-3)																0
	DU-24	ISM	0-1	DU-24 (0-1)																0
			1-2	DU-24 (1-2)										0.4				0.1		0.1
			2-3	DU-24 (2-3)										0.6						0.1
	DU-25	ISM	0-1	DU-25 (0-1)																0
			1-2	DU-25 (1-2)																0
			2-3	DU-25 (2-3)										0.1				0.2		0.03
	DU-26	ISM	0-1	DU-26 (0-1)																0
			1-2	DU-26 (1-2)																0
			2-3	DU-26 (2-3)																0

Please see notes at the end of the table.

Table A-30
Human Health Carcinogenic Risk - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0
			1-2	DU-42 (1-2)										2						0.2
			2-3	DU-42 (2-3)										0.6						0.1
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0
			1-2	DU-27 (1-2)																0
			2-3	DU-27 (2-3)		11								2				0.2	0	1
	DU-28	ISM	0-1	DU-28 (0-1)																0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)														0.6		0.2
	DU-29	ISM	0-1	DU-29 (0-1)										3				0.3		0.4
			1-2	DU-29 (1-2)										1				0.1		0.1
			2-3	DU-29 (2-3)										1				0.1		0.1
	DU-30	ISM	0-1	DU-30 (0-1)										3				0.7		0.4
			1-2	DU-30 (1-2)										1				0.3		0.2
			2-3	DU-30 (2-3)																0
	DU-31	ISM	0-1	DU-31 (0-1)										4				0.2		0.4
			1-2	DU-31 (1-2)										1				0.2		0.1
			2-3	DU-31 (2-3)										0.7				0.2		0.1
	DU-32	ISM	0-1	DU-32 (0-1)		6								2				0.2		0.9
			1-2	DU-32 (1-2)										0.5				0.1		0.1
			2-3	DU-32 (2-3)										0.5				1		0.2
	DU-33	ISM	0-1	DU-33 (0-1)										2					0	0.3
			1-2	DU-33 (1-2)		7								1						0.8
			2-3	DU-33 (2-3)										0.8				0.1		0.1
	DU-34	ISM	0-1	DU-34 (0-1)																0
			1-2	DU-34 (1-2)										2				0.3		0.2
			2-3	DU-34 (2-3)										2				0.2		0.2
	DU-35	ISM	0-1	DU-35 (0-1)										3				0.2		0.3
			1-2	DU-35 (1-2)										0.9				0.2		0.1
			2-3	DU-35 (2-3)										0.7						0.1
	DU-36	ISM	0-1	DU-36 (0-1)										3				0.1		0.3
			1-2	DU-36 (1-2)										2				0.2		0.3
			2-3	DU-36 (2-3)										2						0.2
	DU-38	ISM	0-1	DU-38 (0-1)										2				0.2		0.2
			1-2	DU-38 (1-2)										1				0.1		0.1
			2-3	DU-38 (2-3)										0.7						0.1
	DU-37	Composite	0-1	DU-37 (0-1)																0
			1-2	DU-37 (1-2)																0
			2-3	DU-37 (2-3)														0.2		0.02
	DU-39	Composite	0-1	DU-39 (0-1)										0.2						0.02
			1-2	DU-39 (1-2)																0
			2-3	DU-39 (2-3)																0

Please see notes at the end of the table.

Table A-30
Human Health Carcinogenic Risk - Residual Risk
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-40	Composite	0-1	DU-40 (0-1)																0
			1-2	DU-40 (1-2)																0
			2-3	DU-40 (2-3)																0
	DU-43	Composite	0-1	DU-43 (0-1)										0.2						0.02
			1-2	DU-43 (1-2)																0
			2-3	DU-43 (2-3)																0
	DU-44	Composite	0-1	DU-44 (0-1)																0
			1-2	DU-44 (1-2)																0
			2-3	DU-44 (2-3)																0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0
			1-2	DU-41 (1-2)																0
			2-3	DU-41 (2-3)																0

Notes:

1. Definition of table shading:

	COC was not detected. Risk not calculated.
	Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-06 <u>or</u> Cumulative Excess Lifetime Cancer Risk Greater than 1E-05 (Unacceptable Risk)
	Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-04 (Hot Spot)

2. Only Risk Quotients equal to or greater than 1E-07 are shown.

3. Risks not calculated for results below background.

Table A-31
Plant Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105								
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180								
Plant RBC (mg/kg)					5	18	39	70	120	0.30	38	0.52	160						40		
Maximum Residual					1.0	0.9	0.0	3.3	1.7	0.5	0.7	1.0	2.2						0.0	7.4	
Maximum Residual - Uncertainty					1.6	1.6	0.0	5.0	2.7	0.8	0.7	1.0	2.2						0.0	11	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.2			2.6	0.6	0.4	0.7		0.9							5.4	
			1-2	DU-1 (1-2)															0.0		
			2-3	DU-1 (2-3)			1.0	0.5	0.4	0.7		1.1							3.7		
	DU-2	ISM	0-1	DU-2 (0-1)	0.1			1.7	0.8	0.4									3.0		
			1-2	DU-2 (1-2)			2.4	1.0	0.7									4.1			
			2-3	DU-2 (2-3)			0.6		0.3									0.9			
	DU-3	ISM	0-1	DU-3 (0-1)				0.4											0.4		
			1-2	DU-3 (1-2)			0.4		0.2									0.6			
			2-3	DU-3 (2-3)					0.3									0.3			
	DU-4	ISM	0-1	DU-4 (0-1)				0.4		0.4	0.6								1.4		
			1-2	DU-4 (1-2)			0.4		0.3	0.6								1.3			
			2-3	DU-4 (2-3)			0.5	0.4	0.4			0.7						2.0			
	DU-5	ISM	0-1	DU-5 (0-1)															0		
			1-2	DU-5 (1-2)														0			
			2-3	DU-5 (2-3)														0.0			
	DU-6	ISM	0-1	DU-6 (0-1)				1.0	0.2	0.7			0.8						2.7		
			1-2	DU-6 (1-2)														0.0			
			2-3	DU-6 (2-3)			1.4	0.3	0.8			0.7						3.2			
	DU-7	ISM	0-1	DU-7 (0-1)															0.0		
			1-2	DU-7 (1-2)			0.4		0.7									1.1			
			2-3	DU-7 (2-3)			0.3		0.5									0.8			
	DU-8	ISM	0-1	DU-8 (0-1)															0.0		
			1-2	DU-8 (1-2)														0.0			
			2-3	DU-8 (2-3)														0.0			
	DU-9	ISM	0-1	DU-9 (0-1)															0.0		
			1-2	DU-9 (1-2)			0.5	0.3	0.8	0.6		0.7						3.0			
			2-3	DU-9 (2-3)			0.5		0.8	0.7		0.8						2.7			
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0.0		
			1-2	DU-10 (1-2)														0.0			
			2-3	DU-10 (2-3)														0.0			
	DU-11	ISM	0-1	DU-11 (0-1)															0.0		
			1-2	DU-11 (1-2)														0.0			
			2-3	DU-11 (2-3)														0.0			
	DU-12	ISM	0-1	DU-12 (0-1)															0.0		
			1-2	DU-12 (1-2)														0.0			
			2-3	DU-12 (2-3)														0.0			

Please see notes at the end of the table.

Table A-31
Plant Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0.0
			1-2	DU-13 (1-2)																0.0
			2-3	DU-13 (2-3)																0.0
	DU-14	ISM	0-1	DU-14 (0-1)																0.0
			1-2	DU-14 (1-2)																0
			2-3	DU-14 (2-3)																0
	DU-15	ISM	0-1	DU-15 (0-1)																0.0
			1-2	DU-15 (1-2)																0.0
			2-3	DU-15 (2-3)																0.0
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)																0.0
			2-3	DU-16 (2-3)				0.4	0.3	0.5		1.0								2.3
	DU-17	ISM	0-1	DU-17 (0-1)																0.0
			1-2	DU-17 (1-2)																0.0
			2-3	DU-17 (2-3)				0.4	0.3	0.4										1.1
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)																0.0
			2-3	DU-18 (2-3)																0.0
	DU-19	ISM	0-1	DU-19 (0-1)																0.0
			1-2	DU-19 (1-2)																0.0
			2-3	DU-19 (2-3)	0.2			0.6	0.6	0.5			0.7							2.6
	DU-20	ISM	0-1	DU-20 (0-1)																0.0
			1-2	DU-20 (1-2)				0.4		0.5	0.7									1.6
			2-3	DU-20 (2-3)						0.3										0.3
	DU-21	ISM	0-1	DU-21 (0-1)																0.0
			1-2	DU-21 (1-2)																0.0
			2-3	DU-21 (2-3)				0.7	0.7	0.5			0.7							2.6
	DU-22	ISM	0-1	DU-22 (0-1)																0.0
			1-2	DU-22 (1-2)																0.0
			2-3	DU-22 (2-3)																0.0
	DU-23	ISM	0-1	DU-23 (0-1)																0.0
			1-2	DU-23 (1-2)																0.0
			2-3	DU-23 (2-3)																0.0
	DU-24	ISM	0-1	DU-24 (0-1)																0.0
			1-2	DU-24 (1-2)				0.4		0.5			0.8							1.7
			2-3	DU-24 (2-3)						0.3										0.3
	DU-25	ISM	0-1	DU-25 (0-1)																0.0
			1-2	DU-25 (1-2)																0.0
			2-3	DU-25 (2-3)				0.4	0.4	0.4			0.9							2.0
	DU-26	ISM	0-1	DU-26 (0-1)																0
			1-2	DU-26 (1-2)																0.0
			2-3	DU-26 (2-3)																0.0

Please see notes at the end of the table.

Table A-31
Plant Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0
			1-2	DU-42 (1-2)	0.1															0.1
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0.0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)	0.4	1.6		1.0	0.7	0.4			0.9							5.0
	DU-28	ISM	0-1	DU-28 (0-1)																0.0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)	1.6	0.8		5.0	1.5	0.8			1.7							11.4
	DU-29	ISM	0-1	DU-29 (0-1)	0.4	0.7		1.5	1.4	0.3			1.0							5.3
			1-2	DU-29 (1-2)	0.4	0.5		1.0	0.5											2.4
			2-3	DU-29 (2-3)				0.6	0.6											1.2
	DU-30	ISM	0-1	DU-30 (0-1)	0.6			1.4	1.7	0.5			1.1							5.2
			1-2	DU-30 (1-2)	0.7			1.7	2.7	0.3			1.4							6.8
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)	0.6	0.6		0.8	0.6	0.3			0.7							3.6
			1-2	DU-31 (1-2)	0.3	0.5		1.1	0.4	0.4			0.9							3.5
			2-3	DU-31 (2-3)	0.3	0.6		1.5	0.3				0.7							3.4
	DU-32	ISM	0-1	DU-32 (0-1)	0.3	0.9		0.7	0.4				0.7							3.0
			1-2	DU-32 (1-2)		0.7		0.5	0.3											1.5
			2-3	DU-32 (2-3)				0.4	0.4											0.9
	DU-33	ISM	0-1	DU-33 (0-1)	0.8	0.7		1.7	1.2				1.8							6.2
			1-2	DU-33 (1-2)	0.6	1.0		2.1	0.9				2.2							6.8
			2-3	DU-33 (2-3)	0.2	0.6		1.1	0.6				1.5							4.0
	DU-34	ISM	0-1	DU-34 (0-1)																0.0
			1-2	DU-34 (1-2)	0.2	0.5		0.7	0.4	0.2	0.6		1.1							3.8
			2-3	DU-34 (2-3)				0.7	0.3				1.4							2.4
	DU-35	ISM	0-1	DU-35 (0-1)				1.1	0.3				1.1							2.5
			1-2	DU-35 (1-2)				0.6	0.3				1.1							1.9
			2-3	DU-35 (2-3)				0.6					0.9							1.5
	DU-36	ISM	0-1	DU-36 (0-1)	1.3	0.5		1.3	1.0				1.7							5.7
			1-2	DU-36 (1-2)	1.2			1.2	1.7	0.3			1.4							5.8
			2-3	DU-36 (2-3)	1.2			1.0	0.8	0.2			1.2							4.5
	DU-38	ISM	0-1	DU-38 (0-1)	0.3			0.4	0.3				0.7							1.6
			1-2	DU-38 (1-2)	1.0			0.8	0.6											2.4
			2-3	DU-38 (2-3)	0.7			0.7	0.4				0.7							2.6
	DU-37	Composite	0-1	DU-37 (0-1)				0.6												0.6
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0
	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0

Please see notes at the end of the table.

Table A-31
Plant Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)	0.2															0.2
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0.0
			1-2	DU-41 (1-2)																0.0
			2-3	DU-41 (2-3)																0.0

Notes:

1. Definition of table shading:

- COC was not detected. Hazard Quotient not calculated.
- Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
- Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)
- Adjusted Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
- Adjusted Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.
3. Hazard Quotients not calculated for results below background.

Table A-32

Invertebrate Hazard Quotient and Hazard Index - Residual Risk Uncertainty

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105								
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180								
Invertebrate RBC					78		39.0	80	1700	0.10	280	4.1	120			18	29				
Maximum Residual					0.0		0.0	2.9	0.1	1.5	0.1	0.1	3.0			0.7	0.1			6.7	
Maximum Residual - Uncertainty					0.1		0.0	4.4	0.2	2.5	0.1	0.1	3.0			1.0	0.2			9	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)				2.3		1.1			1.3			0.2				4.8	
			1-2	DU-1 (1-2)															0.0		
			2-3	DU-1 (2-3)				0.9		1.3			1.5			0.2				3.8	
	DU-2	ISM	0-1	DU-2 (0-1)				1.5		1.2										2.7	
			1-2	DU-2 (1-2)				2.1		2.0									4.1		
			2-3	DU-2 (2-3)				0.5		1.0									1.5		
	DU-3	ISM	0-1	DU-3 (0-1)				0.3												0.3	
			1-2	DU-3 (1-2)				0.3		0.7									1.1		
			2-3	DU-3 (2-3)						0.8									0.8		
	DU-4	ISM	0-1	DU-4 (0-1)				0.4		1.2						0.2	0.2			1.8	
			1-2	DU-4 (1-2)				0.3		1.0					1.0				2.5		
			2-3	DU-4 (2-3)				0.4		1.2			1.0		0.4				3.0		
	DU-5	ISM	0-1	DU-5 (0-1)																0	
			1-2	DU-5 (1-2)																0.0	
			2-3	DU-5 (2-3)																0.0	
	DU-6	ISM	0-1	DU-6 (0-1)				0.8		2.1			1.1							4.0	
			1-2	DU-6 (1-2)																0.0	
			2-3	DU-6 (2-3)				1.3		2.3			0.9			0.1				4.6	
	DU-7	ISM	0-1	DU-7 (0-1)																0.0	
			1-2	DU-7 (1-2)				0.4		2.1										2.5	
			2-3	DU-7 (2-3)				0.3		1.5										1.8	
	DU-8	ISM	0-1	DU-8 (0-1)																0.0	
			1-2	DU-8 (1-2)																0.0	
			2-3	DU-8 (2-3)																0.0	
	DU-9	ISM	0-1	DU-9 (0-1)																0.0	
			1-2	DU-9 (1-2)				0.4		2.3			1.0							3.7	
			2-3	DU-9 (2-3)				0.5		2.3			1.0							3.8	
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0		
			1-2	DU-10 (1-2)														0			
			2-3	DU-10 (2-3)														0.0			
	DU-11	ISM	0-1	DU-11 (0-1)															0		
			1-2	DU-11 (1-2)															0.0		
			2-3	DU-11 (2-3)															0.0		
DU-12	ISM	0-1	DU-12 (0-1)																0.0		
		1-2	DU-12 (1-2)																0.0		
		2-3	DU-12 (2-3)																0.0		

Please see notes at the end of the table.

Table A-32

Invertebrate Hazard Quotient and Hazard Index - Residual Risk Uncertainty

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																	0
			1-2	DU-13 (1-2)																0.0	
			2-3	DU-13 (2-3)																0.0	
	DU-14	ISM	0-1	DU-14 (0-1)																	0
			1-2	DU-14 (1-2)																0	
			2-3	DU-14 (2-3)																0	
	DU-15	ISM	0-1	DU-15 (0-1)																	0.0
			1-2	DU-15 (1-2)																0	
			2-3	DU-15 (2-3)																0.0	
	DU-16	ISM	0-1	DU-16 (0-1)																	0
			1-2	DU-16 (1-2)																0	
			2-3	DU-16 (2-3)				0.4		1.5		0.1								2.0	
	DU-17	ISM	0-1	DU-17 (0-1)																	0.0
			1-2	DU-17 (1-2)																0.0	
			2-3	DU-17 (2-3)				0.3		1.2										1.5	
	DU-18	ISM	0-1	DU-18 (0-1)																	0
			1-2	DU-18 (1-2)																0	
			2-3	DU-18 (2-3)																0.0	
	DU-19	ISM	0-1	DU-19 (0-1)																	0
			1-2	DU-19 (1-2)																0	
			2-3	DU-19 (2-3)				0.6		1.5			0.9							3.0	
	DU-20	ISM	0-1	DU-20 (0-1)																	0.0
			1-2	DU-20 (1-2)				0.3		1.4	0.1									1.8	
			2-3	DU-20 (2-3)						1.0										1.0	
DU-21	ISM	0-1	DU-21 (0-1)																	0	
		1-2	DU-21 (1-2)																0.0		
		2-3	DU-21 (2-3)				0.6		1.5			0.9							3.0		
DU-22	ISM	0-1	DU-22 (0-1)																	0.0	
		1-2	DU-22 (1-2)																0.0		
		2-3	DU-22 (2-3)																0.0		
DU-23	ISM	0-1	DU-23 (0-1)																	0	
		1-2	DU-23 (1-2)																0.0		
		2-3	DU-23 (2-3)																0.0		
DU-24	ISM	0-1	DU-24 (0-1)																	0.0	
		1-2	DU-24 (1-2)				0.4		1.5			1.0							2.9		
		2-3	DU-24 (2-3)						0.9										0.9		
DU-25	ISM	0-1	DU-25 (0-1)																	0	
		1-2	DU-25 (1-2)																0.0		
		2-3	DU-25 (2-3)				0.4		1.2			1.2							2.7		
DU-26	ISM	0-1	DU-26 (0-1)																	0	
		1-2	DU-26 (1-2)																0		
		2-3	DU-26 (2-3)																0.0		

Please see notes at the end of the table.

Table A-32

Invertebrate Hazard Quotient and Hazard Index - Residual Risk Uncertainty

RD/RA Work Plan

Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0	
			1-2	DU-42 (1-2)															0.0		
			2-3	DU-42 (2-3)															0.0		
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0.0	
			1-2	DU-27 (1-2)															0.0		
			2-3	DU-27 (2-3)			0.9		1.1			1.2							3.1		
	DU-28	ISM	0-1	DU-28 (0-1)															0.0		
			1-2	DU-28 (1-2)														0.0			
			2-3	DU-28 (2-3)	0.1		4.4	0.1	2.5			2.3		0.1				9.4			
	DU-29	ISM	0-1	DU-29 (0-1)				1.3		1.0			1.4						3.7		
			1-2	DU-29 (1-2)				0.8										0.8			
			2-3	DU-29 (2-3)				0.5										0.5			
	DU-30	ISM	0-1	DU-30 (0-1)				1.2	0.1	1.4			1.5			0.1				4.3	
			1-2	DU-30 (1-2)				1.5	0.2	0.8			1.9						4.4		
			2-3	DU-30 (2-3)															0.0		
	DU-31	ISM	0-1	DU-31 (0-1)				0.7		0.8			1.0							2.4	
			1-2	DU-31 (1-2)				0.9		1.1			1.2						3.2		
			2-3	DU-31 (2-3)				1.3					0.9						2.2		
	DU-32	ISM	0-1	DU-32 (0-1)				0.6					1.0							1.6	
			1-2	DU-32 (1-2)				0.4											0.4		
			2-3	DU-32 (2-3)				0.4							0.2				0.6		
	DU-33	ISM	0-1	DU-33 (0-1)				1.5					2.4							3.9	
			1-2	DU-33 (1-2)				1.8					3.0						4.8		
			2-3	DU-33 (2-3)				1.0					2.0						2.9		
	DU-34	ISM	0-1	DU-34 (0-1)																0.0	
			1-2	DU-34 (1-2)				0.6		0.7			1.5						2.8		
			2-3	DU-34 (2-3)				0.6					1.9						2.5		
	DU-35	ISM	0-1	DU-35 (0-1)				1.0					1.5							2.5	
			1-2	DU-35 (1-2)				0.6					1.4						2.0		
			2-3	DU-35 (2-3)				0.5					1.2						1.7		
	DU-36	ISM	0-1	DU-36 (0-1)				1.1					2.2							3.3	
			1-2	DU-36 (1-2)				1.1	0.1	1.0			1.9						4.0		
			2-3	DU-36 (2-3)				0.9		0.7			1.6						3.2		
	DU-38	ISM	0-1	DU-38 (0-1)				0.3					0.9							1.3	
			1-2	DU-38 (1-2)				0.7											0.7		
			2-3	DU-38 (2-3)				0.6					0.9						1.5		
	DU-37	Composite	0-1	DU-37 (0-1)				0.5												0.5	
			1-2	DU-37 (1-2)															0.0		
			2-3	DU-37 (2-3)															0.0		
	DU-39	Composite	0-1	DU-39 (0-1)																0.0	
			1-2	DU-39 (1-2)															0.0		
			2-3	DU-39 (2-3)															0.0		
	DU-40	Composite	0-1	DU-40 (0-1)																0.0	
			1-2	DU-40 (1-2)															0.0		
			2-3	DU-40 (2-3)															0.0		

Please see notes at the end of the table.

Table A-32
Invertebrate Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)															0.0	
			2-3	DU-43 (2-3)														0.0		
	DU-44	Composite	0-1	DU-44 (0-1)															0.0	
			1-2	DU-44 (1-2)														0.0		
			2-3	DU-44 (2-3)													0.0			
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)															0.0	
			1-2	DU-41 (1-2)														0.0		
			2-3	DU-41 (2-3)													0.0			

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)
	Adjusted Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
	Adjusted Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-33
Bird Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105								
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180								
Bird RBC						575	87	88	33	0.015	139	3.42	673	8.90E-05					0.734		
Maximum Residual						0.0	0.0	2.6	6.1	9.9	0.2	0.2	0.5	0.7					0.8	17	
Maximum Residual - Uncertainty						0.0	0.0	4.0	9.7	16	0.2	0.2	0.5	0.9					1.6	26	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)				2.0	2.3	7.5	0.2		0.2	0.3					1.0	14	
			1-2	DU-1 (1-2)												0					
			2-3	DU-1 (2-3)		0.8	1.7	8.7	0.2	0.3			0.2			0.3	12				
	DU-2	ISM	0-1	DU-2 (0-1)				1.4	2.9	7.8									0.5	13	
			1-2	DU-2 (1-2)		1.9	3.6	13								1.6	20				
			2-3	DU-2 (2-3)		0.5		6.5								7.0					
	DU-3	ISM	0-1	DU-3 (0-1)				0.3						0.4						0.7	
			1-2	DU-3 (1-2)		0.3		4.9								5.3					
			2-3	DU-3 (2-3)				5.3								5.3					
	DU-4	ISM	0-1	DU-4 (0-1)				0.3		8.0	0.2			0.3						8.8	
			1-2	DU-4 (1-2)		0.3		6.4	0.2								7.1				
			2-3	DU-4 (2-3)		0.4	1.4	8.2		0.2			0.2				10				
	DU-5	ISM	0-1	DU-5 (0-1)																0	
			1-2	DU-5 (1-2)													0				
			2-3	DU-5 (2-3)													0				
	DU-6	ISM	0-1	DU-6 (0-1)				0.8	0.9	14			0.2	0.2					0.1	16	
			1-2	DU-6 (1-2)													0				
			2-3	DU-6 (2-3)		1.1	1.1	15		0.2			0.2			0.5	18				
	DU-7	ISM	0-1	DU-7 (0-1)																0	
			1-2	DU-7 (1-2)		0.3		14					0.2				0.1	15			
			2-3	DU-7 (2-3)		0.3		9.9					0.1			10					
	DU-8	ISM	0-1	DU-8 (0-1)																0	
			1-2	DU-8 (1-2)													0				
			2-3	DU-8 (2-3)													0				
	DU-9	ISM	0-1	DU-9 (0-1)																0	
			1-2	DU-9 (1-2)			0.4	1.2	15	0.2				0.2	0.2				17		
			2-3	DU-9 (2-3)		0.4		15	0.2	0.2			0.2			0.1	16				
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)																0	
			1-2	DU-10 (1-2)													0				
			2-3	DU-10 (2-3)													0				
	DU-11	ISM	0-1	DU-11 (0-1)																0	
			1-2	DU-11 (1-2)													0				
			2-3	DU-11 (2-3)													0				
	DU-12	ISM	0-1	DU-12 (0-1)																0	
			1-2	DU-12 (1-2)													0				
			2-3	DU-12 (2-3)													0				

Please see notes at the end of the table.

Table A-33
Bird Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																	0
			1-2	DU-13 (1-2)																0	
			2-3	DU-13 (2-3)																	0
	DU-14	ISM	0-1	DU-14 (0-1)																	0
			1-2	DU-14 (1-2)																0	
			2-3	DU-14 (2-3)																0	
	DU-15	ISM	0-1	DU-15 (0-1)																	0
			1-2	DU-15 (1-2)																0	
			2-3	DU-15 (2-3)																0	
	DU-16	ISM	0-1	DU-16 (0-1)																	0
			1-2	DU-16 (1-2)																0	
			2-3	DU-16 (2-3)			0.3	1.1	9.9		0.2		0.1							12	
	DU-17	ISM	0-1	DU-17 (0-1)																	0
			1-2	DU-17 (1-2)																0	
			2-3	DU-17 (2-3)			0.3	1.1	8.1			0.1								9.6	
	DU-18	ISM	0-1	DU-18 (0-1)																	0
			1-2	DU-18 (1-2)																0	
			2-3	DU-18 (2-3)																0	
	DU-19	ISM	0-1	DU-19 (0-1)																	0
			1-2	DU-19 (1-2)																0	
			2-3	DU-19 (2-3)			0.5	2.1	9.9			0.2	0.9					0.1		14	
	DU-20	ISM	0-1	DU-20 (0-1)																	0
			1-2	DU-20 (1-2)				0.3		9.1	0.2									9.6	
			2-3	DU-20 (2-3)						6.7										6.7	
DU-21	ISM	0-1	DU-21 (0-1)																	0	
		1-2	DU-21 (1-2)																0		
		2-3	DU-21 (2-3)			0.5	2.7	9.9			0.2	0.2							13		
DU-22	ISM	0-1	DU-22 (0-1)																	0	
		1-2	DU-22 (1-2)																0		
		2-3	DU-22 (2-3)																0		
DU-23	ISM	0-1	DU-23 (0-1)																	0	
		1-2	DU-23 (1-2)																0		
		2-3	DU-23 (2-3)																0		
DU-24	ISM	0-1	DU-24 (0-1)																	0	
		1-2	DU-24 (1-2)			0.4		9.9			0.2	0.1							11		
		2-3	DU-24 (2-3)					6.2			0.1								6.3		
DU-25	ISM	0-1	DU-25 (0-1)																	0	
		1-2	DU-25 (1-2)																0		
		2-3	DU-25 (2-3)			0.3	1.3	7.7			0.2								9.6		
DU-26	ISM	0-1	DU-26 (0-1)																	0	
		1-2	DU-26 (1-2)																0		
		2-3	DU-26 (2-3)																0		

Please see notes at the end of the table.

Table A-33
Bird Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0
			1-2	DU-42 (1-2)										0.4						0.4
			2-3	DU-42 (2-3)										0.1						0.1
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)				0.8	2.7	7.1			0.2	0.3					0.3	11.4
	DU-28	ISM	0-1	DU-28 (0-1)																0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)				4.0	5.4	16			0.4	0.2						26
	DU-29	ISM	0-1	DU-29 (0-1)				1.2	4.9	6.5			0.2	0.7						14
			1-2	DU-29 (1-2)				0.8	2.0					0.2						3.0
			2-3	DU-29 (2-3)				0.5	2.2					0.2						2.9
	DU-30	ISM	0-1	DU-30 (0-1)				1.1	6.3	9.1			0.3	0.7						17
			1-2	DU-30 (1-2)				1.4	9.7	5.5			0.3	0.3						17
			2-3	DU-30 (2-3)																0
	DU-31	ISM	0-1	DU-31 (0-1)				0.6	2.1	5.3			0.2	0.8						9.0
			1-2	DU-31 (1-2)				0.8	1.6	7.4			0.2	0.3						10
			2-3	DU-31 (2-3)				1.2	1.2				0.2	0.2						2.7
	DU-32	ISM	0-1	DU-32 (0-1)				0.5	1.4				0.2	0.5						2.6
			1-2	DU-32 (1-2)				0.4	1.0					0.1						1.5
			2-3	DU-32 (2-3)				0.3	1.6					0.1						2.1
	DU-33	ISM	0-1	DU-33 (0-1)				1.4	4.3				0.4	0.5					0.2	6.8
			1-2	DU-33 (1-2)				1.7	3.2				0.5	0.2						5.6
			2-3	DU-33 (2-3)				0.9	2.0				0.3	0.2					0.1	3.6
	DU-34	ISM	0-1	DU-34 (0-1)																0.0
			1-2	DU-34 (1-2)				0.6	1.5	4.9	0.2		0.3	0.4						7.9
			2-3	DU-34 (2-3)				0.6	1.2				0.3	0.4						2.6
	DU-35	ISM	0-1	DU-35 (0-1)				0.9	1.1				0.3	0.6						2.8
			1-2	DU-35 (1-2)				0.5	0.9				0.2	0.2						1.9
			2-3	DU-35 (2-3)				0.5					0.2	0.1						0.8
	DU-36	ISM	0-1	DU-36 (0-1)				1.0	3.5				0.4	0.6						5.5
			1-2	DU-36 (1-2)				1.0	6.2	6.7			0.3	0.5						15
			2-3	DU-36 (2-3)				0.8	3.0	4.9			0.3	0.4						9.5
	DU-38	ISM	0-1	DU-38 (0-1)				0.3	0.9				0.2	0.3						1.7
			1-2	DU-38 (1-2)				0.6	2.3					0.2						3.2
			2-3	DU-38 (2-3)				0.6	1.6				0.2	0.1						2.4
	DU-37	Composite	0-1	DU-37 (0-1)				0.5												0.5
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0
	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0

Please see notes at the end of the table.

Table A-33
 Bird Hazard Quotient and Hazard Index - Residual Risk Uncertainty
 RD/RA Work Plan
 Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)																0.0
			2-3	DU-43 (2-3)																0.0
	DU-44	Composite	0-1	DU-44 (0-1)																0.0
			1-2	DU-44 (1-2)																0.0
			2-3	DU-44 (2-3)																0.0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0
			1-2	DU-41 (1-2)																0
			2-3	DU-41 (2-3)																0

Notes:

1. Definition of table shading:

- COC was not detected. Hazard Quotient not calculated.
- Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
- Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)
- Adjusted Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
- Adjusted Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.
3. Hazard Quotients not calculated for results below background.

Table A-34
Mammal Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105								
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180								
Mammal RBC					2.7	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098		
Maximum Residual					1.8	0.2	0.0	2.8	1.7	0.0	1.4	0.5	1.8	10	4.1	2.1	0.0		5.7	14	
Maximum Residual - Uncertainty					3.1	0.4	0.0	4.2	2.6	0.0	1.4	0.5	1.8	13	4.1	3.1	0.0		12	19	
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.3			2.2	0.6		1.4		0.8	4.7	0.8	0.7			7.5	19	
			1-2	DU-1 (1-2)															0		
			2-3	DU-1 (2-3)			0.8	0.5		1.3		0.9	2.3		0.5				2.0	8.3	
	DU-2	ISM	0-1	DU-2 (0-1)	0.2			1.5	0.8				1.4	0.5	0.3			3.9	8.5		
			1-2	DU-2 (1-2)			2.1	1.0				0.7		0.2			12	16			
			2-3	DU-2 (2-3)			0.5				0.5					0.5	1.5				
	DU-3	ISM	0-1	DU-3 (0-1)				0.3					5.5		0.3			0.4	6.5		
			1-2	DU-3 (1-2)			0.3				1.6		0.3					2.2			
			2-3	DU-3 (2-3)							1.3		0.2				1.5				
	DU-4	ISM	0-1	DU-4 (0-1)				0.4			1.2			4.4	0.6	0.6			0.6	7.7	
			1-2	DU-4 (1-2)			0.3			1.2			3.5	3.3	3.1			0.4	12		
			2-3	DU-4 (2-3)			0.4	0.4				0.6	3.1	0.9	1.2			0.6	7.2		
	DU-5	ISM	0-1	DU-5 (0-1)															0		
			1-2	DU-5 (1-2)															0		
			2-3	DU-5 (2-3)															0		
	DU-6	ISM	0-1	DU-6 (0-1)				0.8	0.2				0.7	2.2	0.5	0.3			1.1	5.9	
			1-2	DU-6 (1-2)															0.0		
			2-3	DU-6 (2-3)			1.2	0.3			0.6	2.4	1.1	0.4			3.4	9.4			
	DU-7	ISM	0-1	DU-7 (0-1)															0.0		
			1-2	DU-7 (1-2)			0.4						2.6		0.1			1.0	4.1		
			2-3	DU-7 (2-3)			0.3					1.7					0.9	2.9			
	DU-8	ISM	0-1	DU-8 (0-1)															0.0		
			1-2	DU-8 (1-2)														0.0			
			2-3	DU-8 (2-3)														0.0			
	DU-9	ISM	0-1	DU-9 (0-1)															0.0		
			1-2	DU-9 (1-2)			0.4	0.3		1.2		0.6	2.7		0.1			0.6	6.0		
			2-3	DU-9 (2-3)			0.5			1.3		0.6	2.6	0.8	0.3			0.8	6.9		
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0		
			1-2	DU-10 (1-2)														0			
			2-3	DU-10 (2-3)														0.0			
	DU-11	ISM	0-1	DU-11 (0-1)															0		
			1-2	DU-11 (1-2)														0			
			2-3	DU-11 (2-3)														0			
	DU-12	ISM	0-1	DU-12 (0-1)															0.0		
			1-2	DU-12 (1-2)														0.0			
			2-3	DU-12 (2-3)														0.0			

Please see notes at the end of the table.

Table A-34
Mammal Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient																Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs		
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0	
			1-2	DU-13 (1-2)															0		
			2-3	DU-13 (2-3)																0.0	
	DU-14	ISM	0-1	DU-14 (0-1)																0	
			1-2	DU-14 (1-2)															0		
			2-3	DU-14 (2-3)															0		
	DU-15	ISM	0-1	DU-15 (0-1)																0	
			1-2	DU-15 (1-2)															0		
			2-3	DU-15 (2-3)															0		
	DU-16	ISM	0-1	DU-16 (0-1)																0	
			1-2	DU-16 (1-2)															0.0		
			2-3	DU-16 (2-3)			0.4	0.3		0.5		2.0		0.1					3.3		
	DU-17	ISM	0-1	DU-17 (0-1)																0.0	
			1-2	DU-17 (1-2)															0.0		
			2-3	DU-17 (2-3)			0.3	0.3				2.1							2.7		
	DU-18	ISM	0-1	DU-18 (0-1)																0	
			1-2	DU-18 (1-2)															0.0		
			2-3	DU-18 (2-3)															0.0		
	DU-19	ISM	0-1	DU-19 (0-1)																0	
			1-2	DU-19 (1-2)															0		
			2-3	DU-19 (2-3)	0.3		0.5	0.6			0.6	13		0.2			1.1	16			
	DU-20	ISM	0-1	DU-20 (0-1)																0.0	
			1-2	DU-20 (1-2)				0.3			1.4			1.1					2.9		
			2-3	DU-20 (2-3)									1.1						1.1		
DU-21	ISM	0-1	DU-21 (0-1)																0		
		1-2	DU-21 (1-2)															0.0			
		2-3	DU-21 (2-3)			0.6	0.7				0.5	2.7	1.2	0.2				5.9			
DU-22	ISM	0-1	DU-22 (0-1)																0		
		1-2	DU-22 (1-2)															0.0			
		2-3	DU-22 (2-3)															0.0			
DU-23	ISM	0-1	DU-23 (0-1)																0		
		1-2	DU-23 (1-2)															0.0			
		2-3	DU-23 (2-3)															0.0			
DU-24	ISM	0-1	DU-24 (0-1)																0.0		
		1-2	DU-24 (1-2)				0.4					0.6	1.5		0.2			2.7			
		2-3	DU-24 (2-3)									2.1						2.1			
DU-25	ISM	0-1	DU-25 (0-1)																0		
		1-2	DU-25 (1-2)															0.0			
		2-3	DU-25 (2-3)			0.4	0.4			0.7	0.4		0.2					2.1			
DU-26	ISM	0-1	DU-26 (0-1)																0		
		1-2	DU-26 (1-2)															0			
		2-3	DU-26 (2-3)															0.0			

Please see notes at the end of the table.

Table A-34
Mammal Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient															Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0
			1-2	DU-42 (1-2)	0.2									6.0						6.2
			2-3	DU-42 (2-3)										2.2						2.2
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0
			1-2	DU-27 (1-2)																0
			2-3	DU-27 (2-3)	0.7	0.4		0.8	0.7				0.7	5.0		0.1			2.6	11
	DU-28	ISM	0-1	DU-28 (0-1)																0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)	3.1	0.2		4.2	1.5				1.4	3.2	0.8	0.3			0.5	15
	DU-29	ISM	0-1	DU-29 (0-1)	0.7	0.2		1.3	1.3				0.8	10	0.8	0.2			0.3	16
			1-2	DU-29 (1-2)	0.6	0.1		0.8	0.5					3.2						5.3
			2-3	DU-29 (2-3)				0.5	0.6					3.2						4.3
	DU-30	ISM	0-1	DU-30 (0-1)	1.1			1.2	1.7				0.9	11	0.7	0.4			0.4	17
			1-2	DU-30 (1-2)	1.3			1.5	2.6				1.1	4.7		0.2				11
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)	1.2	0.1		0.7	0.6				0.6	12	0.5	0.2			0.3	16
			1-2	DU-31 (1-2)	0.5	0.1		0.9	0.4				0.7	4.0	0.5	0.1			0.4	7.7
			2-3	DU-31 (2-3)	0.5	0.1		1.3	0.3				0.5	2.3		0.1			0.4	5.5
	DU-32	ISM	0-1	DU-32 (0-1)	0.6	0.2		0.6	0.4				0.6	7.3	0.6	0.1				10
			1-2	DU-32 (1-2)		0.2		0.4	0.3					1.6						2.5
			2-3	DU-32 (2-3)				0.4	0.4					1.6	4.1	0.6				7.1
	DU-33	ISM	0-1	DU-33 (0-1)	1.5	0.1		1.5	1.2				1.4	7.7	0.8				1.2	15
			1-2	DU-33 (1-2)	1.2	0.2		1.8	0.9				1.8	3.5	0.7				0.7	11
			2-3	DU-33 (2-3)	0.4	0.1		1.0	0.6				1.2	2.6					0.8	6.6
	DU-34	ISM	0-1	DU-34 (0-1)																0
			1-2	DU-34 (1-2)	0.4	0.1		0.6	0.4		1.2		0.9	6.0	1.0	0.2			0.6	11
			2-3	DU-34 (2-3)				0.6	0.3				1.1	6.5	0.5	0.1				9.2
	DU-35	ISM	0-1	DU-35 (0-1)				1.0	0.3				0.9	8.5	0.5	0.1			0.4	12
			1-2	DU-35 (1-2)				0.5	0.2				0.8	2.8		0.1			0.5	5.1
			2-3	DU-35 (2-3)				0.5					0.7	2.2						3.4
	DU-36	ISM	0-1	DU-36 (0-1)	2.4	0.1		1.1	0.9				1.3	8.9	0.6	0.1			0.4	16
			1-2	DU-36 (1-2)	2.2			1.1	1.7				1.1	7.8	0.8	0.1				15
			2-3	DU-36 (2-3)	2.3			0.9	0.8				0.9	5.9					0.4	11
	DU-38	ISM	0-1	DU-38 (0-1)	0.5			0.3	0.3				0.5	4.8	0.6	0.1			0.4	7.5
			1-2	DU-38 (1-2)	1.8			0.7	0.6					3.1					0.5	6.7
			2-3	DU-38 (2-3)	1.4			0.6	0.4				0.5	1.7					0.3	5.0
	DU-37	Composite	0-1	DU-37 (0-1)				0.5						0.1						0.6
			1-2	DU-37 (1-2)										0.1						0.1
			2-3	DU-37 (2-3)										0.1	1.2	0.2				1.4
	DU-39	Composite	0-1	DU-39 (0-1)										0.8						0.8
			1-2	DU-39 (1-2)										0.3						0.3
			2-3	DU-39 (2-3)										0.3						0.3
	DU-40	Composite	0-1	DU-40 (0-1)										0.2						0.2
			1-2	DU-40 (1-2)										0.1						0.1
			2-3	DU-40 (2-3)										0.1						0.1

Please see notes at the end of the table.

Table A-34
Mammal Hazard Quotient and Hazard Index - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Hazard Quotient														Hazard Index
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)										0.6					0.6
			1-2	DU-43 (1-2)									0.3					0.3	
			2-3	DU-43 (2-3)									0.1					0.1	
	DU-44	Composite	0-1	DU-44 (0-1)	0.4									0.3					0.7
			1-2	DU-44 (1-2)									0.2					0.2	
			2-3	DU-44 (2-3)									0.2					0.2	
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)															0
			1-2	DU-41 (1-2)															0
			2-3	DU-41 (2-3)															0

Notes:

1. Definition of table shading:

- COC was not detected. Hazard Quotient not calculated.
- Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
- Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)
- Adjusted Hazard Quotient or Hazard Index Greater than or Equal to 1.0 (Unacceptable Risk)
- Adjusted Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.
3. Hazard Quotients not calculated for results below background.

Table A-35
Human Health Non-Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Human Health Non-Carcinogenic RBC					24	74		11,000	400					1.70E-04				60	4	
Maximum Residual					0.2	0.2		0.0	0.5					0.3				0.0	0.1	0.7
Maximum Residual - Uncertainty					0.3	0.4		0.0	0.8					0.5				0.0	0.3	1.1
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)					0.2					0.2					0.2	0.5
			1-2	DU-1 (1-2)															0.0	
			2-3	DU-1 (2-3)					0.1											0.1
	DU-2	ISM	0-1	DU-2 (0-1)					0.2										0.2	0.2
			1-2	DU-2 (1-2)					0.3										0.3	0.6
			2-3	DU-2 (2-3)																0.0
	DU-3	ISM	0-1	DU-3 (0-1)										0.2						0.2
			1-2	DU-3 (1-2)																0.0
			2-3	DU-3 (2-3)																0.0
	DU-4	ISM	0-1	DU-4 (0-1)										0.2						0.2
			1-2	DU-4 (1-2)										0.1						0.1
			2-3	DU-4 (2-3)					0.1					0.1						0.2
	DU-5	ISM	0-1	DU-5 (0-1)																0.0
			1-2	DU-5 (1-2)																0.0
			2-3	DU-5 (2-3)																0.0
	DU-6	ISM	0-1	DU-6 (0-1)																0.0
			1-2	DU-6 (1-2)																0.0
			2-3	DU-6 (2-3)																0.0
	DU-7	ISM	0-1	DU-7 (0-1)																0.0
			1-2	DU-7 (1-2)																0.0
			2-3	DU-7 (2-3)																0.0
	DU-8	ISM	0-1	DU-8 (0-1)																0.0
			1-2	DU-8 (1-2)																0.0
			2-3	DU-8 (2-3)																0.0
	DU-9	ISM	0-1	DU-9 (0-1)																0.0
			1-2	DU-9 (1-2)					0.1											0.1
			2-3	DU-9 (2-3)																0.0
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)															0.0	
			1-2	DU-10 (1-2)															0.0	
			2-3	DU-10 (2-3)															0.0	
	DU-11	ISM	0-1	DU-11 (0-1)															0.0	
			1-2	DU-11 (1-2)															0.0	
			2-3	DU-11 (2-3)															0.0	
	DU-12	ISM	0-1	DU-12 (0-1)															0.0	
			1-2	DU-12 (1-2)															0.0	
			2-3	DU-12 (2-3)															0.0	

Please see notes at the end of the table.

Table A-35
Human Health Non-Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0.0
			1-2	DU-13 (1-2)															0.0	
			2-3	DU-13 (2-3)															0.0	
	DU-14	ISM	0-1	DU-14 (0-1)																0.0
			1-2	DU-14 (1-2)															0.0	
			2-3	DU-14 (2-3)															0.0	
	DU-15	ISM	0-1	DU-15 (0-1)																0.0
			1-2	DU-15 (1-2)															0.0	
			2-3	DU-15 (2-3)															0.0	
	DU-16	ISM	0-1	DU-16 (0-1)																0.0
			1-2	DU-16 (1-2)															0.0	
			2-3	DU-16 (2-3)															0.0	
	DU-17	ISM	0-1	DU-17 (0-1)																0.0
			1-2	DU-17 (1-2)															0.0	
			2-3	DU-17 (2-3)															0.0	
	DU-18	ISM	0-1	DU-18 (0-1)																0.0
			1-2	DU-18 (1-2)															0.0	
			2-3	DU-18 (2-3)															0.0	
	DU-19	ISM	0-1	DU-19 (0-1)																0.0
			1-2	DU-19 (1-2)															0.0	
			2-3	DU-19 (2-3)					0.2				0.5						0.6	
	DU-20	ISM	0-1	DU-20 (0-1)																0.0
			1-2	DU-20 (1-2)															0.0	
			2-3	DU-20 (2-3)															0.0	
DU-21	ISM	0-1	DU-21 (0-1)																0.0	
		1-2	DU-21 (1-2)															0.0		
		2-3	DU-21 (2-3)					0.2										0.2		
DU-22	ISM	0-1	DU-22 (0-1)																0.0	
		1-2	DU-22 (1-2)															0.0		
		2-3	DU-22 (2-3)															0.0		
DU-23	ISM	0-1	DU-23 (0-1)																0.0	
		1-2	DU-23 (1-2)															0.0		
		2-3	DU-23 (2-3)															0.0		
DU-24	ISM	0-1	DU-24 (0-1)																0.0	
		1-2	DU-24 (1-2)															0.0		
		2-3	DU-24 (2-3)															0.0		
DU-25	ISM	0-1	DU-25 (0-1)																0.0	
		1-2	DU-25 (1-2)															0.0		
		2-3	DU-25 (2-3)					0.1										0.1		
DU-26	ISM	0-1	DU-26 (0-1)																0.0	
		1-2	DU-26 (1-2)															0.0		
		2-3	DU-26 (2-3)															0.0		

Please see notes at the end of the table.

Table A-35
Human Health Non-Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0.0
			1-2	DU-42 (1-2)										0.2						0.2
			2-3	DU-42 (2-3)																0.0
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0.0
			1-2	DU-27 (1-2)																0.0
			2-3	DU-27 (2-3)		0.4			0.2					0.2						0.8
	DU-28	ISM	0-1	DU-28 (0-1)																0.0
			1-2	DU-28 (1-2)																0.0
			2-3	DU-28 (2-3)	0.3	0.2			0.4					0.1						1.1
	DU-29	ISM	0-1	DU-29 (0-1)		0.2			0.4					0.4						1.0
			1-2	DU-29 (1-2)		0.1			0.2					0.1						0.4
			2-3	DU-29 (2-3)					0.2					0.1						0.3
	DU-30	ISM	0-1	DU-30 (0-1)	0.1				0.5					0.4						1.0
			1-2	DU-30 (1-2)	0.1				0.8					0.2						1.1
			2-3	DU-30 (2-3)																0.0
	DU-31	ISM	0-1	DU-31 (0-1)	0.1	0.2			0.2					0.4						0.9
			1-2	DU-31 (1-2)		0.1			0.1					0.1						0.4
			2-3	DU-31 (2-3)		0.2														0.2
	DU-32	ISM	0-1	DU-32 (0-1)		0.2			0.1					0.3						0.6
			1-2	DU-32 (1-2)		0.2														0.2
			2-3	DU-32 (2-3)					0.1											0.1
	DU-33	ISM	0-1	DU-33 (0-1)	0.2	0.2			0.4					0.3						1.0
			1-2	DU-33 (1-2)	0.1	0.2			0.3					0.1						0.8
			2-3	DU-33 (2-3)		0.1			0.2											0.3
	DU-34	ISM	0-1	DU-34 (0-1)		0.1														0.0
			1-2	DU-34 (1-2)					0.1					0.2						0.5
			2-3	DU-34 (2-3)					0.1					0.2						0.3
	DU-35	ISM	0-1	DU-35 (0-1)										0.3						0.3
			1-2	DU-35 (1-2)										0.1						0.1
			2-3	DU-35 (2-3)																0.0
	DU-36	ISM	0-1	DU-36 (0-1)	0.3	0.1			0.3					0.3						1.0
			1-2	DU-36 (1-2)	0.2				0.5					0.3						1.0
			2-3	DU-36 (2-3)	0.3				0.3					0.2						0.7
	DU-38	ISM	0-1	DU-38 (0-1)										0.2						0.2
			1-2	DU-38 (1-2)	0.2				0.2					0.1						0.5
			2-3	DU-38 (2-3)	0.2				0.1											0.3
	DU-37	Composite	0-1	DU-37 (0-1)																0.0
			1-2	DU-37 (1-2)																0.0
			2-3	DU-37 (2-3)																0.0
	DU-39	Composite	0-1	DU-39 (0-1)																0.0
			1-2	DU-39 (1-2)																0.0
			2-3	DU-39 (2-3)																0.0
	DU-40	Composite	0-1	DU-40 (0-1)																0.0
			1-2	DU-40 (1-2)																0.0
			2-3	DU-40 (2-3)																0.0

Please see notes at the end of the table.

Table A-35
Human Health Non-Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Non-Cancer Risk Ratio															Cumulative Non-Cancer Risk Ratio
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
East Parcel	DU-43	Composite	0-1	DU-43 (0-1)																0.0
			1-2	DU-43 (1-2)															0.0	
			2-3	DU-43 (2-3)														0.0		
	DU-44	Composite	0-1	DU-44 (0-1)															0.0	
			1-2	DU-44 (1-2)														0.0		
			2-3	DU-44 (2-3)													0.0			
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)															0.0	
			1-2	DU-41 (1-2)														0.0		
			2-3	DU-41 (2-3)													0.0			

Notes:

1. Definition of table shading:

	COC was not detected. Hazard Quotient not calculated.
	Non-Cancer Hazard Quotient or Cumulative Risk Greater than 1.0 (Unacceptable Risk)
	Non-Cancer Hazard Quotient Greater than or Equal to 10.0 (Hot Spot)
	Adjusted Non-Cancer Hazard Quotient or Cumulative Risk Greater than 1.0 (Unacceptable Risk)
	Adjusted Non-Cancer Hazard Quotient Greater than 10.0 (Hot Spot)

2. Only Hazard Quotients equal to or greater than 0.1 are shown.

3. Hazard Quotients not calculated for results below background.

Table A-36
Human Health Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)														Cumulative Excess Lifetime Cancer Risk (x 1E-05)	
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs		Total PCBs
ISM Background (mg/kg)					0.29	8.8	39	24	27	0.073	23.4	0.33	105							
Composite Background (mg/kg)					0.56	8.8	76	34	79	0.23	47	0.71	180							
Human Health Carcinogenic RBC						1.4								1.50E-05				0.55	0.74	
Maximum Residual						11								4				3	1	1
Maximum Residual - Uncertainty						21								5				5	2	2
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)										2				1	1	0.4
			1-2	DU-1 (1-2)																0
			2-3	DU-1 (2-3)										0.9				0.8	0.3	0.2
	DU-2	ISM	0-1	DU-2 (0-1)										0.6				0.4	0.5	0.2
			1-2	DU-2 (1-2)												0.3	2	0.2		
			2-3	DU-2 (2-3)										0.2					0.02	
	DU-3	ISM	0-1	DU-3 (0-1)									2				0.4		0.3	
			1-2	DU-3 (1-2)										0.7			0.3		0.1	
			2-3	DU-3 (2-3)										0.5			0.3		0.1	
	DU-4	ISM	0-1	DU-4 (0-1)									2				1		0.3	
			1-2	DU-4 (1-2)										1			5		0.6	
			2-3	DU-4 (2-3)										1			2		0.3	
	DU-5	ISM	0-1	DU-5 (0-1)																0
			1-2	DU-5 (1-2)																0
			2-3	DU-5 (2-3)																0
	DU-6	ISM	0-1	DU-6 (0-1)										0.9				0.5	0.1	0.2
			1-2	DU-6 (1-2)																0
			2-3	DU-6 (2-3)										1			0.6	0.5	0.2	
	DU-7	ISM	0-1	DU-7 (0-1)																0
			1-2	DU-7 (1-2)										1			0.2	0.1	0.1	
			2-3	DU-7 (2-3)										0.7			0.1	0.1	0.1	
	DU-8	ISM	0-1	DU-8 (0-1)																0
			1-2	DU-8 (1-2)																0
			2-3	DU-8 (2-3)																0
	DU-9	ISM	0-1	DU-9 (0-1)																0
			1-2	DU-9 (1-2)										1			0.2		0.1	
			2-3	DU-9 (2-3)										1			0.5	0.1	0.2	
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)																0
			1-2	DU-10 (1-2)																0
			2-3	DU-10 (2-3)																0
	DU-11	ISM	0-1	DU-11 (0-1)																0
			1-2	DU-11 (1-2)																0
			2-3	DU-11 (2-3)																0
	DU-12	ISM	0-1	DU-12 (0-1)																0
			1-2	DU-12 (1-2)																0
			2-3	DU-12 (2-3)																0

Please see notes at the end of the table.

Table A-36
Human Health Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-13	ISM	0-1	DU-13 (0-1)																0
			1-2	DU-13 (1-2)															0	
			2-3	DU-13 (2-3)															0	
	DU-14	ISM	0-1	DU-14 (0-1)																0
			1-2	DU-14 (1-2)															0	
			2-3	DU-14 (2-3)															0	
	DU-15	ISM	0-1	DU-15 (0-1)																0
			1-2	DU-15 (1-2)															0	
			2-3	DU-15 (2-3)															0	
	DU-16	ISM	0-1	DU-16 (0-1)																0
			1-2	DU-16 (1-2)															0	
			2-3	DU-16 (2-3)								0.8				0.2			0.1	
	DU-17	ISM	0-1	DU-17 (0-1)																0
			1-2	DU-17 (1-2)															0	
			2-3	DU-17 (2-3)								0.8							0.1	
	DU-18	ISM	0-1	DU-18 (0-1)																0
			1-2	DU-18 (1-2)															0	
			2-3	DU-18 (2-3)															0	
	DU-19	ISM	0-1	DU-19 (0-1)																0
			1-2	DU-19 (1-2)															0	
			2-3	DU-19 (2-3)								5				0.2	0		0.6	
	DU-20	ISM	0-1	DU-20 (0-1)																0
			1-2	DU-20 (1-2)									0.5						0.05	
			2-3	DU-20 (2-3)								0.4							0.04	
DU-21	ISM	0-1	DU-21 (0-1)																0	
		1-2	DU-21 (1-2)															0		
		2-3	DU-21 (2-3)								1				0.3			0.1		
DU-22	ISM	0-1	DU-22 (0-1)																0	
		1-2	DU-22 (1-2)															0		
		2-3	DU-22 (2-3)															0		
DU-23	ISM	0-1	DU-23 (0-1)																0	
		1-2	DU-23 (1-2)															0		
		2-3	DU-23 (2-3)															0		
DU-24	ISM	0-1	DU-24 (0-1)																0	
		1-2	DU-24 (1-2)									0.6				0.2		0.1		
		2-3	DU-24 (2-3)								0.8							0.1		
DU-25	ISM	0-1	DU-25 (0-1)																0	
		1-2	DU-25 (1-2)															0		
		2-3	DU-25 (2-3)								0.2				0.3			0.04		
DU-26	ISM	0-1	DU-26 (0-1)																0	
		1-2	DU-26 (1-2)															0		
		2-3	DU-26 (2-3)															0		

Please see notes at the end of the table.

Table A-36
Human Health Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
Central Parcel	DU-42	Composite	0-1	DU-42 (0-1)																0
			1-2	DU-42 (1-2)										2						0.2
			2-3	DU-42 (2-3)										0.9						0.1
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)																0
			1-2	DU-27 (1-2)																0
			2-3	DU-27 (2-3)		21								2				0.2	0.3	2
	DU-28	ISM	0-1	DU-28 (0-1)																0
			1-2	DU-28 (1-2)																0
			2-3	DU-28 (2-3)		10								1				0.6		1
	DU-29	ISM	0-1	DU-29 (0-1)		9								4				0.3		1
			1-2	DU-29 (1-2)		7								1				0.1		0.8
			2-3	DU-29 (2-3)										1				0.1		0.1
	DU-30	ISM	0-1	DU-30 (0-1)										4				0.7		0.5
			1-2	DU-30 (1-2)										2				0.3		0.2
			2-3	DU-30 (2-3)																0
	DU-31	ISM	0-1	DU-31 (0-1)		8								5				0.2		1
			1-2	DU-31 (1-2)		7								2				0.2		0.8
			2-3	DU-31 (2-3)		8								0.9				0.2		0.9
	DU-32	ISM	0-1	DU-32 (0-1)		12								3				0.2		2
			1-2	DU-32 (1-2)		9								0.6				0.1		1
			2-3	DU-32 (2-3)										0.7				1		0.2
	DU-33	ISM	0-1	DU-33 (0-1)		9								3					0	1
			1-2	DU-33 (1-2)		13								1						1
			2-3	DU-33 (2-3)		7								1				0.1	0	0.8
	DU-34	ISM	0-1	DU-34 (0-1)																0
			1-2	DU-34 (1-2)		7								2				0.3		0.9
			2-3	DU-34 (2-3)										3				0.2		0.3
	DU-35	ISM	0-1	DU-35 (0-1)										3				0.2		0.4
			1-2	DU-35 (1-2)										1				0.2		0.1
			2-3	DU-35 (2-3)										0.9						0.1
	DU-36	ISM	0-1	DU-36 (0-1)		7								4				0.1		1
			1-2	DU-36 (1-2)										3				0.2		0.3
			2-3	DU-36 (2-3)										2						0.2
	DU-38	ISM	0-1	DU-38 (0-1)										2				0.2		0.2
			1-2	DU-38 (1-2)										1				0.1		0.1
			2-3	DU-38 (2-3)										0.7						0.1
	DU-37	Composite	0-1	DU-37 (0-1)																0
			1-2	DU-37 (1-2)																0
			2-3	DU-37 (2-3)														0.2		0.02
	DU-39	Composite	0-1	DU-39 (0-1)										0.3						0.03
			1-2	DU-39 (1-2)										0.1						0.01
			2-3	DU-39 (2-3)										0.1						0.01
	DU-40	Composite	0-1	DU-40 (0-1)																0
			1-2	DU-40 (1-2)																0
			2-3	DU-40 (2-3)																0

Please see notes at the end of the table.

Table A-36
Human Health Carcinogenic Risk - Residual Risk Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Excess Lifetime Cancer Risk (x 1E-06)															Cumulative Excess Lifetime Cancer Risk (x 1E-05)
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs	
	DU-43	Composite	0-1	DU-43 (0-1)										0.3						0.03
			1-2	DU-43 (1-2)										0.1						0.01
			2-3	DU-43 (2-3)																0
	DU-44	Composite	0-1	DU-44 (0-1)										0.1						0.01
			1-2	DU-44 (1-2)																0
			2-3	DU-44 (2-3)																0
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)																0
			1-2	DU-41 (1-2)																0
			2-3	DU-41 (2-3)																0

Notes:

1. Definition of table shading:

	COC was not detected. Risk not calculated.
	Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-06 <u>or</u> Cumulative Excess Lifetime Cancer Risk Greater than 1E-05 (Unacceptable Risk)
	Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-04 (Hot Spot)
	Adjusted Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-06 <u>or</u> Cumulative Excess Lifetime Cancer Risk Greater than 1E-05 (Unacceptable Risk)
	Adjusted Excess Lifetime Cancer Risk Hazard Quotient Greater than 1E-04 (Hot Spot)

2. Only Risk Quotients equal to or greater than 1E-07 are shown.

3. Risks not calculated for results below background.

Table A-37
Human Health Residual Risk - Exposure Area Size Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Risk Category	Exposure Area	COC	Parcel Exposure Area Residual Risk	Maximum Decision Unit Residual Risk
Non-Carcinogenic	West Parcel	Lead	0.1	0.3
		Cumulative Risk	0.1	0.4
	Central Parcel*	Lead	0.2	0.2
		D/F TEQ	0.2	0.3
		Cumulative Risk	0.4	0.5
	East Parcel	Lead	0.1	0.5
		D/F TEQ	0.1	0.3
		Cumulative Risk	0.2	0.7
Carcinogenic	West Parcel	D/F TEQ	9.E-07	2.E-06
		cPAHs	1.E-06	3.E-06
		PCBs	2.E-07	1.E-06
		Cumulative Risk	2.E-06	4.E-06
	Central Parcel*	D/F TEQ	2.E-06	3.E-06
		cPAHs	1.E-06	2.E-07
		Cumulative Risk	3.E-06	3.E-06
	East Parcel	D/F TEQ	1.E-06	4.E-06
		cPAHs	2.E-07	1.E-06
		Arsenic	Background	1.E-05
		Cumulative Risk	2.E-06	1.E-05

Notes:

1. * Parcel exposure area residual risk analysis includes excavated Layer 3 data
2. Shaded values exceed Acceptable Risk Level (ARL)
 ARL for individual COCs: 1.0 for non-carcinogens; 1E-06 for carcinogens
 ARL for cumulative risk: 1.0 for non-carcinogens; 1E-05 for carcinogens

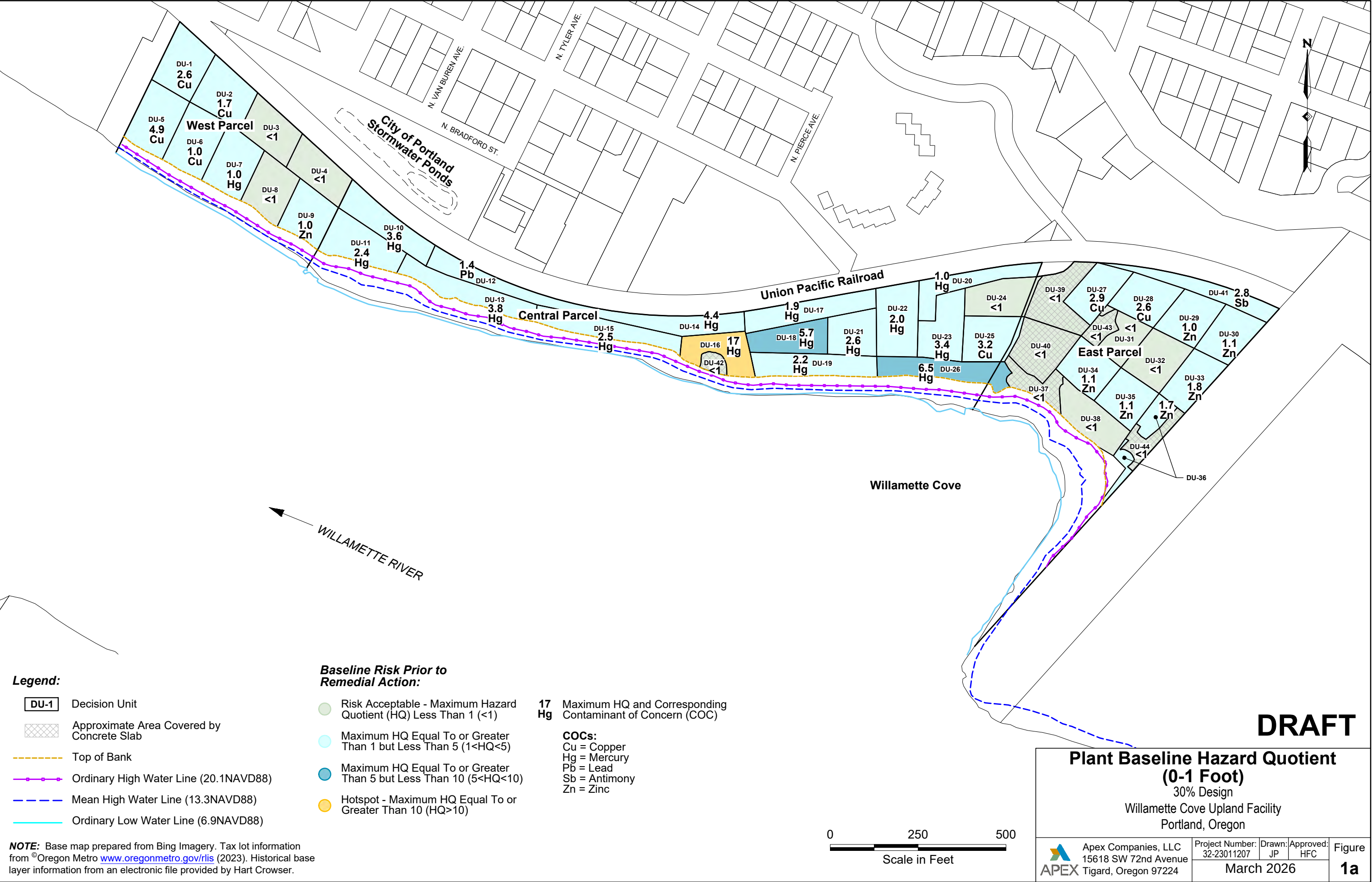
Table A-38
Human Health Residual Risk - Exposure Depth Uncertainty
RD/RA Work Plan
Willamette Cove Upland Facility

Risk Category	Exposure Area	COC	Parcel Exposure Area Residual Risk, 0-3 Ft	Parcel Exposure Area Residual Risk, 0-1 Ft
Non-Carcinogenic	West Parcel	Lead	0.1	0.1
		D/F TEQ	<0.1	0.1
		Cumulative Risk	0.1	0.3
	Central Parcel*	Lead	0.2	0.2
		D/F TEQ	0.2	0.2
		Cumulative Risk	0.4	0.4
	East Parcel	Lead	0.1	0.2
		D/F TEQ	0.1	0.2
		Cumulative Risk	0.2	0.4
Carcinogenic	West Parcel	D/F TEQ	9.E-07	1.E-06
		cPAHs	1.E-06	1.E-06
		PCBs	2.E-07	3.E-07
		Cumulative Risk	2.E-06	2.E-06
	Central Parcel*	D/F TEQ	2.E-06	2.E-06
		cPAHs	1.E-06	2.E-06
		Cumulative Risk	3.E-06	4.E-06
	East Parcel	D/F TEQ	1.E-06	2.E-06
		cPAHs	2.E-07	3.E-07
		Cumulative Risk	2.E-06	2.E-06

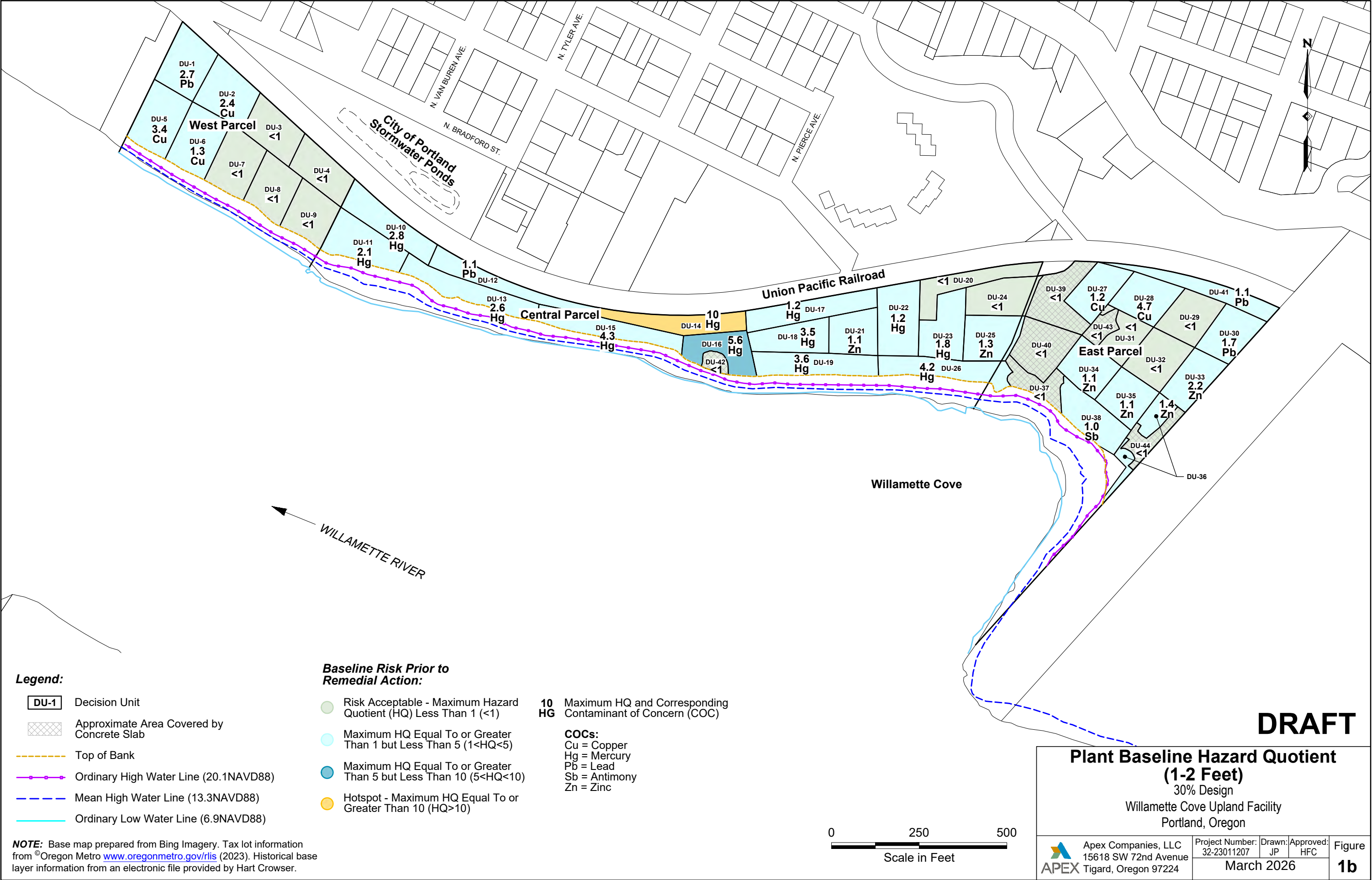
Notes:

- * Parcel exposure area residual risk (0-3 ft) analysis includes excavated Layer 3 data
- Shaded values exceed Acceptable Risk Level (ARL)
 ARL for non-carcinogens: 1.0 (for both individual COCs and cumulative risk)
 ARL for carcinogens: 1E-06 for individual COCs; 1E-05 for cumulative risk

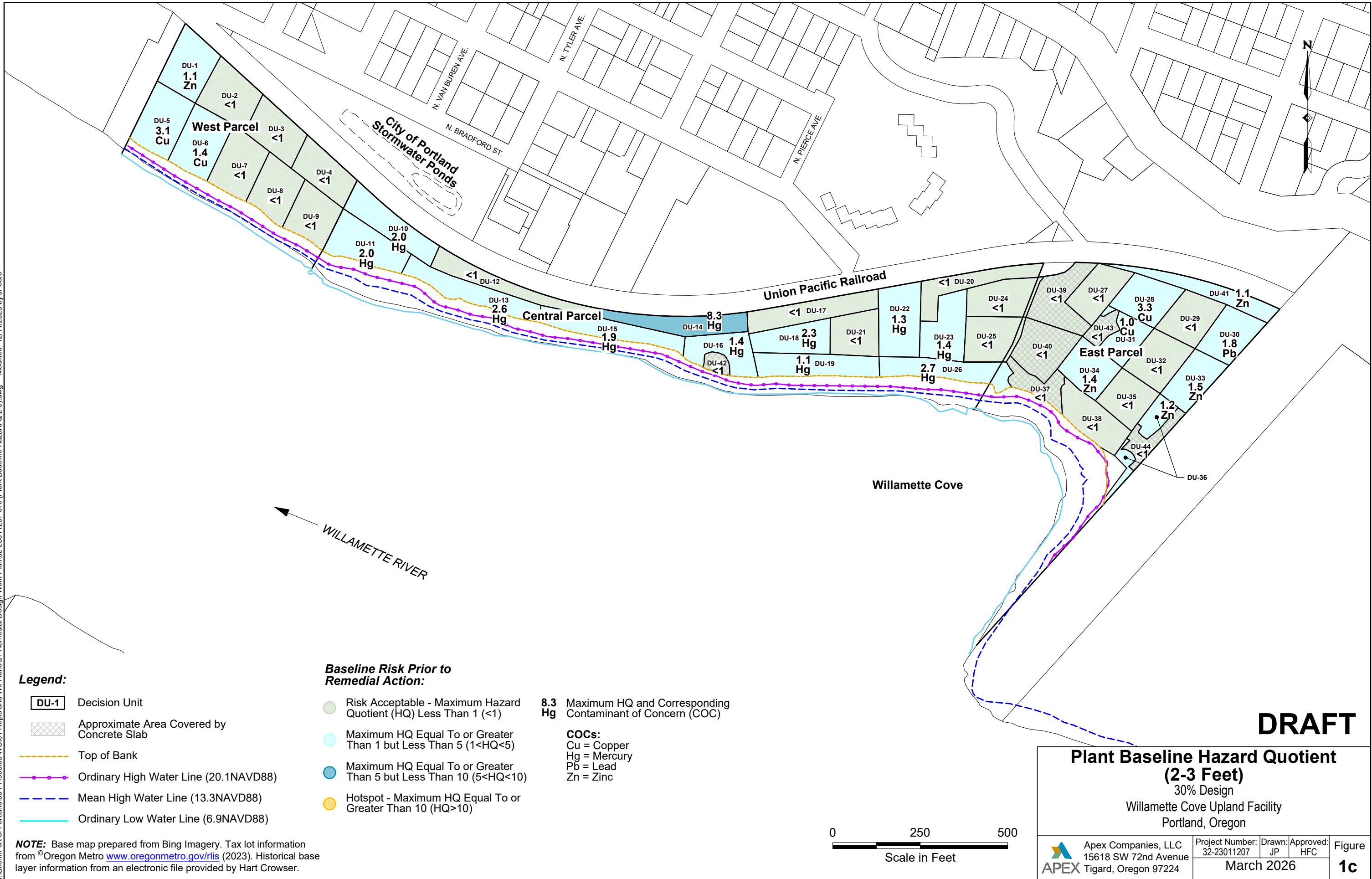
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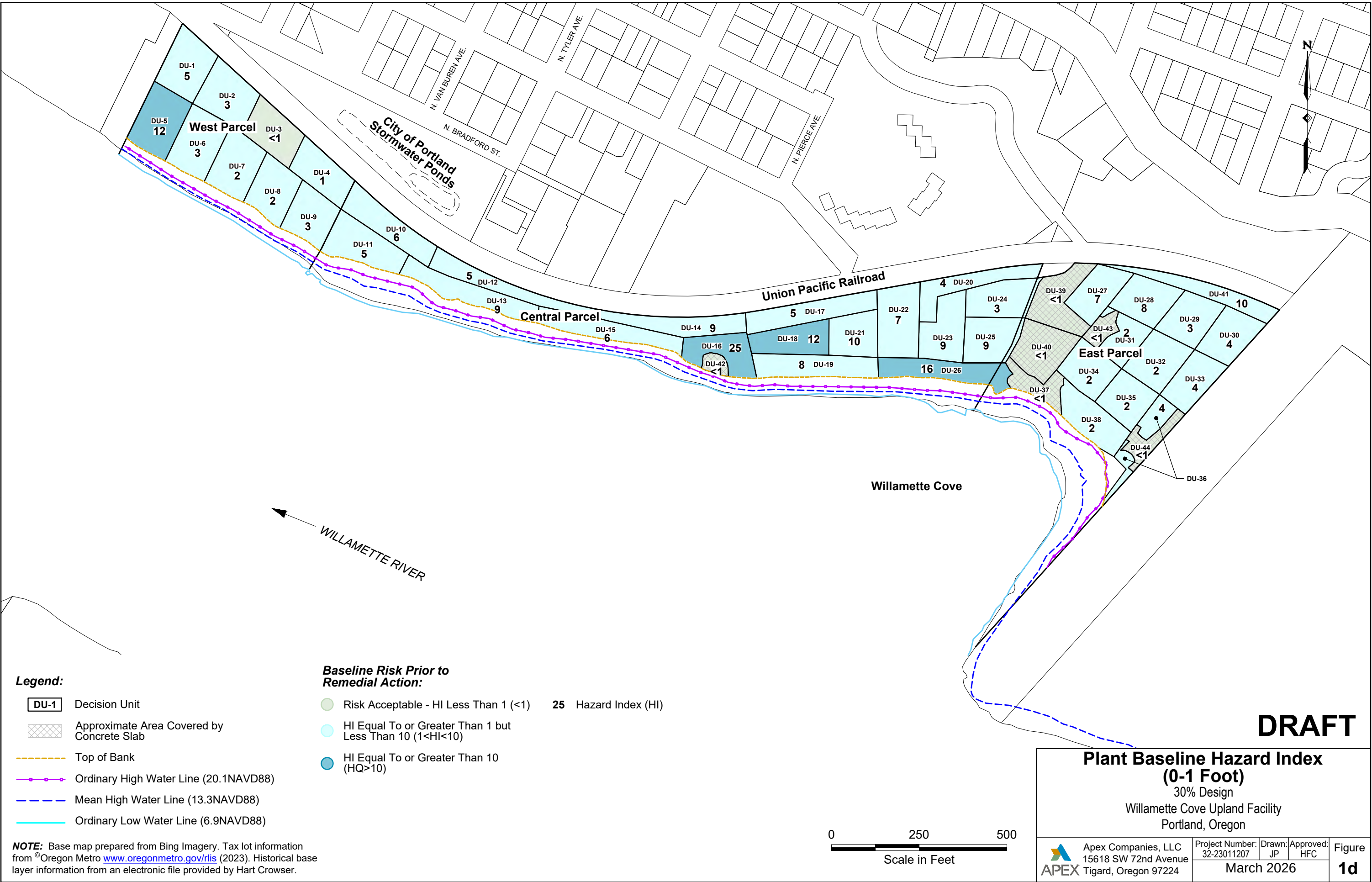
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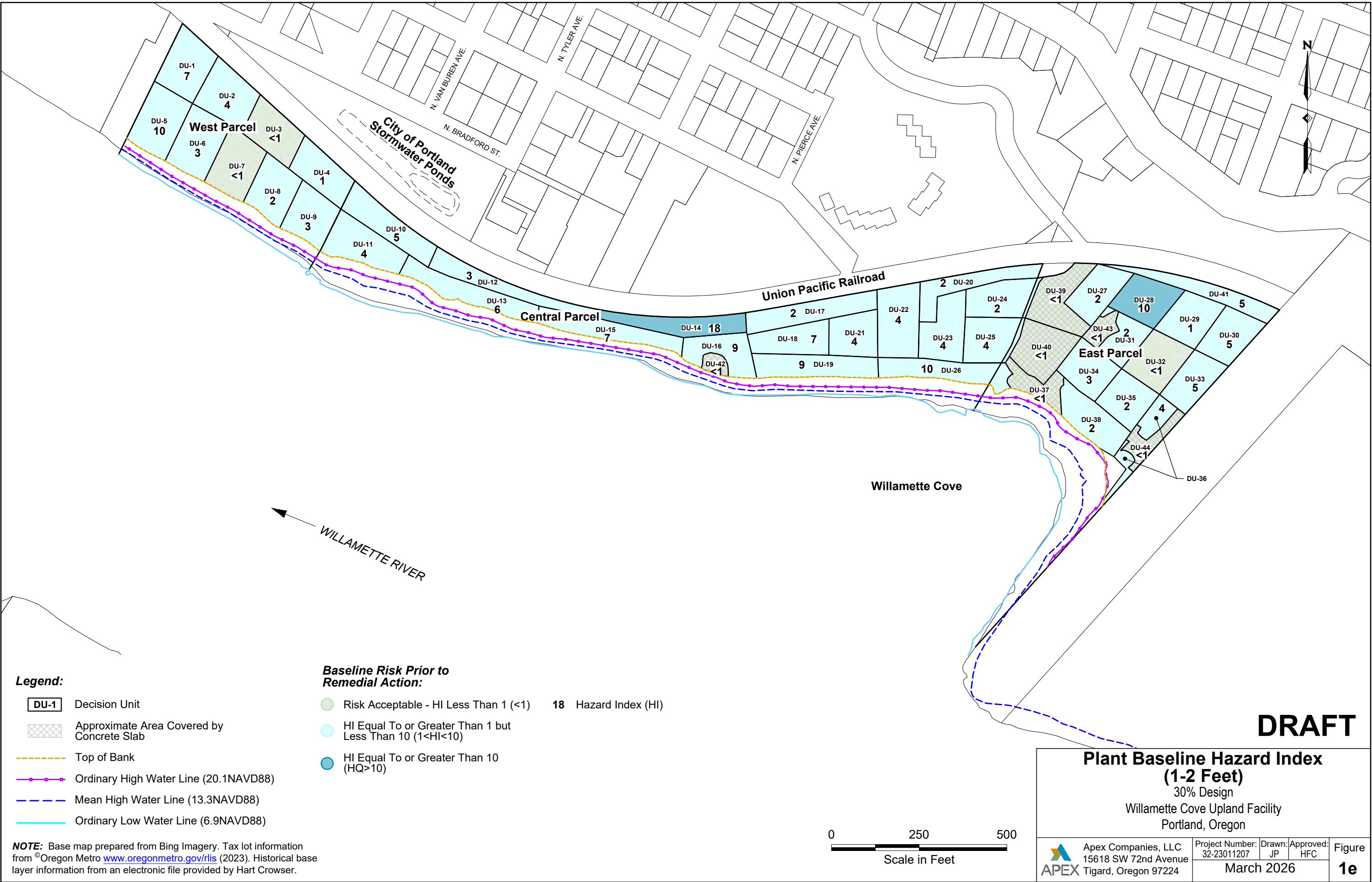
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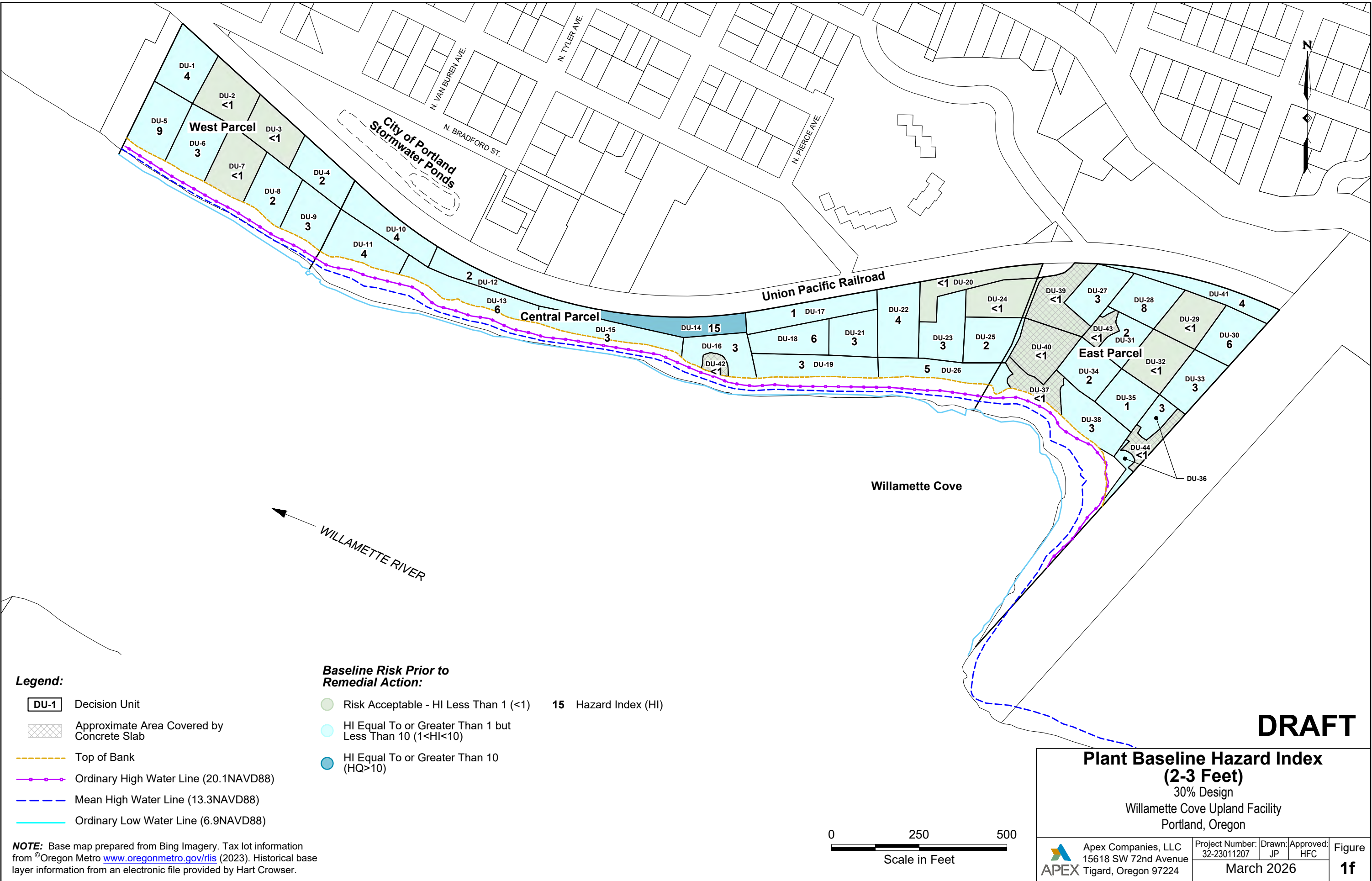
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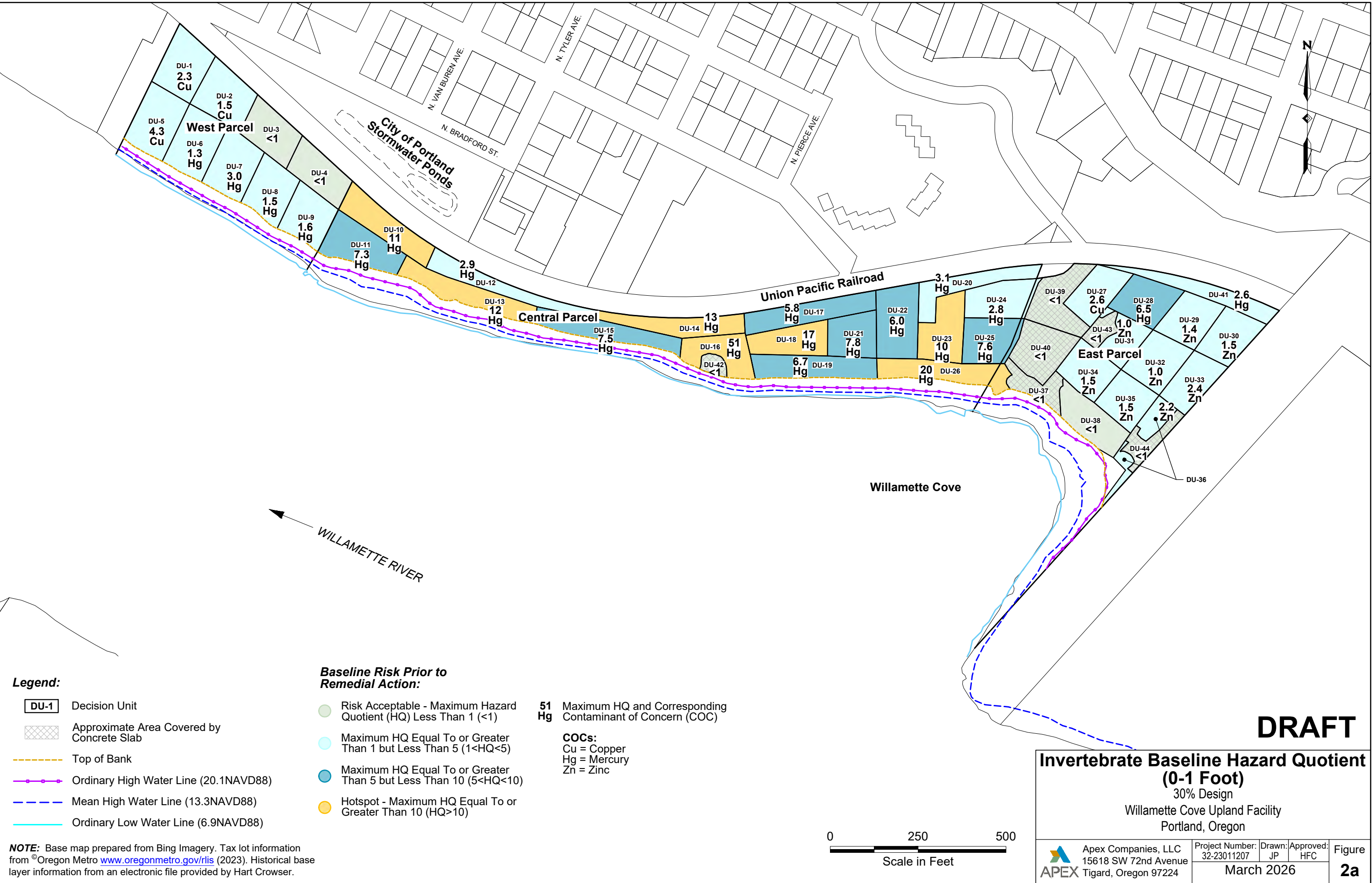
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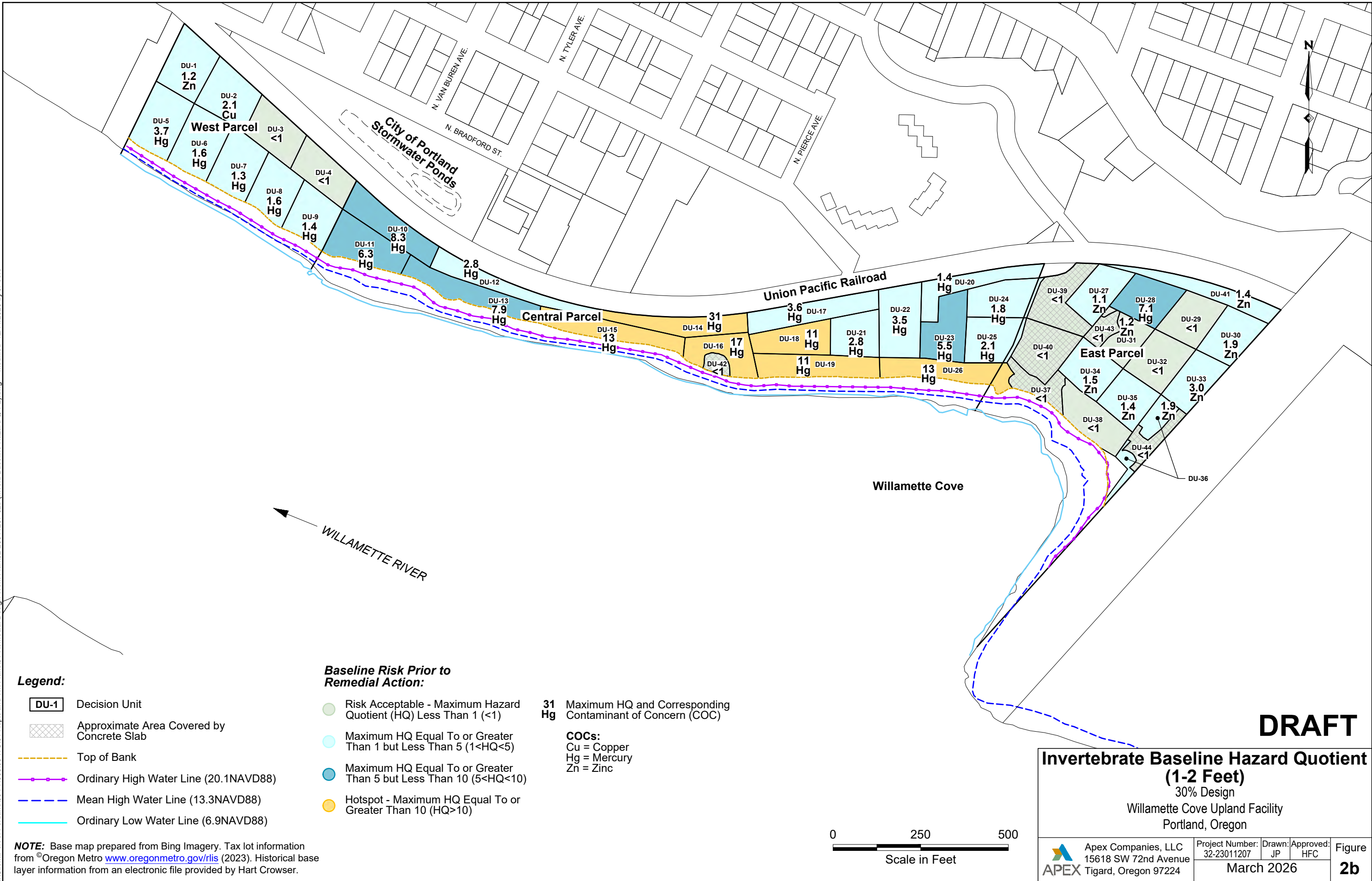
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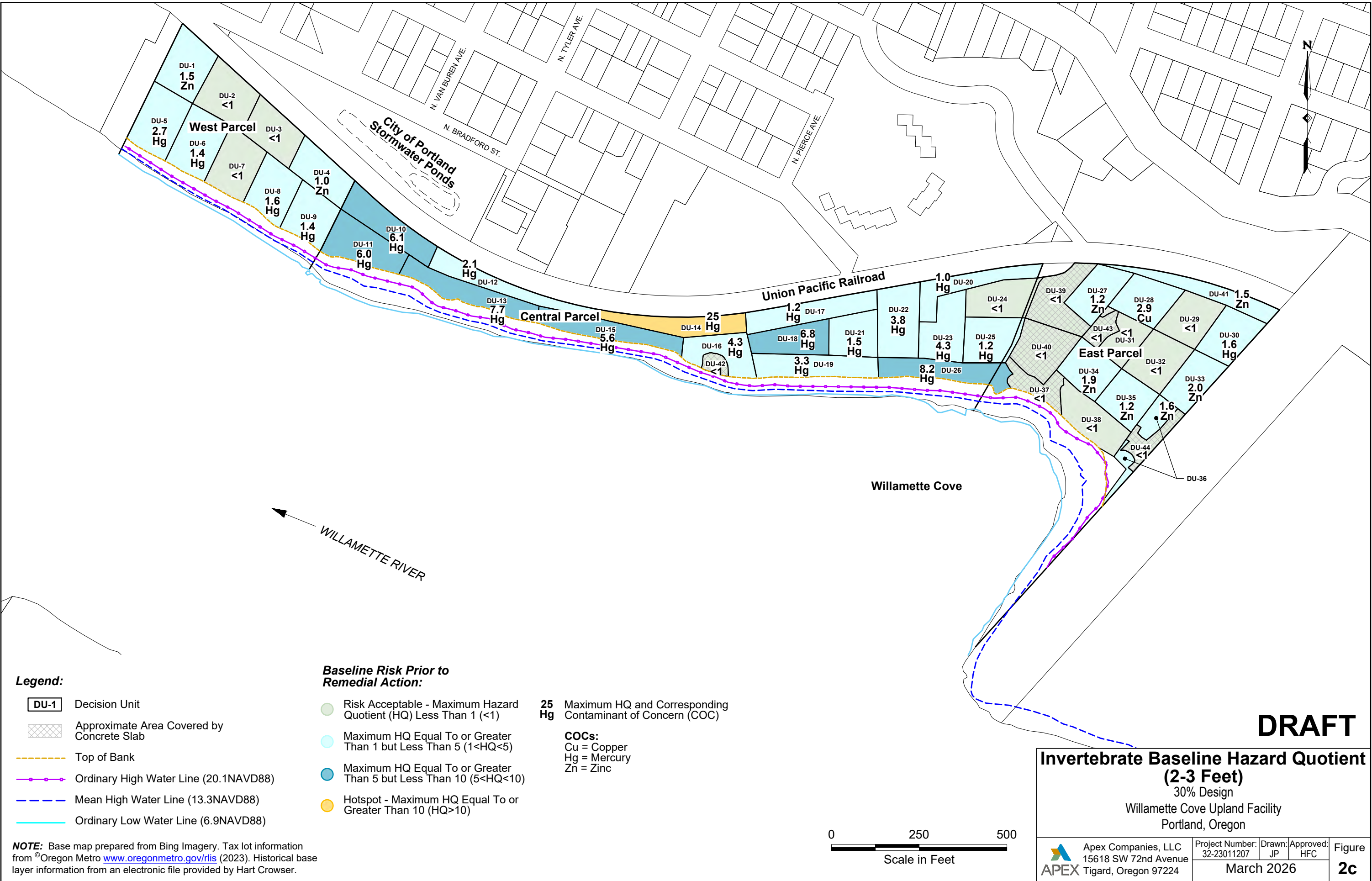
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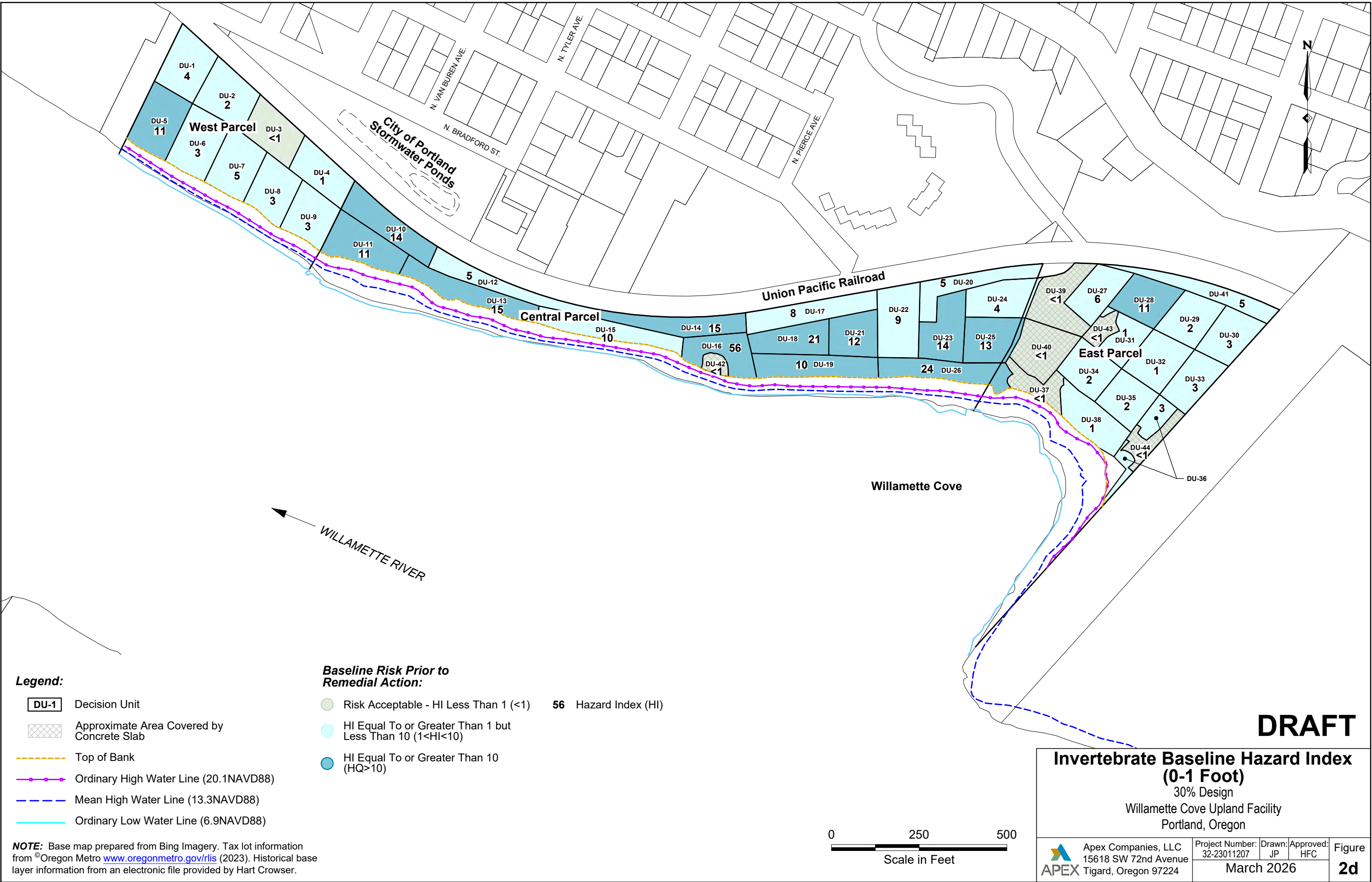
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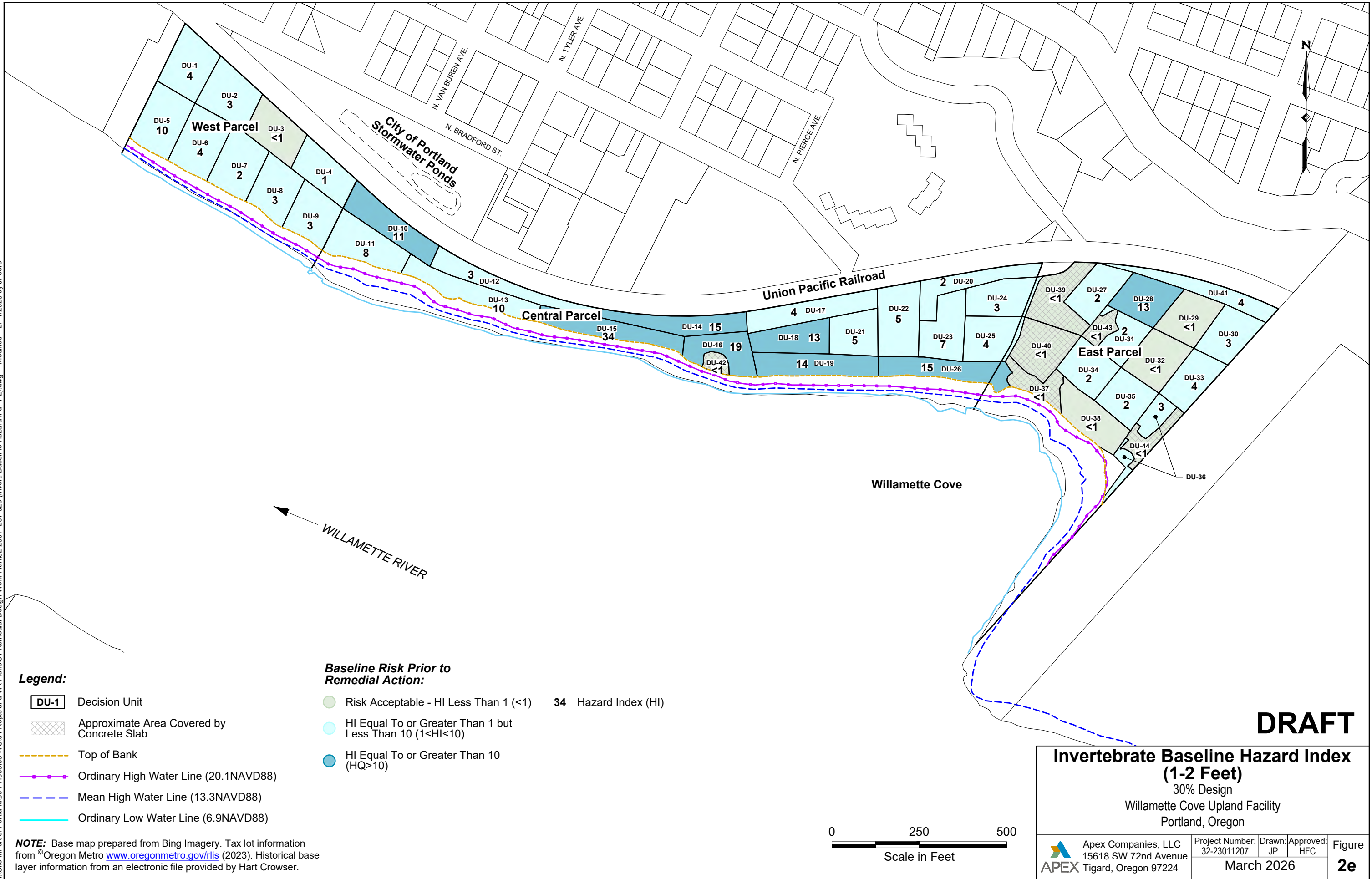
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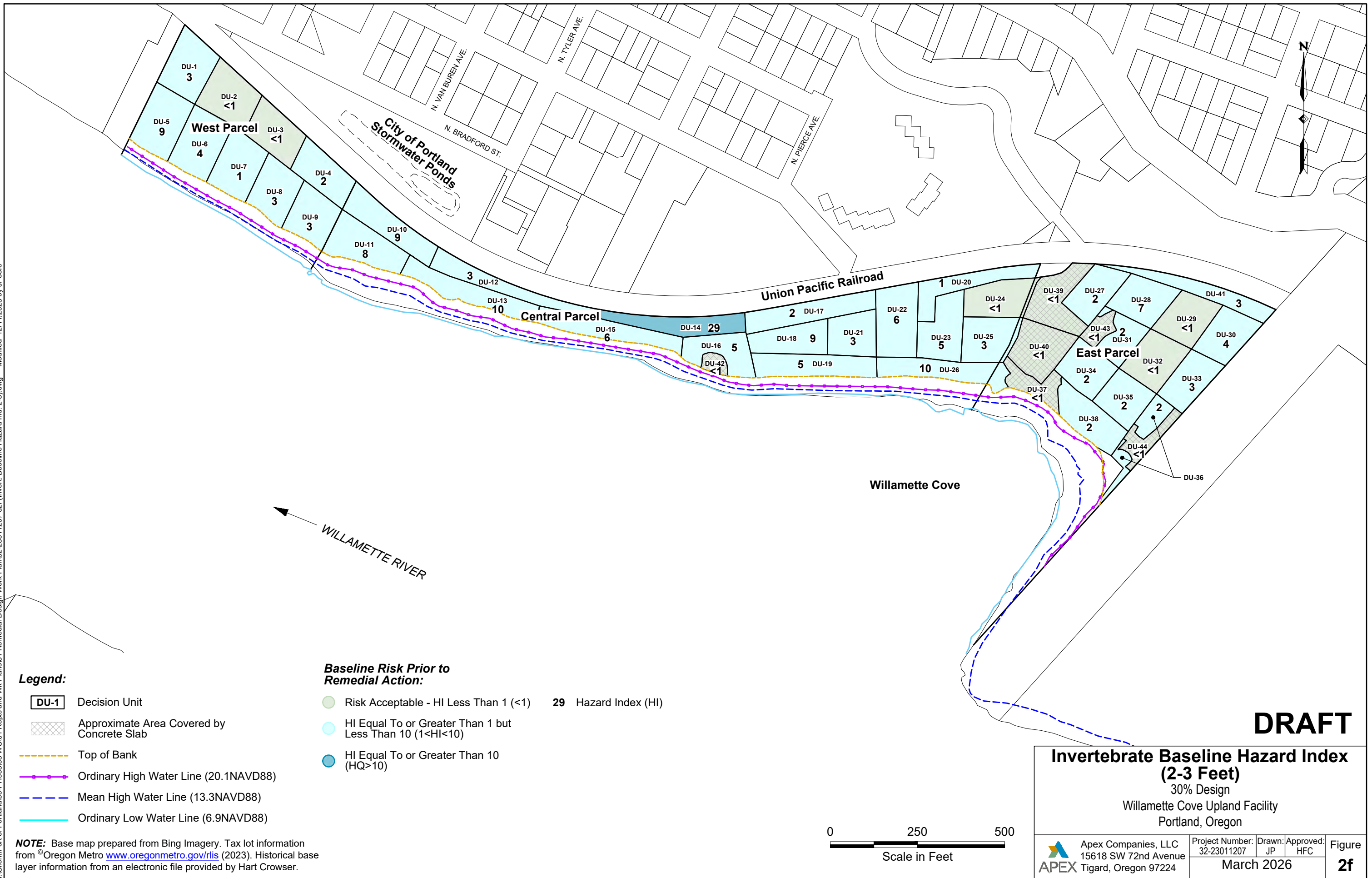
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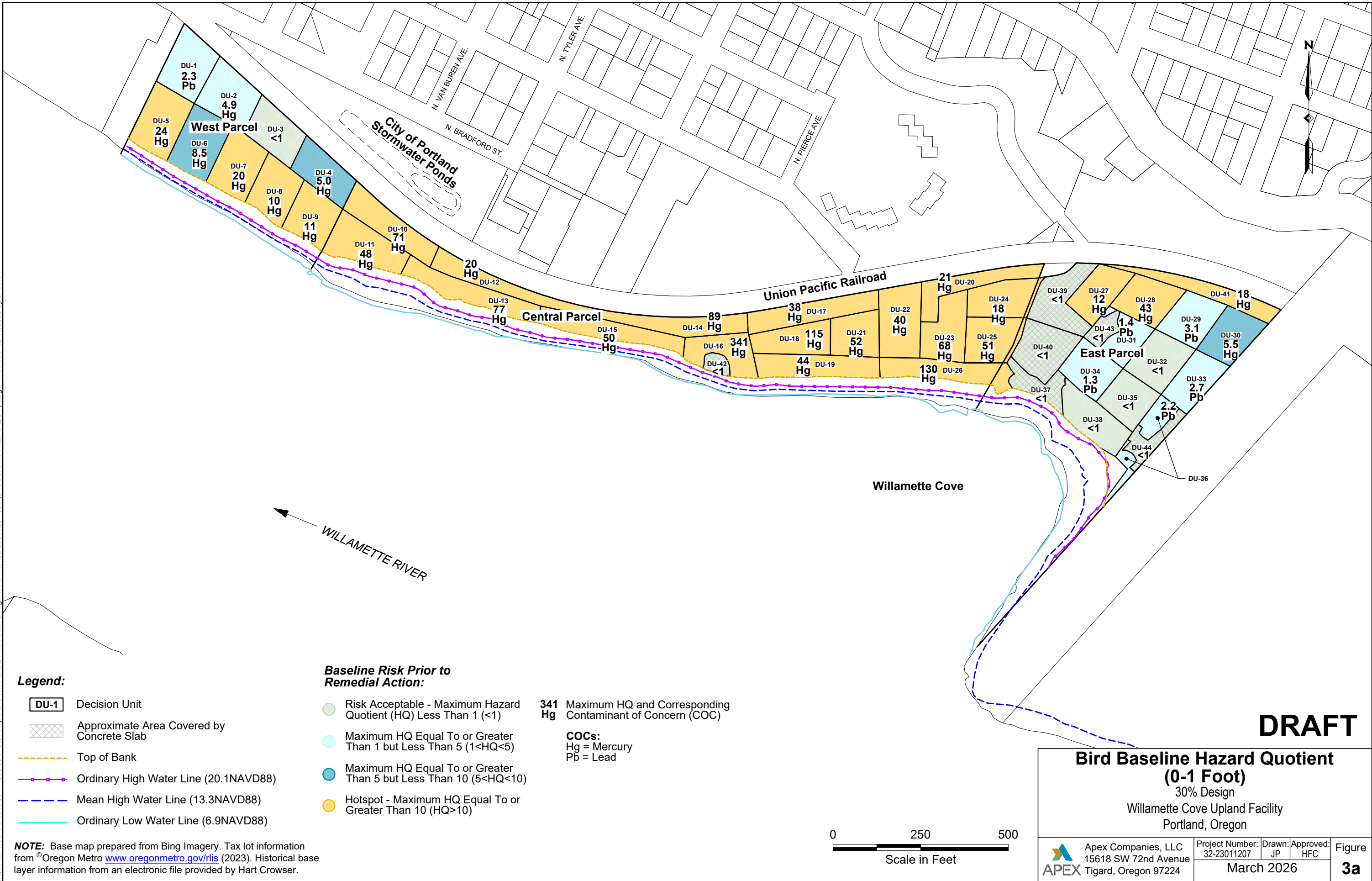
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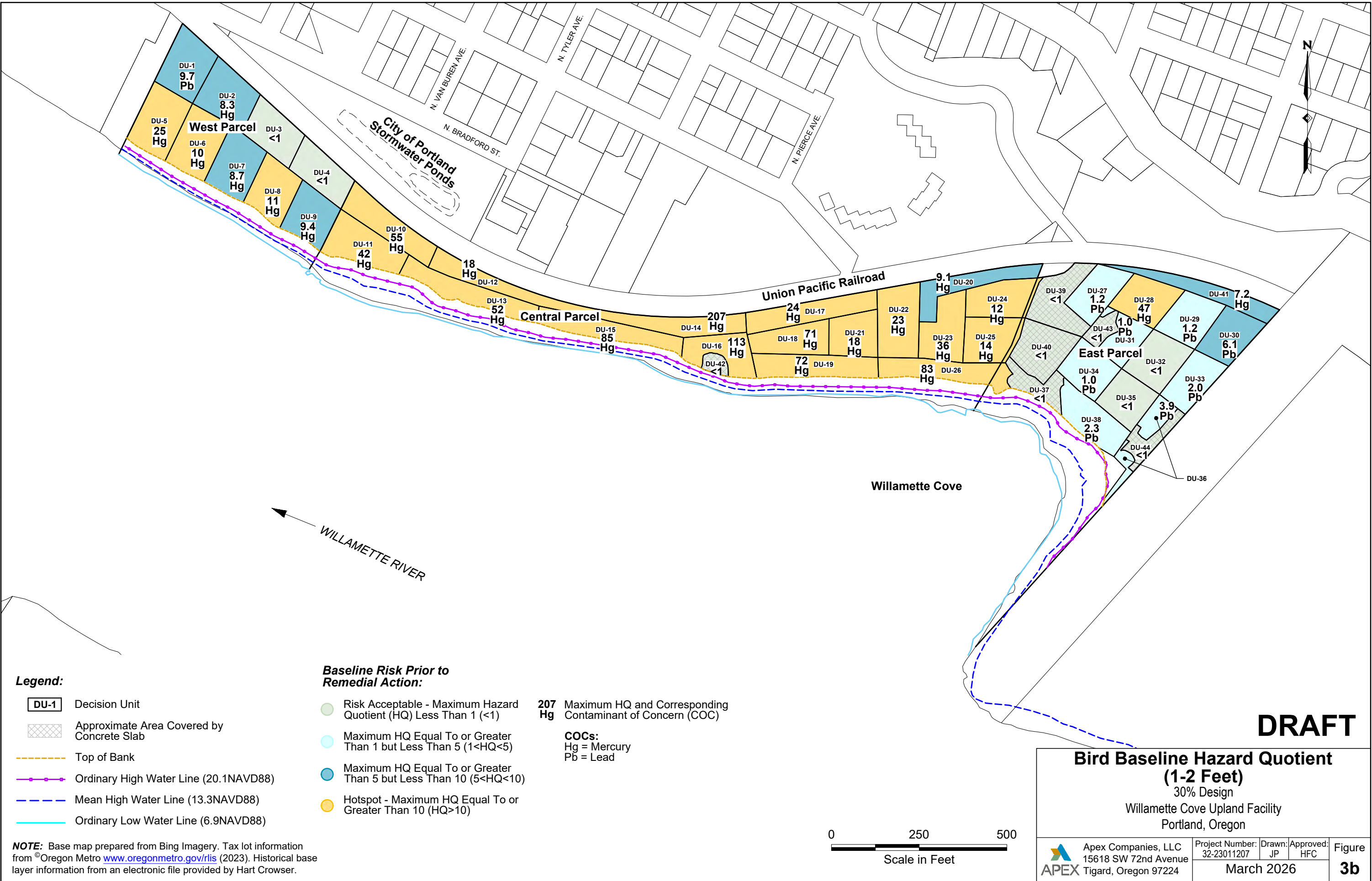
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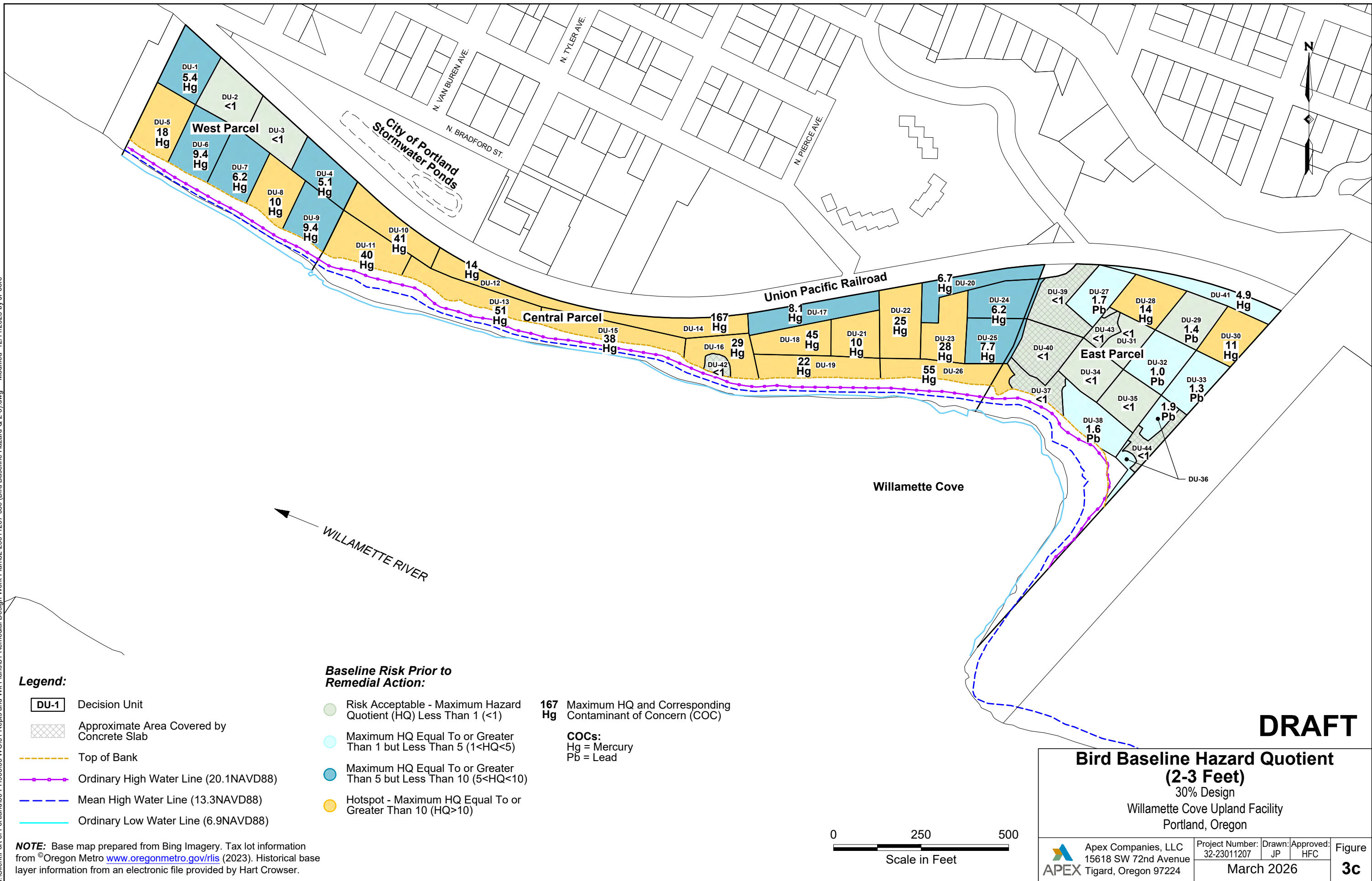
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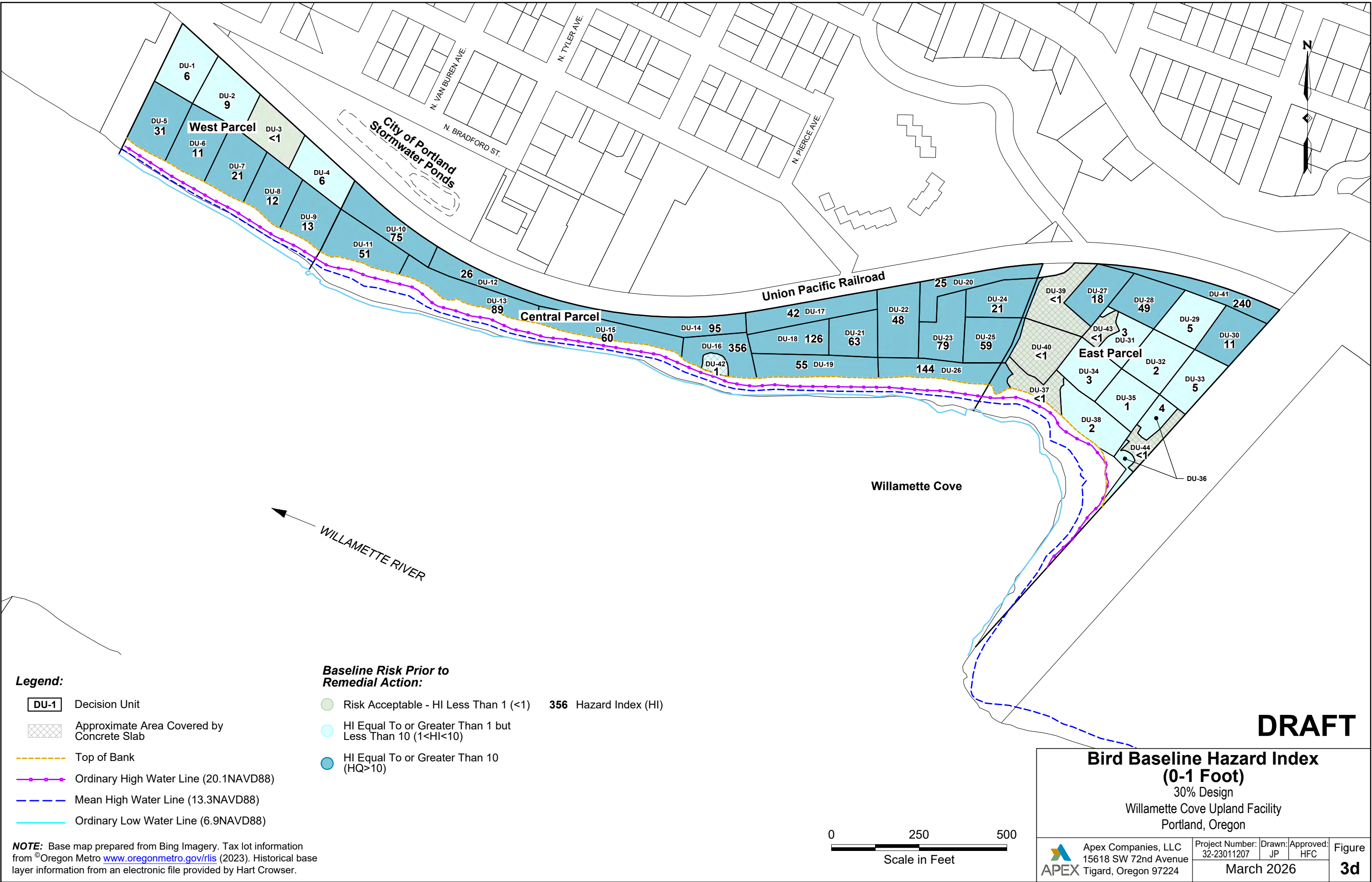
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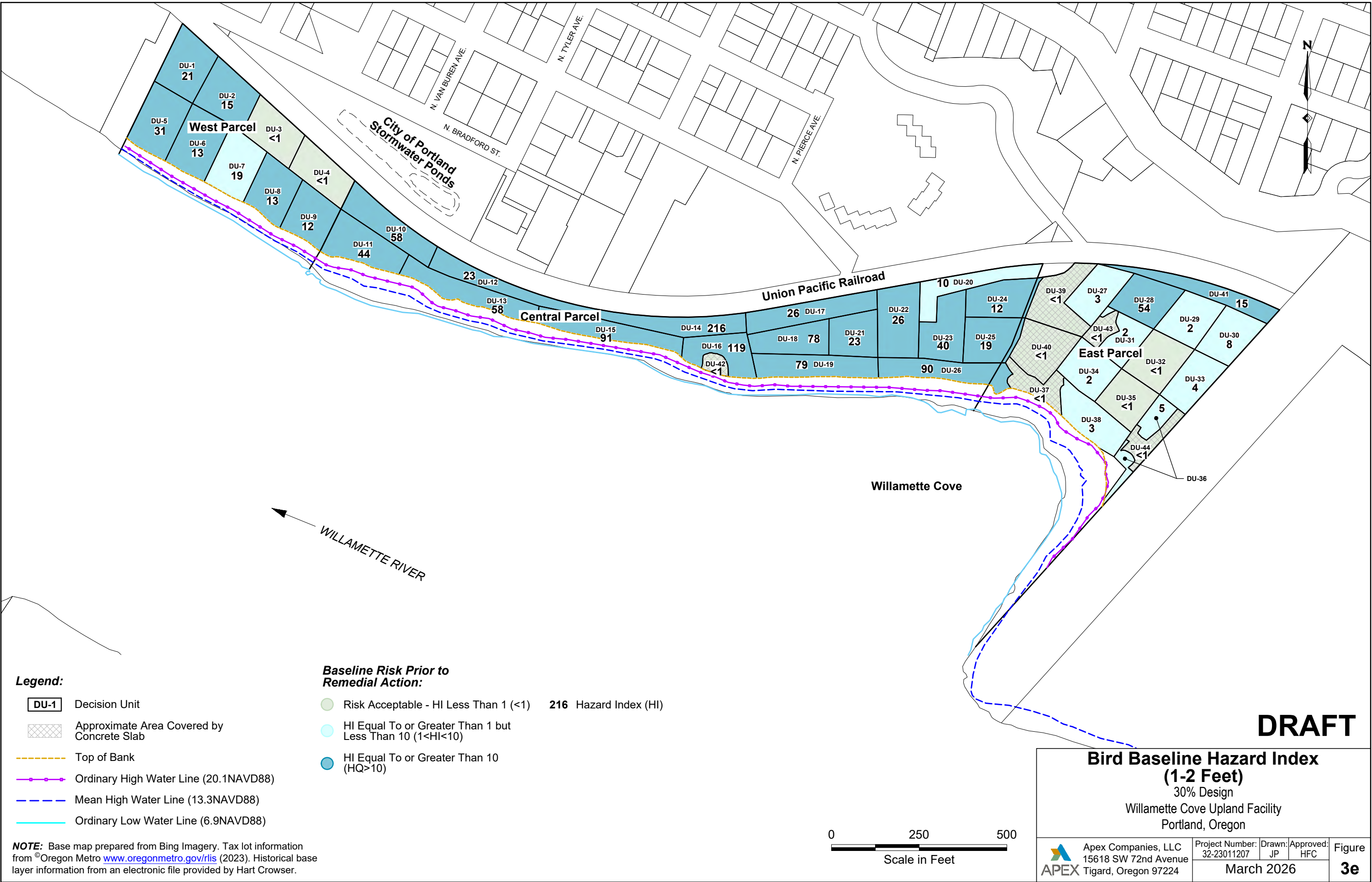
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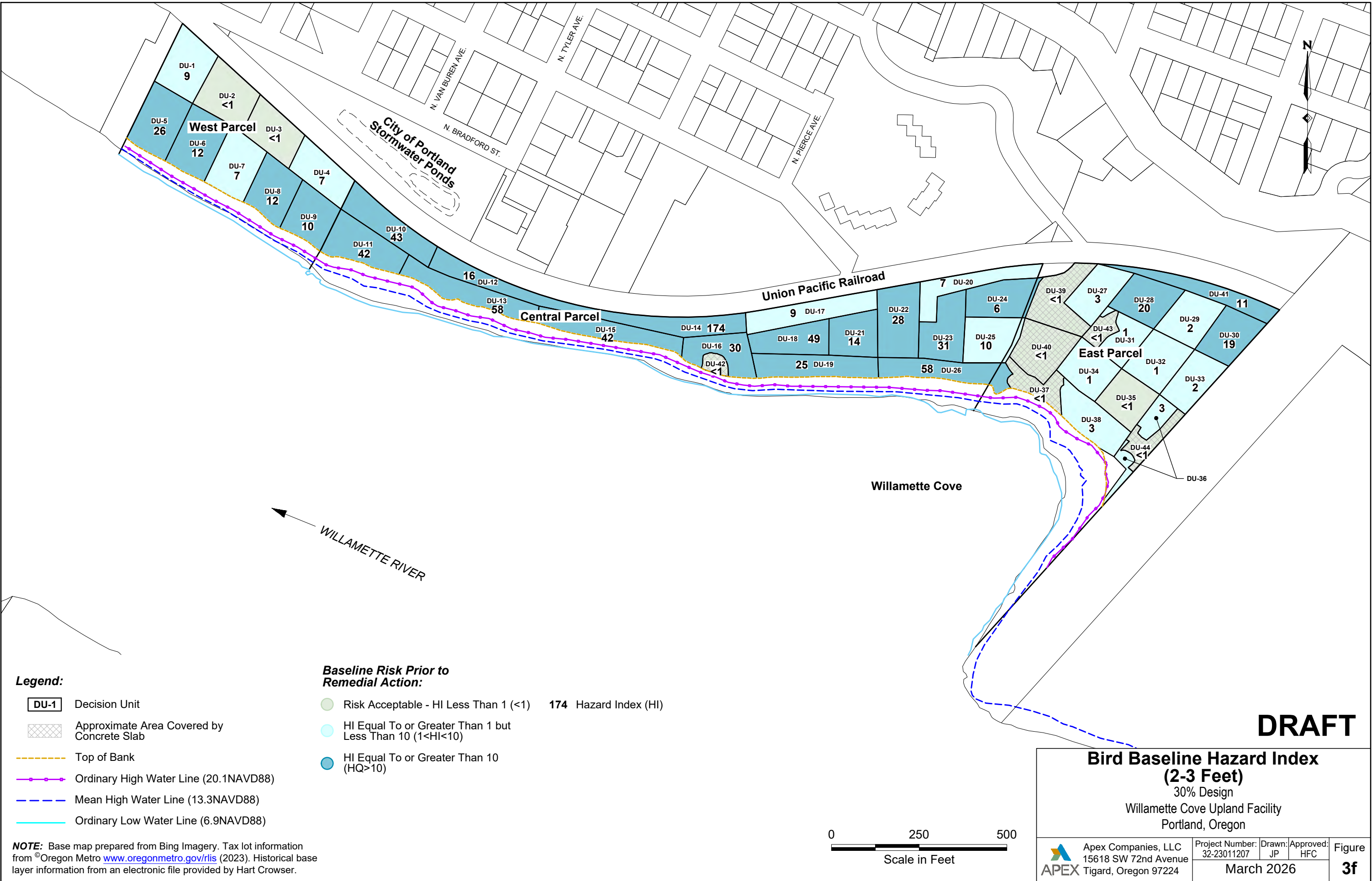
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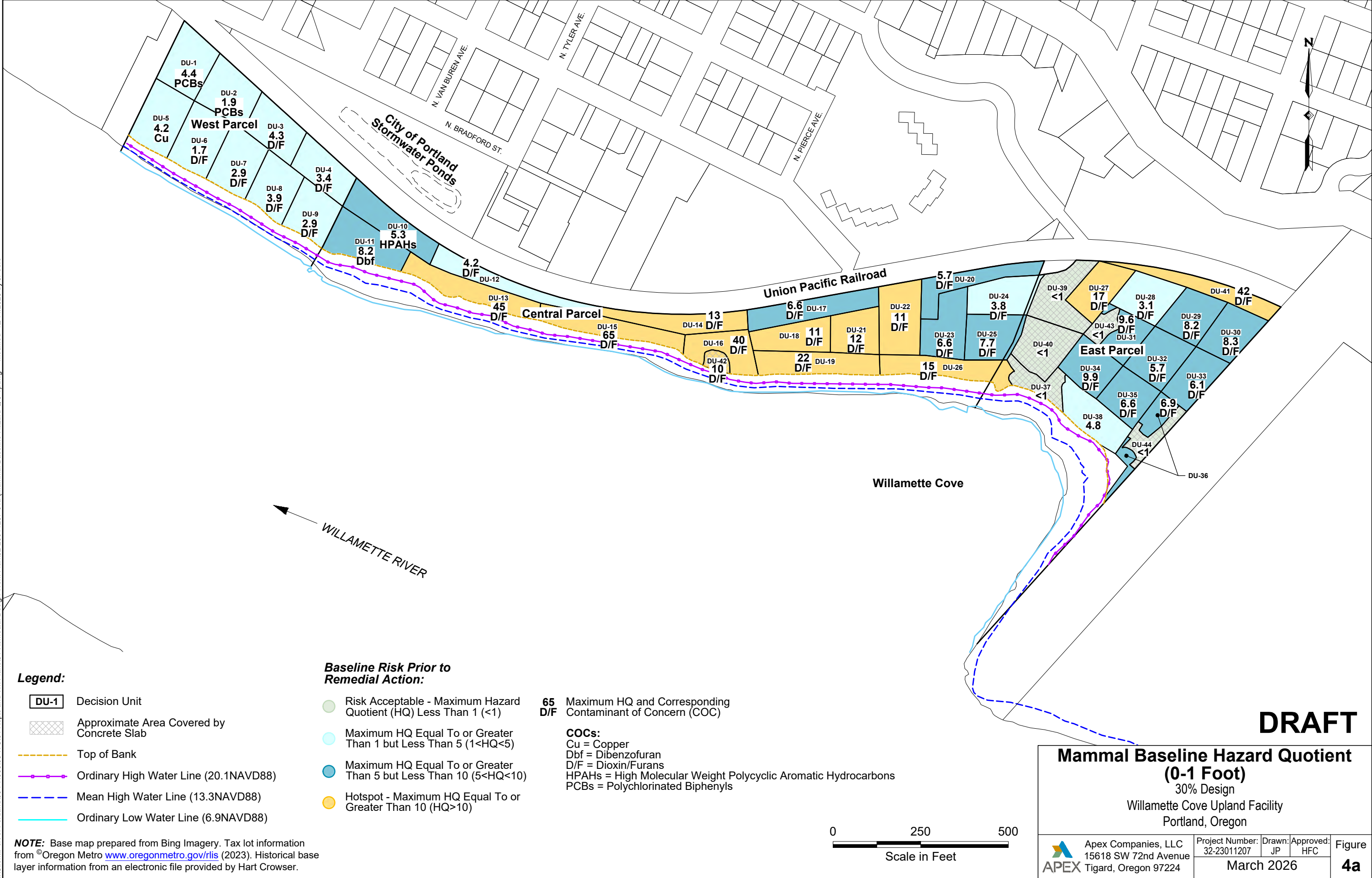
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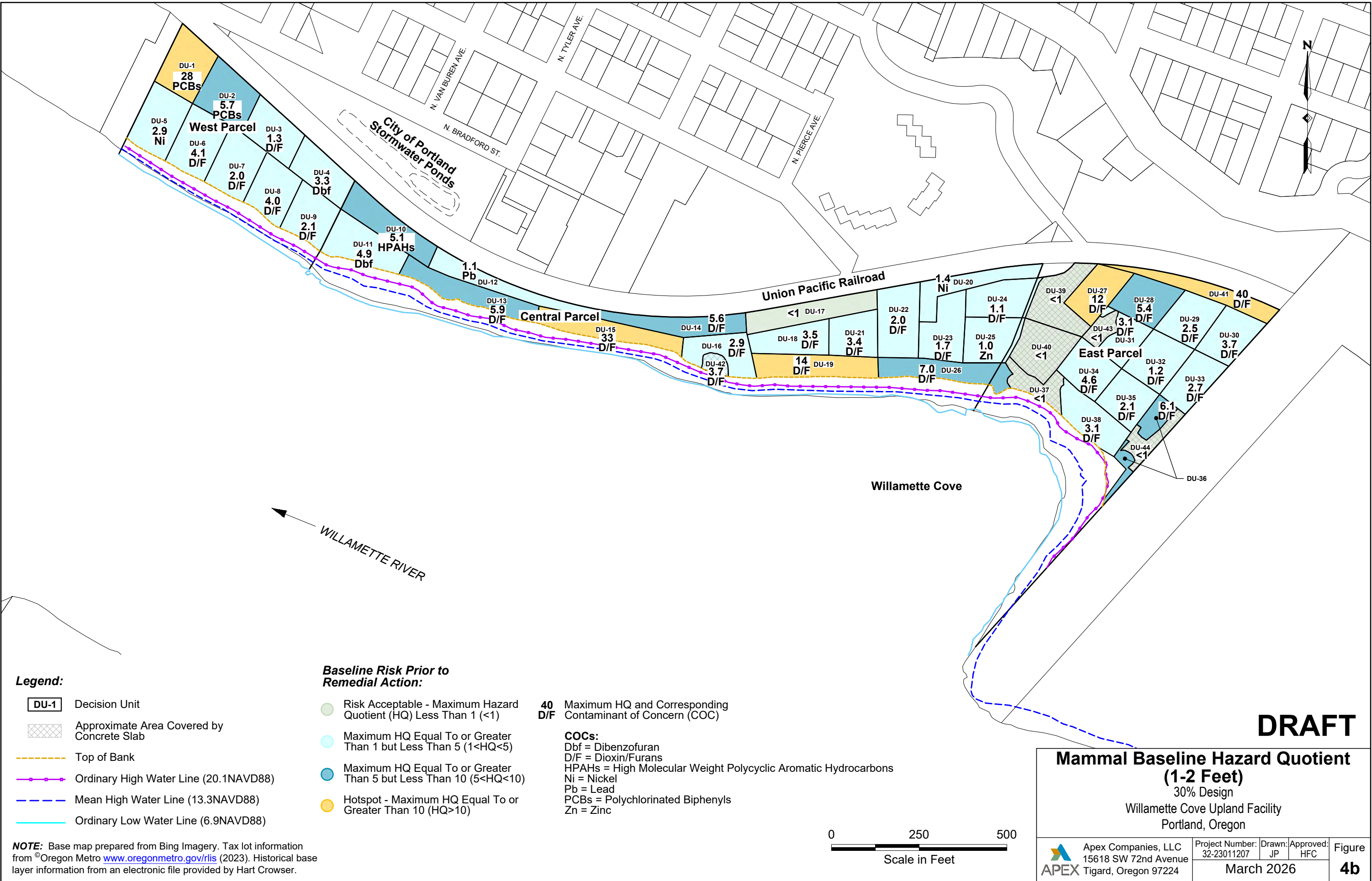
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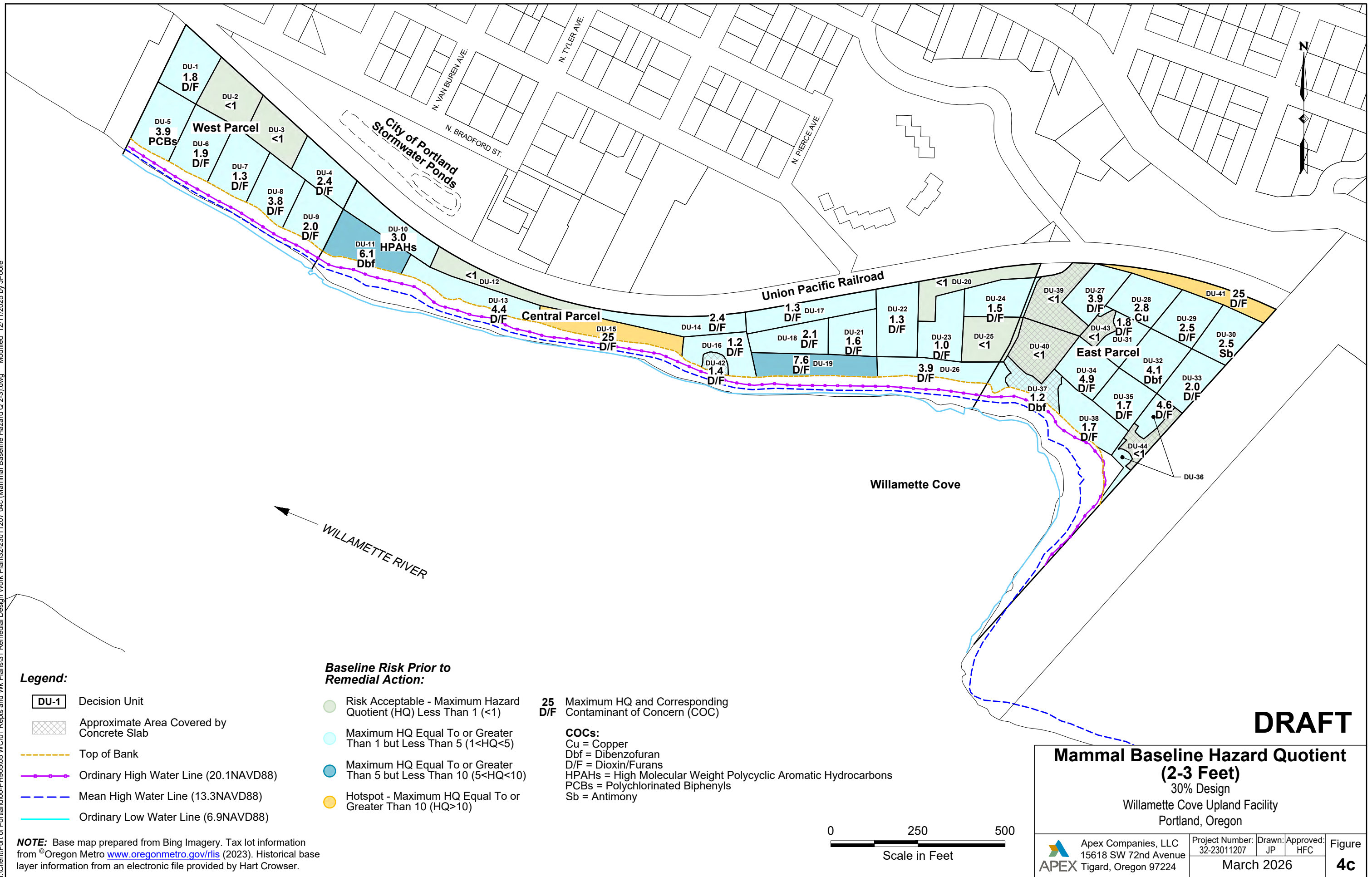
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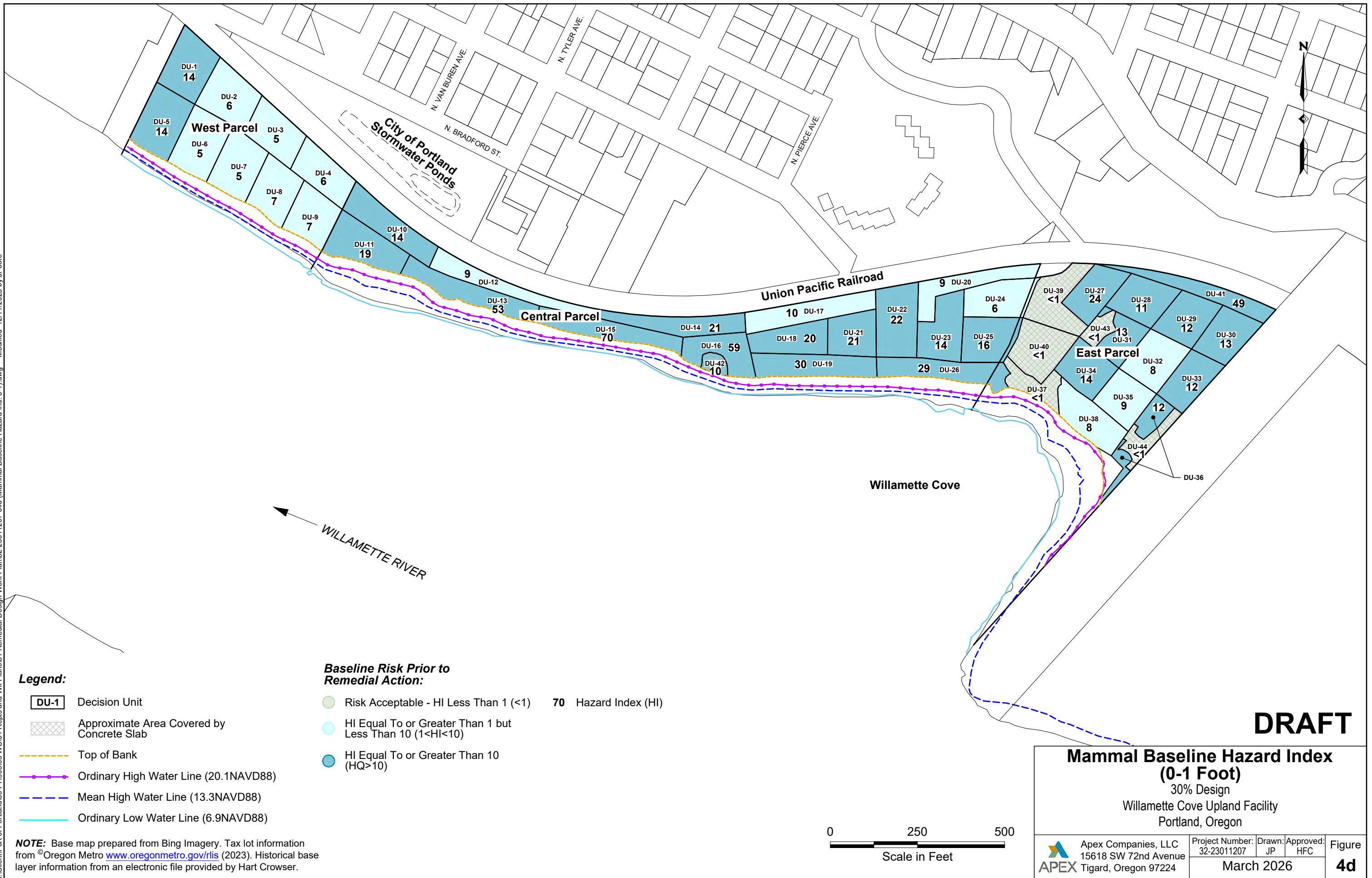
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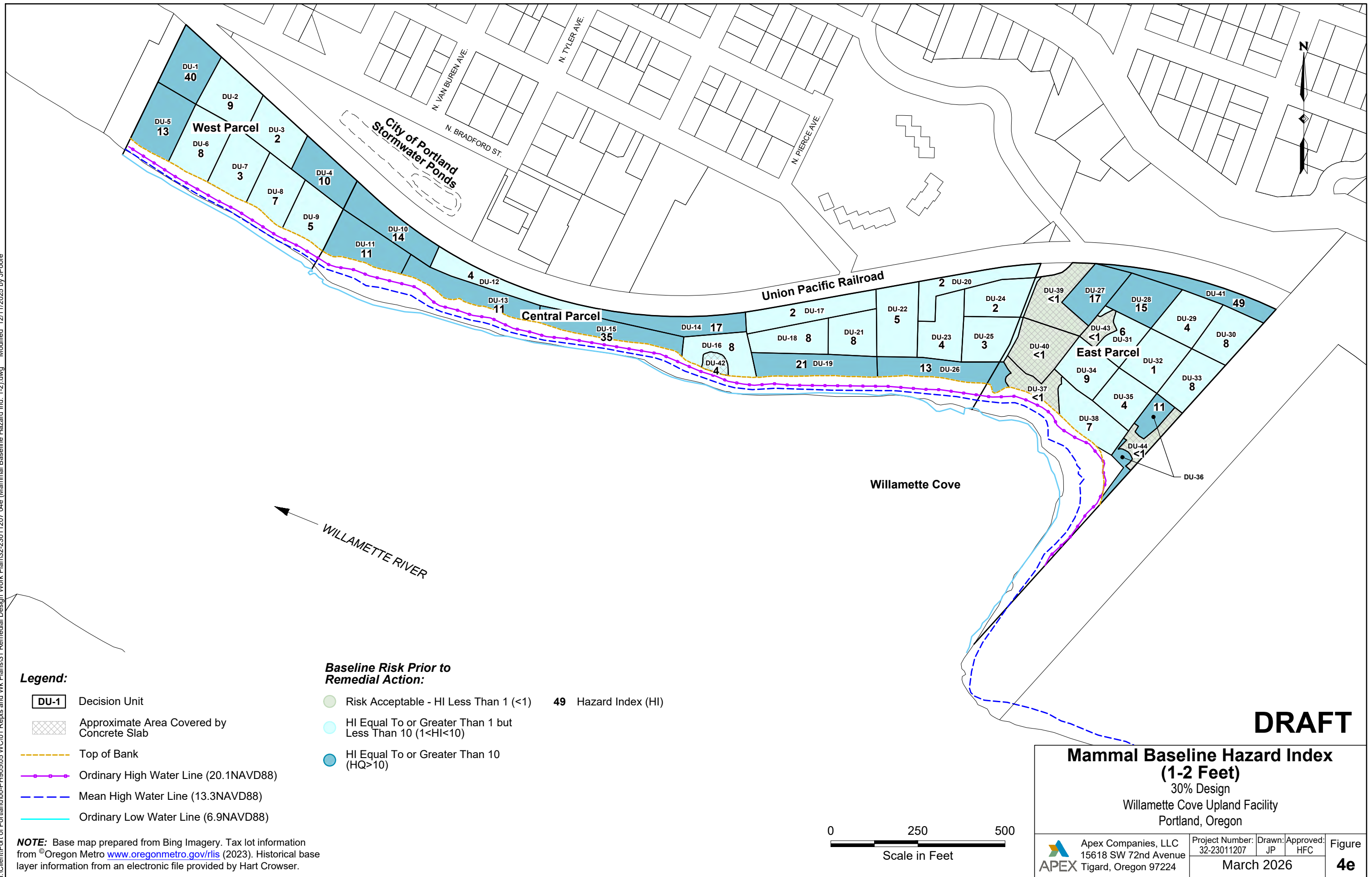
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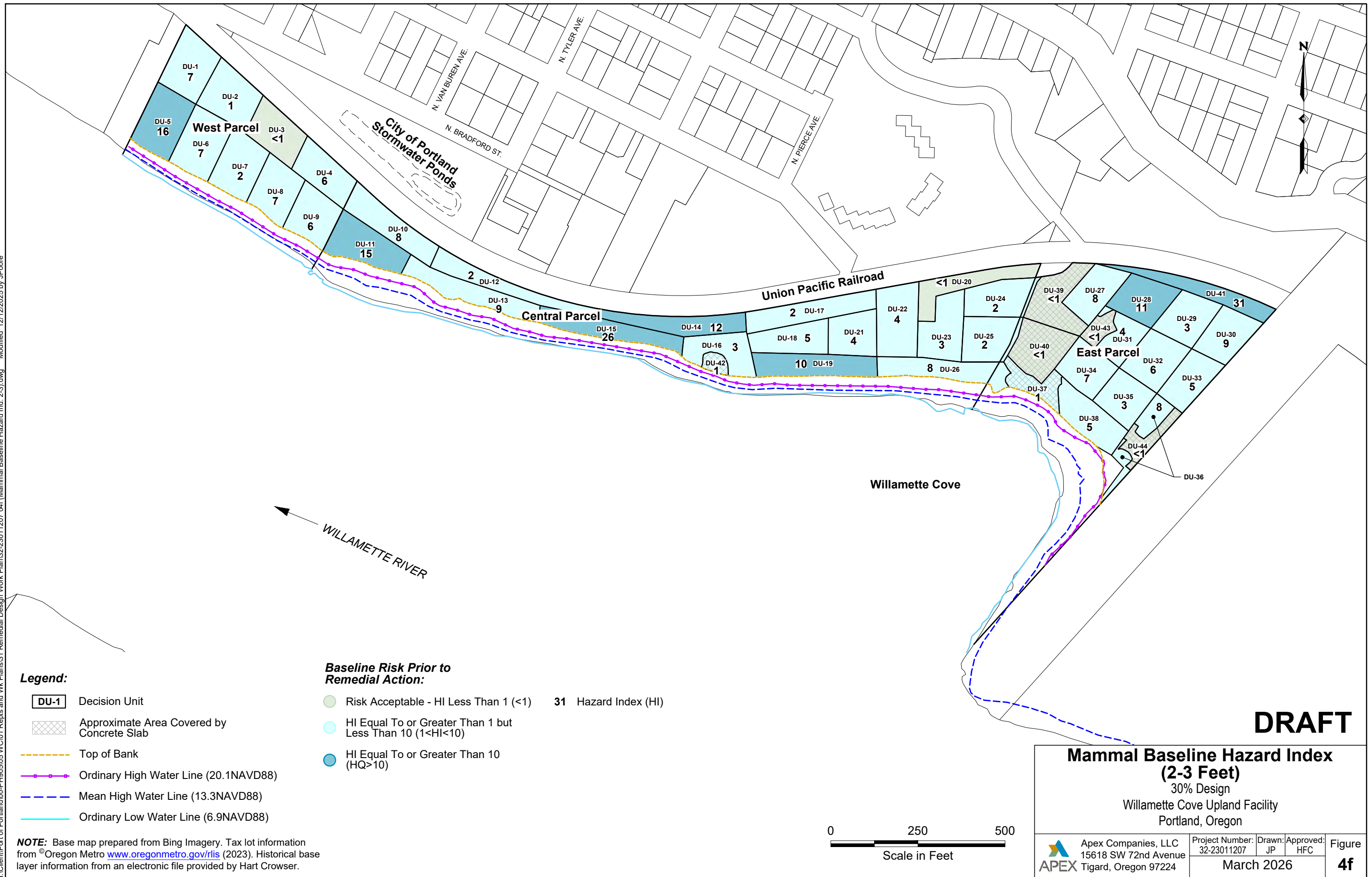
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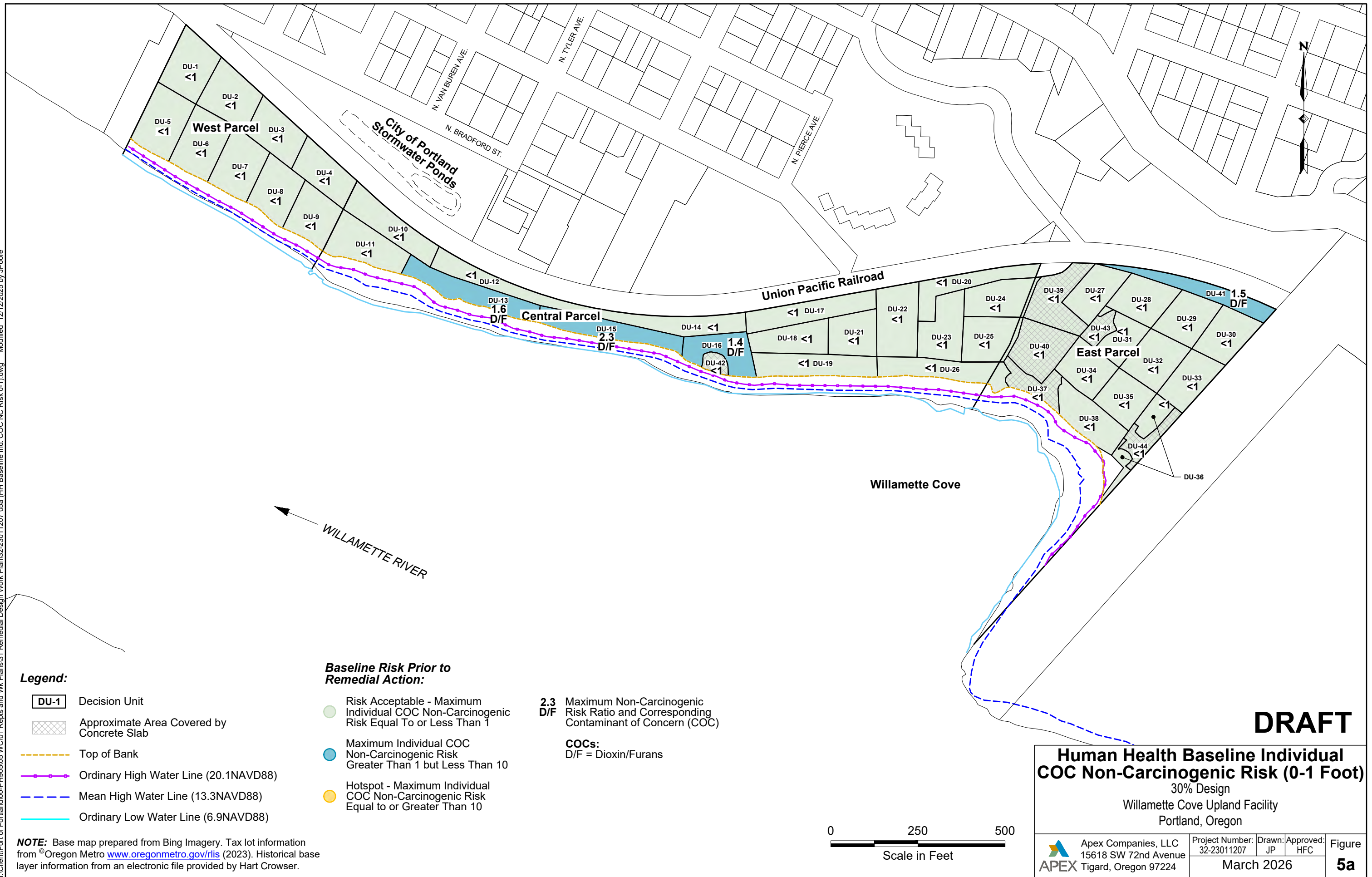
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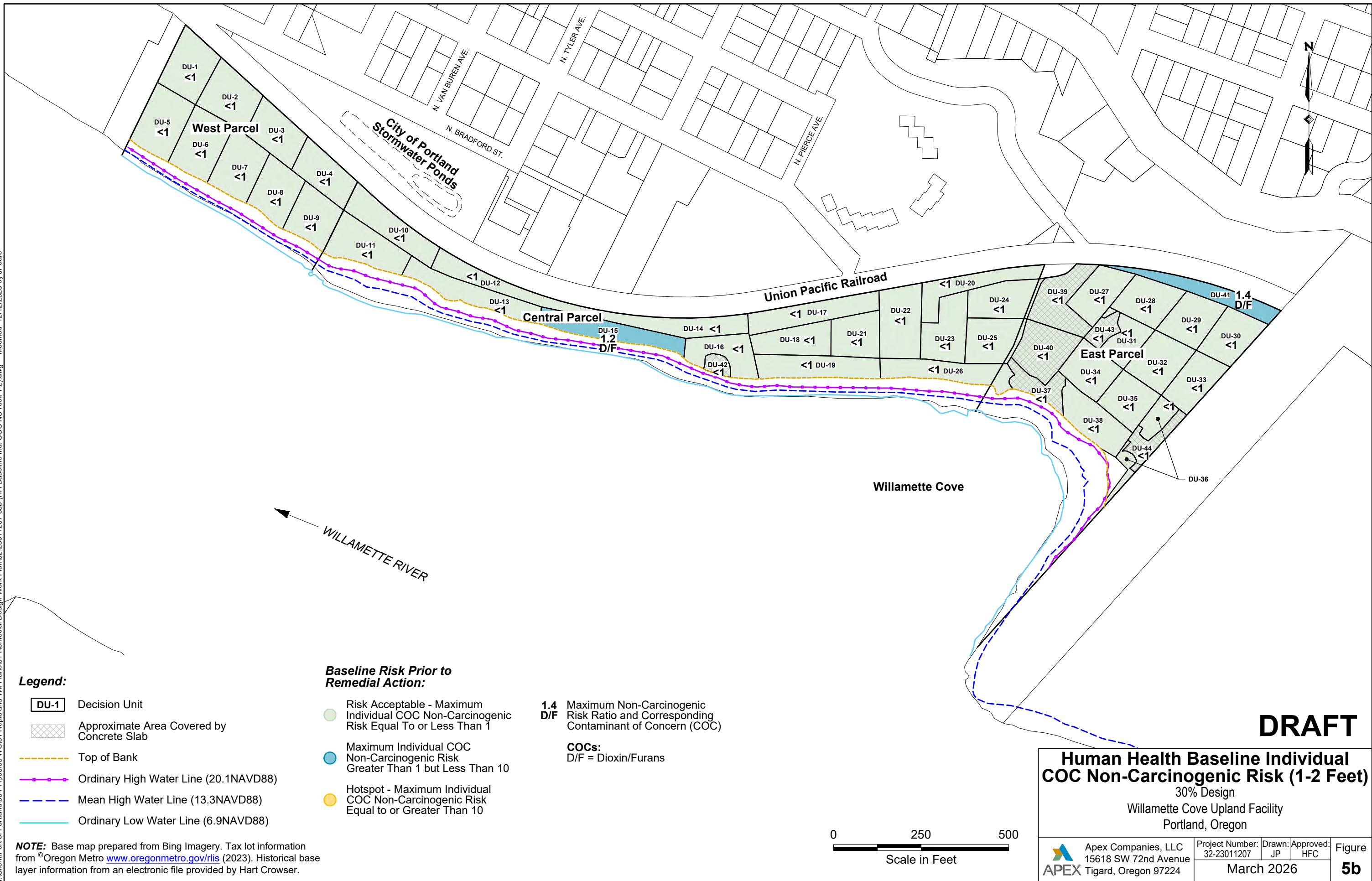
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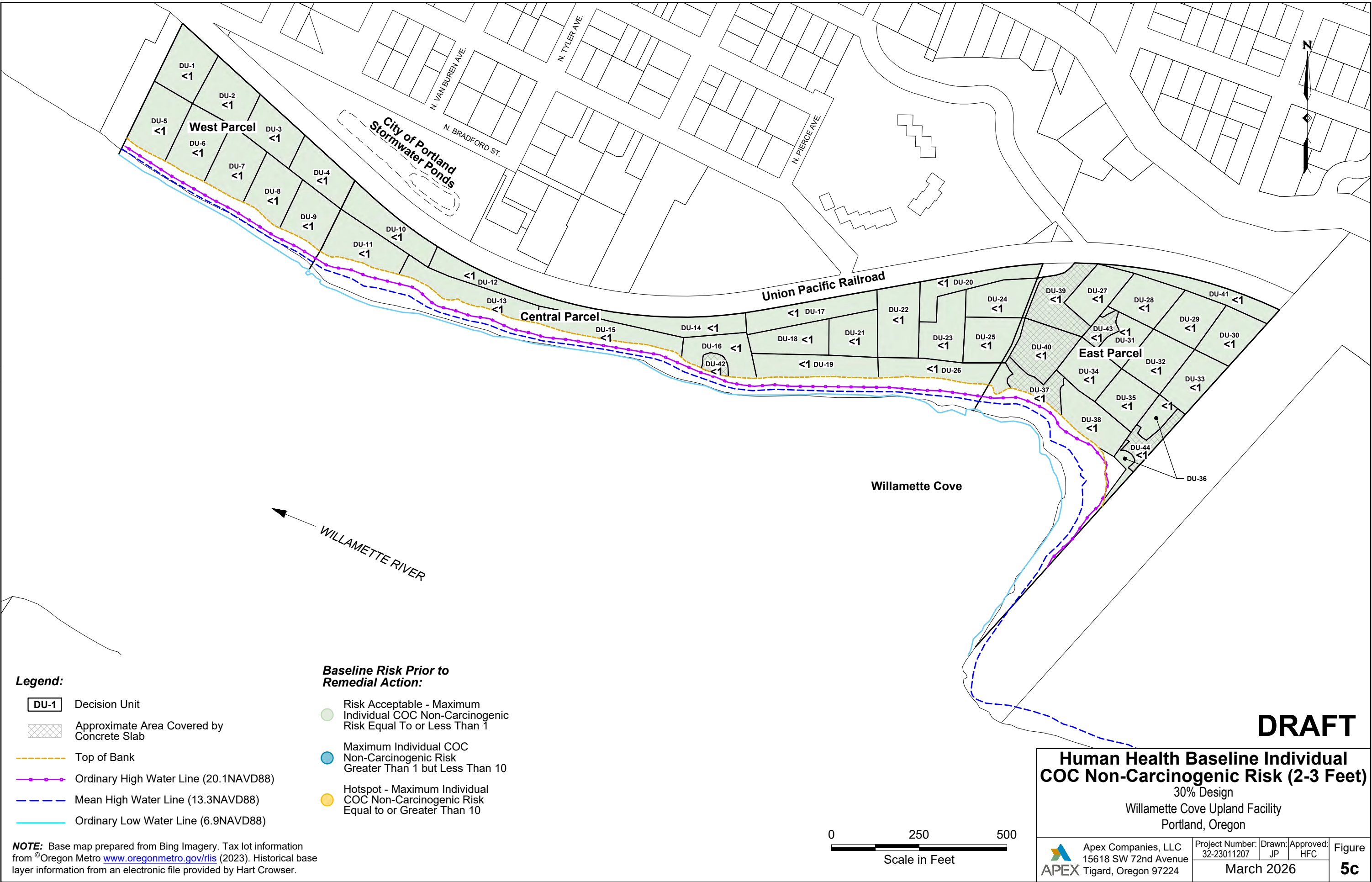
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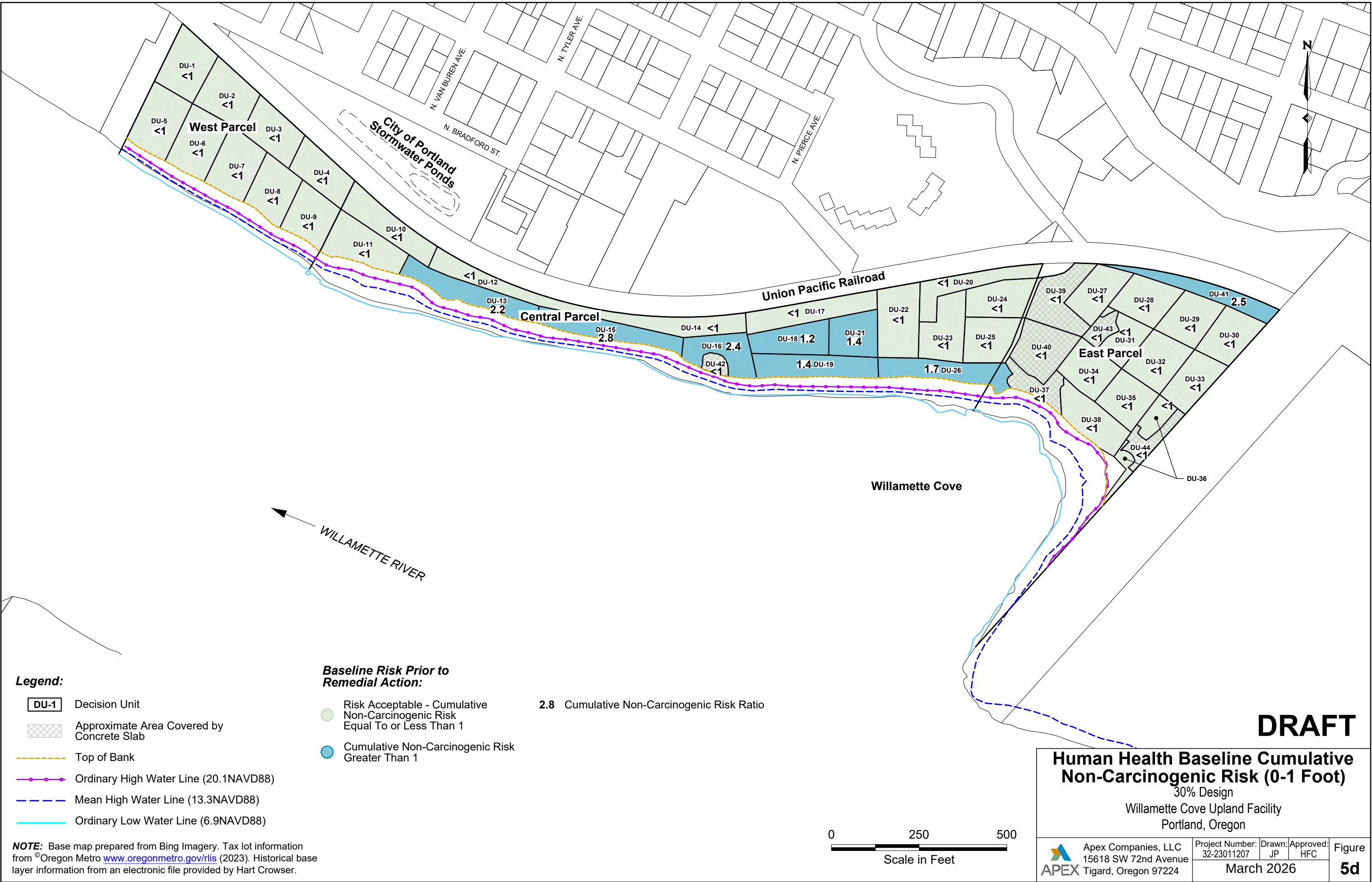
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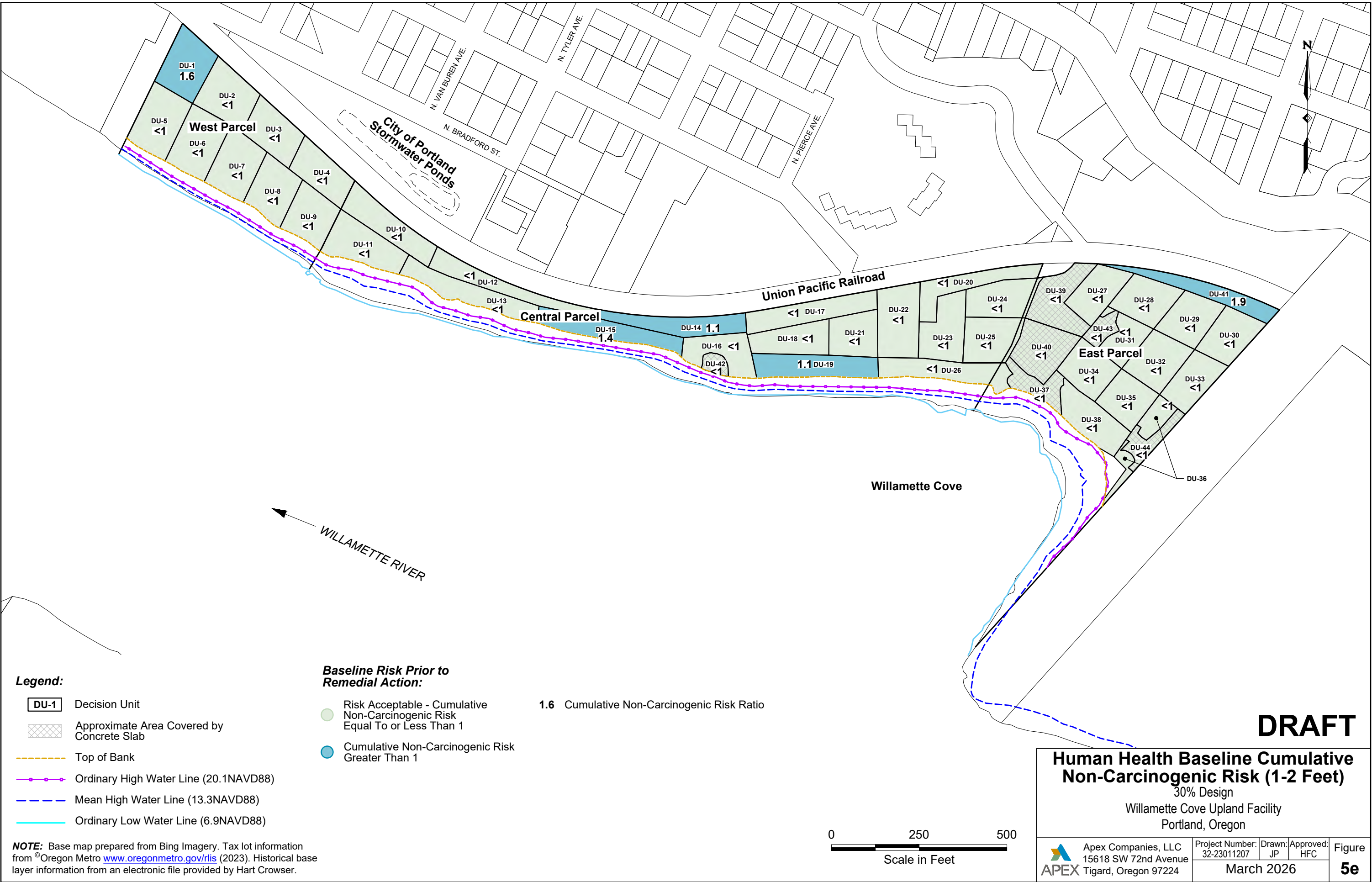
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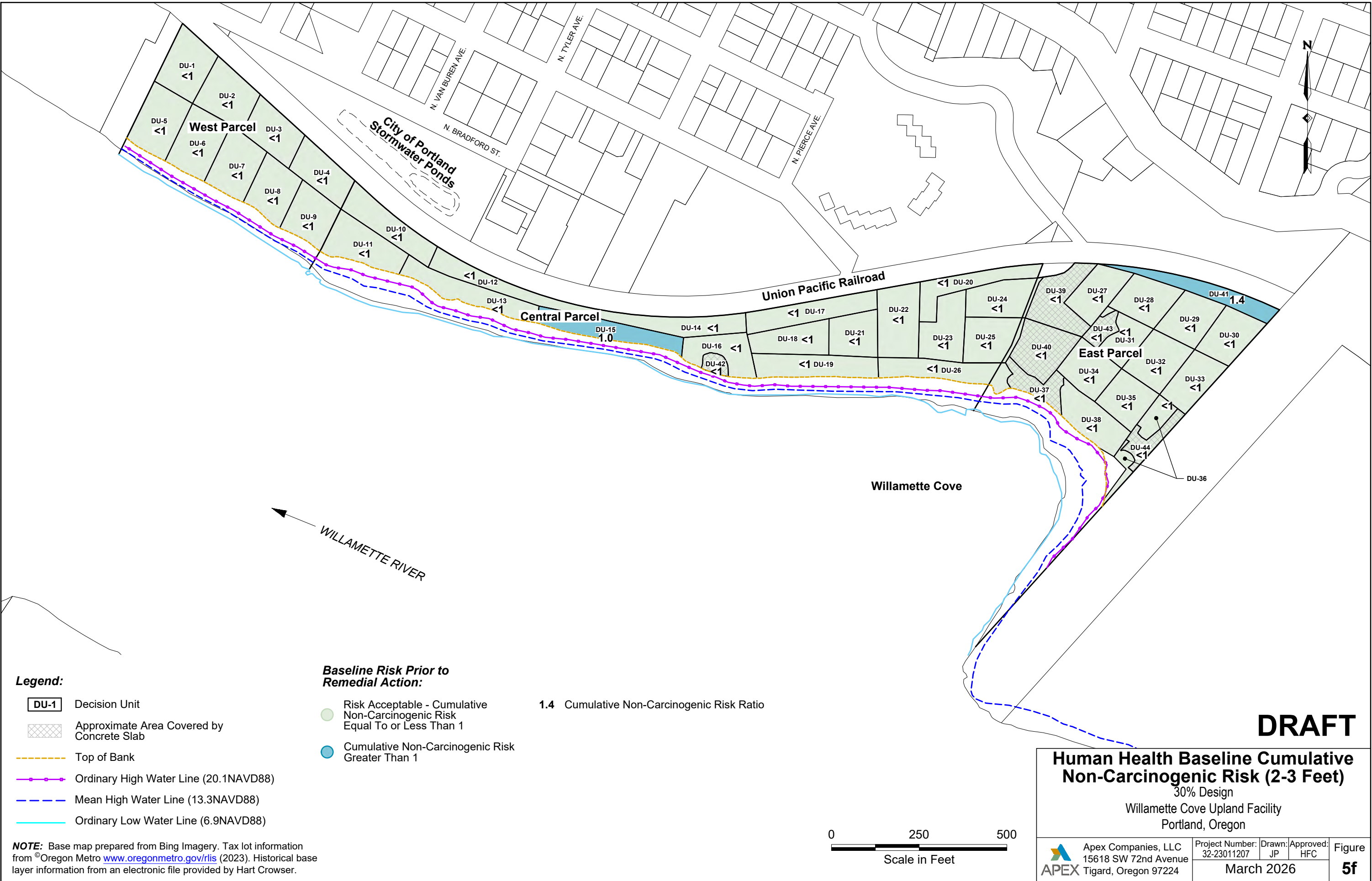
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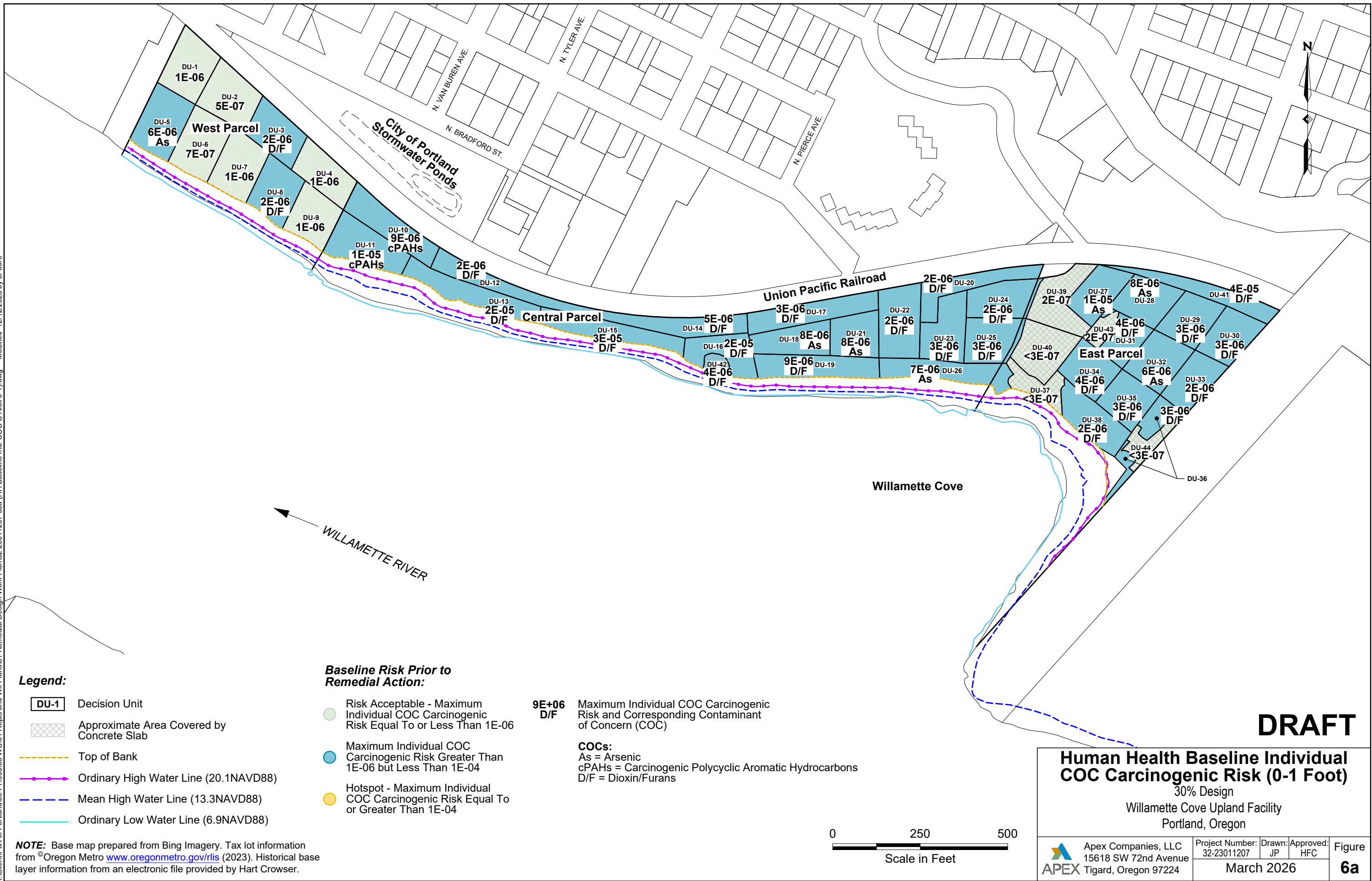
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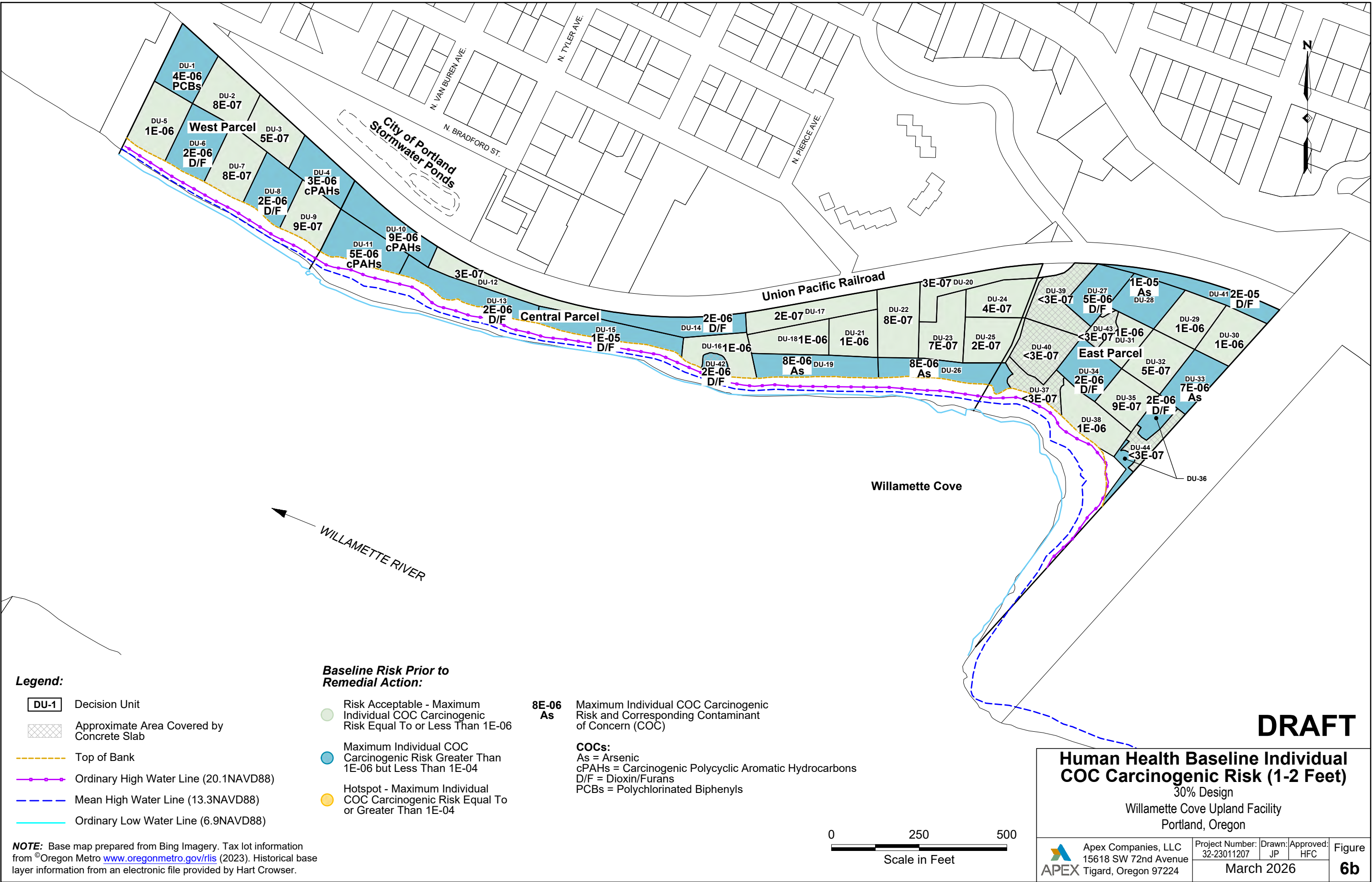
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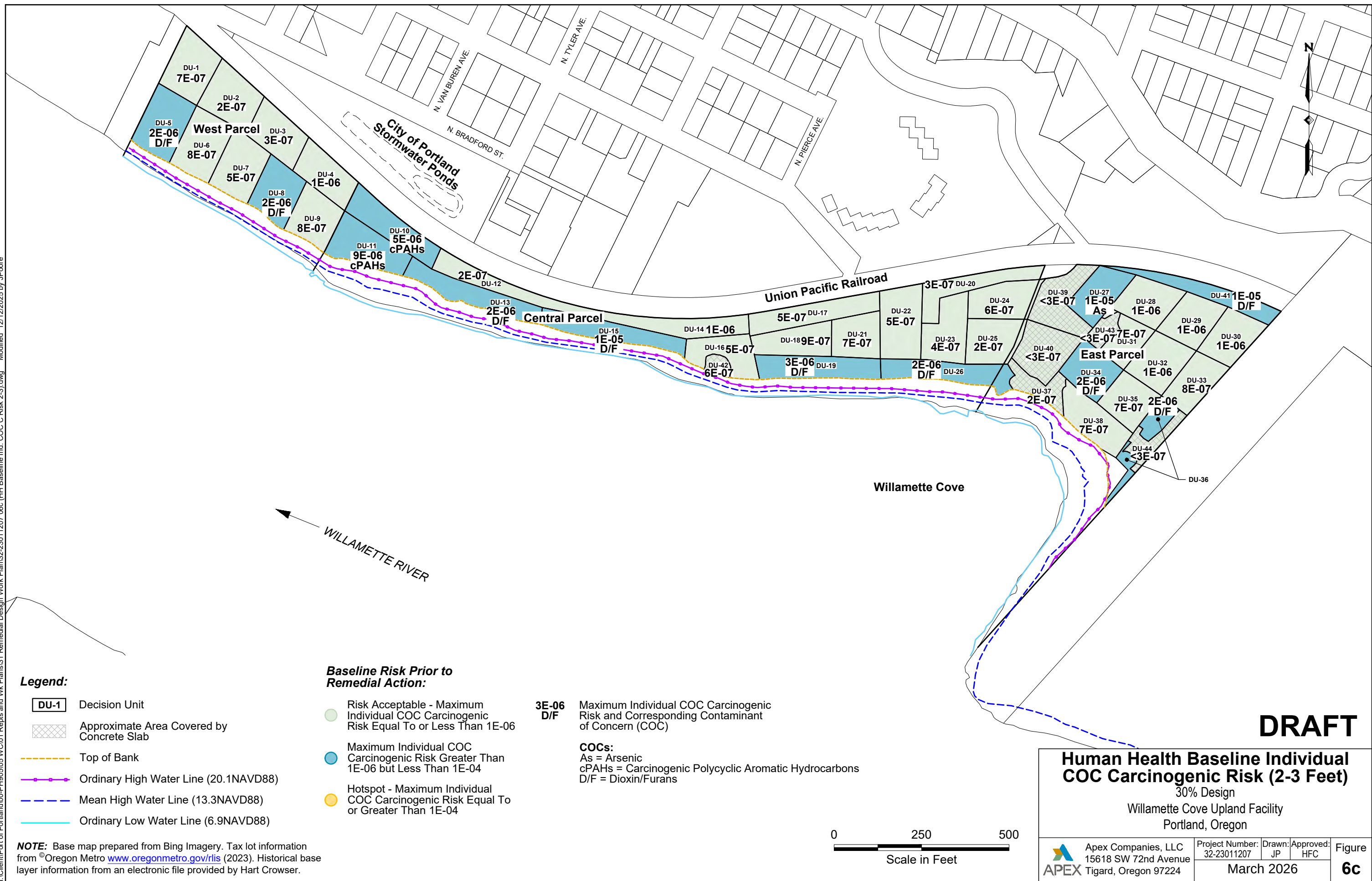
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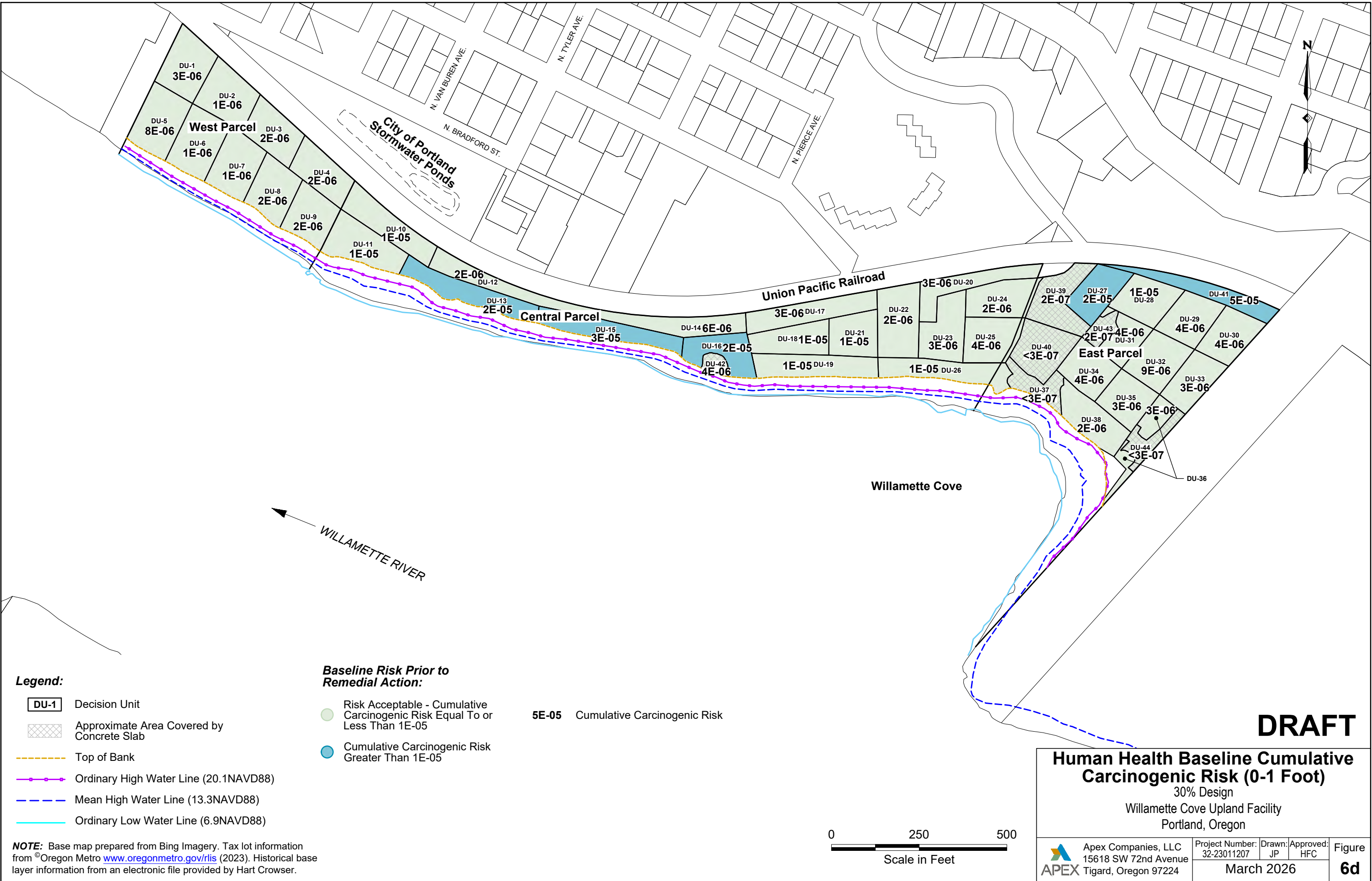
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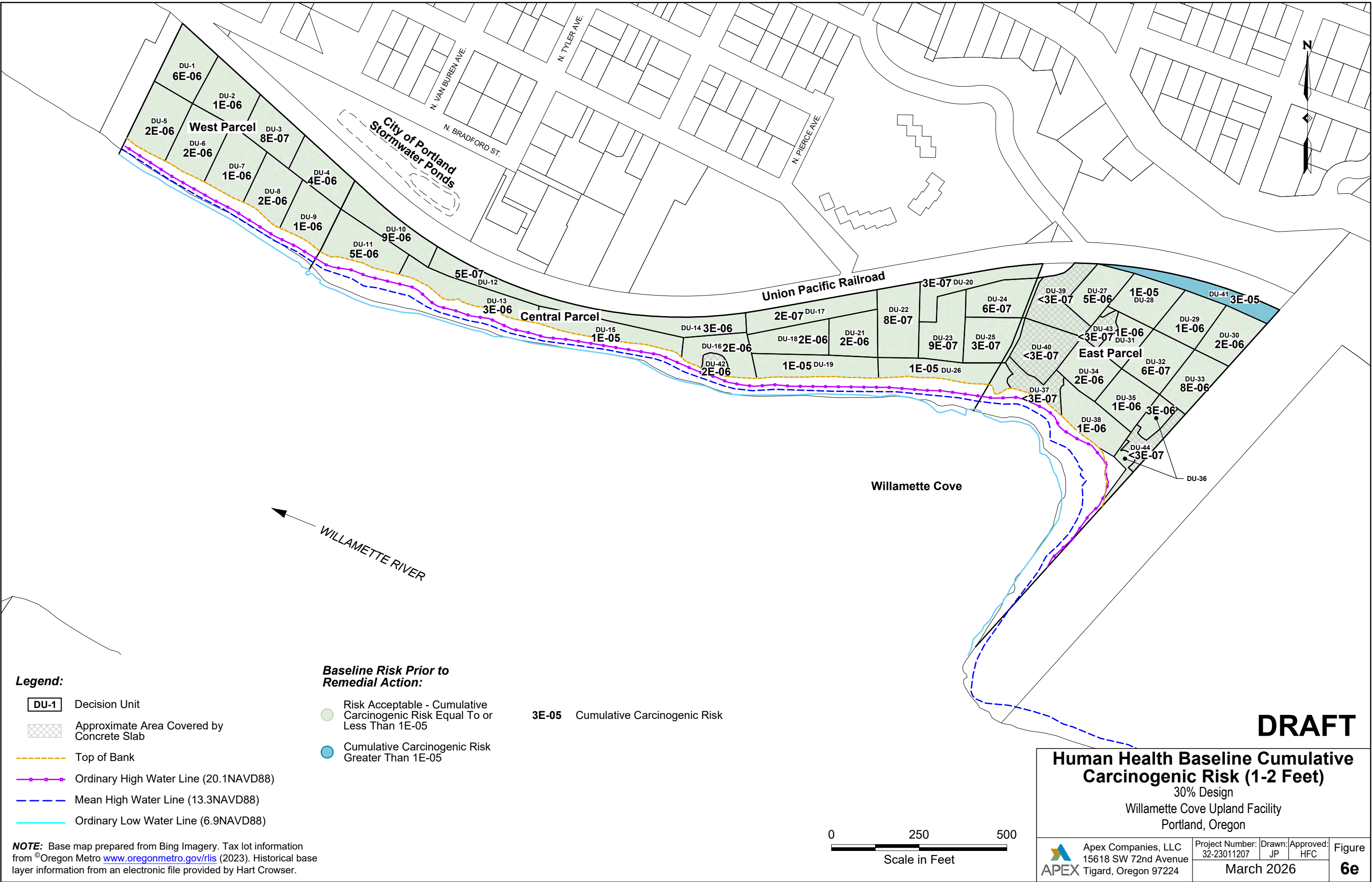
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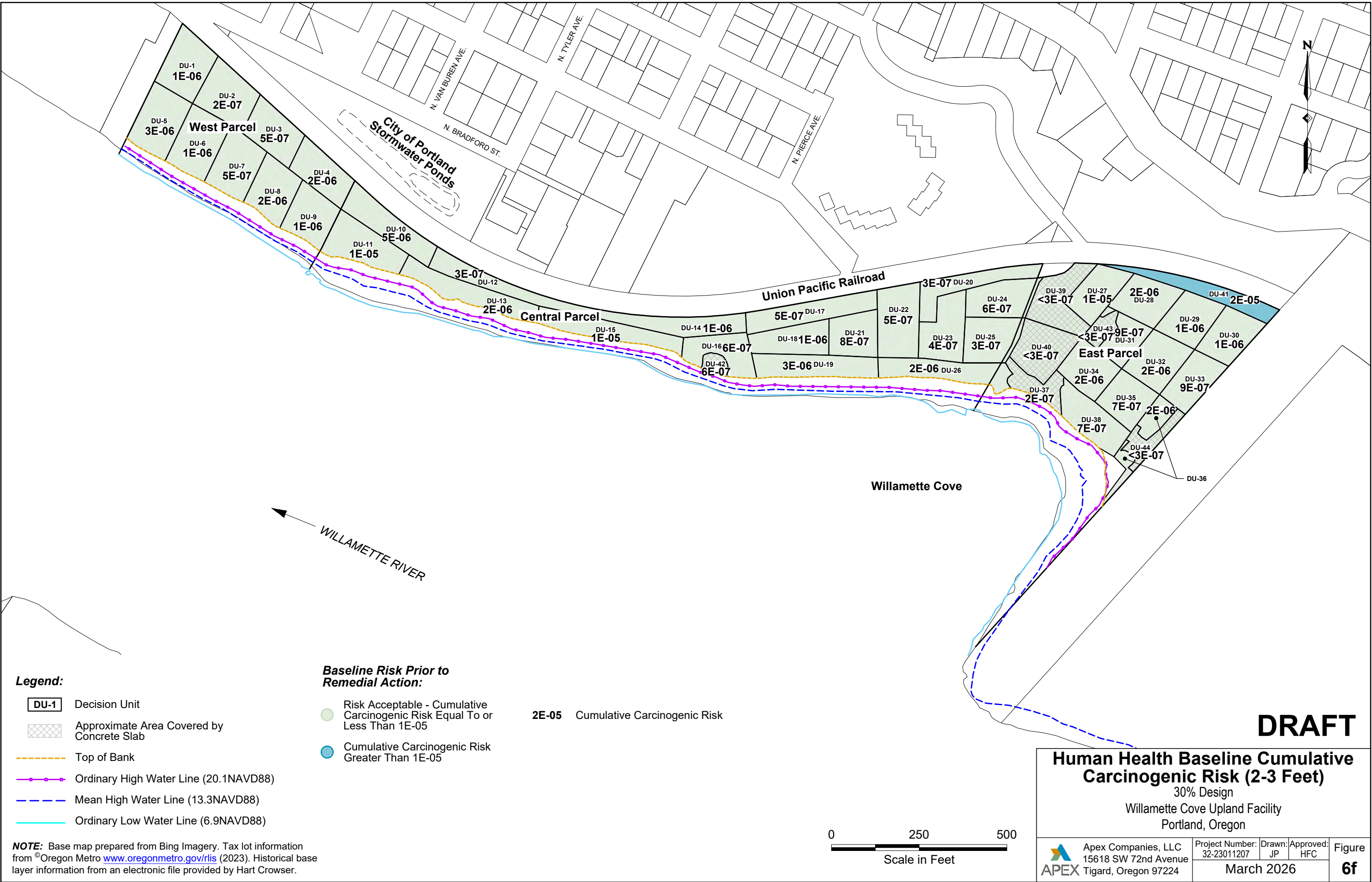
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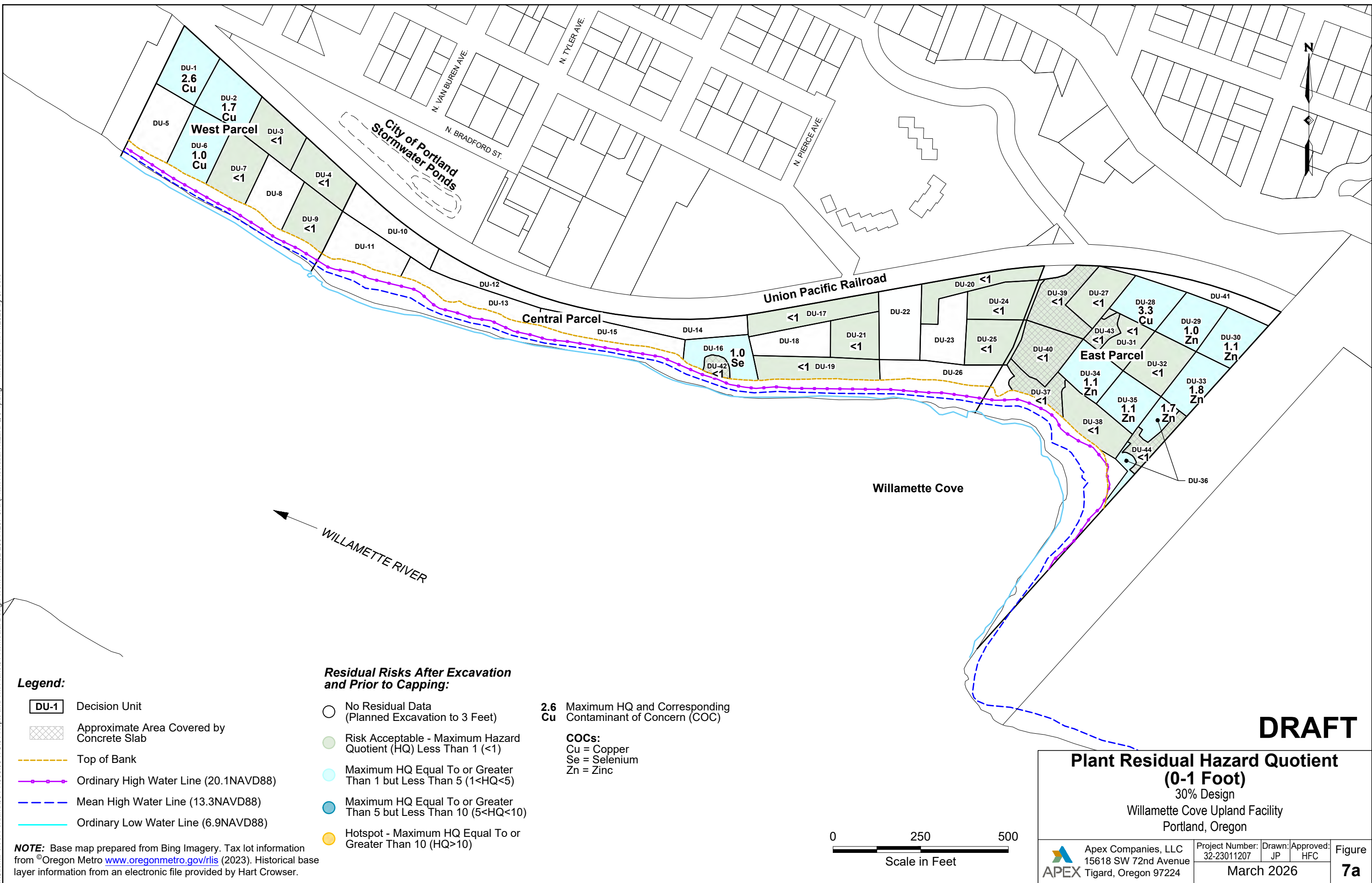
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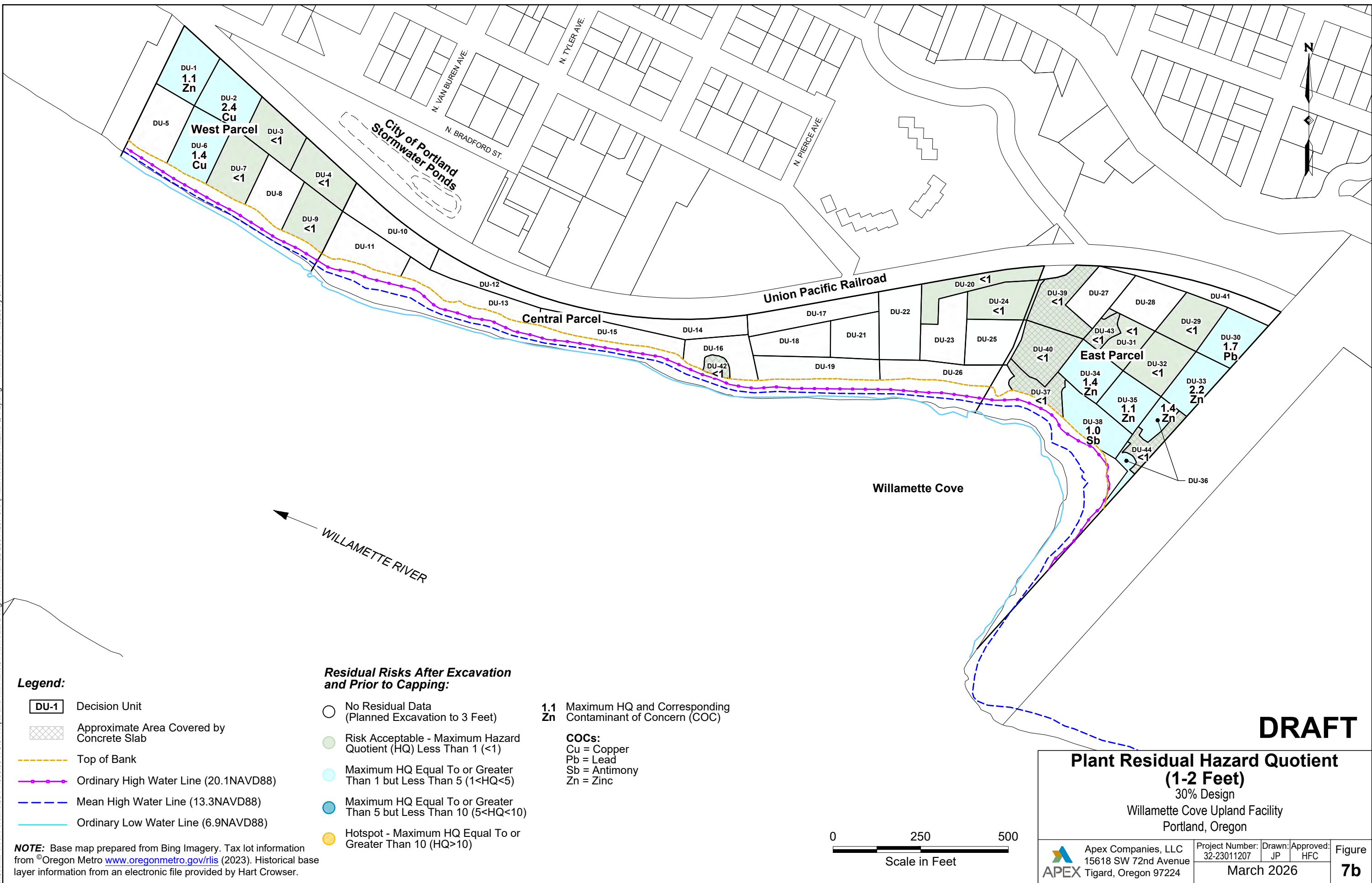
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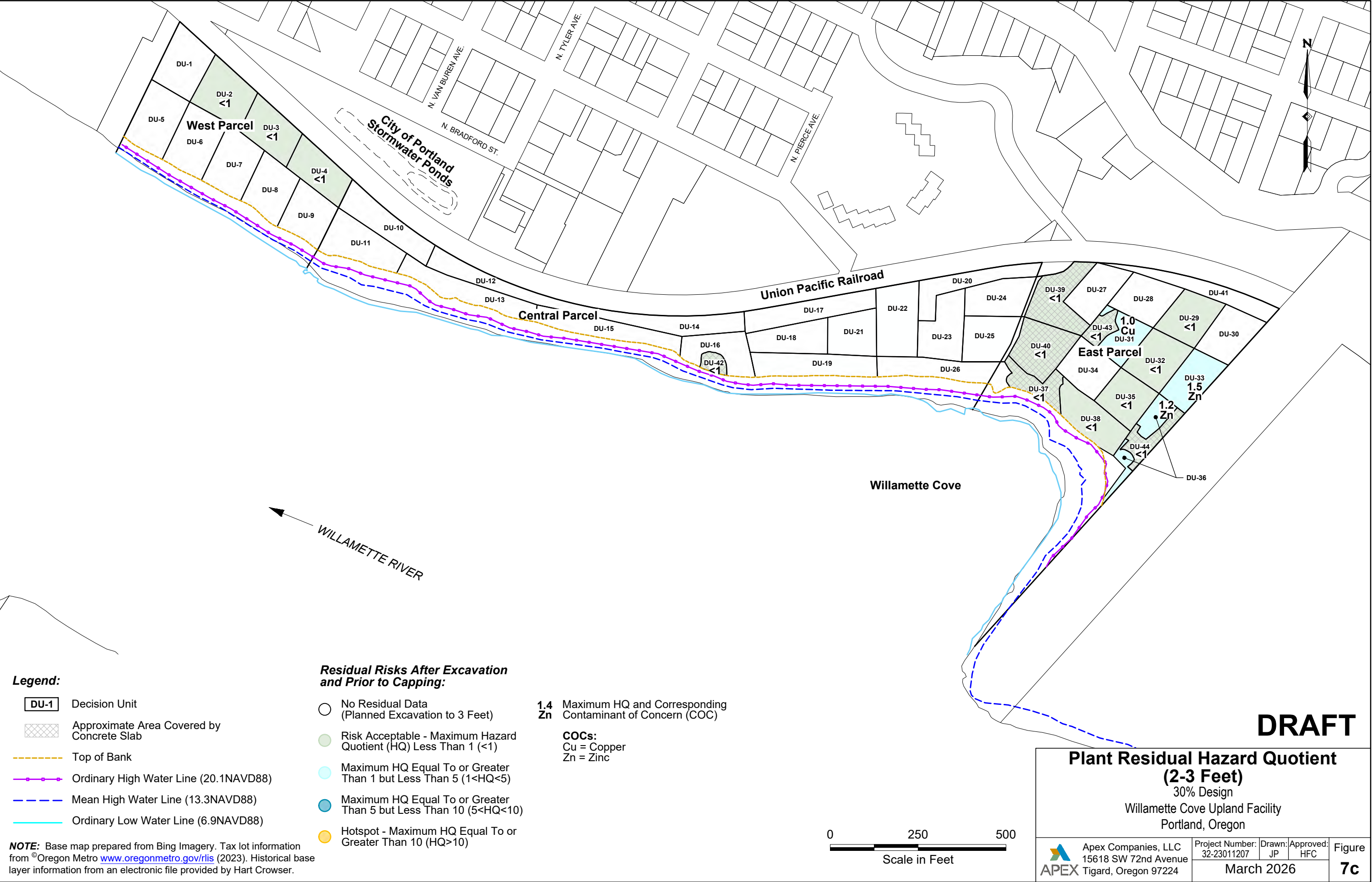
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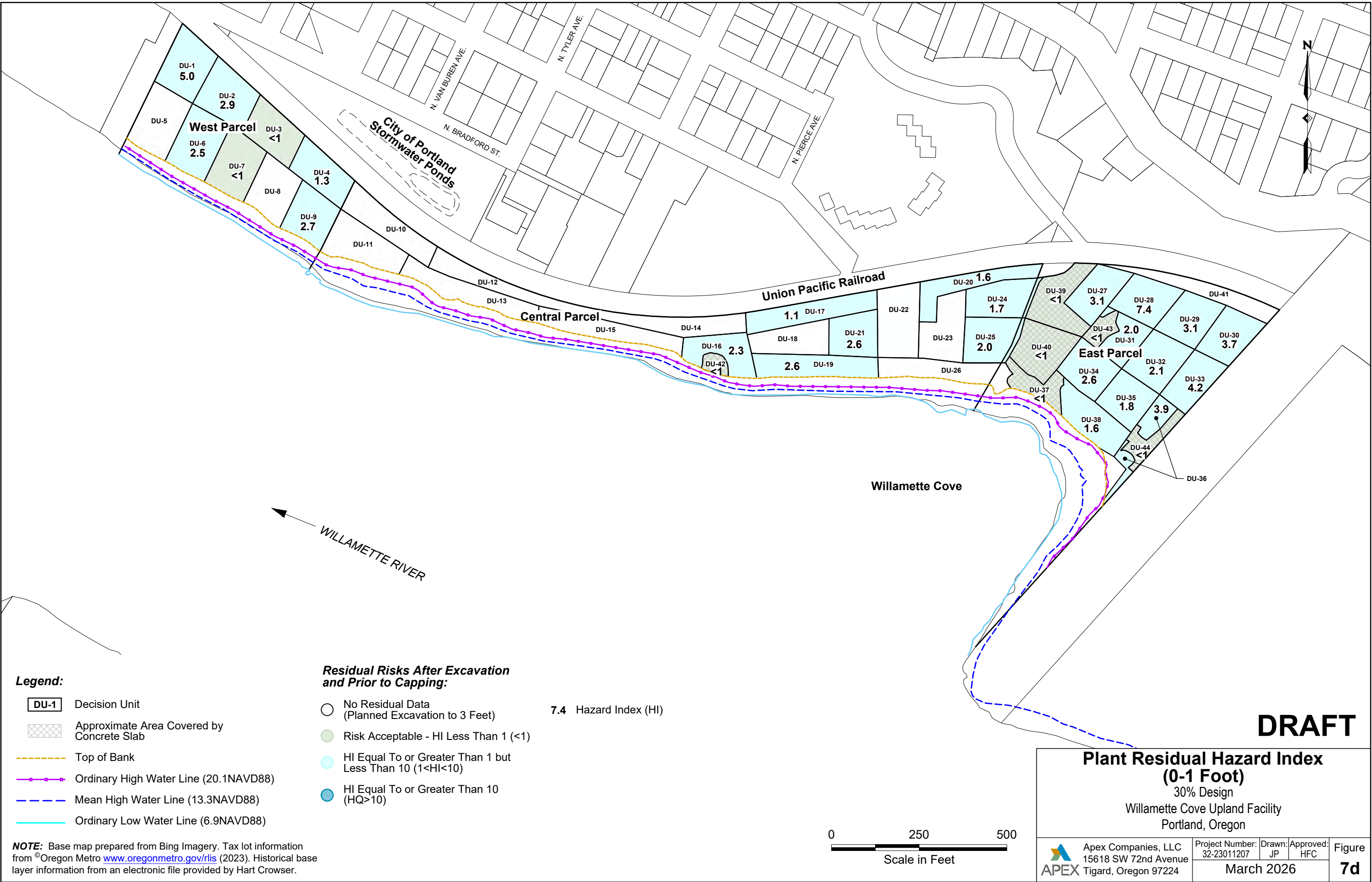
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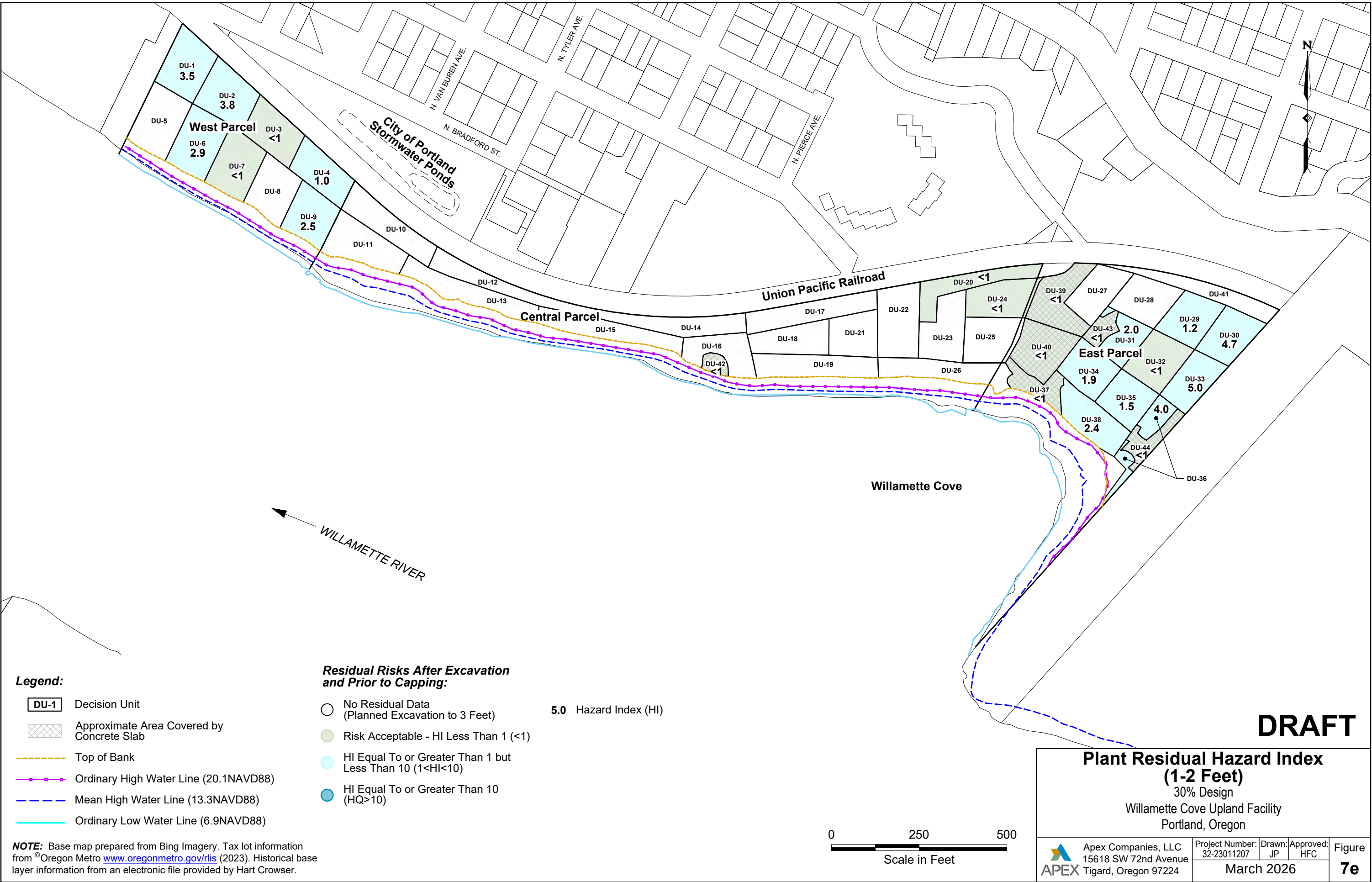
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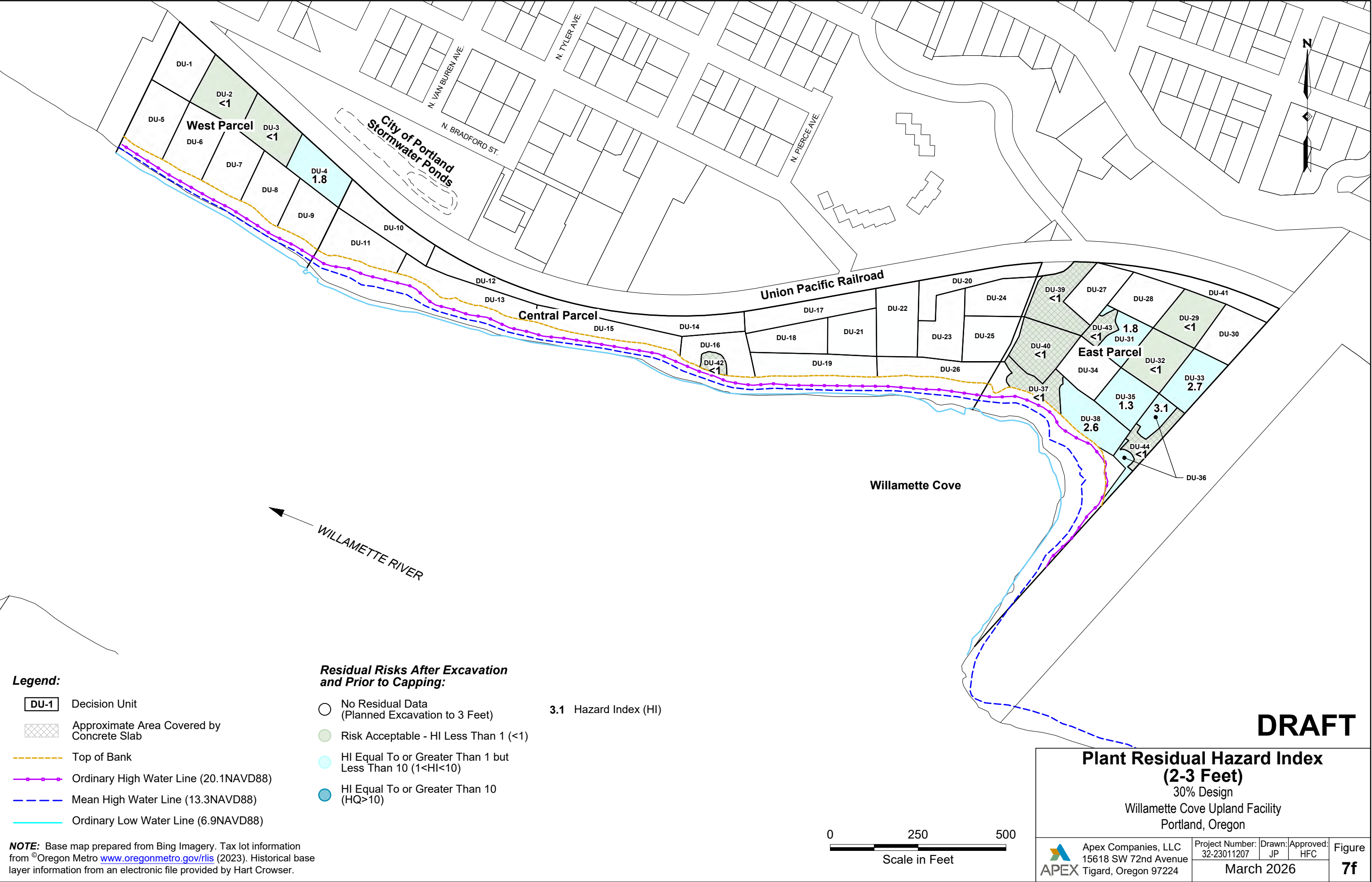
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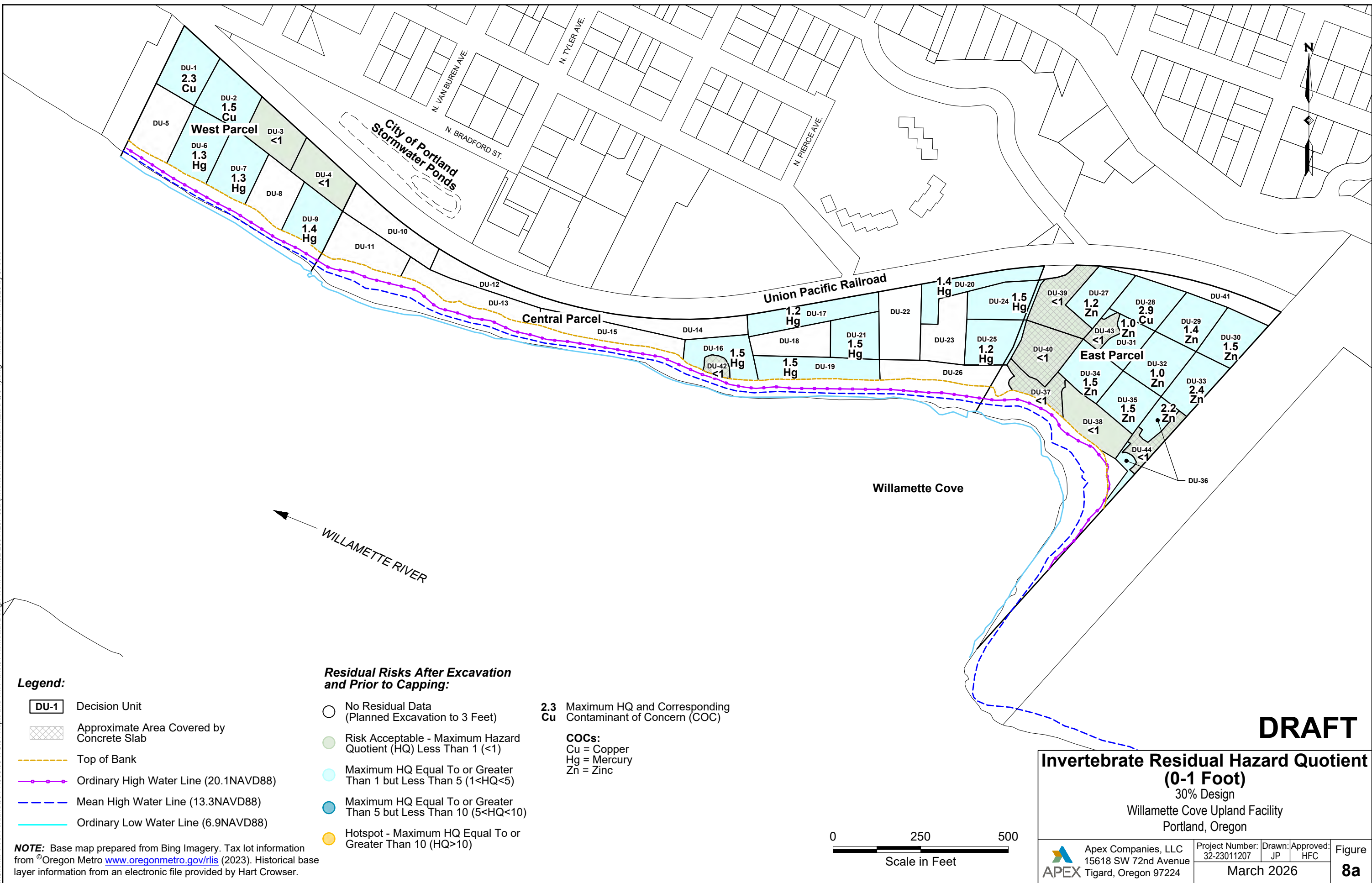
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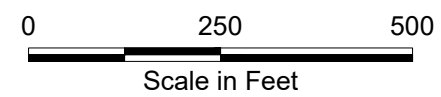
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NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rliis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

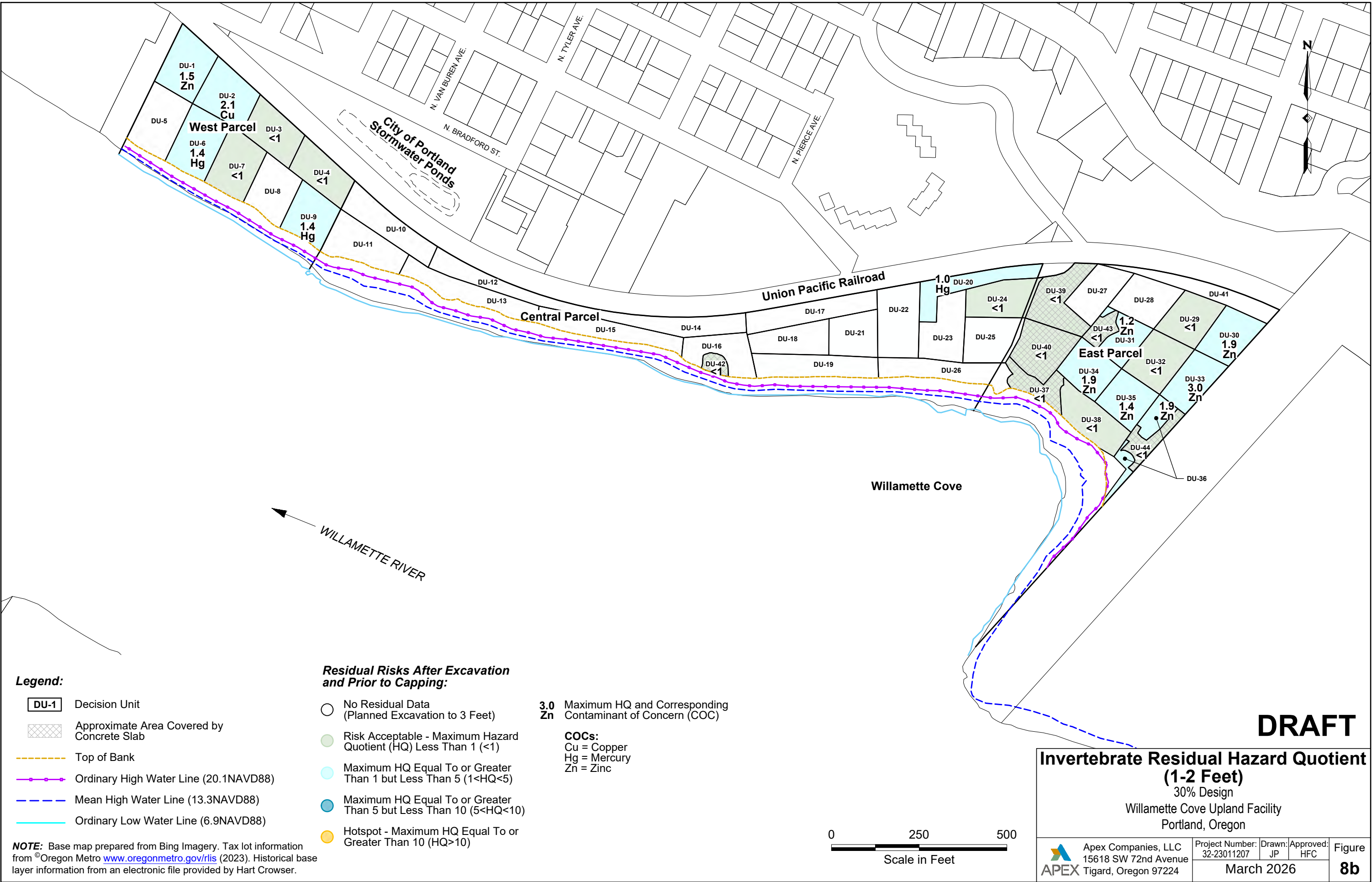


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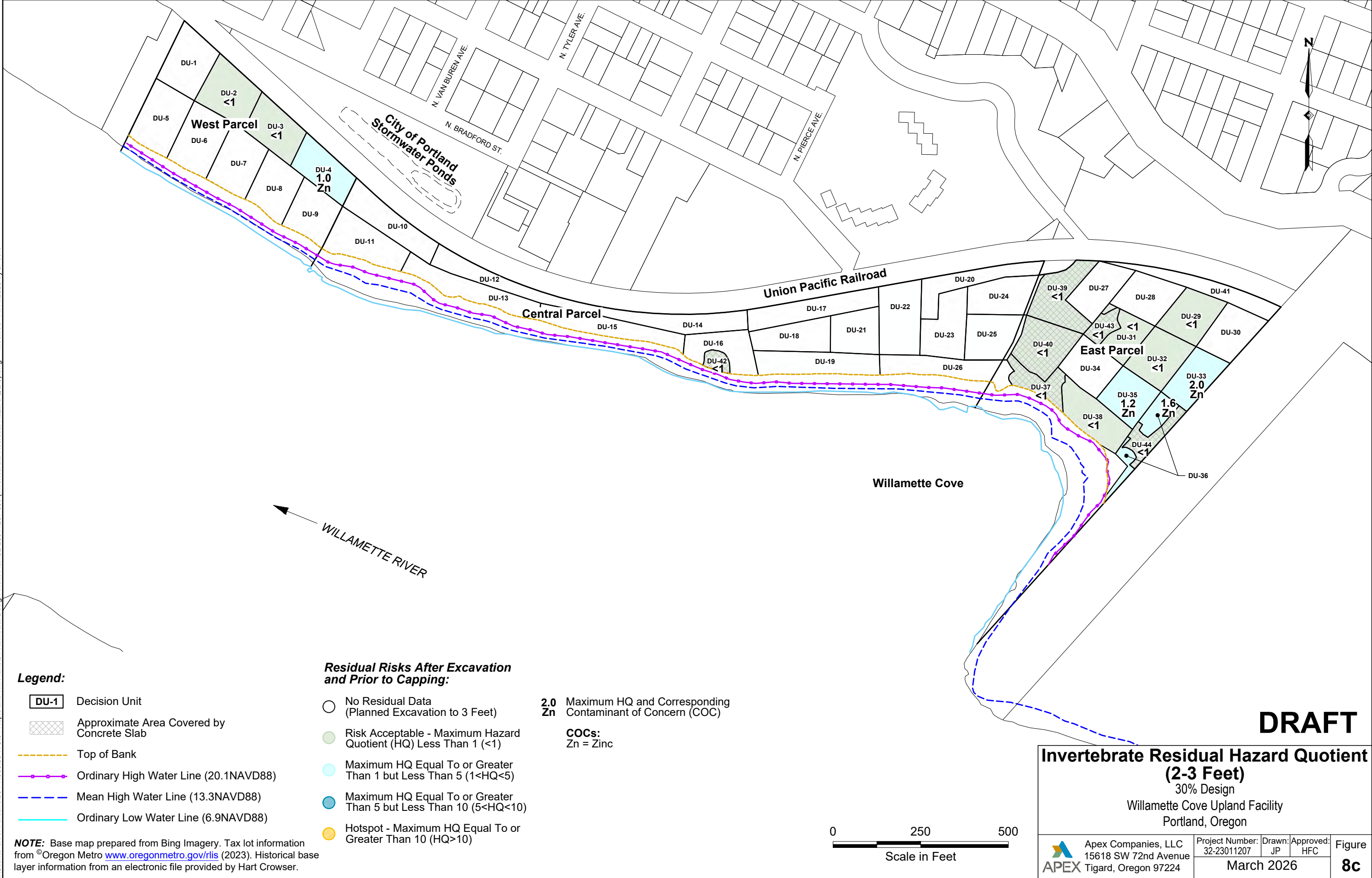
Invertebrate Residual Hazard Quotient (0-1 Foot)
30% Design
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 8a
	March 2026			

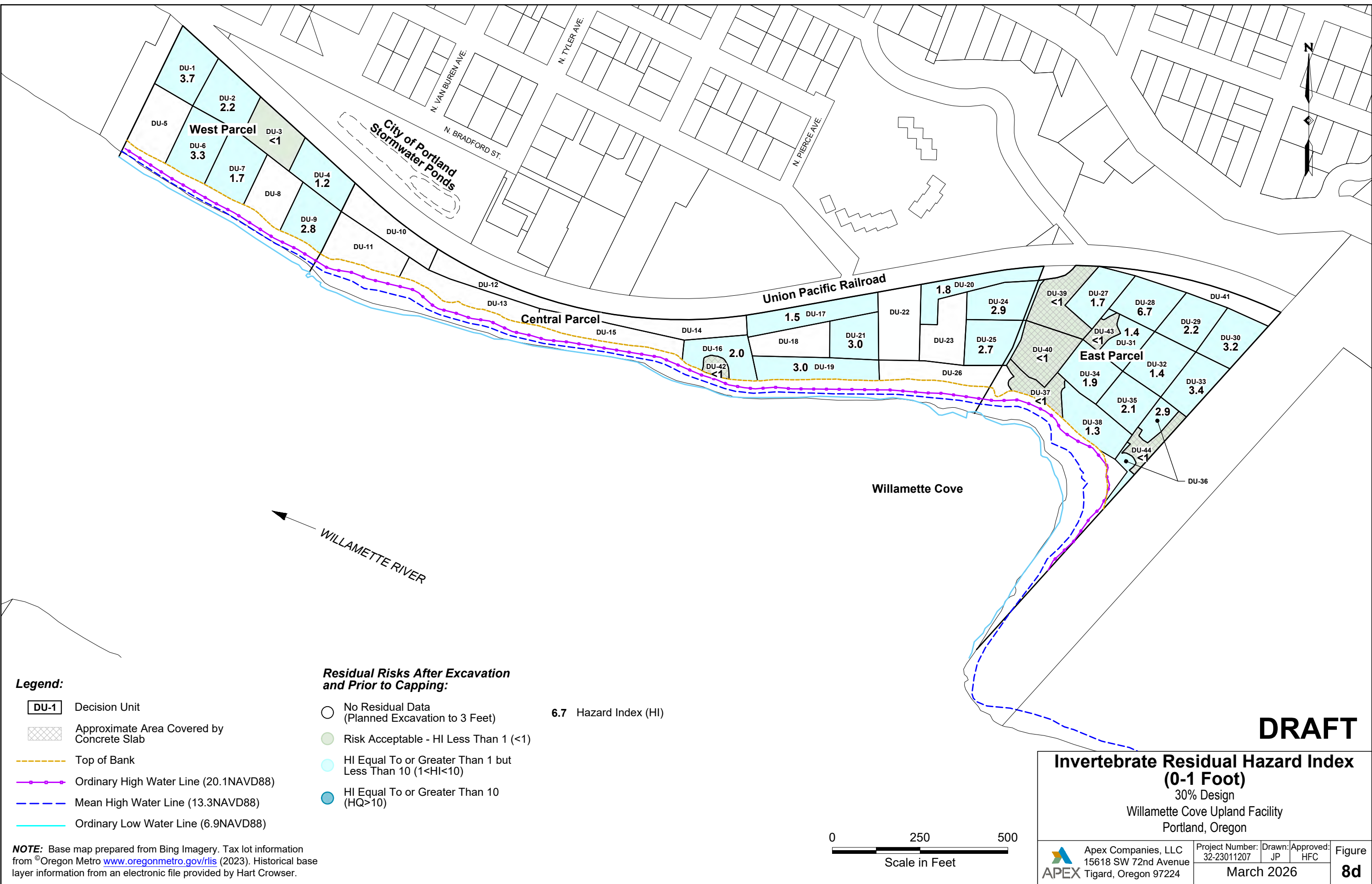
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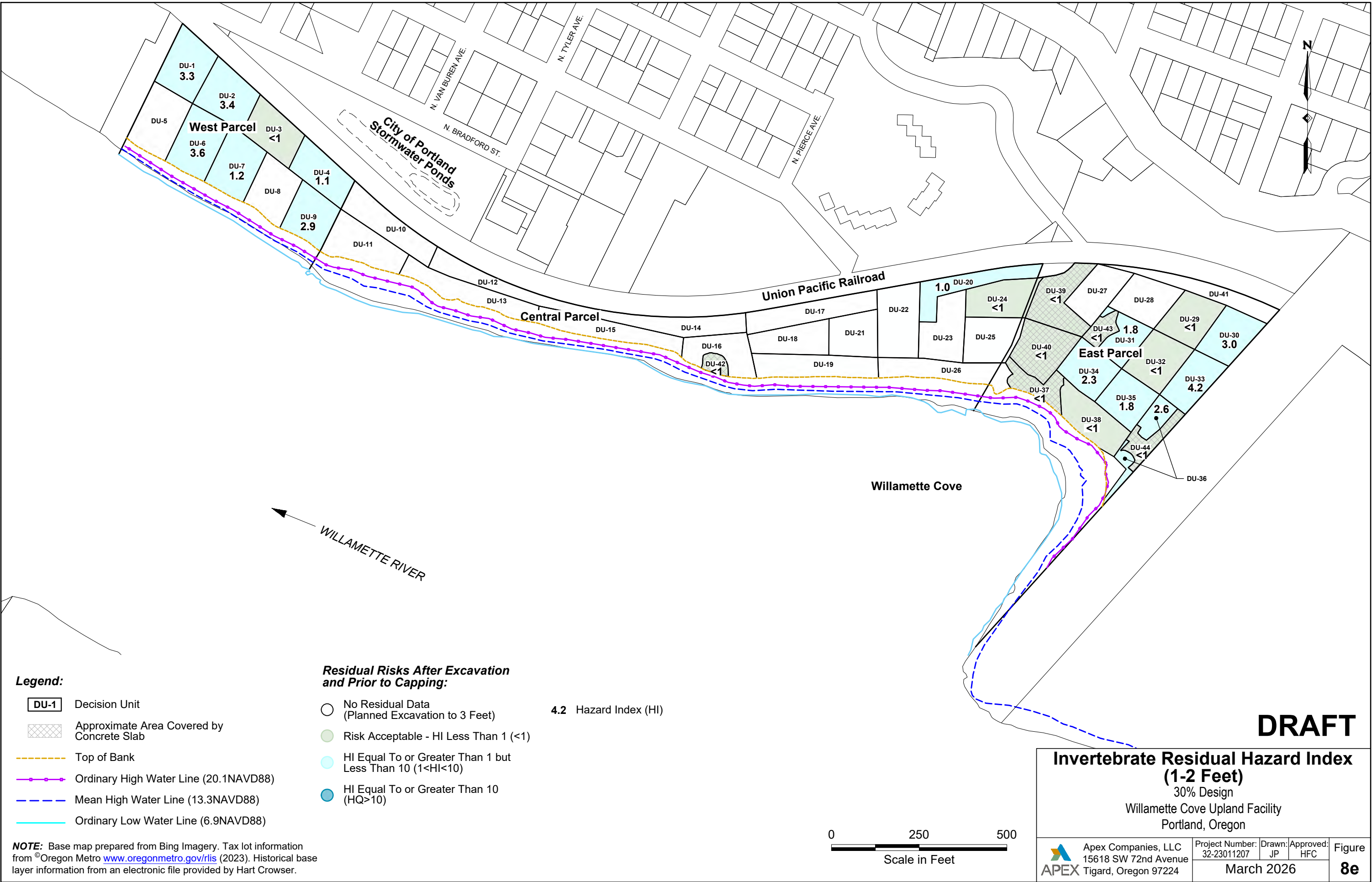
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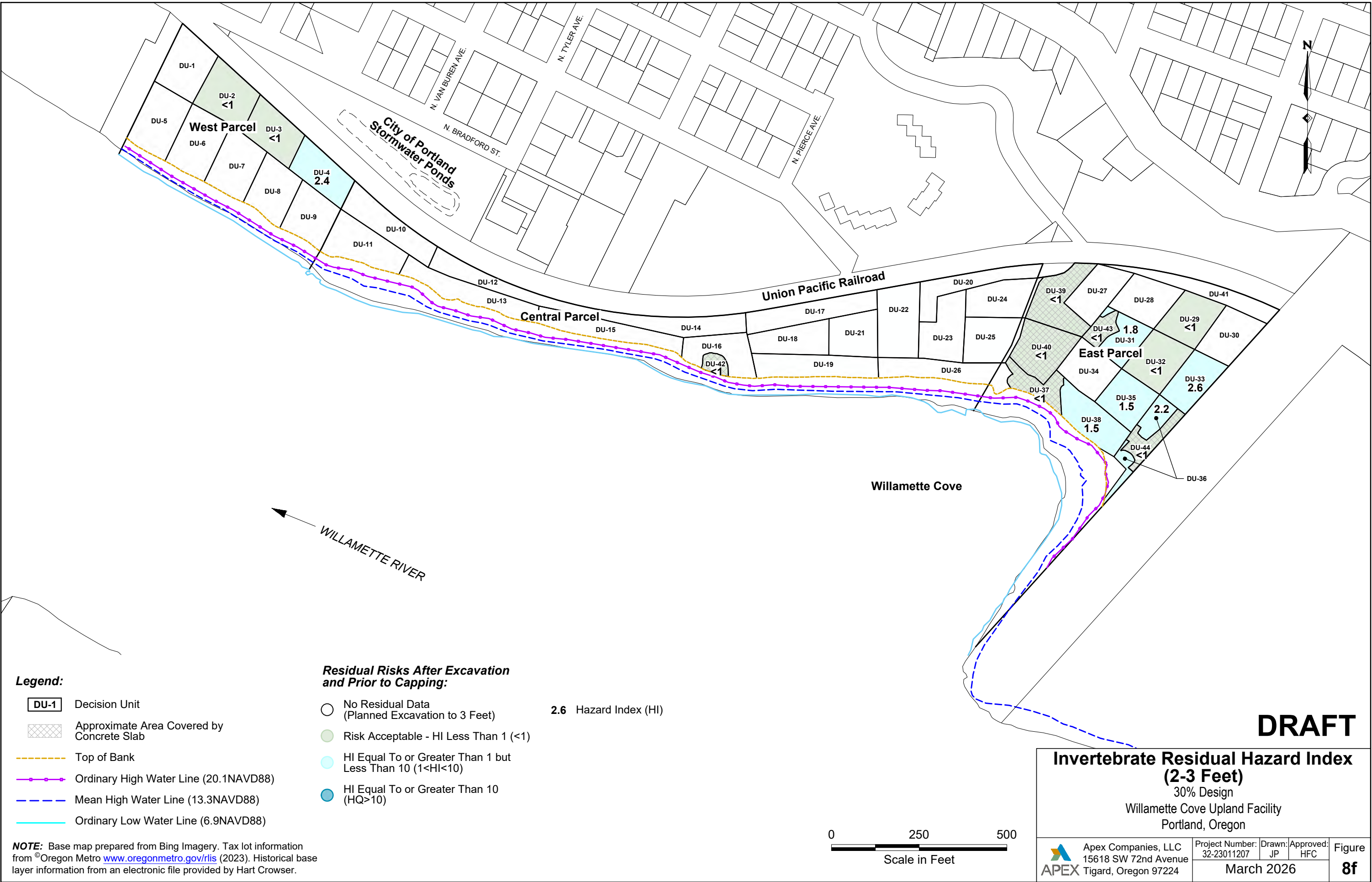
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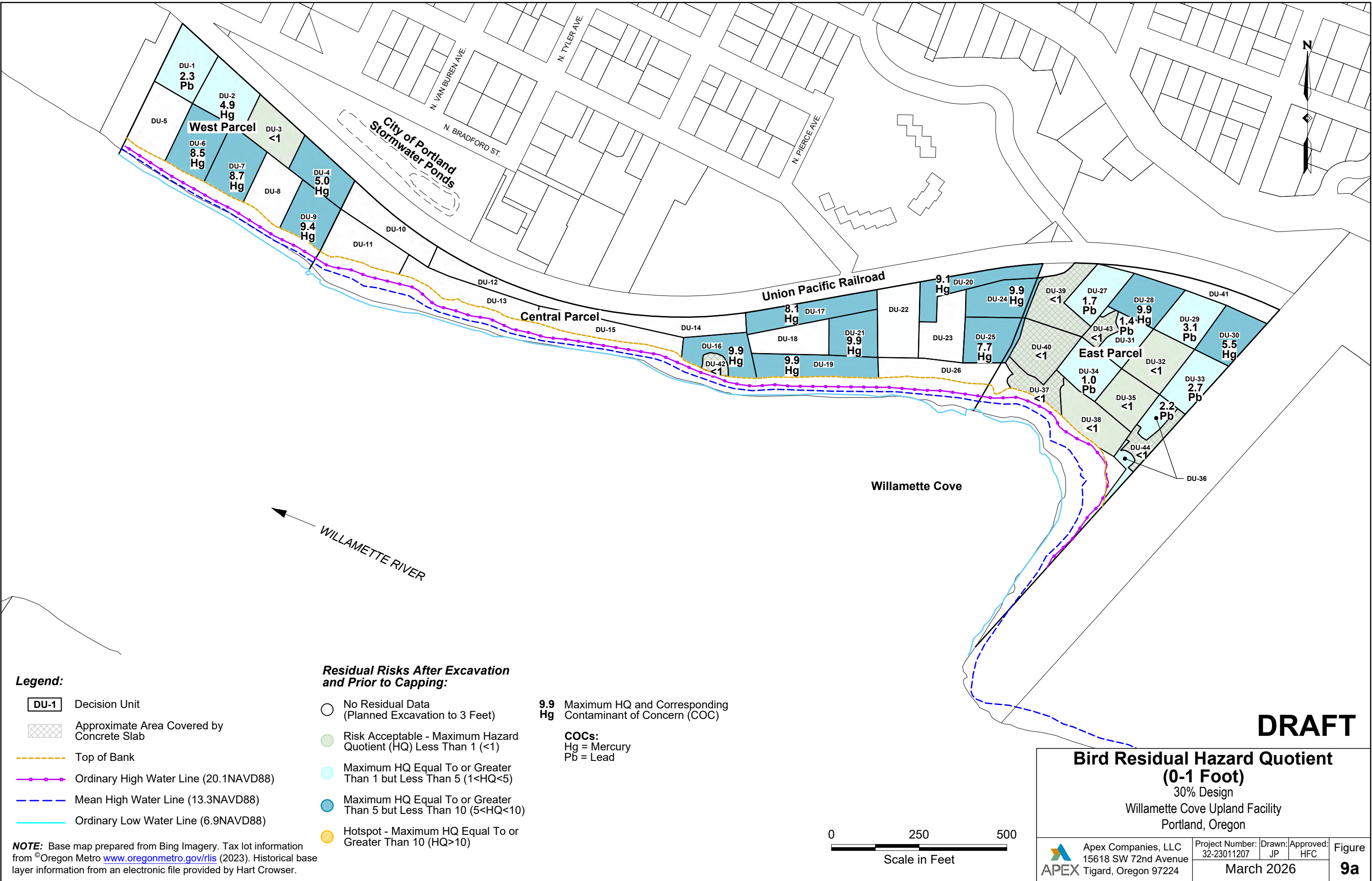
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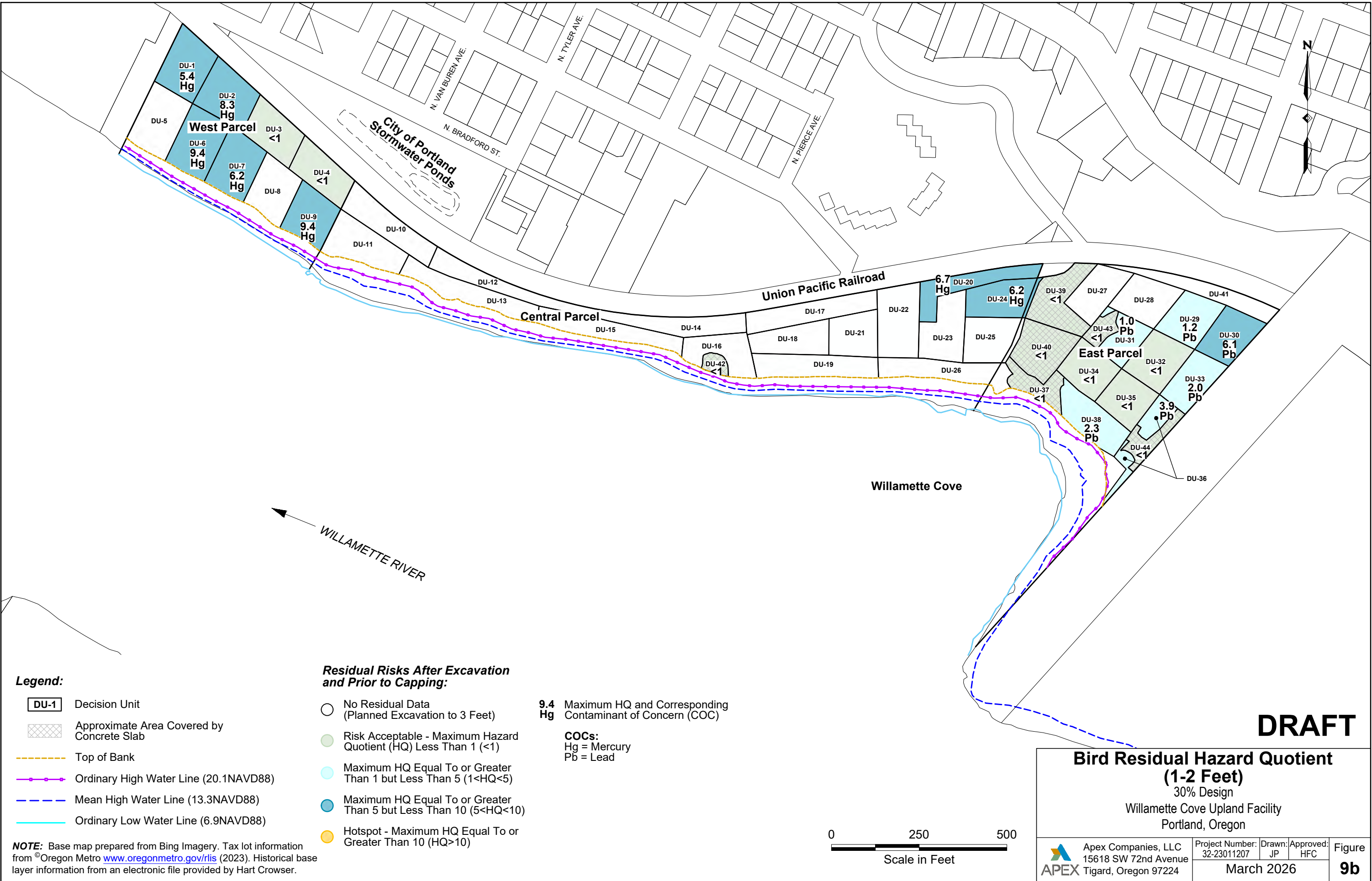
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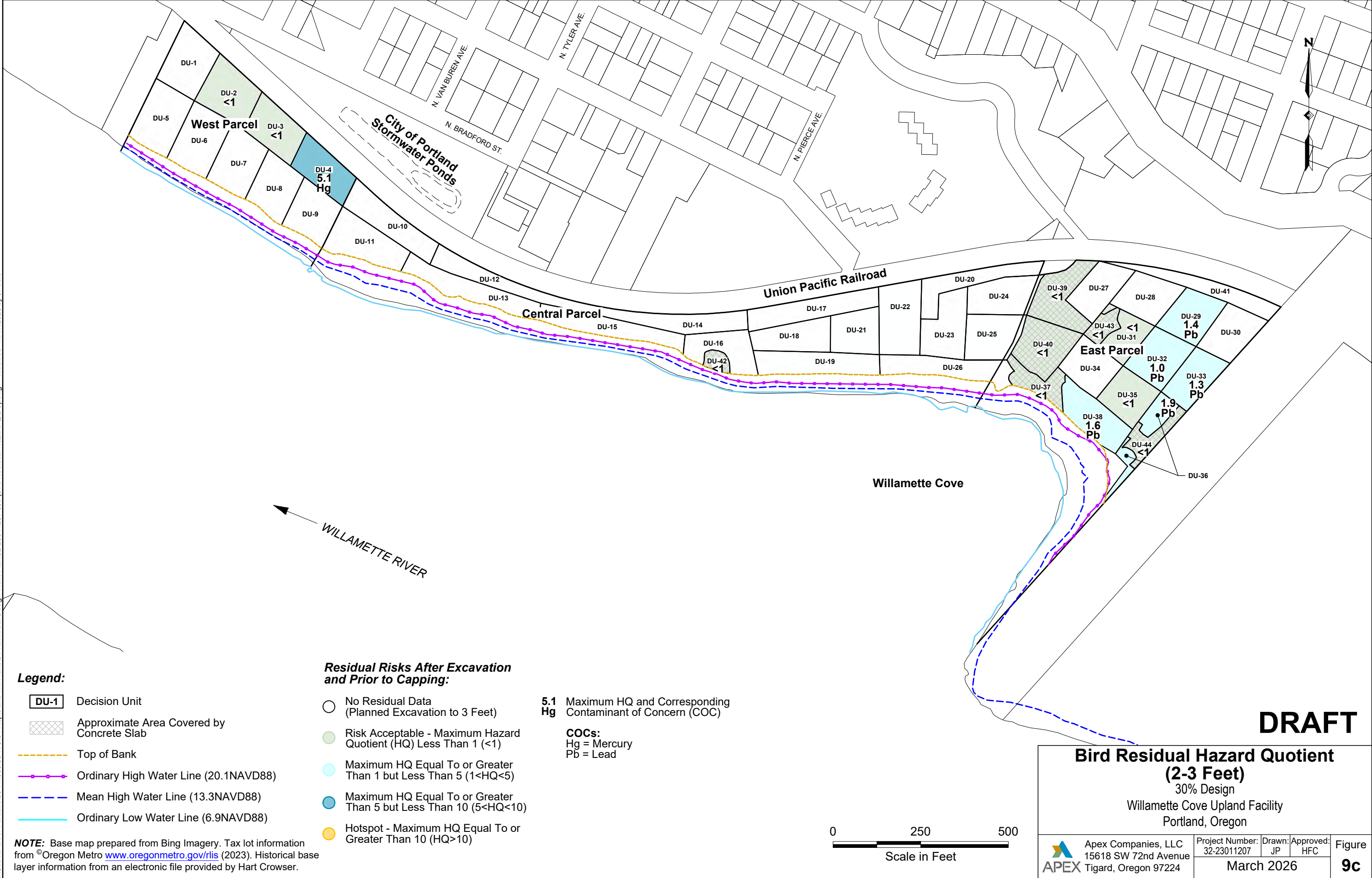
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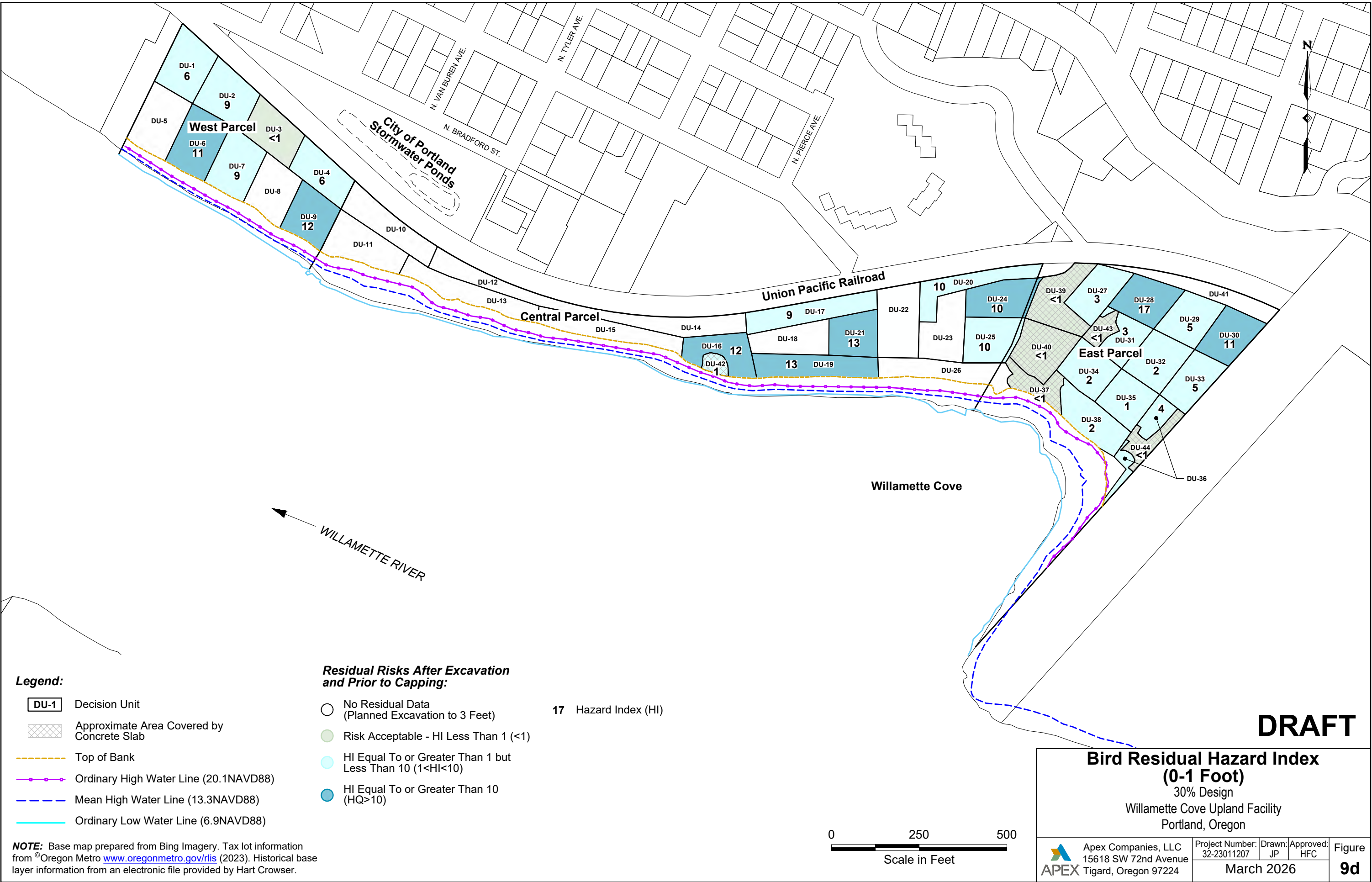
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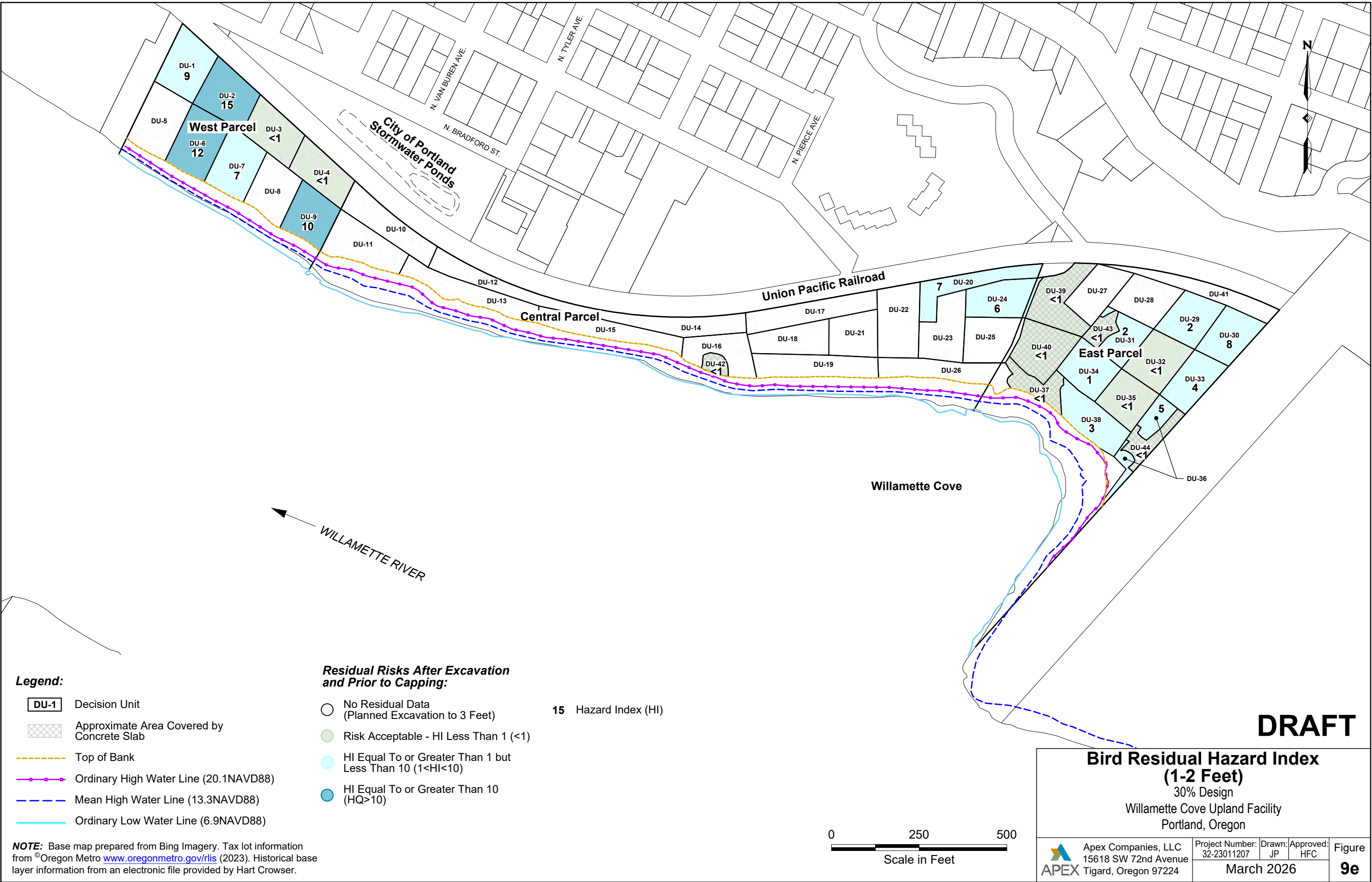
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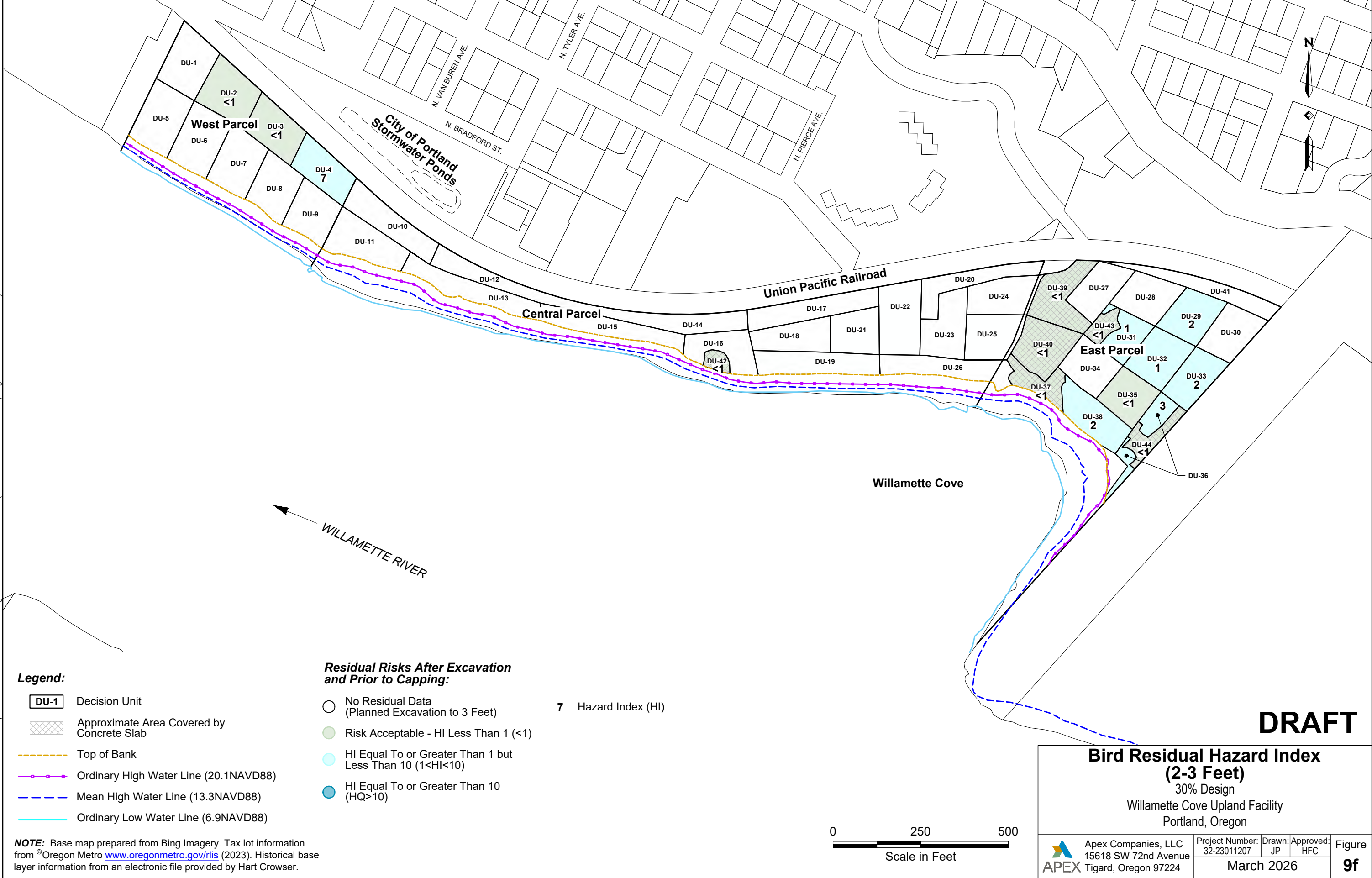
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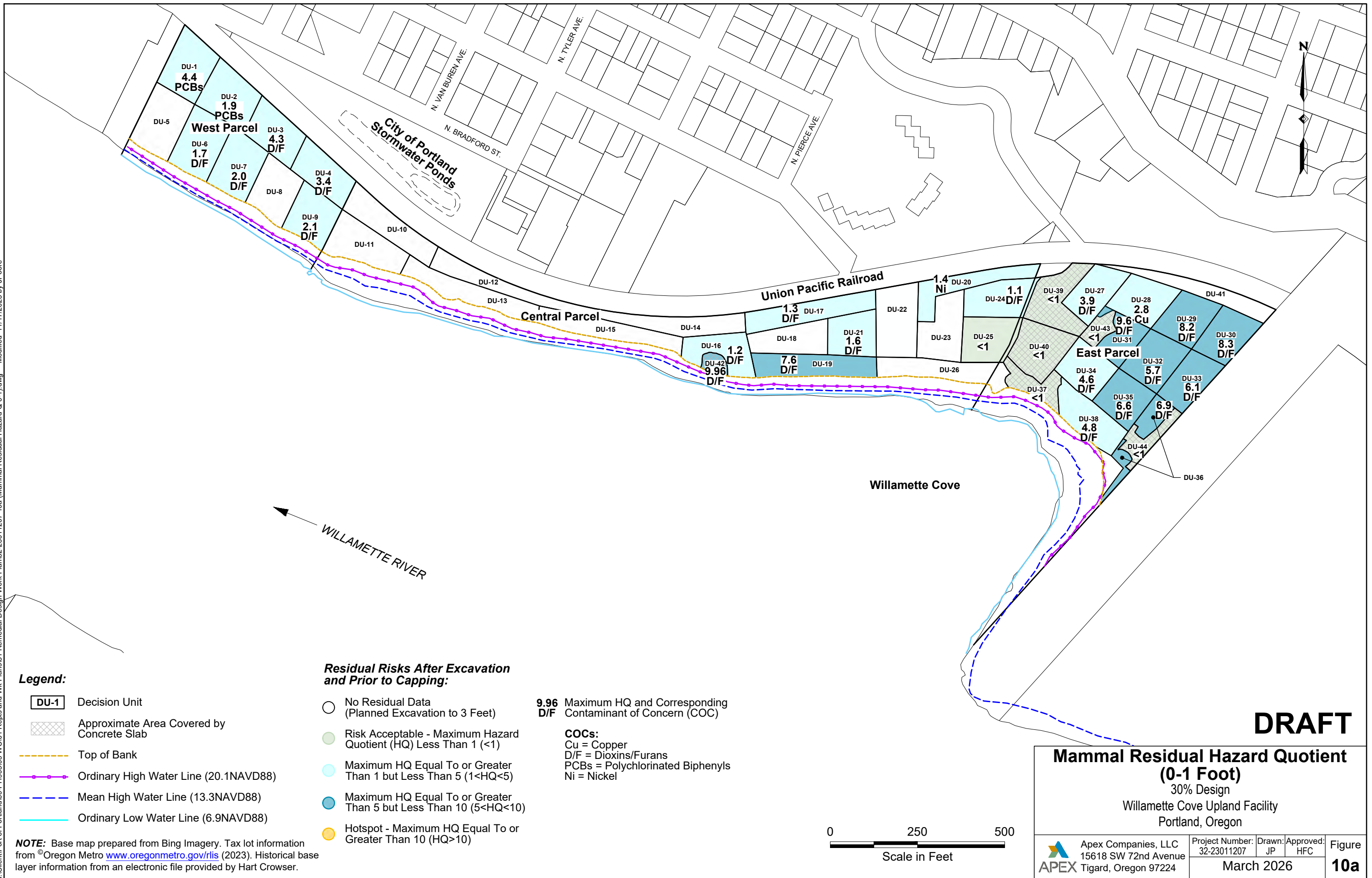
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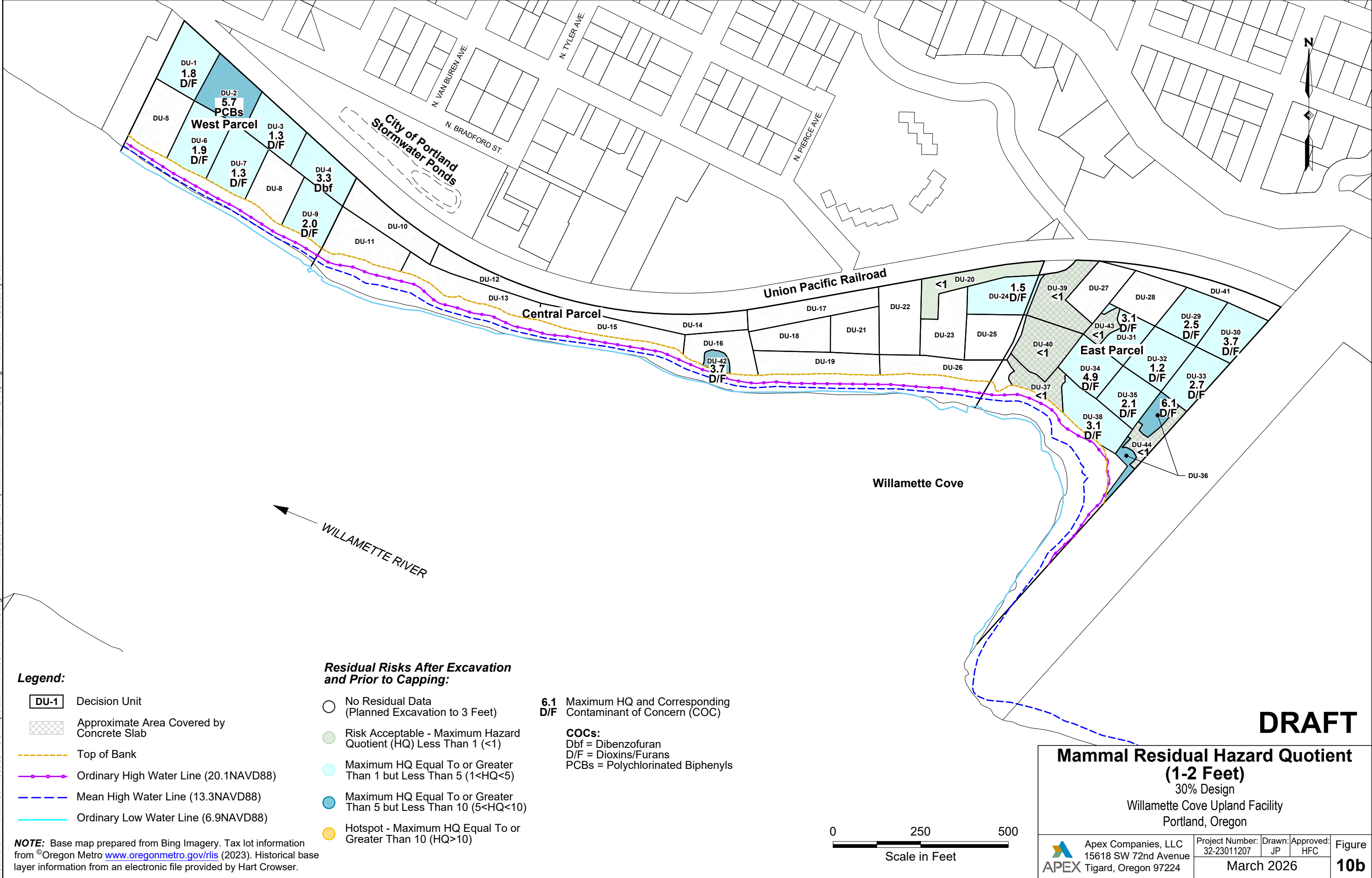
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Legend:

- DU-1 Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

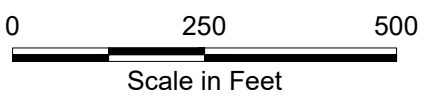
Residual Risks After Excavation and Prior to Capping:

- No Residual Data (Planned Excavation to 3 Feet)
- Risk Acceptable - Maximum Hazard Quotient (HQ) Less Than 1 (<1)
- Maximum HQ Equal To or Greater Than 1 but Less Than 5 (1<HQ<5)
- Maximum HQ Equal To or Greater Than 5 but Less Than 10 (5<HQ<10)
- Hotspot - Maximum HQ Equal To or Greater Than 10 (HQ>10)

6.1 D/F Maximum HQ and Corresponding Contaminant of Concern (COC)

COCs:
Dbf = Dibenzofuran
D/F = Dioxins/Furans
PCBs = Polychlorinated Biphenyls

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rliis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

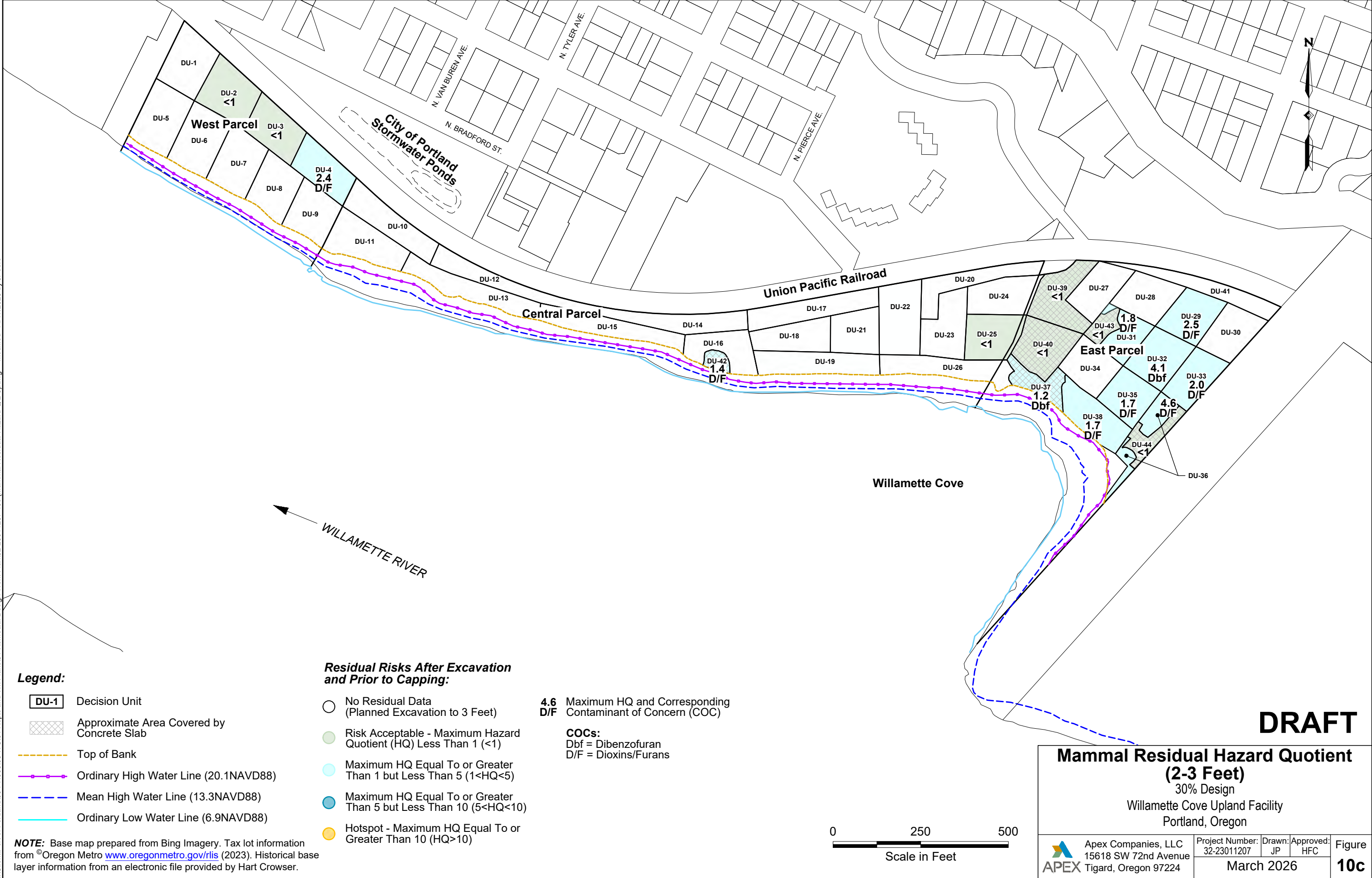


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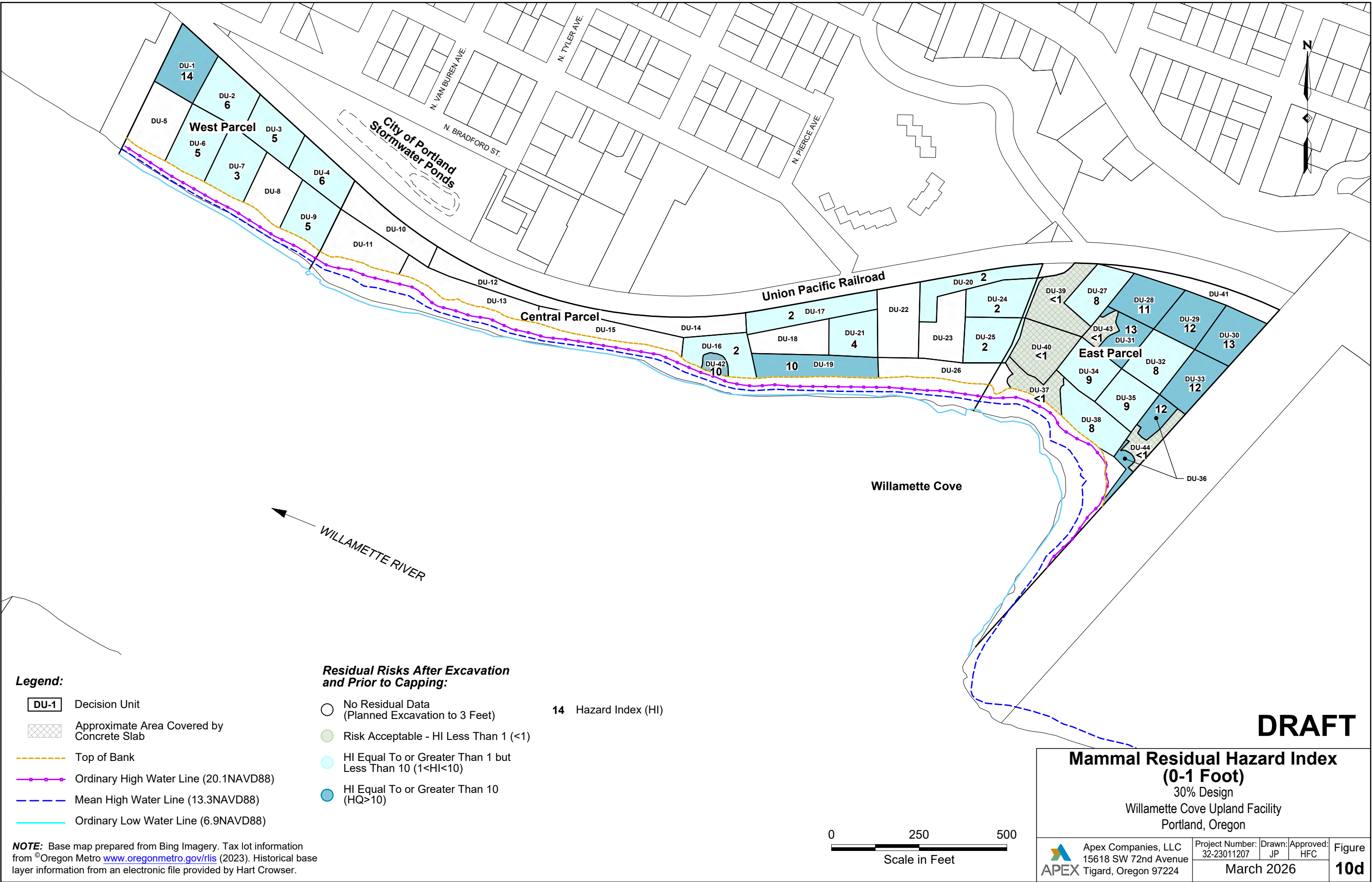
Mammal Residual Hazard Quotient (1-2 Feet)
30% Design
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 10b
	March 2026			

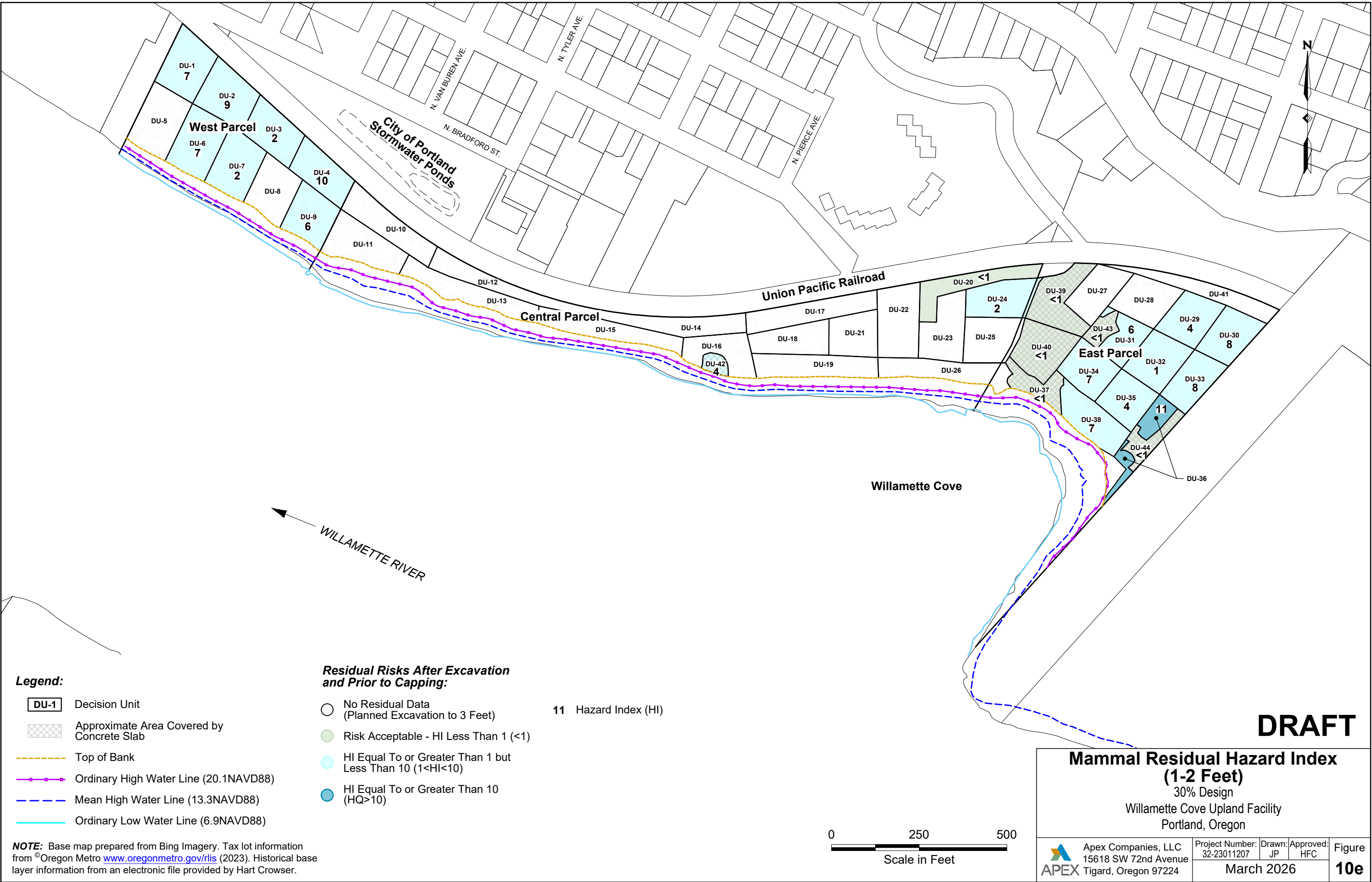
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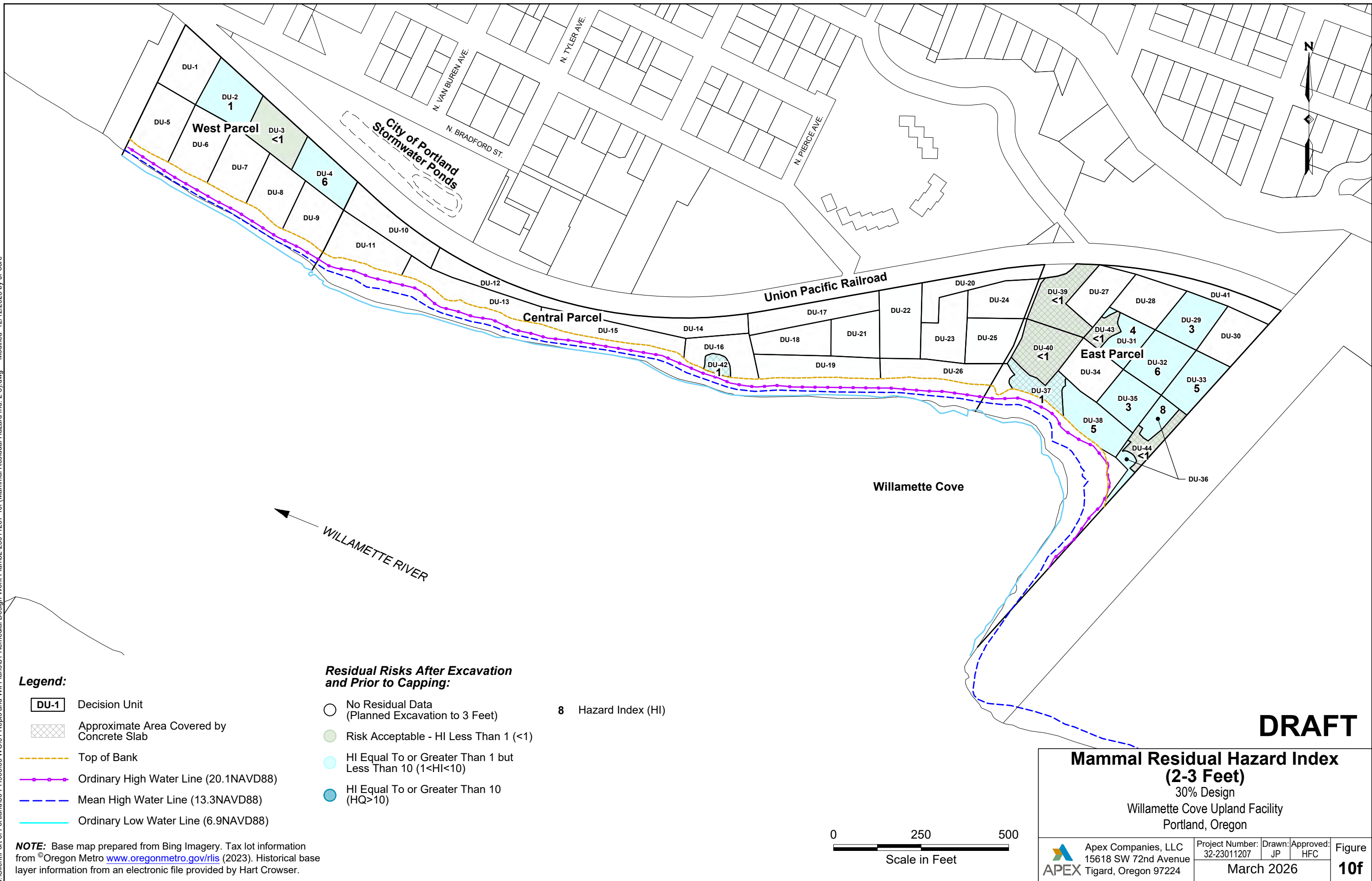
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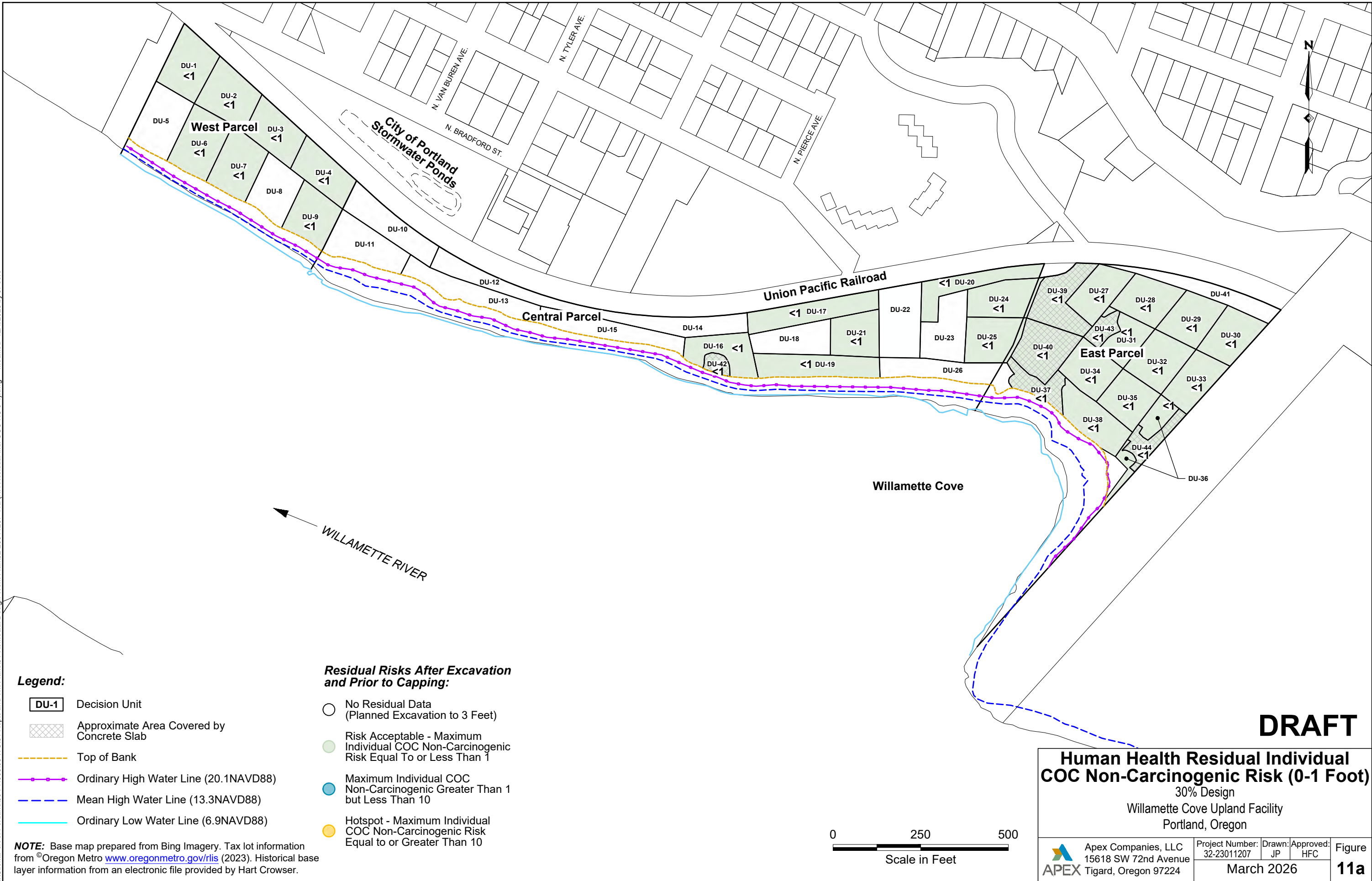
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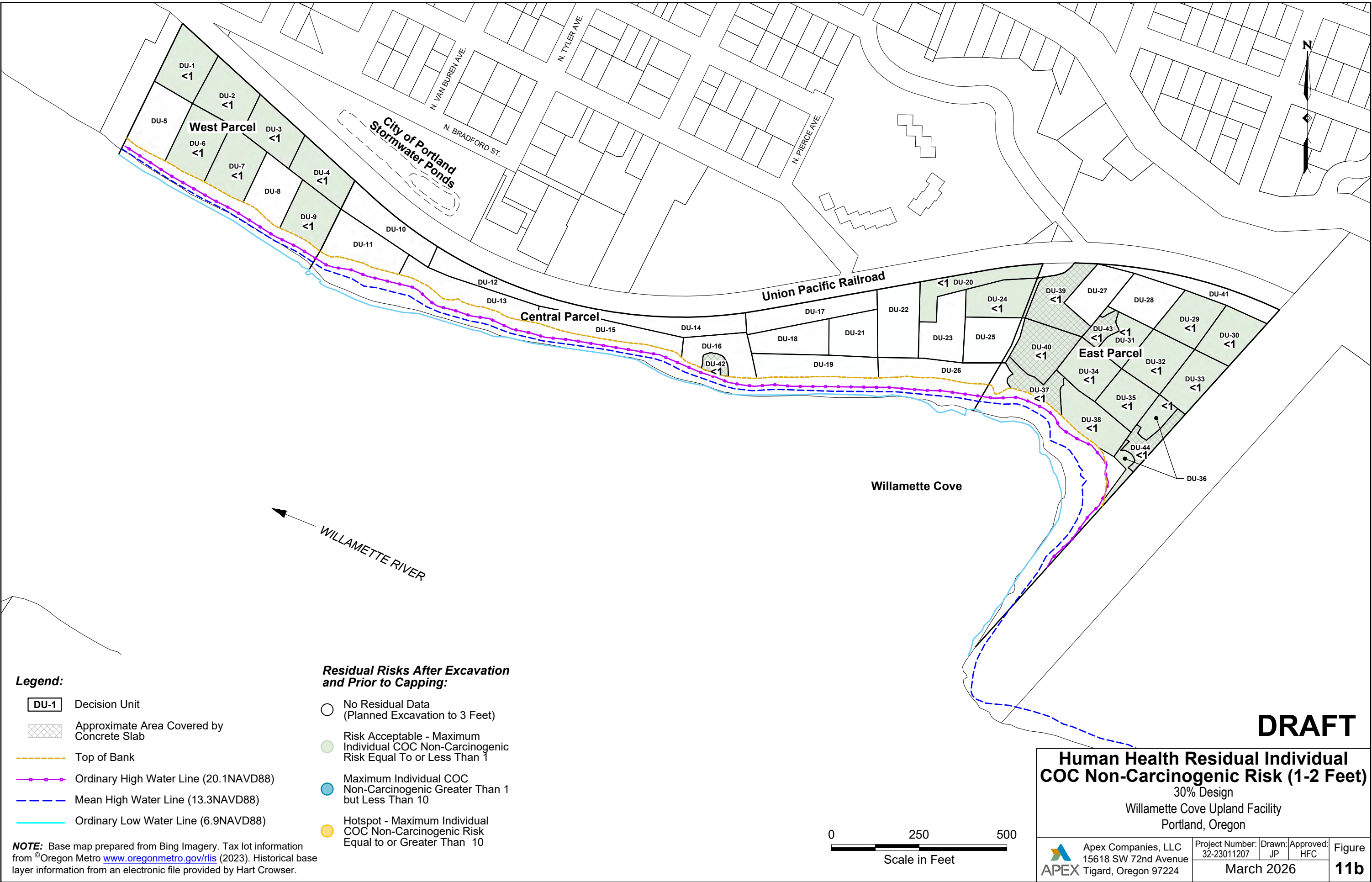
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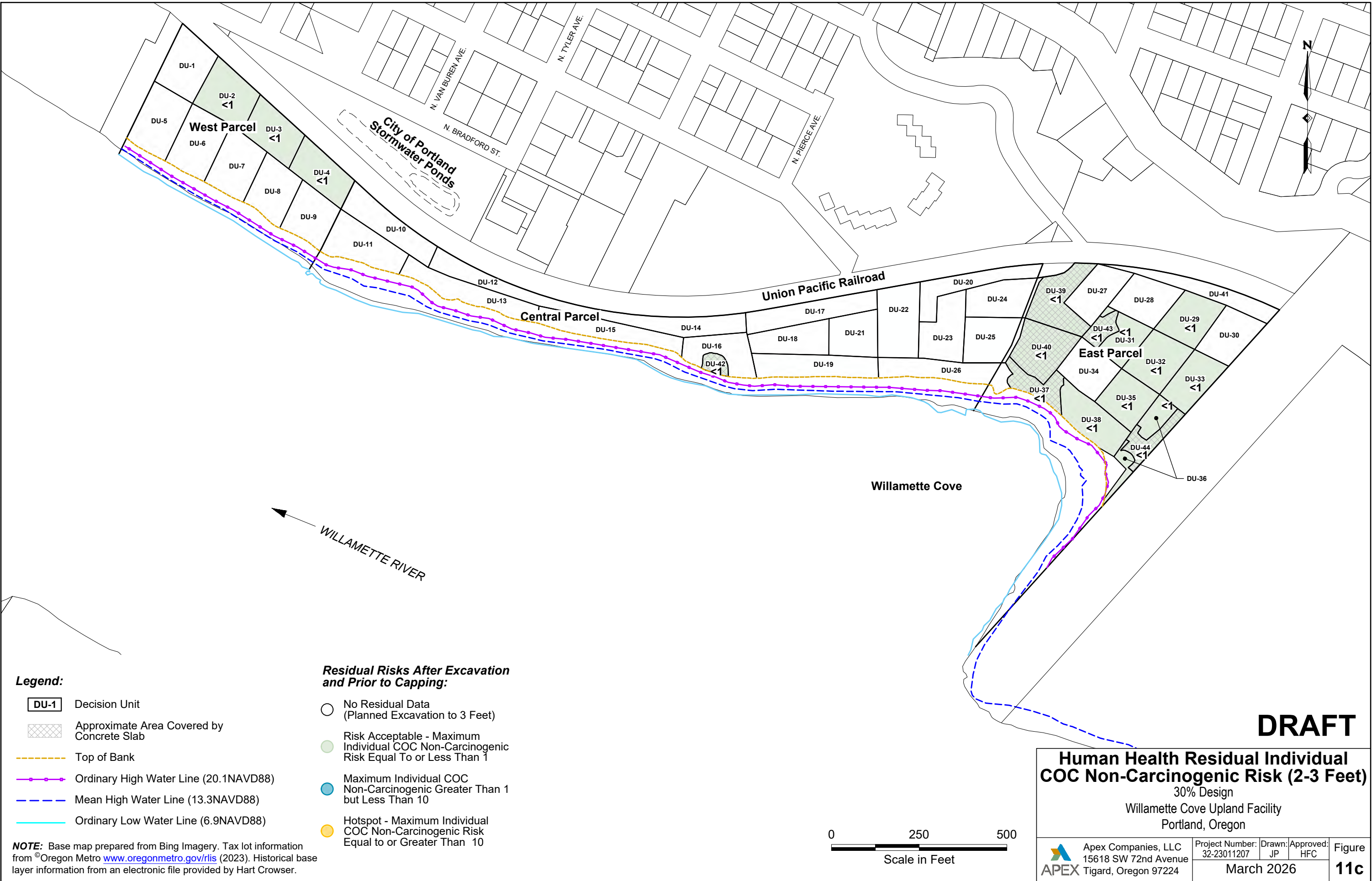
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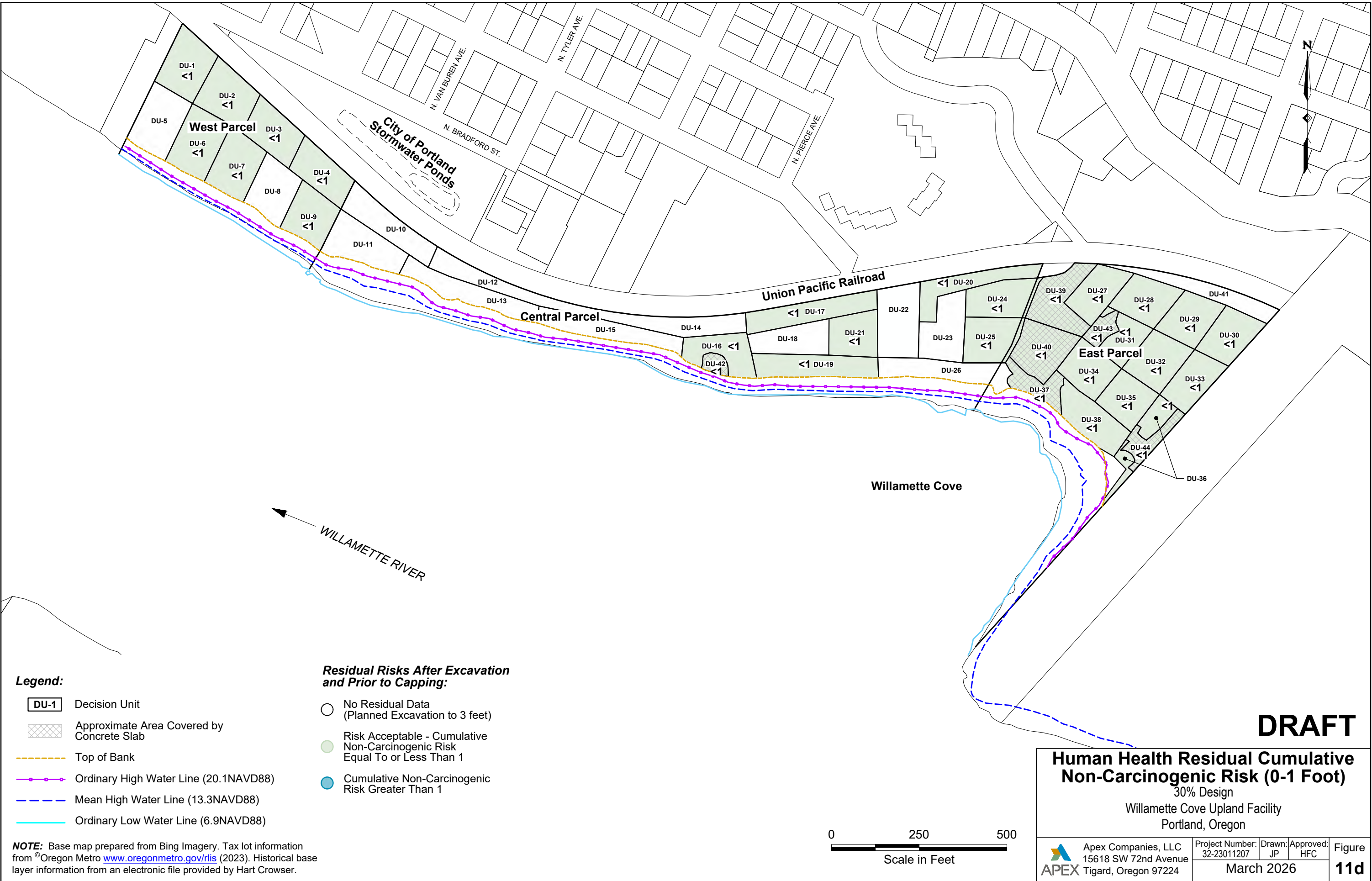
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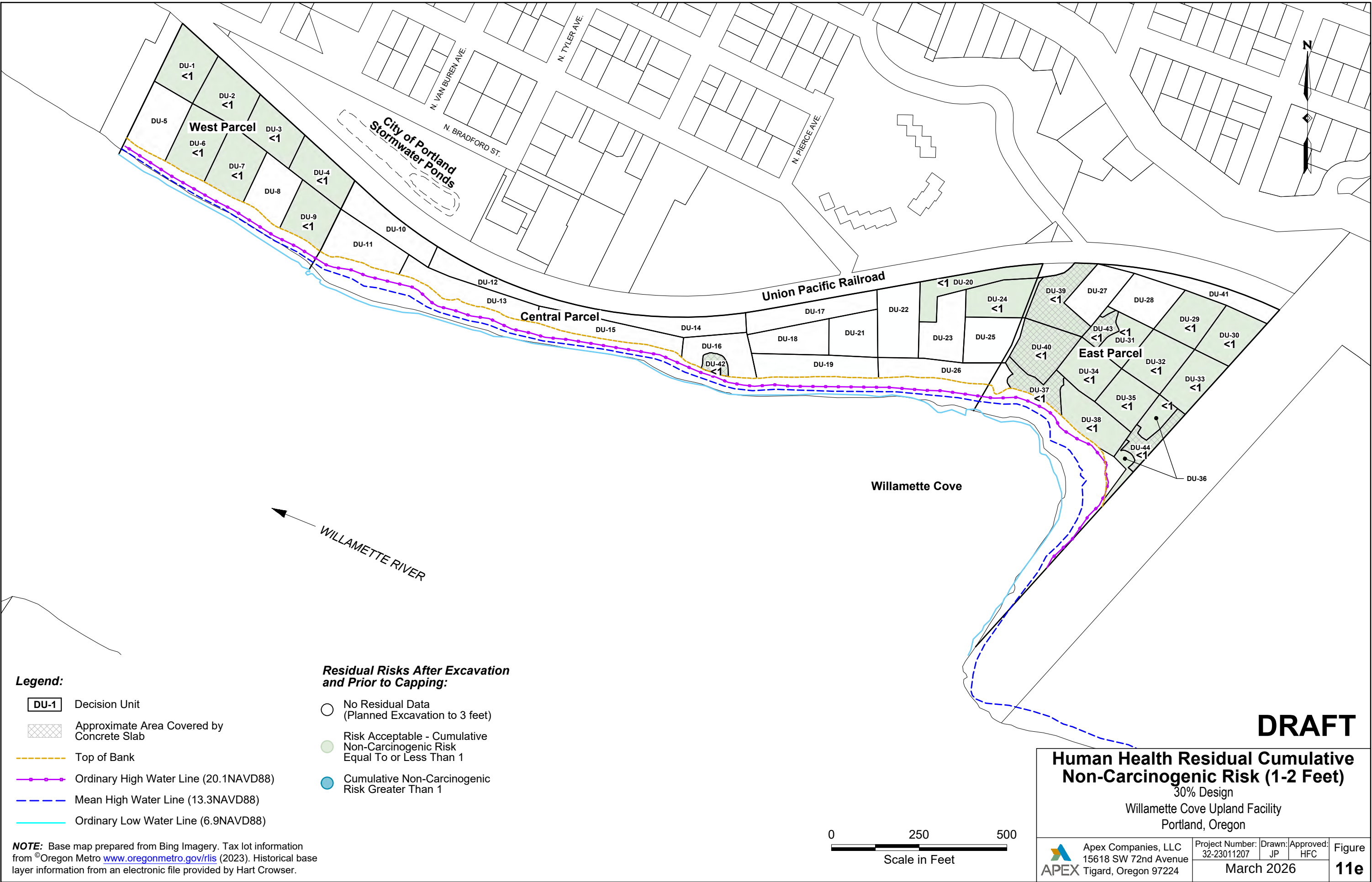
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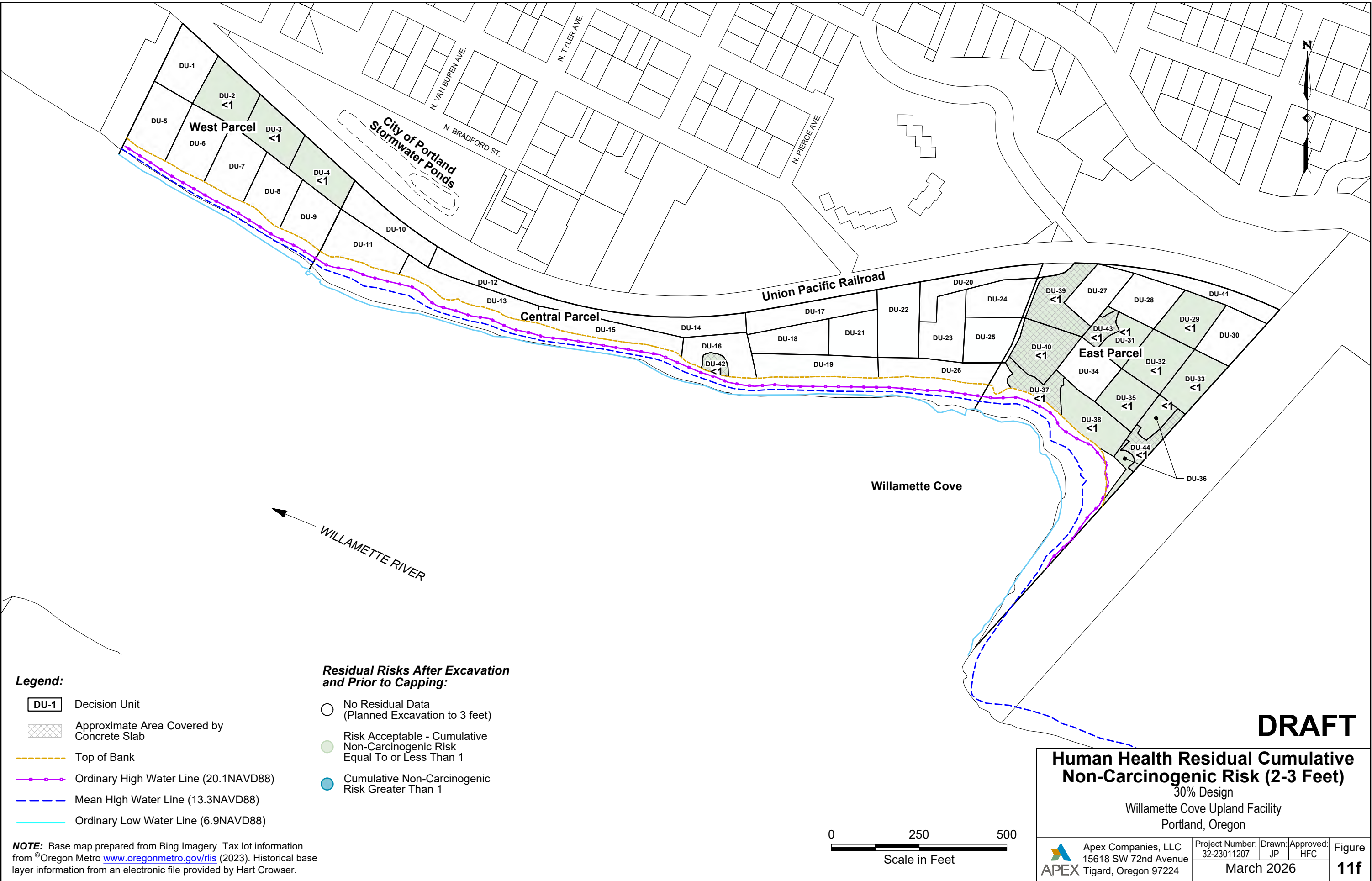
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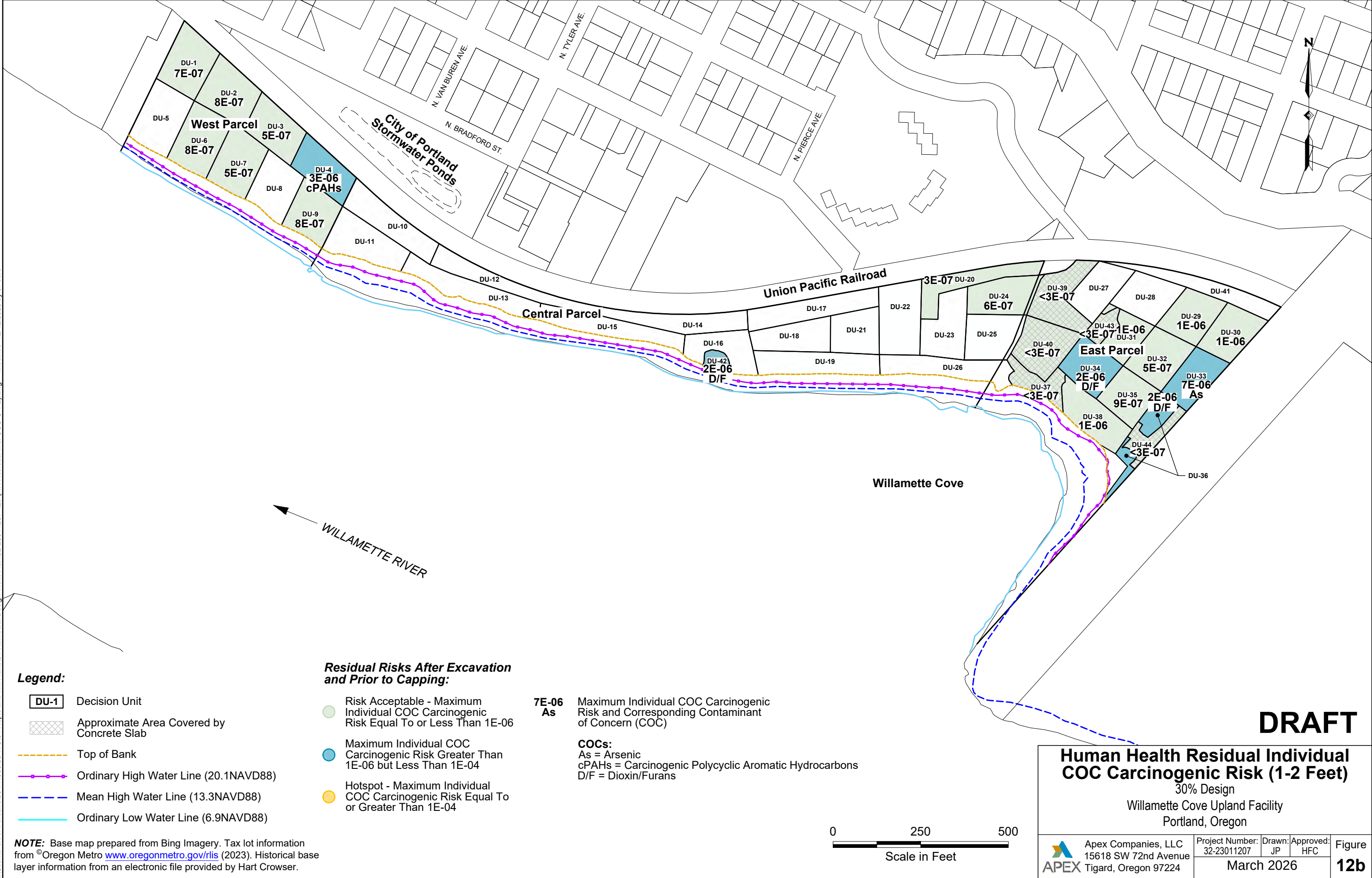
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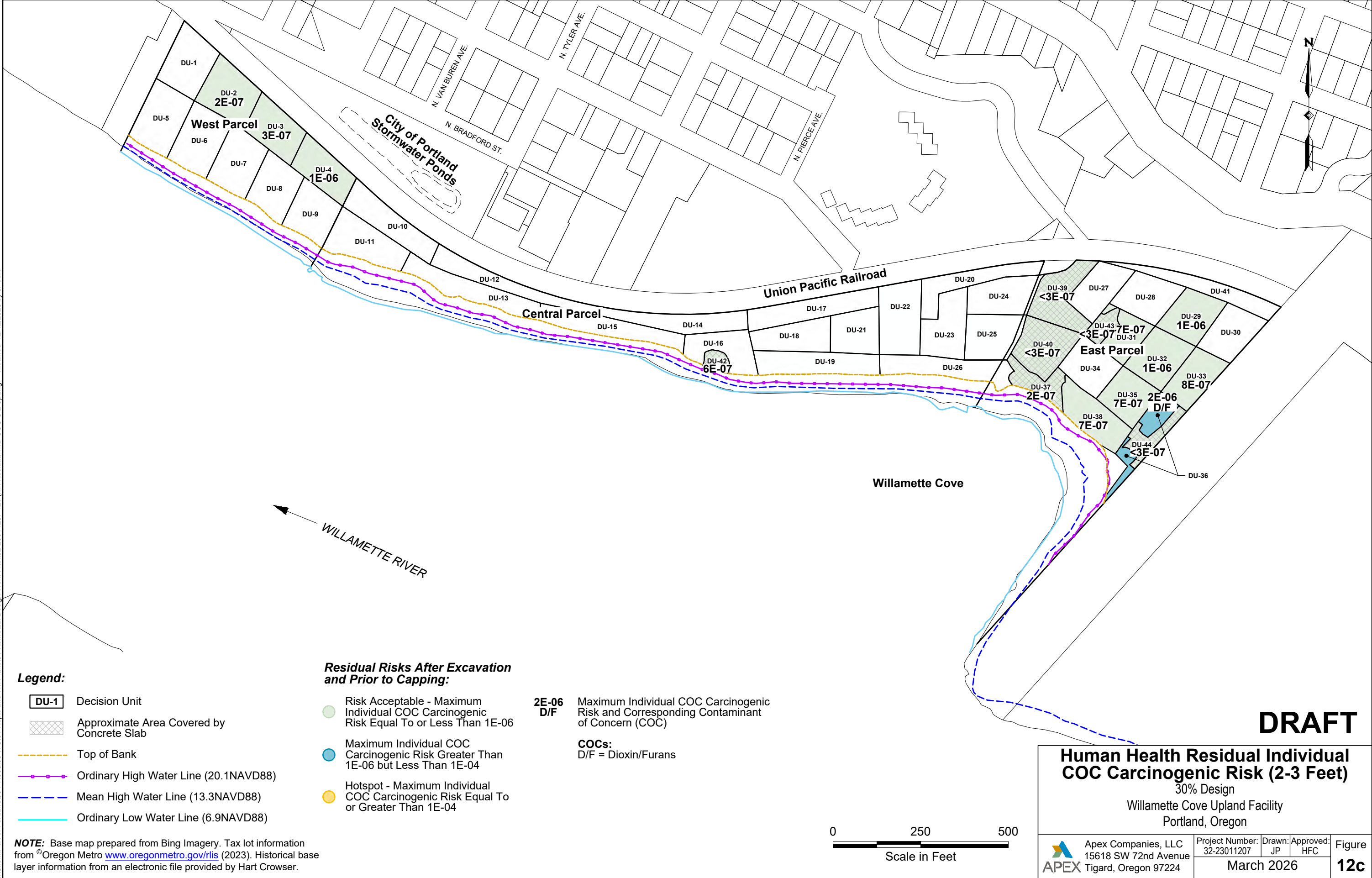


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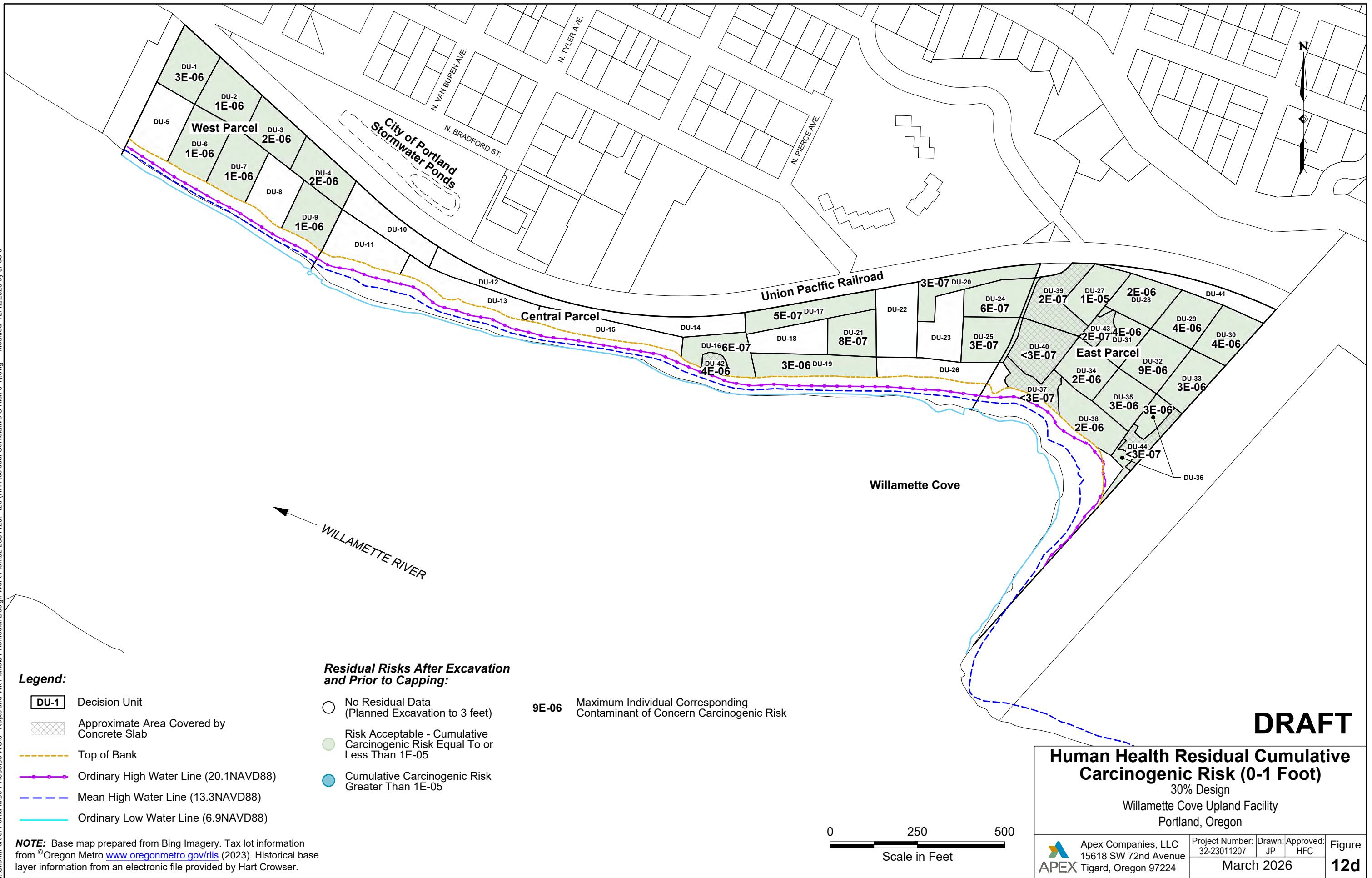


NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rliis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

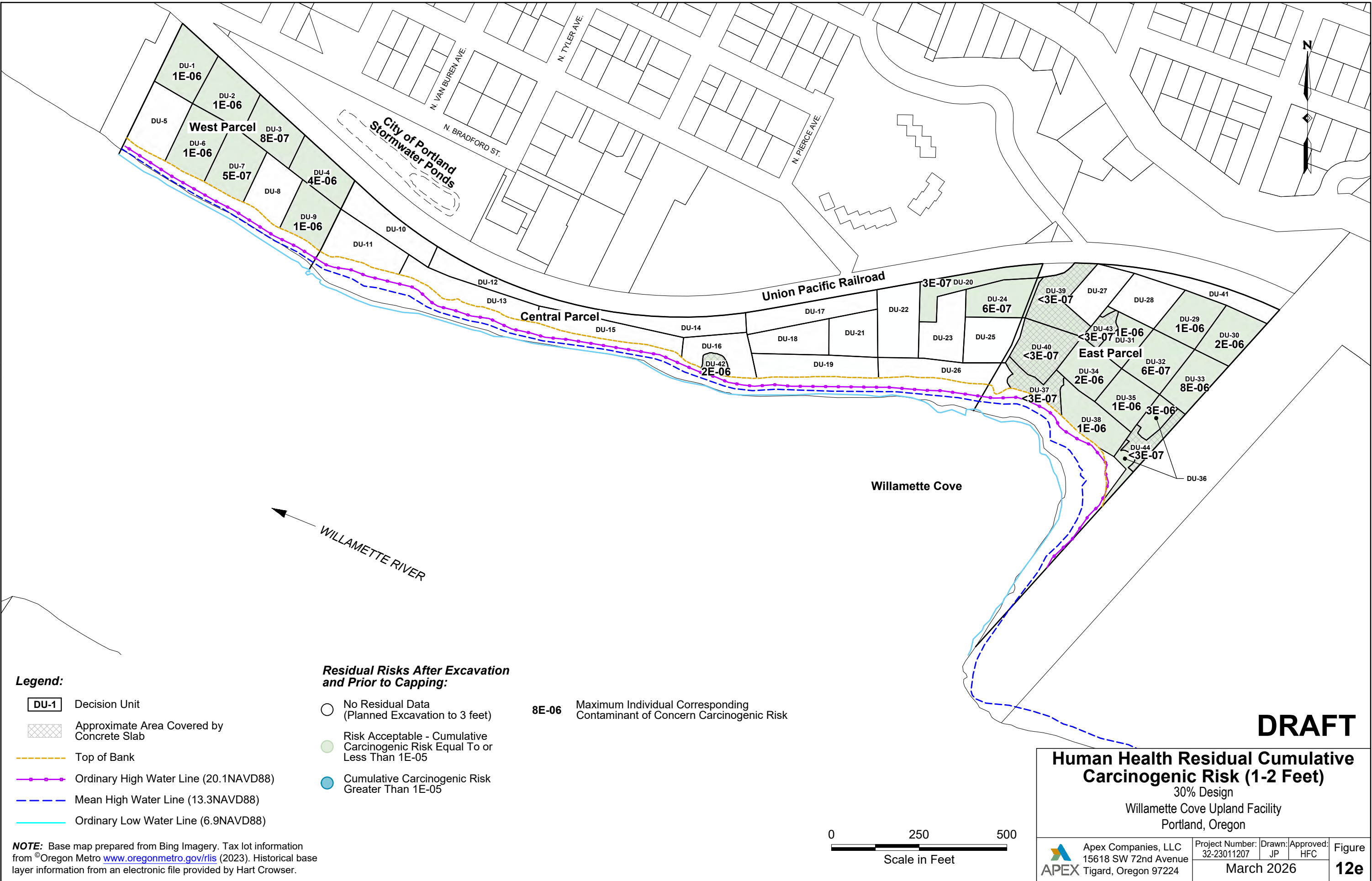
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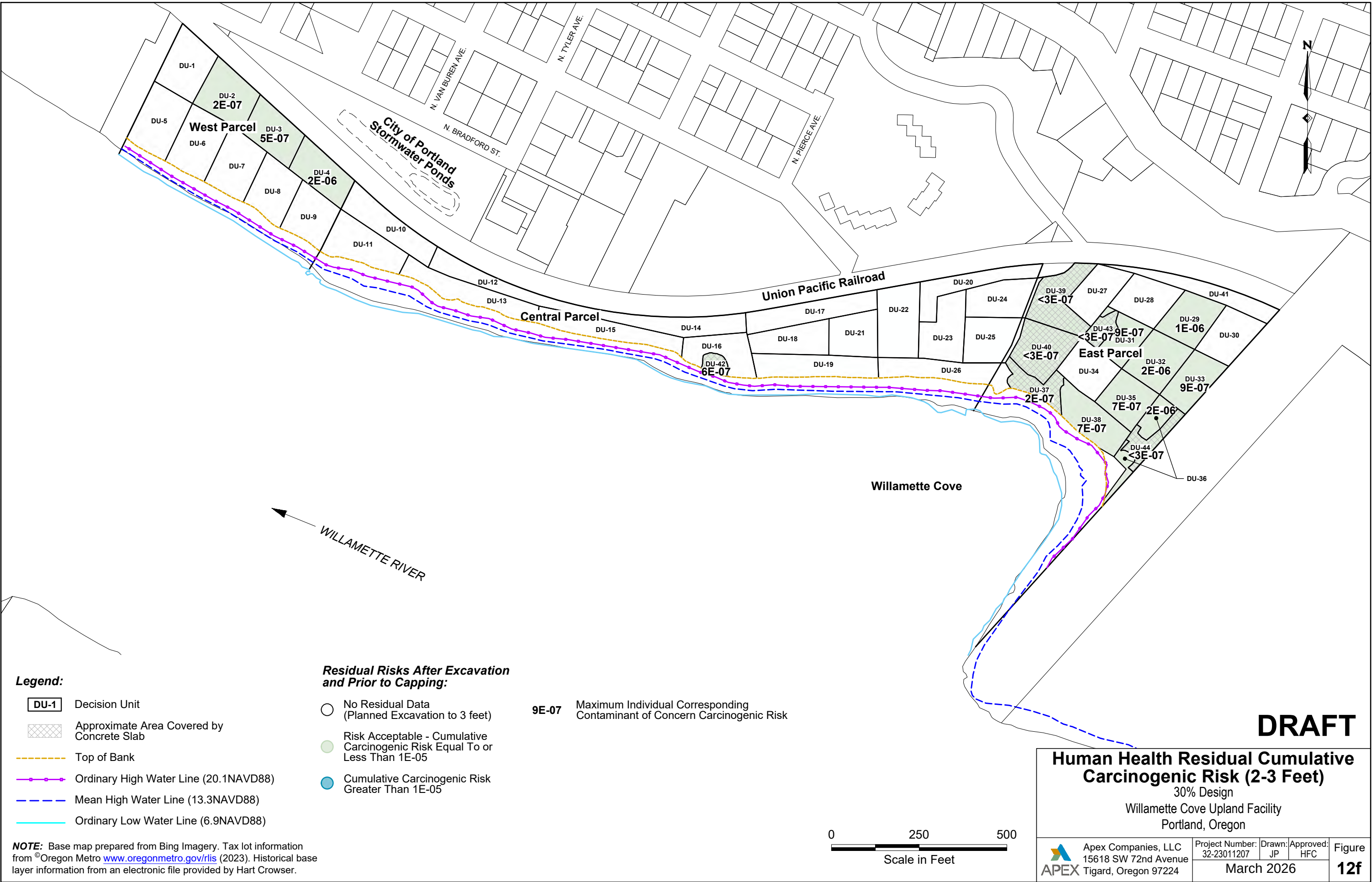
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Appendix B

ProUCL Input and Output Files

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium	D_Chromium
West	Baseline	DU-1	0.801	1	6.24	1	37.4	1
West	Baseline	DU-1	0.712	1	5.41	1	41.3	1
West	Baseline	DU-1	0.529	0	5.79	1	29.5	1
West	Baseline	DU-2	0.603	1	5.41	1	21.5	1
West	Baseline	DU-2	0.515	0	5.36	1	22	1
West	Baseline	DU-2	0.495	0	5.21	1	15.5	1
West	Baseline	DU-3	0.547	0	6.87	1	16.2	1
West	Baseline	DU-3	0.497	0	6.65	1	16.5	1
West	Baseline	DU-3	0.536	0	6.65	1	15.7	1
West	Baseline	DU-4	0.565	0	6.57	1	16.3	1
West	Baseline	DU-4	0.515	0	6.87	1	16.3	1
West	Baseline	DU-4	0.502	0	7.63	1	18.4	1
West	Baseline	DU-5	0.992	1	8.98	1	52.3	1
West	Baseline	DU-5	0.832	1	8.09	1	42.9	1
West	Baseline	DU-5	0.596	1	6.73	1	47.1	1
West	Baseline	DU-6	0.539	0	4.93	1	22.1	1
West	Baseline	DU-6	0.56	0	4.89	1	25.2	1
West	Baseline	DU-6	0.526	0	4.67	1	23.2	1
West	Baseline	DU-7	0.537	0	4.37	1	19.2	1
West	Baseline	DU-7	0.547	0	3.98	1	18.6	1
West	Baseline	DU-7	0.536	0	3.07	1	16.2	1
West	Baseline	DU-8	0.56	0	4.33	1	21.7	1
West	Baseline	DU-8	0.501	0	4.13	1	24.6	1
West	Baseline	DU-8	0.545	0	4.13	1	21.9	1
West	Baseline	DU-9	0.623	1	5.25	1	30.6	1
West	Baseline	DU-9	0.555	0	4.81	1	27.8	1
West	Baseline	DU-9	0.512	0	5.12	1	31	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium	D_Chromium
Central	Baseline	DU-10	0.541	0	4.5	1	14.8	1
Central	Baseline	DU-10	0.531	1	5.56	1	15.3	1
Central	Baseline	DU-10	0.514	1	5.16	1	14.5	1
Central	Baseline	DU-11	0.545	0	4.6	1	23.6	1
Central	Baseline	DU-11	0.535	0	4.15	1	22	1
Central	Baseline	DU-11	0.526	0	4.23	1	22	1
Central	Baseline	DU-12	0.83	1	4.95	1	14.8	1
Central	Baseline	DU-12	0.493	0	4.26	1	14	1
Central	Baseline	DU-12	0.551	0	3.62	1	13.7	1
Central	Baseline	DU-13	0.923	1	6.04	1	14.2	1
Central	Baseline	DU-13	0.54	0	4.79	1	13.8	1
Central	Baseline	DU-13	0.562	0	4.04	1	12.6	1
Central	Baseline	DU-14	2.81	1	6.14	1	22.9	1
Central	Baseline	DU-14	7.38	1	6.87	1	21.6	1
Central	Baseline	DU-14	3.04	1	5.66	1	20.6	1
Central	Baseline	DU-15	2.81	1	5.04	1	16	1
Central	Baseline	DU-15	0.576	1	3.75	1	14	1
Central	Baseline	DU-15	0.492	0	2.91	1	11.2	1
Central	Baseline	DU-16	4.29	1	8.31	1	26.6	1
Central	Baseline	DU-16	2.29	1	6.92	1	13.6	1
Central	Baseline	DU-16	0.499	0	3.72	1	12.9	1
Central	Baseline	DU-17	1.06	1	4.95	1	12.4	1
Central	Baseline	DU-17	0.511	0	3.72	1	11.8	1
Central	Baseline	DU-17	0.504	0	3.16	1	11.1	1
Central	Baseline	DU-18	1.41	1	10.9	1	22.8	1
Central	Baseline	DU-18	0.495	0	6.22	1	15.3	1
Central	Baseline	DU-18	0.502	0	5.63	1	13.9	1
Central	Baseline	DU-19	1.39	1	7.67	1	13.2	1
Central	Baseline	DU-19	0.957	1	11.2	1	12	1
Central	Baseline	DU-19	0.926	1	5.68	1	11.2	1
Central	Baseline	DU-20	1.69	1	5.69	1	19.6	1
Central	Baseline	DU-20	0.536	0	4.08	1	19.5	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium	D_Chromium
Central	Baseline	DU-20	0.511	0	3.68	1	16.7	1
Central	Baseline	DU-21	2.73	1	10.5	1	14.8	1
Central	Baseline	DU-21	1.01	1	4.93	1	11.8	1
Central	Baseline	DU-21	0.497	0	4.48	1	11.6	1
Central	Baseline	DU-22	2.89	1	6.48	1	19.6	1
Central	Baseline	DU-22	2.63	1	4.53	1	18.8	1
Central	Baseline	DU-22	1.09	1	4.45	1	18	1
Central	Baseline	DU-23	1.62	1	5.99	1	22.1	1
Central	Baseline	DU-23	0.61	1	4.63	1	18.4	1
Central	Baseline	DU-23	0.498	1	3.82	1	15.6	1
Central	Baseline	DU-24	0.546	0	4.16	1	15.5	1
Central	Baseline	DU-24	0.496	0	3.56	1	15	1
Central	Baseline	DU-24	0.501	0	2.84	1	10.9	1
Central	Baseline	DU-25	0.822	1	5.24	1	20.2	1
Central	Baseline	DU-25	0.493	0	3.29	1	14.5	1
Central	Baseline	DU-25	0.496	0	3.17	1	12.6	1
Central	Baseline	DU-26	4.79	1	9.5	1	19.1	1
Central	Baseline	DU-26	1.4	1	11.6	1	15.5	1
Central	Baseline	DU-26	0.529	1	4.75	1	14.6	1
Central	Baseline	DU-42	0.512	0	4.38	1	17.8	1
Central	Baseline	DU-42	0.667	1	4.11	1	18.4	1
Central	Baseline	DU-42	0.531	0	3.76	1	17.4	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium	D_Chromium
East	Baseline	DU-27	1.3	1	14.5	1	19.8	1
East	Baseline	DU-27	0.488	0	8.72	1	16.9	1
East	Baseline	DU-27	1.15	1	15.8	1	15.5	1
East	Baseline	DU-28	2.32	1	10.5	1	16.4	1
East	Baseline	DU-28	2.87	1	13.3	1	17.3	1
East	Baseline	DU-28	4.79	1	7.4	1	16.9	1
East	Baseline	DU-29	1.08	1	6.95	1	12.1	1
East	Baseline	DU-29	1.02	1	5.08	1	10.4	1
East	Baseline	DU-29	0.511	0	3.6	1	10	1
East	Baseline	DU-30	1.66	1	4.22	1	14.5	1
East	Baseline	DU-30	2.09	1	3.72	1	13.9	1
East	Baseline	DU-30	6.81	1	4.14	1	11.6	1
East	Baseline	DU-31	1.85	1	6.09	1	14.5	1
East	Baseline	DU-31	0.743	1	4.98	1	12.6	1
East	Baseline	DU-31	0.735	1	5.96	1	12.9	1
East	Baseline	DU-32	0.879	1	8.99	1	12.4	1
East	Baseline	DU-32	0.535	0	7.1	1	11.1	1
East	Baseline	DU-32	0.492	0	3.56	1	9.91	1
East	Baseline	DU-33	2.31	1	6.62	1	9.85	1
East	Baseline	DU-33	1.84	1	9.6	1	12.3	1
East	Baseline	DU-33	0.666	1	5.35	1	10.3	1
East	Baseline	DU-34	1.05	1	5.13	1	14	1
East	Baseline	DU-34	0.557	1	4.95	1	14.6	1
East	Baseline	DU-34	0.537	0	3.69	1	12.1	1
East	Baseline	DU-35	0.512	0	4.4	1	14.5	1
East	Baseline	DU-35	0.531	0	3.81	1	12.3	1
East	Baseline	DU-35	0.524	0	3.37	1	9.45	1
East	Baseline	DU-36	3.77	1	5.03	1	20.1	1
East	Baseline	DU-36	3.44	1	4.23	1	17.3	1
East	Baseline	DU-36	3.62	1	4.12	1	14.4	1
East	Baseline	DU-38	1.31	1	3.71	1	13.1	1
East	Baseline	DU-38	4.88	1	3.76	1	12.3	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium	D_Chromium
East	Baseline	DU-38	3.71	1	4.06	1	13.6	1
East	Baseline	DU-37	0.495	0	3.72	1	17.4	1
East	Baseline	DU-37	0.495	0	3.00	1	14.9	1
East	Baseline	DU-37	0.513	0	2.85	1	13.4	1
East	Baseline	DU-39	0.534	0	2.69	1	13.4	1
East	Baseline	DU-39	0.56	0	3.24	1	15.1	1
East	Baseline	DU-39	0.525	0	3.44	1	16	1
East	Baseline	DU-40	0.509	0	2.88	1	12.9	1
East	Baseline	DU-40	0.513	0	3.4	1	13.4	1
East	Baseline	DU-40	0.525	0	3.13	1	13.7	1
East	Baseline	DU-43	0.503	0	2.92	1	13.8	1
East	Baseline	DU-43	0.536	0	2.89	1	14	1
East	Baseline	DU-43	0.523	0	3.06	1	13.8	1
East	Baseline	DU-44	0.619	1	3.12	1	14	1
East	Baseline	DU-44	0.486	0	3.24	1	14.3	1
East	Baseline	DU-44	0.505	0	3.06	1	13.2	1
East	Baseline	DU-41	2.81	1	50.1	1	16.9	1
East	Baseline	DU-41	2.39	1	14.1	1	20.7	1
East	Baseline	DU-41	1.69	1	19.6	1	21.7	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Copper	D_Copper	Lead	D_Lead	Mercury	D_Mercury
West	Baseline	DU-1	180	1	74.8	1	0.0696	1
West	Baseline	DU-1	64.6	1	321	1	0.0863	1
West	Baseline	DU-1	69.5	1	57.5	1	0.0813	1
West	Baseline	DU-2	119	1	96.2	1	0.0731	1
West	Baseline	DU-2	170	1	118	1	0.124	1
West	Baseline	DU-2	41.9	1	24.4	1	0.0607	1
West	Baseline	DU-3	26.8	1	20.1	1	0.0438	0
West	Baseline	DU-3	25.8	1	15.8	1	0.0455	1
West	Baseline	DU-3	21.6	1	13.5	1	0.0497	1
West	Baseline	DU-4	29.1	1	23.7	1	0.0746	1
West	Baseline	DU-4	26.6	1	23.9	1	0.0596	1
West	Baseline	DU-4	34	1	45.1	1	0.076	1
West	Baseline	DU-5	344	1	62.1	1	0.352	1
West	Baseline	DU-5	237	1	70.5	1	0.369	1
West	Baseline	DU-5	214	1	118	1	0.273	1
West	Baseline	DU-6	67.6	1	28.2	1	0.128	1
West	Baseline	DU-6	91.6	1	40	1	0.156	1
West	Baseline	DU-6	100	1	37.8	1	0.141	1
West	Baseline	DU-7	36	1	23.3	1	0.304	1
West	Baseline	DU-7	30.1	1	18.7	1	0.13	1
West	Baseline	DU-7	24.2	1	14.9	1	0.0927	1
West	Baseline	DU-8	32.5	1	39.1	1	0.154	1
West	Baseline	DU-8	32.9	1	31.4	1	0.164	1
West	Baseline	DU-8	32	1	31	1	0.156	1
West	Baseline	DU-9	40.6	1	28.2	1	0.16	1
West	Baseline	DU-9	34.6	1	40.7	1	0.141	1
West	Baseline	DU-9	37.4	1	21.5	1	0.141	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Copper	D_Copper	Lead	D_Lead	Mercury	D_Mercury
Central	Baseline	DU-10	33.3	1	86.5	1	1.07	1
Central	Baseline	DU-10	33.6	1	54.8	1	0.829	1
Central	Baseline	DU-10	32.2	1	73.3	1	0.609	1
Central	Baseline	DU-11	38.5	1	56.1	1	0.726	1
Central	Baseline	DU-11	37.3	1	49	1	0.633	1
Central	Baseline	DU-11	35.2	1	43.3	1	0.604	1
Central	Baseline	DU-12	78.9	1	165	1	0.292	1
Central	Baseline	DU-12	55.7	1	131	1	0.275	1
Central	Baseline	DU-12	41	1	70.8	1	0.207	1
Central	Baseline	DU-13	94.3	1	241	1	1.15	1
Central	Baseline	DU-13	53	1	154	1	0.785	1
Central	Baseline	DU-13	54.2	1	175	1	0.769	1
Central	Baseline	DU-14	73.5	1	134	1	1.33	1
Central	Baseline	DU-14	122	1	240	1	3.1	1
Central	Baseline	DU-14	185	1	162	1	2.5	1
Central	Baseline	DU-15	95.4	1	131	1	0.75	1
Central	Baseline	DU-15	57.7	1	68.6	1	1.28	1
Central	Baseline	DU-15	36.2	1	63.6	1	0.563	1
Central	Baseline	DU-16	131	1	306	1	5.12	1
Central	Baseline	DU-16	71.8	1	151	1	1.69	1
Central	Baseline	DU-16	29.1	1	37.5	1	0.429	1
Central	Baseline	DU-17	59.2	1	81.4	1	0.575	1
Central	Baseline	DU-17	34.3	1	62.5	1	0.356	1
Central	Baseline	DU-17	26.8	1	35.1	1	0.121	1
Central	Baseline	DU-18	111	1	280	1	1.72	1
Central	Baseline	DU-18	79.5	1	179	1	1.06	1
Central	Baseline	DU-18	59.9	1	92.3	1	0.681	1
Central	Baseline	DU-19	107	1	257	1	0.666	1
Central	Baseline	DU-19	110	1	161	1	1.08	1
Central	Baseline	DU-19	44.9	1	70.8	1	0.327	1
Central	Baseline	DU-20	58.4	1	76.2	1	0.314	1
Central	Baseline	DU-20	25.8	1	17.7	1	0.136	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Copper	D_Copper	Lead	D_Lead	Mercury	D_Mercury
Central	Baseline	DU-20	23	1	14.3	1	0.101	1
Central	Baseline	DU-21	128	1	295	1	0.776	1
Central	Baseline	DU-21	56.2	1	116	1	0.276	1
Central	Baseline	DU-21	45.9	1	89.7	1	0.154	1
Central	Baseline	DU-22	96.6	1	190	1	0.602	1
Central	Baseline	DU-22	47.4	1	72.3	1	0.349	1
Central	Baseline	DU-22	54	1	57.5	1	0.376	1
Central	Baseline	DU-23	150	1	276	1	1.02	1
Central	Baseline	DU-23	69.5	1	70.9	1	0.545	1
Central	Baseline	DU-23	41.9	1	82.2	1	0.426	1
Central	Baseline	DU-24	39.9	1	48.8	1	0.276	1
Central	Baseline	DU-24	31.1	1	23.2	1	0.175	1
Central	Baseline	DU-24	17.6	1	13.8	1	0.0928	1
Central	Baseline	DU-25	226	1	144	1	0.762	1
Central	Baseline	DU-25	48.5	1	113	1	0.213	1
Central	Baseline	DU-25	30	1	43.2	1	0.116	1
Central	Baseline	DU-26	152	1	330	1	1.95	1
Central	Baseline	DU-26	80.7	1	151	1	1.25	1
Central	Baseline	DU-26	41.6	1	76.1	1	0.82	1
Central	Baseline	DU-42	36.3	1	53.3	1	0.226	1
Central	Baseline	DU-42	25.4	1	30.3	1	0.186	1
Central	Baseline	DU-42	21.1	1	20.1	1	0.125	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Copper	D_Copper	Lead	D_Lead	Mercury	D_Mercury
East	Baseline	DU-27	204	1	46.1	1	0.184	1
East	Baseline	DU-27	81.2	1	39.1	1	0.0555	1
East	Baseline	DU-27	45.6	1	55.4	1	0.0643	1
East	Baseline	DU-28	184	1	78.1	1	0.649	1
East	Baseline	DU-28	327	1	74.1	1	0.706	1
East	Baseline	DU-28	229	1	113	1	0.207	1
East	Baseline	DU-29	69.3	1	103	1	0.0595	1
East	Baseline	DU-29	44.3	1	41.1	1	0.0436	0
East	Baseline	DU-29	27.8	1	45.7	1	0.0409	0
East	Baseline	DU-30	63.4	1	131	1	0.0829	1
East	Baseline	DU-30	79.8	1	202	1	0.05	1
East	Baseline	DU-30	86.6	1	220	1	0.159	1
East	Baseline	DU-31	35.4	1	44.8	1	0.0479	1
East	Baseline	DU-31	49.2	1	34.1	1	0.067	1
East	Baseline	DU-31	68.2	1	25	1	0.0415	0
East	Baseline	DU-32	31.6	1	28.9	1	0.0428	0
East	Baseline	DU-32	23.4	1	20.9	1	0.0428	0
East	Baseline	DU-32	20.1	1	34.1	1	0.0394	0
East	Baseline	DU-33	79.8	1	88.8	1	0.0435	1
East	Baseline	DU-33	96.6	1	66.2	1	0.0413	0
East	Baseline	DU-33	52.6	1	42.8	1	0.0423	0
East	Baseline	DU-34	32.6	1	41.4	1	0.044	1
East	Baseline	DU-34	33.2	1	31.9	1	0.0447	1
East	Baseline	DU-34	33.1	1	25.9	1	0.043	0
East	Baseline	DU-35	52.9	1	22.6	1	0.0415	1
East	Baseline	DU-35	29.1	1	19	1	0.0425	0
East	Baseline	DU-35	27.8	1	12.4	1	0.042	0
East	Baseline	DU-36	57.9	1	73.2	1	0.0398	0
East	Baseline	DU-36	56.7	1	130	1	0.0606	1
East	Baseline	DU-36	46.3	1	63.3	1	0.0449	1
East	Baseline	DU-38	27.7	1	30.5	1	0.0454	1
East	Baseline	DU-38	56	1	76.7	1	0.0415	0

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Copper	D_Copper	Lead	D_Lead	Mercury	D_Mercury
East	Baseline	DU-38	51.4	1	51.3	1	0.0421	0
East	Baseline	DU-37	26.1	1	39.3	1	0.0396	0
East	Baseline	DU-37	21.4	1	12.6	1	0.043	1
East	Baseline	DU-37	16.9	1	8.96	1	0.0411	0
East	Baseline	DU-39	21.3	1	6.09	1	0.0427	0
East	Baseline	DU-39	17.9	1	5.11	1	0.0448	0
East	Baseline	DU-39	18.4	1	6.88	1	0.042	0
East	Baseline	DU-40	16.2	1	3.75	1	0.0407	0
East	Baseline	DU-40	15.4	1	3.47	1	0.0411	0
East	Baseline	DU-40	16.6	1	3.1	1	0.042	0
East	Baseline	DU-43	18.8	1	5.42	1	0.0402	0
East	Baseline	DU-43	18.7	1	9.65	1	0.0429	0
East	Baseline	DU-43	16.3	1	4.35	1	0.0418	0
East	Baseline	DU-44	17.9	1	13	1	0.0394	0
East	Baseline	DU-44	15.7	1	6.23	1	0.0389	0
East	Baseline	DU-44	15	1	5.94	1	0.0404	0
East	Baseline	DU-41	78.6	1	83.8	1	0.262	1
East	Baseline	DU-41	71.1	1	129	1	0.108	1
East	Baseline	DU-41	45.2	1	109	1	0.0732	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Nickel	D_Nickel	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan
West	Baseline	DU-1	27.1	1	151	1	2.21E-05	1
West	Baseline	DU-1	30.9	1	140	1	2.56E-05	1
West	Baseline	DU-1	25.0	1	179	1	1.07E-05	1
West	Baseline	DU-2	18.9	1	99.4	1	6.95E-06	1
West	Baseline	DU-2	16.4	1	88.8	1	3.44E-06	1
West	Baseline	DU-2	14.7	1	78	1	2.42E-06	1
West	Baseline	DU-3	16.3	1	80.4	1	2.63E-05	1
West	Baseline	DU-3	17.1	1	72.2	1	7.82E-06	1
West	Baseline	DU-3	16.0	1	64.7	1	4.57E-06	1
West	Baseline	DU-4	23.9	1	89.4	1	2.09E-05	1
West	Baseline	DU-4	24.6	1	79.4	1	1.66E-05	1
West	Baseline	DU-4	22.4	1	115	1	1.47E-05	1
West	Baseline	DU-5	32.6	1	211	1	1.71E-05	1
West	Baseline	DU-5	58.9	1	179	1	1.53E-05	1
West	Baseline	DU-5	31.3	1	224	1	2.33E-05	1
West	Baseline	DU-6	19.6	1	135	1	1.04E-05	1
West	Baseline	DU-6	21.8	1	124	1	2.51E-05	1
West	Baseline	DU-6	22.0	1	112	1	1.14E-05	1
West	Baseline	DU-7	19.3	1	126	1	1.74E-05	1
West	Baseline	DU-7	19.7	1	92.7	1	1.24E-05	1
West	Baseline	DU-7	19.1	1	75.1	1	8.17E-06	1
West	Baseline	DU-8	19.6	1	144	1	2.36E-05	1
West	Baseline	DU-8	19.7	1	130	1	2.46E-05	1
West	Baseline	DU-8	20.7	1	126	1	2.34E-05	1
West	Baseline	DU-9	26.5	1	154	1	1.78E-05	1
West	Baseline	DU-9	24.4	1	115	1	1.28E-05	1
West	Baseline	DU-9	26.2	1	122	1	1.23E-05	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Nickel	D_Nickel	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan
Central	Baseline	DU-10	29.9	1	106	1	1.73E-05	1
Central	Baseline	DU-10	27.5	1	94.9	1	5.46E-06	1
Central	Baseline	DU-10	22.6	1	117	1	4.52E-06	1
Central	Baseline	DU-11	29.3	1	116	1	1.17E-05	1
Central	Baseline	DU-11	28.2	1	99.5	1	5.21E-06	1
Central	Baseline	DU-11	26.4	1	95	1	5.89E-06	1
Central	Baseline	DU-12	19.8	1	166	1	2.54E-05	1
Central	Baseline	DU-12	19	1	104	1	4.21E-06	1
Central	Baseline	DU-12	17.8	1	79.7	1	2.60E-06	1
Central	Baseline	DU-13	21.4	1	204	1	2.77E-04	1
Central	Baseline	DU-13	18.6	1	128	1	3.62E-05	1
Central	Baseline	DU-13	18.4	1	127	1	2.66E-05	1
Central	Baseline	DU-14	24.3	1	147	1	7.87E-05	1
Central	Baseline	DU-14	23.7	1	204	1	3.43E-05	1
Central	Baseline	DU-14	24.8	1	164	1	1.43E-05	1
Central	Baseline	DU-15	21.7	1	131	1	3.96E-04	1
Central	Baseline	DU-15	19.3	1	120	1	2.00E-04	1
Central	Baseline	DU-15	17.6	1	76.8	1	1.50E-04	1
Central	Baseline	DU-16	28.1	1	371	1	2.44E-04	1
Central	Baseline	DU-16	18.5	1	139	1	1.75E-05	1
Central	Baseline	DU-16	16.8	1	71.3	1	7.62E-06	1
Central	Baseline	DU-17	16.4	1	156	1	4.04E-05	1
Central	Baseline	DU-17	16.3	1	70.6	1	3.43E-06	1
Central	Baseline	DU-17	14.6	1	58.4	1	7.81E-06	1
Central	Baseline	DU-18	23.5	1	204	1	6.68E-05	1
Central	Baseline	DU-18	21.8	1	158	1	2.16E-05	1
Central	Baseline	DU-18	18.3	1	118	1	1.29E-05	1
Central	Baseline	DU-19	16.5	1	215	1	1.34E-04	1
Central	Baseline	DU-19	15.5	1	198	1	8.48E-05	1
Central	Baseline	DU-19	15.5	1	113	1	4.66E-05	1
Central	Baseline	DU-20	22.7	1	117	1	3.49E-05	1
Central	Baseline	DU-20	28.4	1	87.3	1	4.30E-06	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Nickel	D_Nickel	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan
Central	Baseline	DU-20	21.1	1	90.4	1	3.97E-06	1
Central	Baseline	DU-21	20.3	1	242	1	7.03E-05	1
Central	Baseline	DU-21	17.7	1	180	1	2.06E-05	1
Central	Baseline	DU-21	18	1	109	1	1.01E-05	1
Central	Baseline	DU-22	23.2	1	178	1	3.25E-05	1
Central	Baseline	DU-22	22.6	1	164	1	1.23E-05	1
Central	Baseline	DU-22	21.4	1	123	1	7.93E-06	1
Central	Baseline	DU-23	22.9	1	184	1	4.00E-05	1
Central	Baseline	DU-23	20.5	1	127	1	1.05E-05	1
Central	Baseline	DU-23	18.8	1	99	1	5.92E-06	1
Central	Baseline	DU-24	19.2	1	117	1	2.33E-05	1
Central	Baseline	DU-24	20.6	1	124	1	6.44E-06	1
Central	Baseline	DU-24	18.5	1	83.1	1	8.88E-06	1
Central	Baseline	DU-25	21.3	1	242	1	4.69E-05	1
Central	Baseline	DU-25	19.6	1	202	1	2.60E-06	1
Central	Baseline	DU-25	18.7	1	138	1	1.94E-06	1
Central	Baseline	DU-26	20.7	1	260	1	9.33E-05	1
Central	Baseline	DU-26	19.9	1	206	1	4.27E-05	1
Central	Baseline	DU-26	18.3	1	138	1	2.36E-05	1
Central	Baseline	DU-42	23.3	1	126	1	6.07E-05	1
Central	Baseline	DU-42	22.6	1	109	1	2.27E-05	1
Central	Baseline	DU-42	20.7	1	87	1	8.27E-06	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Nickel	D_Nickel	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan
East	Baseline	DU-27	21.1	1	173	1	1.03E-04	1
East	Baseline	DU-27	21.3	1	130	1	6.99E-05	1
East	Baseline	DU-27	18.4	1	139	1	2.40E-05	1
East	Baseline	DU-28	17.9	1	267	1	1.91E-05	1
East	Baseline	DU-28	17.2	1	231	1	3.27E-05	1
East	Baseline	DU-28	19.6	1	275	1	1.49E-05	1
East	Baseline	DU-29	18.1	1	164	1	4.97E-05	1
East	Baseline	DU-29	15.3	1	100	1	1.53E-05	1
East	Baseline	DU-29	15.2	1	92.7	1	1.53E-05	1
East	Baseline	DU-30	18.3	1	179	1	5.05E-05	1
East	Baseline	DU-30	17.7	1	228	1	2.24E-05	1
East	Baseline	DU-30	15.7	1	152	1	1.44E-05	1
East	Baseline	DU-31	16.5	1	116	1	5.84E-05	1
East	Baseline	DU-31	17	1	140	1	1.90E-05	1
East	Baseline	DU-31	16.7	1	109	1	1.09E-05	1
East	Baseline	DU-32	15.7	1	118	1	3.48E-05	1
East	Baseline	DU-32	15.3	1	104	1	7.54E-06	1
East	Baseline	DU-32	14.2	1	90.2	1	7.59E-06	1
East	Baseline	DU-33	14.9	1	290	1	3.69E-05	1
East	Baseline	DU-33	17.8	1	354	1	1.67E-05	1
East	Baseline	DU-33	16.4	1	234	1	1.21E-05	1
East	Baseline	DU-34	22	1	182	1	6.03E-05	1
East	Baseline	DU-34	24.3	1	177	1	2.82E-05	1
East	Baseline	DU-34	20.1	1	222	1	3.02E-05	1
East	Baseline	DU-35	17.8	1	174	1	4.05E-05	1
East	Baseline	DU-35	15.3	1	168	1	1.31E-05	1
East	Baseline	DU-35	14.2	1	141	1	1.02E-05	1
East	Baseline	DU-36	22.6	1	266	1	4.21E-05	1
East	Baseline	DU-36	19	1	222	1	3.70E-05	1
East	Baseline	DU-36	18.3	1	190	1	2.80E-05	1
East	Baseline	DU-38	16.5	1	110	1	2.94E-05	1
East	Baseline	DU-38	16	1	102	1	1.90E-05	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Nickel	D_Nickel	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan
East	Baseline	DU-38	17.1	1	108	1	1.05E-05	1
East	Baseline	DU-37	18.6	1	74.4	1	6.78E-07	1
East	Baseline	DU-37	18.8	1	61.5	1	6.32E-07	1
East	Baseline	DU-37	17.1	1	52.2	1	5.69E-07	1
East	Baseline	DU-39	16	1	62.8	1	3.68E-06	1
East	Baseline	DU-39	18.3	1	57.4	1	1.38E-06	1
East	Baseline	DU-39	19.2	1	54.3	1	1.36E-06	1
East	Baseline	DU-40	16.3	1	44.3	1	7.34E-07	1
East	Baseline	DU-40	17.7	1	44.7	1	5.18E-07	1
East	Baseline	DU-40	18.2	1	45.1	1	5.52E-07	1
East	Baseline	DU-43	16.9	1	53.9	1	3.00E-06	1
East	Baseline	DU-43	18.5	1	56.4	1	1.26E-06	1
East	Baseline	DU-43	18.4	1	46	1	6.63E-07	1
East	Baseline	DU-44	17.7	1	83.7	1	1.38E-06	1
East	Baseline	DU-44	17.2	1	51.3	1	8.37E-07	1
East	Baseline	DU-44	16.0	1	45.9	1	7.25E-07	1
East	Baseline	DU-41	16.5	1	139	1	2.55E-04	1
East	Baseline	DU-41	18.4	1	165	1	2.42E-04	1
East	Baseline	DU-41	21.7	1	182	1	1.55E-04	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Dibenzofuran	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs
West	Baseline	DU-1	0.0078	1	2.6600	1	0.4460
West	Baseline	DU-1	0.0102	1	2.6200	1	0.4000
West	Baseline	DU-1	0.0048	0	2.1100	1	0.3280
West	Baseline	DU-2	0.0051	1	1.0200	1	0.1650
West	Baseline	DU-2	0.0047	0	0.7920	1	0.1080
West	Baseline	DU-2	0.0050	0	0.2230	1	0.0319
West	Baseline	DU-3	0.0048	0	0.9760	1	0.1530
West	Baseline	DU-3	0.0051	0	0.9840	1	0.1290
West	Baseline	DU-3	0.0050	0	0.7450	1	0.1030
West	Baseline	DU-4	0.0057	1	2.5200	1	0.4280
West	Baseline	DU-4	0.0334	1	11.9000	1	1.7500
West	Baseline	DU-4	0.0094	1	4.6500	1	0.7670
West	Baseline	DU-5	0.0073	1	1.4000	1	0.2420
West	Baseline	DU-5	0.0061	1	1.1600	1	0.1990
West	Baseline	DU-5	0.0099	1	2.8800	1	0.4080
West	Baseline	DU-6	0.0052	1	1.1000	1	0.1880
West	Baseline	DU-6	0.0090	1	1.2900	1	0.2040
West	Baseline	DU-6	0.0110	1	1.4300	1	0.2260
West	Baseline	DU-7	0.0051	0	0.7510	1	0.1270
West	Baseline	DU-7	0.0050	0	0.4400	1	0.0711
West	Baseline	DU-7	0.0050	0	0.3160	1	0.0478
West	Baseline	DU-8	0.0055	1	0.7550	1	0.1210
West	Baseline	DU-8	0.0055	1	0.4940	1	0.0731
West	Baseline	DU-8	0.0062	1	0.5890	1	0.0847
West	Baseline	DU-9	0.0057	1	1.1200	1	0.1890
West	Baseline	DU-9	0.0048	0	0.4770	1	0.0771
West	Baseline	DU-9	0.0080	1	1.1600	1	0.1800

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Dibenzofuran	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs
Central	Baseline	DU-10	0.0235	1	29.4000	1	5.1900
Central	Baseline	DU-10	0.0494	1	28.3000	1	4.7000
Central	Baseline	DU-10	0.0244	1	16.9000	1	2.6000
Central	Baseline	DU-11	0.0819	1	31.3000	1	5.4000
Central	Baseline	DU-11	0.0486	1	15.1000	1	2.6500
Central	Baseline	DU-11	0.0613	1	30.2000	1	5.1300
Central	Baseline	DU-12	0.0070	1	2.4700	1	0.3930
Central	Baseline	DU-12	0.0059	1	0.9970	1	0.1430
Central	Baseline	DU-12	0.0050	0	0.5840	1	0.0900
Central	Baseline	DU-13	0.0084	1	7.9300	1	1.1700
Central	Baseline	DU-13	0.0155	1	3.0600	1	0.4500
Central	Baseline	DU-13	0.0052	1	1.6700	1	0.2630
Central	Baseline	DU-14	0.0229	1	0.9920	1	0.1490
Central	Baseline	DU-14	0.0224	1	1.7000	1	0.2570
Central	Baseline	DU-14	0.0143	1	1.3200	1	0.1950
Central	Baseline	DU-15	0.0081	1	0.9590	1	0.1380
Central	Baseline	DU-15	0.0049	0	0.3280	1	0.0499
Central	Baseline	DU-15	0.0049	0	0.6910	1	0.1010
Central	Baseline	DU-16	0.0776	1	3.2200	1	0.4960
Central	Baseline	DU-16	0.0075	1	1.6300	1	0.2460
Central	Baseline	DU-16	0.0050	0	0.4170	1	0.0569
Central	Baseline	DU-17	0.0050	0	0.4280	1	0.0634
Central	Baseline	DU-17	0.0050	0	0.3630	1	0.0513
Central	Baseline	DU-17	0.0050	0	0.2220	1	0.0309
Central	Baseline	DU-18	0.0069	1	1.8100	1	0.2710
Central	Baseline	DU-18	0.0050	0	0.8940	1	0.1380
Central	Baseline	DU-18	0.0051	0	0.5870	1	0.0862
Central	Baseline	DU-19	0.0121	1	2.3700	1	0.4030
Central	Baseline	DU-19	0.0174	1	1.8200	1	0.2700
Central	Baseline	DU-19	0.0051	0	0.5140	1	0.0790
Central	Baseline	DU-20	0.0048	0	0.8920	1	0.1450
Central	Baseline	DU-20	0.0049	0	0.0881	1	0.0132

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Dibenzofuran	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs
Central	Baseline	DU-20	0.0047	0	0.1350	1	0.0193
Central	Baseline	DU-21	0.0187	1	2.0900	1	0.3140
Central	Baseline	DU-21	0.0074	1	1.0500	1	0.1640
Central	Baseline	DU-21	0.0052	1	0.6240	1	0.0879
Central	Baseline	DU-22	0.1120	1	2.6500	1	0.1310
Central	Baseline	DU-22	0.0051	0	0.2350	1	0.0289
Central	Baseline	DU-22	0.0051	0	0.2250	1	0.0292
Central	Baseline	DU-23	0.0061	1	0.7550	1	0.1060
Central	Baseline	DU-23	0.0050	0	0.5370	1	0.1040
Central	Baseline	DU-23	0.0051	0	0.2310	1	0.0362
Central	Baseline	DU-24	0.0050	0	0.6300	1	0.0907
Central	Baseline	DU-24	0.0050	0	0.5000	1	0.0740
Central	Baseline	DU-24	0.0050	0	0.0883	1	0.0145
Central	Baseline	DU-25	0.0123	1	2.7700	1	0.3860
Central	Baseline	DU-25	0.0050	0	0.6430	1	0.0905
Central	Baseline	DU-25	0.0048	0	0.6130	1	0.0873
Central	Baseline	DU-26	0.0246	1	4.8900	1	0.7230
Central	Baseline	DU-26	0.0050	0	1.6600	1	0.2810
Central	Baseline	DU-26	0.0050	0	0.9930	1	0.1480
Central	Baseline	DU-42	0.0050	0	0.3470	1	0.0507
Central	Baseline	DU-42	0.0048	0	0.2200	1	0.0309
Central	Baseline	DU-42	0.0050	0	0.1580	1	0.0229

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Dibenzofuran	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs
East	Baseline	DU-27	0.0050	0	1.4000	1	0.2130
East	Baseline	DU-27	0.0101	1	1.7800	1	0.2420
East	Baseline	DU-27	0.0050	0	0.6570	1	0.0973
East	Baseline	DU-28	0.0070	1	2.3600	1	0.4330
East	Baseline	DU-28	0.0085	1	3.1400	1	0.5280
East	Baseline	DU-28	0.0084	1	1.8900	1	0.3530
East	Baseline	DU-29	0.0085	1	0.9880	1	0.1540
East	Baseline	DU-29	0.0051	0	0.4780	1	0.0697
East	Baseline	DU-29	0.0050	0	0.3800	1	0.0588
East	Baseline	DU-30	0.0072	1	2.1500	1	0.3980
East	Baseline	DU-30	0.0050	0	1.0000	1	0.1690
East	Baseline	DU-30	0.0050	0	0.4650	1	0.0709
East	Baseline	DU-31	0.0050	1	0.8540	1	0.1240
East	Baseline	DU-31	0.0054	1	0.7680	1	0.1190
East	Baseline	DU-31	0.0050	0	0.6490	1	0.0919
East	Baseline	DU-32	0.0063	1	0.7760	1	0.1150
East	Baseline	DU-32	0.0047	0	0.4910	1	0.0754
East	Baseline	DU-32	0.0405	1	3.5300	1	0.5660
East	Baseline	DU-33	0.0081	1	0.4140	1	0.0542
East	Baseline	DU-33	0.0066	1	0.4510	1	0.0519
East	Baseline	DU-33	0.0049	0	0.4010	1	0.0555
East	Baseline	DU-34	0.0178	1	1.7200	1	0.2530
East	Baseline	DU-34	0.0098	1	1.1900	1	0.1840
East	Baseline	DU-34	0.0051	1	0.6510	1	0.0973
East	Baseline	DU-35	0.0053	1	0.6160	1	0.0931
East	Baseline	DU-35	0.0050	0	0.7040	1	0.1190
East	Baseline	DU-35	0.0049	0	0.2500	1	0.0355
East	Baseline	DU-36	0.0060	1	0.6170	1	0.0823
East	Baseline	DU-36	0.0082	1	0.7770	1	0.1030
East	Baseline	DU-36	0.0050	0	0.2950	1	0.0379
East	Baseline	DU-38	0.0056	1	0.5940	1	0.0828
East	Baseline	DU-38	0.0051	0	0.4550	1	0.0635

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	Dibenzofuran	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs
East	Baseline	DU-38	0.0051	0	0.5190	1	0.0442
East	Baseline	DU-37	0.0050	0	0.0834	1	0.0124
East	Baseline	DU-37	0.0050	0	0.1050	1	0.0114
East	Baseline	DU-37	0.0115	1	0.8510	1	0.0970
East	Baseline	DU-39	0.0049	0	0.0270	1	0.0057
East	Baseline	DU-39	0.0049	0	0.0247	0	0.0057
East	Baseline	DU-39	0.0049	0	0.0955	1	0.0124
East	Baseline	DU-40	0.0050	0	0.0249	0	0.0057
East	Baseline	DU-40	0.0050	0	0.0281	1	0.0061
East	Baseline	DU-40	0.0051	0	0.0279	1	0.0061
East	Baseline	DU-43	0.0049	0	0.1200	1	0.0163
East	Baseline	DU-43	0.0051	0	0.1220	1	0.0106
East	Baseline	DU-43	0.0050	0	0.0616	1	0.0097
East	Baseline	DU-44	0.0050	0	0.1430	1	0.0180
East	Baseline	DU-44	0.0050	0	0.0910	1	0.0127
East	Baseline	DU-44	0.0049	0	0.0840	1	0.0129
East	Baseline	DU-41	0.0184	1	2.1100	1	0.3360
East	Baseline	DU-41	0.0427	1	1.9400	1	0.2760
East	Baseline	DU-41	0.0129	1	1.0800	1	0.1490

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	D_cPAHs	TotalPCBs	D_TotalPCBs
West	Baseline	DU-1	1	0.4270	1
West	Baseline	DU-1	1	2.7500	1
West	Baseline	DU-1	1	0.1100	1
West	Baseline	DU-2	1	0.1860	1
West	Baseline	DU-2	1	0.5580	1
West	Baseline	DU-2	1	0.0299	1
West	Baseline	DU-3	1	0.0250	1
West	Baseline	DU-3	1	0.0050	0
West	Baseline	DU-3	1	0.0048	0
West	Baseline	DU-4	1	0.0317	1
West	Baseline	DU-4	1	0.0245	1
West	Baseline	DU-4	1	0.0351	1
West	Baseline	DU-5	1	0.1770	1
West	Baseline	DU-5	1	0.1430	1
West	Baseline	DU-5	1	0.3870	1
West	Baseline	DU-6	1	0.0625	1
West	Baseline	DU-6	1	0.1110	1
West	Baseline	DU-6	1	0.1670	1
West	Baseline	DU-7	1	0.0527	1
West	Baseline	DU-7	1	0.0567	1
West	Baseline	DU-7	1	0.0502	1
West	Baseline	DU-8	1	0.0989	1
West	Baseline	DU-8	1	0.0678	1
West	Baseline	DU-8	1	0.0984	1
West	Baseline	DU-9	1	0.0640	1
West	Baseline	DU-9	1	0.0353	1
West	Baseline	DU-9	1	0.0478	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	D_cPAHs	TotalPCBs	D_TotalPCBs
Central	Baseline	DU-10	1	0.0337	1
Central	Baseline	DU-10	1	0.0262	1
Central	Baseline	DU-10	1	0.0051	0
Central	Baseline	DU-11	1	0.0369	1
Central	Baseline	DU-11	1	0.0372	1
Central	Baseline	DU-11	1	0.0389	1
Central	Baseline	DU-12	1	0.0532	1
Central	Baseline	DU-12	1	0.0317	1
Central	Baseline	DU-12	1	0.0050	0
Central	Baseline	DU-13	1	0.0701	1
Central	Baseline	DU-13	1	0.0272	1
Central	Baseline	DU-13	1	0.0330	1
Central	Baseline	DU-14	1	0.0283	1
Central	Baseline	DU-14	1	0.0048	0
Central	Baseline	DU-14	1	0.0048	0
Central	Baseline	DU-15	1	0.0268	1
Central	Baseline	DU-15	1	0.0048	0
Central	Baseline	DU-15	1	0.0048	0
Central	Baseline	DU-16	1	0.0346	1
Central	Baseline	DU-16	1	0.0049	0
Central	Baseline	DU-16	1	0.0050	0
Central	Baseline	DU-17	1	0.0257	1
Central	Baseline	DU-17	1	0.0050	0
Central	Baseline	DU-17	1	0.0049	0
Central	Baseline	DU-18	1	0.0584	1
Central	Baseline	DU-18	1	0.0336	1
Central	Baseline	DU-18	1	0.0316	1
Central	Baseline	DU-19	1	0.1440	1
Central	Baseline	DU-19	1	0.0311	1
Central	Baseline	DU-19	1	0.0568	1
Central	Baseline	DU-20	1	0.0390	1
Central	Baseline	DU-20	1	0.0050	0

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	D_cPAHs	TotalPCBs	D_TotalPCBs
Central	Baseline	DU-20	1	0.0050	0
Central	Baseline	DU-21	1	0.0492	1
Central	Baseline	DU-21	1	0.0364	1
Central	Baseline	DU-21	1	0.0050	0
Central	Baseline	DU-22	1	0.0438	1
Central	Baseline	DU-22	1	0.0258	1
Central	Baseline	DU-22	1	0.0050	0
Central	Baseline	DU-23	1	0.0591	1
Central	Baseline	DU-23	1	0.0265	1
Central	Baseline	DU-23	1	0.0050	0
Central	Baseline	DU-24	1	0.0326	1
Central	Baseline	DU-24	1	0.0049	0
Central	Baseline	DU-24	1	0.0048	0
Central	Baseline	DU-25	1	0.0653	1
Central	Baseline	DU-25	1	0.0050	0
Central	Baseline	DU-25	1	0.0050	0
Central	Baseline	DU-26	1	0.1850	1
Central	Baseline	DU-26	1	0.0705	1
Central	Baseline	DU-26	1	0.1890	1
Central	Baseline	DU-42	1	0.0050	0
Central	Baseline	DU-42	1	0.0050	0
Central	Baseline	DU-42	1	0.0049	0

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	D_cPAHs	TotalPCBs	D_TotalPCBs
East	Baseline	DU-27	1	0.1860	1
East	Baseline	DU-27	1	0.1680	1
East	Baseline	DU-27	1	0.1780	1
East	Baseline	DU-28	1	0.1000	1
East	Baseline	DU-28	1	0.0718	1
East	Baseline	DU-28	1	0.0370	1
East	Baseline	DU-29	1	0.0250	1
East	Baseline	DU-29	1	0.0047	0
East	Baseline	DU-29	1	0.0049	0
East	Baseline	DU-30	1	0.0325	1
East	Baseline	DU-30	1	0.0050	0
East	Baseline	DU-30	1	0.0456	0
East	Baseline	DU-31	1	0.0257	1
East	Baseline	DU-31	1	0.0298	1
East	Baseline	DU-31	1	0.0270	1
East	Baseline	DU-32	1	0.0048	0
East	Baseline	DU-32	1	0.0048	0
East	Baseline	DU-32	1	0.0047	0
East	Baseline	DU-33	1	0.0852	1
East	Baseline	DU-33	1	0.0501	1
East	Baseline	DU-33	1	0.0579	1
East	Baseline	DU-34	1	0.0330	1
East	Baseline	DU-34	1	0.0476	1
East	Baseline	DU-34	1	0.0050	0
East	Baseline	DU-35	1	0.0284	1
East	Baseline	DU-35	1	0.0396	1
East	Baseline	DU-35	1	0.0050	0
East	Baseline	DU-36	1	0.0279	1
East	Baseline	DU-36	1	0.0050	0
East	Baseline	DU-36	1	0.0284	1
East	Baseline	DU-38	1	0.0412	1
East	Baseline	DU-38	1	0.0444	1

Pro UCL Input - Willamette Cove Baseline

Parcel	Group	Decision Unit	D_cPAHs	TotalPCBs	D_TotalPCBs
East	Baseline	DU-38	1	0.0300	1
East	Baseline	DU-37	1	0.0049	0
East	Baseline	DU-37	1	0.0050	0
East	Baseline	DU-37	1	0.0051	0
East	Baseline	DU-39	1	0.0049	0
East	Baseline	DU-39	1	0.0049	0
East	Baseline	DU-39	1	0.0049	0
East	Baseline	DU-40	1	0.0049	0
East	Baseline	DU-40	1	0.0050	0
East	Baseline	DU-40	1	0.0050	0
East	Baseline	DU-43	1	0.0051	0
East	Baseline	DU-43	1	0.0051	0
East	Baseline	DU-43	1	0.0050	0
East	Baseline	DU-44	1	0.0049	0
East	Baseline	DU-44	1	0.0049	0
East	Baseline	DU-44	1	0.0048	0
East	Baseline	DU-41	1	0.0691	1
East	Baseline	DU-41	1	0.0926	1
East	Baseline	DU-41	1	0.0438	1

ProUCL Input - Willamette Cove Residual (Top Foot)

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Copper	D_Copper
West	Residual	DU-1	0.801	1	6.24	1	180	1
West	Residual	DU-2	0.603	1	5.41	1	119	1
West	Residual	DU-3	0.547	0	6.87	1	26.8	1
West	Residual	DU-4	0.565	0	6.57	1	29.1	1
West	Residual	DU-6	0.539	0	4.93	1	67.6	1
West	Residual	DU-7	0.547	0	3.98	1	30.1	1
West	Residual	DU-9	0.555	0	4.81	1	34.6	1
Central	Residual	DU-10	0.514	1	5.16	1	32.2	1
Central	Residual	DU-11	0.526	0	4.23	1	35.2	1
Central	Residual	DU-12	0.551	0	3.62	1	41	1
Central	Residual	DU-13	0.562	0	4.04	1	54.2	1
Central	Residual	DU-14	3.04	1	5.66	1	185	1
Central	Residual	DU-15	0.492	0	2.91	1	36.2	1
Central	Residual	DU-16	0.499	0	3.72	1	29.1	1
Central	Residual	DU-17	0.504	0	3.16	1	26.8	1
Central	Residual	DU-18	0.502	0	5.63	1	59.9	1
Central	Residual	DU-19	0.926	1	5.68	1	44.9	1
Central	Residual	DU-20	0.536	0	4.08	1	25.8	1
Central	Residual	DU-21	0.497	0	4.48	1	45.9	1
Central	Residual	DU-22	1.09	1	4.45	1	54	1
Central	Residual	DU-23	0.498	1	3.82	1	41.9	1
Central	Residual	DU-24	0.496	0	3.56	1	31.1	1
Central	Residual	DU-25	0.496	0	3.17	1	30	1
Central	Residual	DU-26	0.529	1	4.75	1	41.6	1
Central	Residual	DU-42	0.512	0	4.38	1	36.3	1
East	Residual	DU-27	1.15	1	15.8	1	45.6	1
East	Residual	DU-28	4.79	1	7.4	1	229	1
East	Residual	DU-29	1.08	1	6.95	1	69.3	1
East	Residual	DU-30	1.66	1	4.22	1	63.4	1
East	Residual	DU-31	1.85	1	6.09	1	35.4	1

ProUCL Input - Willamette Cove Residual (Top Foot)

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Copper	D_Copper
East	Residual	DU-32	0.879	1	8.99	1	31.6	1
East	Residual	DU-33	2.31	1	6.62	1	79.8	1
East	Residual	DU-34	0.557	1	4.95	1	33.2	1
East	Residual	DU-35	0.512	0	4.4	1	52.9	1
East	Residual	DU-36	3.77	1	5.03	1	57.9	1
East	Residual	DU-38	1.31	1	3.71	1	27.7	1
East	Residual	DU-37	0.495	0	3.72	1	26.1	1
East	Residual	DU-39	0.534	0	2.69	1	21.3	1
East	Residual	DU-40	0.509	0	2.88	1	16.2	1
East	Residual	DU-43	0.503	0	2.92	1	18.8	1
East	Residual	DU-44	0.619	1	3.12	1	17.9	1

ProUCL Input - Willamette Cove Residual (To

Parcel	Group	Decision Unit	Lead	D_Lead	Mercury	D_Mercury	Nickel	D_Nickel	Zinc
West	Residual	DU-1	74.8	1	0.0696	1	27.1	1	151
West	Residual	DU-2	96.2	1	0.0731	1	18.9	1	99.4
West	Residual	DU-3	20.1	1	0.0438	0	16.3	1	80.4
West	Residual	DU-4	23.7	1	0.0746	1	23.9	1	89.4
West	Residual	DU-6	28.2	1	0.128	1	19.6	1	135
West	Residual	DU-7	18.7	1	0.13	1	19.7	1	92.7
West	Residual	DU-9	40.7	1	0.141	1	24.4	1	115
Central	Residual	DU-10	73.3	1	0.609	1	22.6	1	117
Central	Residual	DU-11	43.3	1	0.604	1	26.4	1	95
Central	Residual	DU-12	70.8	1	0.207	1	17.8	1	79.7
Central	Residual	DU-13	175	1	0.769	1	18.4	1	127
Central	Residual	DU-14	162	1	2.5	1	24.8	1	164
Central	Residual	DU-15	63.6	1	0.563	1	17.6	1	76.8
Central	Residual	DU-16	37.5	1	0.1485	1	16.8	1	71.3
Central	Residual	DU-17	35.1	1	0.121	1	14.6	1	58.4
Central	Residual	DU-18	92.3	1	0.681	1	18.3	1	118
Central	Residual	DU-19	70.8	1	0.1485	1	15.5	1	113
Central	Residual	DU-20	17.7	1	0.136	1	28.4	1	87.3
Central	Residual	DU-21	89.7	1	0.1485	1	18	1	109
Central	Residual	DU-22	57.5	1	0.376	1	21.4	1	123
Central	Residual	DU-23	82.2	1	0.426	1	18.8	1	99
Central	Residual	DU-24	23.2	1	0.1485	1	20.6	1	124
Central	Residual	DU-25	43.2	1	0.116	1	18.7	1	138
Central	Residual	DU-26	76.1	1	0.82	1	18.3	1	138
Central	Residual	DU-42	53.3	1	0.226	1	23.3	1	126
East	Residual	DU-27	55.4	1	0.0643	1	18.4	1	139
East	Residual	DU-28	113	1	0.1485	1	19.6	1	275
East	Residual	DU-29	103	1	0.0595	1	18.1	1	164
East	Residual	DU-30	131	1	0.0829	1	18.3	1	179
East	Residual	DU-31	44.8	1	0.0479	1	16.5	1	116

ProUCL Input - Willamette Cove Residual (To

Parcel	Group	Decision Unit	Lead	D_Lead	Mercury	D_Mercury	Nickel	D_Nickel	Zinc
East	Residual	DU-32	28.9	1	0.0428	0	15.7	1	118
East	Residual	DU-33	88.8	1	0.0435	1	14.9	1	290
East	Residual	DU-34	31.9	1	0.0447	1	24.3	1	177
East	Residual	DU-35	22.6	1	0.0415	1	17.8	1	174
East	Residual	DU-36	73.2	1	0.0398	0	22.6	1	266
East	Residual	DU-38	30.5	1	0.0454	1	16.5	1	110
East	Residual	DU-37	39.3	1	0.0396	0	18.6	1	74.4
East	Residual	DU-39	6.09	1	0.0427	0	16	1	62.8
East	Residual	DU-40	3.75	1	0.0407	0	16.3	1	44.3
East	Residual	DU-43	5.42	1	0.0402	0	16.9	1	53.9
East	Residual	DU-44	13	1	0.0394	0	17.7	1	83.7

ProUCL Input - Willamette Cove Residual (To

Parcel	Group	Decision Unit	D_Zinc	Dioxin/Furan	D_Dioxin/Furan	Dibenzofuran	D_Dibenzofuran
West	Residual	DU-1	1	2.21E-05	1	0.0078	1
West	Residual	DU-2	1	6.95E-06	1	0.0051	1
West	Residual	DU-3	1	2.63E-05	1	0.0048	0
West	Residual	DU-4	1	2.09E-05	1	0.0057	1
West	Residual	DU-6	1	1.04E-05	1	0.0052	1
West	Residual	DU-7	1	1.24E-05	1	0.0050	0
West	Residual	DU-9	1	1.28E-05	1	0.0048	0
Central	Residual	DU-10	1	4.52E-06	1	0.0244	1
Central	Residual	DU-11	1	5.89E-06	1	0.0613	1
Central	Residual	DU-12	1	2.60E-06	1	0.0050	0
Central	Residual	DU-13	1	2.66E-05	1	0.0052	1
Central	Residual	DU-14	1	1.43E-05	1	0.0143	1
Central	Residual	DU-15	1	1.50E-04	1	0.0049	0
Central	Residual	DU-16	1	7.62E-06	1	0.0050	0
Central	Residual	DU-17	1	7.81E-06	1	0.0050	0
Central	Residual	DU-18	1	1.29E-05	1	0.0051	0
Central	Residual	DU-19	1	4.66E-05	1	0.0051	0
Central	Residual	DU-20	1	4.30E-06	1	0.0049	0
Central	Residual	DU-21	1	1.01E-05	1	0.0052	1
Central	Residual	DU-22	1	7.93E-06	1	0.0051	0
Central	Residual	DU-23	1	5.92E-06	1	0.0051	0
Central	Residual	DU-24	1	6.44E-06	1	0.0050	0
Central	Residual	DU-25	1	1.94E-06	1	0.0048	0
Central	Residual	DU-26	1	2.36E-05	1	0.0050	0
Central	Residual	DU-42	1	6.07E-05	1	0.0050	0
East	Residual	DU-27	1	2.40E-05	1	0.0050	0
East	Residual	DU-28	1	1.49E-05	1	0.0084	1
East	Residual	DU-29	1	4.97E-05	1	0.0085	1
East	Residual	DU-30	1	5.05E-05	1	0.0072	1
East	Residual	DU-31	1	5.84E-05	1	0.0050	1

ProUCL Input - Willamette Cove Residual (To

Parcel	Group	Decision Unit	D_Zinc	Dioxin/Furan	D_Dioxin/Furan	Dibenzofuran	D_Dibenzofuran
East	Residual	DU-32	1	3.48E-05	1	0.0063	1
East	Residual	DU-33	1	3.69E-05	1	0.0081	1
East	Residual	DU-34	1	2.82E-05	1	0.0098	1
East	Residual	DU-35	1	4.05E-05	1	0.0053	1
East	Residual	DU-36	1	4.21E-05	1	0.0060	1
East	Residual	DU-38	1	2.94E-05	1	0.0056	1
East	Residual	DU-37	1	6.78E-07	1	0.0050	0
East	Residual	DU-39	1	3.68E-06	1	0.0049	0
East	Residual	DU-40	1	7.34E-07	1	0.0050	0
East	Residual	DU-43	1	3.00E-06	1	0.0049	0
East	Residual	DU-44	1	1.38E-06	1	0.0050	0

ProUCL Input - Willamette Cove Residual (To

Parcel	Group	Decision Unit	TotalHPAHs	D_TotalHPAHs	cPAHs	D_cPAHs	TotalPCBs	D_TotalPCBs
West	Residual	DU-1	2.6600	1	0.4460	1	0.4270	1
West	Residual	DU-2	1.0200	1	0.1650	1	0.1860	1
West	Residual	DU-3	0.9760	1	0.1530	1	0.0250	1
West	Residual	DU-4	2.5200	1	0.4280	1	0.0317	1
West	Residual	DU-6	1.1000	1	0.1880	1	0.0625	1
West	Residual	DU-7	0.4400	1	0.0711	1	0.0567	1
West	Residual	DU-9	0.4770	1	0.0771	1	0.0353	1
Central	Residual	DU-10	16.9000	1	2.6000	1	0.0051	0
Central	Residual	DU-11	30.2000	1	5.1300	1	0.0389	1
Central	Residual	DU-12	0.5840	1	0.0900	1	0.0050	0
Central	Residual	DU-13	1.6700	1	0.2630	1	0.0330	1
Central	Residual	DU-14	1.3200	1	0.1950	1	0.0048	0
Central	Residual	DU-15	0.6910	1	0.1010	1	0.0048	0
Central	Residual	DU-16	0.4170	1	0.0569	1	0.0050	0
Central	Residual	DU-17	0.2220	1	0.0309	1	0.0049	0
Central	Residual	DU-18	0.5870	1	0.0862	1	0.0316	1
Central	Residual	DU-19	0.5140	1	0.0790	1	0.0568	1
Central	Residual	DU-20	0.0881	1	0.0132	1	0.0050	0
Central	Residual	DU-21	0.6240	1	0.0879	1	0.0050	0
Central	Residual	DU-22	0.2250	1	0.0292	1	0.0050	0
Central	Residual	DU-23	0.2310	1	0.0362	1	0.0050	0
Central	Residual	DU-24	0.5000	1	0.0740	1	0.0049	0
Central	Residual	DU-25	0.6130	1	0.0873	1	0.0050	0
Central	Residual	DU-26	0.9930	1	0.1480	1	0.1890	1
Central	Residual	DU-42	0.3470	1	0.0507	1	0.0050	0
East	Residual	DU-27	0.6570	1	0.0973	1	0.1780	1
East	Residual	DU-28	1.8900	1	0.3530	1	0.0370	1
East	Residual	DU-29	0.9880	1	0.1540	1	0.0250	1
East	Residual	DU-30	2.1500	1	0.3980	1	0.0325	1
East	Residual	DU-31	0.8540	1	0.1240	1	0.0257	1

ProUCL Input - Willamette Cove Residual (To

Parcel	Group	Decision Unit	TotalHPAHs	D_TotalHPAHs	cPAHs	D_cPAHs	TotalPCBs	D_TotalPCBs
East	Residual	DU-32	0.7760	1	0.1150	1	0.0048	0
East	Residual	DU-33	0.4140	1	0.0542	1	0.0852	1
East	Residual	DU-34	1.1900	1	0.1840	1	0.0476	1
East	Residual	DU-35	0.6160	1	0.0931	1	0.0284	1
East	Residual	DU-36	0.6170	1	0.0823	1	0.0279	1
East	Residual	DU-38	0.5940	1	0.0828	1	0.0412	1
East	Residual	DU-37	0.0834	1	0.0124	1	0.0049	0
East	Residual	DU-39	0.0270	1	0.0057	1	0.0049	0
East	Residual	DU-40	0.0249	1	0.0057	1	0.0049	0
East	Residual	DU-43	0.1200	1	0.0163	1	0.0051	0
East	Residual	DU-44	0.1430	1	0.0180	1	0.0049	0

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Copper
West	Residual	DU-1	0.801	1	6.24	1	180
West	Residual	DU-1	0.529	0	5.79	1	69.5
West	Residual	DU-2	0.603	1	5.41	1	119
West	Residual	DU-2	0.515	0	5.36	1	170
West	Residual	DU-2	0.495	0	5.21	1	41.9
West	Residual	DU-3	0.547	0	6.87	1	26.8
West	Residual	DU-3	0.497	0	6.65	1	25.8
West	Residual	DU-3	0.536	0	6.65	1	21.6
West	Residual	DU-4	0.565	0	6.57	1	29.1
West	Residual	DU-4	0.515	0	6.87	1	26.6
West	Residual	DU-4	0.502	0	7.63	1	34
West	Residual	DU-6	0.539	0	4.93	1	67.6
West	Residual	DU-6	0.526	0	4.67	1	100
West	Residual	DU-7	0.547	0	3.98	1	30.1
West	Residual	DU-7	0.536	0	3.07	1	24.2
West	Residual	DU-9	0.555	0	4.81	1	34.6
West	Residual	DU-9	0.512	0	5.12	1	37.4
Central	Residual	DU-10	0.514	1	5.16	1	32.2
Central	Residual	DU-11	0.526	0	4.23	1	35.2
Central	Residual	DU-12	0.551	0	3.62	1	41
Central	Residual	DU-13	0.562	0	4.04	1	54.2
Central	Residual	DU-14	3.04	1	5.66	1	185
Central	Residual	DU-15	0.492	0	2.91	1	36.2
Central	Residual	DU-16	0.499	0	3.72	1	29.1
Central	Residual	DU-17	0.504	0	3.16	1	26.8
Central	Residual	DU-18	0.502	0	5.63	1	59.9
Central	Residual	DU-19	0.926	1	5.68	1	44.9
Central	Residual	DU-20	0.536	0	4.08	1	25.8
Central	Residual	DU-20	0.511	0	3.68	1	23
Central	Residual	DU-21	0.497	0	4.48	1	45.9
Central	Residual	DU-22	1.09	1	4.45	1	54
Central	Residual	DU-23	0.498	1	3.82	1	41.9

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Copper
Central	Residual	DU-24	0.496	0	3.56	1	31.1
Central	Residual	DU-24	0.501	0	2.84	1	17.6
Central	Residual	DU-25	0.496	0	3.17	1	30
Central	Residual	DU-26	0.529	1	4.75	1	41.6
Central	Residual	DU-42	0.512	0	4.38	1	36.3
Central	Residual	DU-42	0.667	1	4.11	1	25.4
Central	Residual	DU-42	0.531	0	3.76	1	21.1
East	Residual	DU-27	1.15	1	15.8	1	45.6
East	Residual	DU-28	4.79	1	7.4	1	229
East	Residual	DU-29	1.08	1	6.95	1	69.3
East	Residual	DU-29	1.02	1	5.08	1	44.3
East	Residual	DU-29	0.511	0	3.6	1	27.8
East	Residual	DU-30	1.66	1	4.22	1	63.4
East	Residual	DU-30	2.09	1	3.72	1	79.8
East	Residual	DU-31	1.85	1	6.09	1	35.4
East	Residual	DU-31	0.743	1	4.98	1	49.2
East	Residual	DU-31	0.735	1	5.96	1	68.2
East	Residual	DU-32	0.879	1	8.99	1	31.6
East	Residual	DU-32	0.535	0	7.1	1	23.4
East	Residual	DU-32	0.492	0	3.56	1	20.1
East	Residual	DU-33	2.31	1	6.62	1	79.8
East	Residual	DU-33	1.84	1	9.6	1	96.6
East	Residual	DU-33	0.666	1	5.35	1	52.6
East	Residual	DU-34	0.557	1	4.95	1	33.2
East	Residual	DU-34	0.537	0	3.69	1	33.1
East	Residual	DU-35	0.512	0	4.4	1	52.9
East	Residual	DU-35	0.531	0	3.81	1	29.1
East	Residual	DU-35	0.524	0	3.37	1	27.8
East	Residual	DU-36	3.77	1	5.03	1	57.9
East	Residual	DU-36	3.44	1	4.23	1	56.7
East	Residual	DU-36	3.62	1	4.12	1	46.3
East	Residual	DU-38	1.31	1	3.71	1	27.7

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	Antimony	D_Antimony	Arsenic	D_Arsenic	Copper
East	Residual	DU-38	4.88	1	3.76	1	56
East	Residual	DU-38	3.71	1	4.06	1	51.4
East	Residual	DU-37	0.495	0	3.72	1	26.1
East	Residual	DU-37	0.495	0	3.00	1	21.4
East	Residual	DU-37	0.513	0	2.85	1	16.9
East	Residual	DU-39	0.534	0	2.69	1	21.3
East	Residual	DU-39	0.56	0	3.24	1	17.9
East	Residual	DU-39	0.525	0	3.44	1	18.4
East	Residual	DU-40	0.509	0	2.88	1	16.2
East	Residual	DU-40	0.513	0	3.4	1	15.4
East	Residual	DU-40	0.525	0	3.13	1	16.6
East	Residual	DU-43	0.503	0	2.92	1	18.8
East	Residual	DU-43	0.536	0	2.89	1	18.7
East	Residual	DU-43	0.523	0	3.06	1	16.3
East	Residual	DU-44	0.619	1	3.12	1	17.9
East	Residual	DU-44	0.486	0	3.24	1	15.7
East	Residual	DU-44	0.505	0	3.06	1	15

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	D_Copper	Lead	D_Lead	Mercury	D_Mercury	Nickel	D_Nickel
West	Residual	DU-1	1	74.8	1	0.0696	1	27.1	1
West	Residual	DU-1	1	57.5	1	0.0813	1	25.0	1
West	Residual	DU-2	1	96.2	1	0.0731	1	18.9	1
West	Residual	DU-2	1	118	1	0.124	1	16.4	1
West	Residual	DU-2	1	24.4	1	0.0607	1	14.7	1
West	Residual	DU-3	1	20.1	1	0.0438	0	16.3	1
West	Residual	DU-3	1	15.8	1	0.0455	1	17.1	1
West	Residual	DU-3	1	13.5	1	0.0497	1	16.0	1
West	Residual	DU-4	1	23.7	1	0.0746	1	23.9	1
West	Residual	DU-4	1	23.9	1	0.0596	1	24.6	1
West	Residual	DU-4	1	45.1	1	0.076	1	22.4	1
West	Residual	DU-6	1	28.2	1	0.128	1	19.6	1
West	Residual	DU-6	1	37.8	1	0.141	1	22.0	1
West	Residual	DU-7	1	18.7	1	0.13	1	19.7	1
West	Residual	DU-7	1	14.9	1	0.0927	1	19.1	1
West	Residual	DU-9	1	40.7	1	0.141	1	24.4	1
West	Residual	DU-9	1	21.5	1	0.141	1	26.2	1
Central	Residual	DU-10	1	73.3	1	0.609	1	22.6	1
Central	Residual	DU-11	1	43.3	1	0.604	1	26.4	1
Central	Residual	DU-12	1	70.8	1	0.207	1	17.8	1
Central	Residual	DU-13	1	175	1	0.769	1	18.4	1
Central	Residual	DU-14	1	162	1	2.5	1	24.8	1
Central	Residual	DU-15	1	63.6	1	0.563	1	17.6	1
Central	Residual	DU-16	1	37.5	1	0.1485	1	16.8	1
Central	Residual	DU-17	1	35.1	1	0.121	1	14.6	1
Central	Residual	DU-18	1	92.3	1	0.681	1	18.3	1
Central	Residual	DU-19	1	70.8	1	0.1485	1	15.5	1
Central	Residual	DU-20	1	17.7	1	0.136	1	28.4	1
Central	Residual	DU-20	1	14.3	1	0.101	1	21.1	1
Central	Residual	DU-21	1	89.7	1	0.1485	1	18	1
Central	Residual	DU-22	1	57.5	1	0.376	1	21.4	1
Central	Residual	DU-23	1	82.2	1	0.426	1	18.8	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	D_Copper	Lead	D_Lead	Mercury	D_Mercury	Nickel	D_Nickel
Central	Residual	DU-24	1	23.2	1	0.1485	1	20.6	1
Central	Residual	DU-24	1	13.8	1	0.0928	1	18.5	1
Central	Residual	DU-25	1	43.2	1	0.116	1	18.7	1
Central	Residual	DU-26	1	76.1	1	0.82	1	18.3	1
Central	Residual	DU-42	1	53.3	1	0.226	1	23.3	1
Central	Residual	DU-42	1	30.3	1	0.186	1	22.6	1
Central	Residual	DU-42	1	20.1	1	0.125	1	20.7	1
East	Residual	DU-27	1	55.4	1	0.0643	1	18.4	1
East	Residual	DU-28	1	113	1	0.1485	1	19.6	1
East	Residual	DU-29	1	103	1	0.0595	1	18.1	1
East	Residual	DU-29	1	41.1	1	0.0436	0	15.3	1
East	Residual	DU-29	1	45.7	1	0.0409	0	15.2	1
East	Residual	DU-30	1	131	1	0.0829	1	18.3	1
East	Residual	DU-30	1	202	1	0.05	1	17.7	1
East	Residual	DU-31	1	44.8	1	0.0479	1	16.5	1
East	Residual	DU-31	1	34.1	1	0.067	1	17	1
East	Residual	DU-31	1	25	1	0.0415	0	16.7	1
East	Residual	DU-32	1	28.9	1	0.0428	0	15.7	1
East	Residual	DU-32	1	20.9	1	0.0428	0	15.3	1
East	Residual	DU-32	1	34.1	1	0.0394	0	14.2	1
East	Residual	DU-33	1	88.8	1	0.0435	1	14.9	1
East	Residual	DU-33	1	66.2	1	0.0413	0	17.8	1
East	Residual	DU-33	1	42.8	1	0.0423	0	16.4	1
East	Residual	DU-34	1	31.9	1	0.0447	1	24.3	1
East	Residual	DU-34	1	25.9	1	0.043	0	20.1	1
East	Residual	DU-35	1	22.6	1	0.0415	1	17.8	1
East	Residual	DU-35	1	19	1	0.0425	0	15.3	1
East	Residual	DU-35	1	12.4	1	0.042	0	14.2	1
East	Residual	DU-36	1	73.2	1	0.0398	0	22.6	1
East	Residual	DU-36	1	130	1	0.0606	1	19	1
East	Residual	DU-36	1	63.3	1	0.0449	1	18.3	1
East	Residual	DU-38	1	30.5	1	0.0454	1	16.5	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	D_Copper	Lead	D_Lead	Mercury	D_Mercury	Nickel	D_Nickel
East	Residual	DU-38	1	76.7	1	0.0415	0	16	1
East	Residual	DU-38	1	51.3	1	0.0421	0	17.1	1
East	Residual	DU-37	1	39.3	1	0.0396	0	18.6	1
East	Residual	DU-37	1	12.6	1	0.043	1	18.8	1
East	Residual	DU-37	1	8.96	1	0.0411	0	17.1	1
East	Residual	DU-39	1	6.09	1	0.0427	0	16	1
East	Residual	DU-39	1	5.11	1	0.0448	0	18.3	1
East	Residual	DU-39	1	6.88	1	0.042	0	19.2	1
East	Residual	DU-40	1	3.75	1	0.0407	0	16.3	1
East	Residual	DU-40	1	3.47	1	0.0411	0	17.7	1
East	Residual	DU-40	1	3.1	1	0.042	0	18.2	1
East	Residual	DU-43	1	5.42	1	0.0402	0	16.9	1
East	Residual	DU-43	1	9.65	1	0.0429	0	18.5	1
East	Residual	DU-43	1	4.35	1	0.0418	0	18.4	1
East	Residual	DU-44	1	13	1	0.0394	0	17.7	1
East	Residual	DU-44	1	6.23	1	0.0389	0	17.2	1
East	Residual	DU-44	1	5.94	1	0.0404	0	16.0	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan	Dibenzofuran
West	Residual	DU-1	151	1	2.21E-05	1	0.0078
West	Residual	DU-1	179	1	1.07E-05	1	0.0048
West	Residual	DU-2	99.4	1	6.95E-06	1	0.0051
West	Residual	DU-2	88.8	1	3.44E-06	1	0.0047
West	Residual	DU-2	78	1	2.42E-06	1	0.0050
West	Residual	DU-3	80.4	1	2.63E-05	1	0.0048
West	Residual	DU-3	72.2	1	7.82E-06	1	0.0051
West	Residual	DU-3	64.7	1	4.57E-06	1	0.0050
West	Residual	DU-4	89.4	1	2.09E-05	1	0.0057
West	Residual	DU-4	79.4	1	1.66E-05	1	0.0334
West	Residual	DU-4	115	1	1.47E-05	1	0.0094
West	Residual	DU-6	135	1	1.04E-05	1	0.0052
West	Residual	DU-6	112	1	1.14E-05	1	0.0110
West	Residual	DU-7	92.7	1	1.24E-05	1	0.0050
West	Residual	DU-7	75.1	1	8.17E-06	1	0.0050
West	Residual	DU-9	115	1	1.28E-05	1	0.0048
West	Residual	DU-9	122	1	1.23E-05	1	0.0080
Central	Residual	DU-10	117	1	4.52E-06	1	0.0244
Central	Residual	DU-11	95	1	5.89E-06	1	0.0613
Central	Residual	DU-12	79.7	1	2.60E-06	1	0.0050
Central	Residual	DU-13	127	1	2.66E-05	1	0.0052
Central	Residual	DU-14	164	1	1.43E-05	1	0.0143
Central	Residual	DU-15	76.8	1	1.50E-04	1	0.0049
Central	Residual	DU-16	71.3	1	7.62E-06	1	0.0050
Central	Residual	DU-17	58.4	1	7.81E-06	1	0.0050
Central	Residual	DU-18	118	1	1.29E-05	1	0.0051
Central	Residual	DU-19	113	1	4.66E-05	1	0.0051
Central	Residual	DU-20	87.3	1	4.30E-06	1	0.0049
Central	Residual	DU-20	90.4	1	3.97E-06	1	0.0047
Central	Residual	DU-21	109	1	1.01E-05	1	0.0052
Central	Residual	DU-22	123	1	7.93E-06	1	0.0051
Central	Residual	DU-23	99	1	5.92E-06	1	0.0051

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan	Dibenzofuran
Central	Residual	DU-24	124	1	6.44E-06	1	0.0050
Central	Residual	DU-24	83.1	1	8.88E-06	1	0.0050
Central	Residual	DU-25	138	1	1.94E-06	1	0.0048
Central	Residual	DU-26	138	1	2.36E-05	1	0.0050
Central	Residual	DU-42	126	1	6.07E-05	1	0.0050
Central	Residual	DU-42	109	1	2.27E-05	1	0.0048
Central	Residual	DU-42	87	1	8.27E-06	1	0.0050
East	Residual	DU-27	139	1	2.40E-05	1	0.0050
East	Residual	DU-28	275	1	1.49E-05	1	0.0084
East	Residual	DU-29	164	1	4.97E-05	1	0.0085
East	Residual	DU-29	100	1	1.53E-05	1	0.0051
East	Residual	DU-29	92.7	1	1.53E-05	1	0.0050
East	Residual	DU-30	179	1	5.05E-05	1	0.0072
East	Residual	DU-30	228	1	2.24E-05	1	0.0050
East	Residual	DU-31	116	1	5.84E-05	1	0.0050
East	Residual	DU-31	140	1	1.90E-05	1	0.0054
East	Residual	DU-31	109	1	1.09E-05	1	0.0050
East	Residual	DU-32	118	1	3.48E-05	1	0.0063
East	Residual	DU-32	104	1	7.54E-06	1	0.0047
East	Residual	DU-32	90.2	1	7.59E-06	1	0.0405
East	Residual	DU-33	290	1	3.69E-05	1	0.0081
East	Residual	DU-33	354	1	1.67E-05	1	0.0066
East	Residual	DU-33	234	1	1.21E-05	1	0.0049
East	Residual	DU-34	177	1	2.82E-05	1	0.0098
East	Residual	DU-34	222	1	3.02E-05	1	0.0051
East	Residual	DU-35	174	1	4.05E-05	1	0.0053
East	Residual	DU-35	168	1	1.31E-05	1	0.0050
East	Residual	DU-35	141	1	1.02E-05	1	0.0049
East	Residual	DU-36	266	1	4.21E-05	1	0.0060
East	Residual	DU-36	222	1	3.70E-05	1	0.0082
East	Residual	DU-36	190	1	2.80E-05	1	0.0050
East	Residual	DU-38	110	1	2.94E-05	1	0.0056

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	Zinc	D_Zinc	Dioxin/Furan	D_Dioxin/Furan	Dibenzofuran
East	Residual	DU-38	102	1	1.90E-05	1	0.0051
East	Residual	DU-38	108	1	1.05E-05	1	0.0051
East	Residual	DU-37	74.4	1	6.78E-07	1	0.0050
East	Residual	DU-37	61.5	1	6.32E-07	1	0.0050
East	Residual	DU-37	52.2	1	5.69E-07	1	0.0115
East	Residual	DU-39	62.8	1	3.68E-06	1	0.0049
East	Residual	DU-39	57.4	1	1.38E-06	1	0.0049
East	Residual	DU-39	54.3	1	1.36E-06	1	0.0049
East	Residual	DU-40	44.3	1	7.34E-07	1	0.0050
East	Residual	DU-40	44.7	1	5.18E-07	1	0.0050
East	Residual	DU-40	45.1	1	5.52E-07	1	0.0051
East	Residual	DU-43	53.9	1	3.00E-06	1	0.0049
East	Residual	DU-43	56.4	1	1.26E-06	1	0.0051
East	Residual	DU-43	46	1	6.63E-07	1	0.0050
East	Residual	DU-44	83.7	1	1.38E-06	1	0.0050
East	Residual	DU-44	51.3	1	8.37E-07	1	0.0050
East	Residual	DU-44	45.9	1	7.25E-07	1	0.0049

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs	D_cPAHs
West	Residual	DU-1	1	2.6600	1	0.4460	1
West	Residual	DU-1	0	2.1100	1	0.3280	1
West	Residual	DU-2	1	1.0200	1	0.1650	1
West	Residual	DU-2	0	0.7920	1	0.1080	1
West	Residual	DU-2	0	0.2230	1	0.0319	1
West	Residual	DU-3	0	0.9760	1	0.1530	1
West	Residual	DU-3	0	0.9840	1	0.1290	1
West	Residual	DU-3	0	0.7450	1	0.1030	1
West	Residual	DU-4	1	2.5200	1	0.4280	1
West	Residual	DU-4	1	11.9000	1	1.7500	1
West	Residual	DU-4	1	4.6500	1	0.7670	1
West	Residual	DU-6	1	1.1000	1	0.1880	1
West	Residual	DU-6	1	1.4300	1	0.2260	1
West	Residual	DU-7	0	0.4400	1	0.0711	1
West	Residual	DU-7	0	0.3160	1	0.0478	1
West	Residual	DU-9	0	0.4770	1	0.0771	1
West	Residual	DU-9	1	1.1600	1	0.1800	1
Central	Residual	DU-10	1	16.9000	1	2.6000	1
Central	Residual	DU-11	1	30.2000	1	5.1300	1
Central	Residual	DU-12	0	0.5840	1	0.0900	1
Central	Residual	DU-13	1	1.6700	1	0.2630	1
Central	Residual	DU-14	1	1.3200	1	0.1950	1
Central	Residual	DU-15	0	0.6910	1	0.1010	1
Central	Residual	DU-16	0	0.4170	1	0.0569	1
Central	Residual	DU-17	0	0.2220	1	0.0309	1
Central	Residual	DU-18	0	0.5870	1	0.0862	1
Central	Residual	DU-19	0	0.5140	1	0.0790	1
Central	Residual	DU-20	0	0.0881	1	0.0132	1
Central	Residual	DU-20	0	0.1350	1	0.0193	1
Central	Residual	DU-21	1	0.6240	1	0.0879	1
Central	Residual	DU-22	0	0.2250	1	0.0292	1
Central	Residual	DU-23	0	0.2310	1	0.0362	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs	D_cPAHs
Central	Residual	DU-24	0	0.5000	1	0.0740	1
Central	Residual	DU-24	0	0.0883	1	0.0145	1
Central	Residual	DU-25	0	0.6130	1	0.0873	1
Central	Residual	DU-26	0	0.9930	1	0.1480	1
Central	Residual	DU-42	0	0.3470	1	0.0507	1
Central	Residual	DU-42	0	0.2200	1	0.0309	1
Central	Residual	DU-42	0	0.1580	1	0.0229	1
East	Residual	DU-27	0	0.6570	1	0.0973	1
East	Residual	DU-28	1	1.8900	1	0.3530	1
East	Residual	DU-29	1	0.9880	1	0.1540	1
East	Residual	DU-29	0	0.4780	1	0.0697	1
East	Residual	DU-29	0	0.3800	1	0.0588	1
East	Residual	DU-30	1	2.1500	1	0.3980	1
East	Residual	DU-30	0	1.0000	1	0.1690	1
East	Residual	DU-31	1	0.8540	1	0.1240	1
East	Residual	DU-31	1	0.7680	1	0.1190	1
East	Residual	DU-31	0	0.6490	1	0.0919	1
East	Residual	DU-32	1	0.7760	1	0.1150	1
East	Residual	DU-32	0	0.4910	1	0.0754	1
East	Residual	DU-32	1	3.5300	1	0.5660	1
East	Residual	DU-33	1	0.4140	1	0.0542	1
East	Residual	DU-33	1	0.4510	1	0.0519	1
East	Residual	DU-33	0	0.4010	1	0.0555	1
East	Residual	DU-34	1	1.1900	1	0.1840	1
East	Residual	DU-34	1	0.6510	1	0.0973	1
East	Residual	DU-35	1	0.6160	1	0.0931	1
East	Residual	DU-35	0	0.7040	1	0.1190	1
East	Residual	DU-35	0	0.2500	1	0.0355	1
East	Residual	DU-36	1	0.6170	1	0.0823	1
East	Residual	DU-36	1	0.7770	1	0.1030	1
East	Residual	DU-36	0	0.2950	1	0.0379	1
East	Residual	DU-38	1	0.5940	1	0.0828	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	D_Dibenzofuran	TotalHPAHs	D_TotalHPAHs	cPAHs	D_cPAHs
East	Residual	DU-38	0	0.4550	1	0.0635	1
East	Residual	DU-38	0	0.5190	1	0.0442	1
East	Residual	DU-37	0	0.0834	1	0.0124	1
East	Residual	DU-37	0	0.1050	1	0.0114	1
East	Residual	DU-37	1	0.8510	1	0.0970	1
East	Residual	DU-39	0	0.0270	1	0.0057	1
East	Residual	DU-39	0	0.0247		0.0057	1
East	Residual	DU-39	0	0.0955	1	0.0124	1
East	Residual	DU-40	0	0.0249		0.0057	1
East	Residual	DU-40	0	0.0281	1	0.0061	1
East	Residual	DU-40	0	0.0279	1	0.0061	1
East	Residual	DU-43	0	0.1200	1	0.0163	1
East	Residual	DU-43	0	0.1220	1	0.0106	1
East	Residual	DU-43	0	0.0616	1	0.0097	1
East	Residual	DU-44	0	0.1430	1	0.0180	1
East	Residual	DU-44	0	0.0910	1	0.0127	1
East	Residual	DU-44	0	0.0840	1	0.0129	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	TotalPCBs	D_TotalPCBs
West	Residual	DU-1	0.4270	1
West	Residual	DU-1	0.1100	1
West	Residual	DU-2	0.1860	1
West	Residual	DU-2	0.5580	1
West	Residual	DU-2	0.0299	1
West	Residual	DU-3	0.0250	1
West	Residual	DU-3	0.0050	0
West	Residual	DU-3	0.0048	0
West	Residual	DU-4	0.0317	1
West	Residual	DU-4	0.0245	1
West	Residual	DU-4	0.0351	1
West	Residual	DU-6	0.0625	1
West	Residual	DU-6	0.1670	1
West	Residual	DU-7	0.0567	1
West	Residual	DU-7	0.0502	1
West	Residual	DU-9	0.0353	1
West	Residual	DU-9	0.0478	1
Central	Residual	DU-10	0.0051	0
Central	Residual	DU-11	0.0389	1
Central	Residual	DU-12	0.0050	0
Central	Residual	DU-13	0.0330	1
Central	Residual	DU-14	0.0048	0
Central	Residual	DU-15	0.0048	0
Central	Residual	DU-16	0.0050	0
Central	Residual	DU-17	0.0049	0
Central	Residual	DU-18	0.0316	1
Central	Residual	DU-19	0.0568	1
Central	Residual	DU-20	0.0050	0
Central	Residual	DU-20	0.0050	0
Central	Residual	DU-21	0.0050	0
Central	Residual	DU-22	0.0050	0
Central	Residual	DU-23	0.0050	0

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	TotalPCBs	D_TotalPCBs
Central	Residual	DU-24	0.0049	0
Central	Residual	DU-24	0.0048	0
Central	Residual	DU-25	0.0050	0
Central	Residual	DU-26	0.1890	1
Central	Residual	DU-42	0.0050	0
Central	Residual	DU-42	0.0050	0
Central	Residual	DU-42	0.0049	0
East	Residual	DU-27	0.1780	1
East	Residual	DU-28	0.0370	1
East	Residual	DU-29	0.0250	1
East	Residual	DU-29	0.0047	0
East	Residual	DU-29	0.0049	0
East	Residual	DU-30	0.0325	1
East	Residual	DU-30	0.0050	0
East	Residual	DU-31	0.0257	1
East	Residual	DU-31	0.0298	1
East	Residual	DU-31	0.0270	1
East	Residual	DU-32	0.0048	0
East	Residual	DU-32	0.0048	0
East	Residual	DU-32	0.0047	0
East	Residual	DU-33	0.0852	1
East	Residual	DU-33	0.0501	1
East	Residual	DU-33	0.0579	1
East	Residual	DU-34	0.0476	1
East	Residual	DU-34	0.0050	0
East	Residual	DU-35	0.0284	1
East	Residual	DU-35	0.0396	1
East	Residual	DU-35	0.0050	0
East	Residual	DU-36	0.0279	1
East	Residual	DU-36	0.0050	0
East	Residual	DU-36	0.0284	1
East	Residual	DU-38	0.0412	1

Pro UCL Input - Willamette Cove Residual

Parcel	Group	Decision Unit	TotalPCBs	D_TotalPCBs
East	Residual	DU-38	0.0444	1
East	Residual	DU-38	0.0300	1
East	Residual	DU-37	0.0049	0
East	Residual	DU-37	0.0050	0
East	Residual	DU-37	0.0051	0
East	Residual	DU-39	0.0049	0
East	Residual	DU-39	0.0049	0
East	Residual	DU-39	0.0049	0
East	Residual	DU-40	0.0049	0
East	Residual	DU-40	0.0050	0
East	Residual	DU-40	0.0050	0
East	Residual	DU-43	0.0051	0
East	Residual	DU-43	0.0051	0
East	Residual	DU-43	0.0050	0
East	Residual	DU-44	0.0049	0
East	Residual	DU-44	0.0049	0
East	Residual	DU-44	0.0048	0

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:56:03 PM
 From File 90 UCL Input Data_MG_a.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	54	Number of Distinct Observations	49
Number of Detects	30	Number of Non-Detects	24
Number of Distinct Detects	29	Number of Distinct Non-Detects	21
Minimum Detect	0.498	Minimum Non-Detect	0.492
Maximum Detect	7.38	Maximum Non-Detect	0.562
Variance Detects	2.412	Percent Non-Detects	44.44%
Mean Detects	1.824	SD Detects	1.553
Median Detects	1.24	CV Detects	0.851
Skewness Detects	1.964	Kurtosis Detects	4.665
Mean of Logged Detects	0.319	SD of Logged Detects	0.744

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.784	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.9	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.205	Lilliefors GOF Test
1% Lilliefors Critical Value	0.185	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.233	KM Standard Error of Mean	0.182
90KM SD	1.316	95% KM (BCA) UCL	1.491
90% KM (t) UCL	1.469	90% KM (Percentile Bootstrap) UCL	1.473
90% KM (z) UCL	1.466	90% KM Bootstrap t UCL	1.54
90% KM Chebyshev UCL	1.779	95% KM Chebyshev UCL	2.027
97.5% KM Chebyshev UCL	2.37	99% KM Chebyshev UCL	3.045

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.823	Anderson-Darling GOF Test
5% A-D Critical Value	0.759	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.158	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.162	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.923	k star (bias corrected MLE)	1.753
Theta hat (MLE)	0.949	Theta star (bias corrected MLE)	1.041
nu hat (MLE)	115.4	nu star (bias corrected)	105.2
Mean (detects)	1.824		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.018
Maximum	7.38	Median	0.53
SD	1.465	CV	1.44
k hat (MLE)	0.355	k star (bias corrected MLE)	0.348
Theta hat (MLE)	2.863	Theta star (bias corrected MLE)	2.924
nu hat (MLE)	38.39	nu star (bias corrected)	37.59
Adjusted Level of Significance (β)	0.0951		
Approximate Chi Square Value (37.59, α)	26.99	Adjusted Chi Square Value (37.59, β)	26.8
90% Gamma Approximate UCL	1.417	90% Gamma Adjusted UCL	1.428
95% Gamma Approximate UCL	1.558	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.233	SD (KM)	1.316
Variance (KM)	1.731	SE of Mean (KM)	0.182
k hat (KM)	0.878	k star (KM)	0.842
nu hat (KM)	94.82	nu star (KM)	90.88
theta hat (KM)	1.404	theta star (KM)	1.465
80% gamma percentile (KM)	2.009	90% gamma percentile (KM)	2.961
95% gamma percentile (KM)	3.928	99% gamma percentile (KM)	6.2

Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (90.88, α)	74.09	Adjusted Chi Square Value (90.88, β)	73.76
90% KM Approximate Gamma UCL	1.512	90% KM Adjusted Gamma UCL	1.519

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.943	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.939	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.123	Lilliefors GOF Test
10% Lilliefors Critical Value	0.146	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.117	Mean in Log Scale	-0.479
SD in Original Scale	1.399	SD in Log Scale	1.063
90% t UCL (assumes normality of ROS data)	1.364	90% Percentile Bootstrap UCL	1.362
90% BCA Bootstrap UCL	1.394	90% Bootstrap t UCL	1.421
90% H-UCL (Log ROS)	1.077		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.136	KM Geo Mean	0.873
KM SD (logged)	0.745	90% Critical H Value (KM-Log)	1.572
KM Standard Error of Mean (logged)	0.103	90% H-UCL (KM -Log)	1.354
KM SD (logged)	0.745	90% Critical H Value (KM-Log)	1.572
KM Standard Error of Mean (logged)	0.103		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.128	Mean in Log Scale	-0.424
SD in Original Scale	1.391	SD in Log Scale	1.003
90% t UCL (Assumes normality)	1.374	90% H-Stat UCL	1.108

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Arsenic

General Statistics

Total Number of Observations	54	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	2.84	Mean	5.333
Maximum	11.6	Median	4.69
SD	2.106	Std. Error of Mean	0.287
Coefficient of Variation	0.395	Skewness	1.62

Normal GOF Test

Shapiro Wilk Test Statistic	0.817	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	1.1043E-8	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.173	Lilliefors GOF Test
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	5.705	90% Adjusted-CLT UCL (Chen-1995)	5.745
		90% Modified-t UCL (Johnson-1978)	5.715

Gamma GOF Test

A-D Test Statistic	1.592	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.751	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.13	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.121	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.224	k star (bias corrected MLE)	7.78
Theta hat (MLE)	0.648	Theta star (bias corrected MLE)	0.685
nu hat (MLE)	888.2	nu star (bias corrected)	840.2
MLE Mean (bias corrected)	5.333	MLE Sd (bias corrected)	1.912
Adjusted Level of Significance	0.0951	Approximate Chi Square Value (0.1)	788.1
		Adjusted Chi Square Value	787

Assuming Gamma Distribution

90% Approximate Gamma UCL	5.685	90% Adjusted Gamma UCL	5.693

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	0.00449	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.107	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.044	Mean of logged Data	1.612
Maximum of Logged Data	2.451	SD of logged Data	0.34

Assuming Lognormal Distribution

90% H-UCL	5.662	90% Chebyshev (MVUE) UCL	6.06
95% Chebyshev (MVUE) UCL	6.402	97.5% Chebyshev (MVUE) UCL	6.876
99% Chebyshev (MVUE) UCL	7.809		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	5.7	90% BCA Bootstrap UCL	5.754
90% Standard Bootstrap UCL	5.698	90% Bootstrap-t UCL	5.76
90% Hall's Bootstrap UCL	5.745	90% Percentile Bootstrap UCL	5.707
90% Chebyshev(Mean, Sd) UCL	6.192	95% Chebyshev(Mean, Sd) UCL	6.582
97.5% Chebyshev(Mean, Sd) UCL	7.122	99% Chebyshev(Mean, Sd) UCL	8.184

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coeffic

Chromium

General Statistics

Total Number of Observations	54	Number of Distinct Observations	42
		Number of Missing Observations	0
Minimum	10.9	Mean	16.23
Maximum	26.6	Median	15.15
SD	3.843	Std. Error of Mean	0.523
Coefficient of Variation	0.237	Skewness	0.67

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	0.00419	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.158	Lilliefors GOF Test
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	16.91	90% Adjusted-CLT UCL (Chen-1995)	16.93
		90% Modified-t UCL (Johnson-1978)	16.92

Gamma GOF Test

A-D Test Statistic	0.783	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.749	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.131	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.121	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	19.17	k star (bias corrected MLE)	18.12
Theta hat (MLE)	0.847	Theta star (bias corrected MLE)	0.896
nu hat (MLE)	2070	nu star (bias corrected)	1957
MLE Mean (bias corrected)	16.23	MLE Sd (bias corrected)	3.813
		Approximate Chi Square Value (0.1)	1877
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	1875

Assuming Gamma Distribution

90% Approximate Gamma UCL	16.92	90% Adjusted Gamma UCL	16.93

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.952	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	0.0583	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.116	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.11	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	2.389	Mean of logged Data	2.761
Maximum of Logged Data	3.281	SD of logged Data	0.229

Assuming Lognormal Distribution			
90% H-UCL	16.93	90% Chebyshev (MVUE) UCL	17.76
95% Chebyshev (MVUE) UCL	18.45	97.5% Chebyshev (MVUE) UCL	19.42
99% Chebyshev (MVUE) UCL	21.32		

Nonparametric Distribution Free UCL Statistics Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	16.9	90% BCA Bootstrap UCL	16.94
90% Standard Bootstrap UCL	16.89	90% Bootstrap-t UCL	16.94
90% Hall's Bootstrap UCL	16.93	90% Percentile Bootstrap UCL	16.89
90% Chebyshev(Mean, Sd) UCL	17.8	95% Chebyshev(Mean, Sd) UCL	18.51
97.5% Chebyshev(Mean, Sd) UCL	19.5	99% Chebyshev(Mean, Sd) UCL	21.43

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coeffic

Copper

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	54
		Number of Missing Observations	0
Minimum	17.6	Mean	66.08
Maximum	226	Median	53.5
SD	44	Std. Error of Mean	5.988
Coefficient of Variation	0.666	Skewness	1.615

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.837	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	9.7972E-8	Lilliefors GOF Test	
Lilliefors Test Statistic	0.204	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.139		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	73.85	90% Adjusted-CLT UCL (Chen-1995)	74.7
		90% Modified-t UCL (Johnson-1978)	74.07

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.979	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.758	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.135	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.122		

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	2.914	k star (bias corrected MLE)	2.764
Theta hat (MLE)	22.68	Theta star (bias corrected MLE)	23.91
nu hat (MLE)	314.7	nu star (bias corrected)	298.5
MLE Mean (bias corrected)	66.08	MLE Sd (bias corrected)	39.75
		Approximate Chi Square Value (0.1)	267.7
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	267

Assuming Gamma Distribution			
90% Approximate Gamma UCL	73.7	90% Adjusted Gamma UCL	73.88

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.97	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.338	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.0924	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.11		

Data appear Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	2.868	Mean of logged Data	4.01
Maximum of Logged Data	5.421	SD of logged Data	0.593

Assuming Lognormal Distribution

90% H-UCL 74.15
 95% Chebyshev (MVUE) UCL 90.1
 99% Chebyshev (MVUE) UCL 121.7

90% Chebyshev (MVUE) UCL 82.42
 97.5% Chebyshev (MVUE) UCL 100.8

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 73.76
 90% Standard Bootstrap UCL 73.68
 90% Hall's Bootstrap UCL 75.05
 90% Chebyshev(Mean, Sd) UCL 84.05
 97.5% Chebyshev(Mean, Sd) UCL 103.5

90% BCA Bootstrap UCL 74.31
 90% Bootstrap-t UCL 75.23
 90% Percentile Bootstrap UCL 73.94
 95% Chebyshev(Mean, Sd) UCL 92.18
 99% Chebyshev(Mean, Sd) UCL 125.7

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations 54
 Minimum 13.8
 Maximum 330
 SD 83.57
 Coefficient of Variation 0.726

Number of Distinct Observations 51
 Number of Missing Observations 0
 Mean 115.1
 Median 81.8
 Std. Error of Mean 11.37
 Skewness 1.011

Normal GOF Test

Shapiro Wilk Test Statistic 0.879
 1% Shapiro Wilk P Value 1.0460E-5
 Lilliefors Test Statistic 0.182
 1% Lilliefors Critical Value 0.139

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 129.9

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 130.8
 90% Modified-t UCL (Johnson-1978) 130.2

Gamma GOF Test

A-D Test Statistic 0.423
 5% A-D Critical Value 0.764
 K-S Test Statistic 0.0959
 5% K-S Critical Value 0.123

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 1.93
 Theta hat (MLE) 59.65
 nu hat (MLE) 208.5
 MLE Mean (bias corrected) 115.1
 Adjusted Level of Significance 0.0951

k star (bias corrected MLE) 1.835
 Theta star (bias corrected MLE) 62.74
 nu star (bias corrected) 198.2
 MLE Sd (bias corrected) 84.99
 Approximate Chi Square Value (0.1) 173.2
 Adjusted Chi Square Value 172.6

Assuming Gamma Distribution

90% Approximate Gamma UCL 131.8

90% Adjusted Gamma UCL 132.2

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.958
 10% Shapiro Wilk P Value 0.103
 Lilliefors Test Statistic 0.0842
 10% Lilliefors Critical Value 0.11

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data 2.625
 Maximum of Logged Data 5.799

Mean of logged Data 4.465
 SD of logged Data 0.802

Assuming Lognormal Distribution

90% H-UCL 143.3
 95% Chebyshev (MVUE) UCL 182.6
 99% Chebyshev (MVUE) UCL 264.2

90% Chebyshev (MVUE) UCL 162.8
 97.5% Chebyshev (MVUE) UCL 210.2

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	129.7	90% BCA Bootstrap UCL	131.7
90% Standard Bootstrap UCL	129.9	90% Bootstrap-t UCL	130.9
90% Hall's Bootstrap UCL	130.7	90% Percentile Bootstrap UCL	130.4
90% Chebyshev(Mean, Sd) UCL	149.3	95% Chebyshev(Mean, Sd) UCL	164.7
97.5% Chebyshev(Mean, Sd) UCL	186.2	99% Chebyshev(Mean, Sd) UCL	228.3

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coeffic

Mercury

General Statistics

Total Number of Observations	54	Number of Distinct Observations	53
		Number of Missing Observations	0
Minimum	0.0928	Mean	0.788
Maximum	5.12	Median	0.603
SD	0.854	Std. Error of Mean	0.116
Coefficient of Variation	1.084	Skewness	3.081

Normal GOF Test

Shapiro Wilk Test Statistic	0.701
1% Shapiro Wilk P Value	1.017E-13
Lilliefors Test Statistic	0.222
1% Lilliefors Critical Value	0.139

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	0.939

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	0.972
90% Modified-t UCL (Johnson-1978)	0.947

Gamma GOF Test

A-D Test Statistic	0.595
5% A-D Critical Value	0.771
K-S Test Statistic	0.105
5% K-S Critical Value	0.124

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.36	k star (bias corrected MLE)	1.297
Theta hat (MLE)	0.58	Theta star (bias corrected MLE)	0.608
nu hat (MLE)	146.9	nu star (bias corrected)	140
MLE Mean (bias corrected)	0.788	MLE Sd (bias corrected)	0.692
		Approximate Chi Square Value (0.1)	119.1
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	118.6

Assuming Gamma Distribution

90% Approximate Gamma UCL	0.927

90% Adjusted Gamma UCL	0.93

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976
10% Shapiro Wilk P Value	0.557
Lilliefors Test Statistic	0.0922
10% Lilliefors Critical Value	0.11

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.377	Mean of logged Data	-0.649
Maximum of Logged Data	1.633	SD of logged Data	0.917

Assuming Lognormal Distribution

90% H-UCL	0.966
95% Chebyshev (MVUE) UCL	1.281
99% Chebyshev (MVUE) UCL	1.915

90% Chebyshev (MVUE) UCL	1.127
97.5% Chebyshev (MVUE) UCL	1.495

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.937	90% BCA Bootstrap UCL	0.975
90% Standard Bootstrap UCL	0.934	90% Bootstrap-t UCL	0.995
90% Hall's Bootstrap UCL	1.033	90% Percentile Bootstrap UCL	0.946
90% Chebyshev(Mean, Sd) UCL	1.137	95% Chebyshev(Mean, Sd) UCL	1.295
97.5% Chebyshev(Mean, Sd) UCL	1.514	99% Chebyshev(Mean, Sd) UCL	1.945

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Nickel

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	47
		Number of Missing Observations	0
Minimum	14.6	Mean	20.98
Maximum	29.9	Median	20.55
SD	3.714	Std. Error of Mean	0.505
Coefficient of Variation	0.177	Skewness	0.692
Normal GOF Test			
Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0.0158	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.086	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	21.64	90% Adjusted-CLT UCL (Chen-1995)	21.67
		90% Modified-t UCL (Johnson-1978)	21.65
Gamma GOF Test			
A-D Test Statistic	0.496	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0715	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.121	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	34.04	k star (bias corrected MLE)	32.16
Theta hat (MLE)	0.616	Theta star (bias corrected MLE)	0.652
nu hat (MLE)	3677	nu star (bias corrected)	3474
MLE Mean (bias corrected)	20.98	MLE Sd (bias corrected)	3.7
		Approximate Chi Square Value (0.1)	3367
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	3365
Assuming Gamma Distribution			
90% Approximate Gamma UCL	21.65	90% Adjusted Gamma UCL	21.66
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.283	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0629	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.681	Mean of logged Data	3.029
Maximum of Logged Data	3.398	SD of logged Data	0.172
Assuming Lognormal Distribution			
90% H-UCL	21.65	90% Chebyshev (MVUE) UCL	22.46
95% Chebyshev (MVUE) UCL	23.13	97.5% Chebyshev (MVUE) UCL	24.07
99% Chebyshev (MVUE) UCL	25.9		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	21.63	90% BCA Bootstrap UCL	21.66
90% Standard Bootstrap UCL	21.63	90% Bootstrap-t UCL	21.72
90% Hall's Bootstrap UCL	21.7	90% Percentile Bootstrap UCL	21.61
90% Chebyshev(Mean, Sd) UCL	22.5	95% Chebyshev(Mean, Sd) UCL	23.19
97.5% Chebyshev(Mean, Sd) UCL	24.14	99% Chebyshev(Mean, Sd) UCL	26.01

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	45
		Number of Missing Observations	0
Minimum	58.4	Mean	142.3
Maximum	371	Median	126.5
SD	57.81	Std. Error of Mean	7.867
Coefficient of Variation	0.406	Skewness	1.449
Normal GOF Test			
Shapiro Wilk Test Statistic	0.9	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	1.3240E-4	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.153	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	152.5	90% Adjusted-CLT UCL (Chen-1995)	153.5
		90% Modified-t UCL (Johnson-1978)	152.8
Gamma GOF Test			
A-D Test Statistic	0.51	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.116	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.121	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	7.15	k star (bias corrected MLE)	6.765
Theta hat (MLE)	19.9	Theta star (bias corrected MLE)	21.04
nu hat (MLE)	772.2	nu star (bias corrected)	730.6
MLE Mean (bias corrected)	142.3	MLE Sd (bias corrected)	54.72
		Approximate Chi Square Value (0.1)	682.1
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	681.1
Assuming Gamma Distribution			
90% Approximate Gamma UCL	152.4	90% Adjusted Gamma UCL	152.7
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.986	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.895	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0921	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.067	Mean of logged Data	4.886
Maximum of Logged Data	5.916	SD of logged Data	0.376
Assuming Lognormal Distribution			
90% H-UCL	152.7	90% Chebyshev (MVUE) UCL	164.4
95% Chebyshev (MVUE) UCL	174.6	97.5% Chebyshev (MVUE) UCL	188.7
99% Chebyshev (MVUE) UCL	216.4		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	152.4	90% BCA Bootstrap UCL	153.9
90% Standard Bootstrap UCL	152.4	90% Bootstrap-t UCL	153.5
90% Hall's Bootstrap UCL	153.7	90% Percentile Bootstrap UCL	152.7
90% Chebyshev(Mean, Sd) UCL	165.9	95% Chebyshev(Mean, Sd) UCL	176.6
97.5% Chebyshev(Mean, Sd) UCL	191.4	99% Chebyshev(Mean, Sd) UCL	220.6
Suggested UCL to Use			
Recommendation Provided only for 95% Confidence Coeffic			

Dioxin/Furan

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	54
		Number of Missing Observations	0

Minimum	1.9365E-6	Mean	4.7754E-5
Maximum	3.9633E-4	Median	2.1080E-5
SD	7.6020E-5	Std. Error of Mean	1.0345E-5
Coefficient of Variation	N/A	Skewness	2.928

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.612	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	0		
Lilliefors Test Statistic	0.282	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	6.3955E-5
90% Student's-t UCL	6.1179E-5	90% Modified-t UCL (Johnson-1978)	6.1866E-5

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	1.646	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.797	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.127	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.126		

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	0.706	k star (bias corrected MLE)	0.679
Theta hat (MLE)	6.7603E-5	Theta star (bias corrected MLE)	7.0279E-5
nu hat (MLE)	76.29	nu star (bias corrected)	73.39
MLE Mean (bias corrected)	4.7754E-5	MLE Sd (bias corrected)	5.7932E-5
Adjusted Level of Significance	0.0951	Approximate Chi Square Value (0.1)	58.35
		Adjusted Chi Square Value	58.06

Assuming Gamma Distribution		90% Adjusted Gamma UCL	
90% Approximate Gamma UCL	6.0059E-5	90% Adjusted Gamma UCL	6.0363E-5

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.968	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.294	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.0706	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.11		

Data appear Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-13.15	Mean of logged Data	-10.8
Maximum of Logged Data	-7.833	SD of logged Data	1.304

Assuming Lognormal Distribution		90% Chebyshev (MVUE) UCL	
90% H-UCL	7.05E-05	90% Chebyshev (MVUE) UCL	7.7657E-5
95% Chebyshev (MVUE) UCL	9.1876E-5	97.5% Chebyshev (MVUE) UCL	1.1161E-4
99% Chebyshev (MVUE) UCL	1.5038E-4		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs		90% BCA Bootstrap UCL	
90% CLT UCL	6.1012E-5	90% Bootstrap-t UCL	6.5769E-5
90% Standard Bootstrap UCL	6.0908E-5	90% Percentile Bootstrap UCL	6.1586E-5
90% Hall's Bootstrap UCL	6.4757E-5	95% Chebyshev(Mean, Sd) UCL	9.2847E-5
90% Chebyshev(Mean, Sd) UCL	7.8789E-5	99% Chebyshev(Mean, Sd) UCL	1.5069E-4
97.5% Chebyshev(Mean, Sd) UCL	1.1236E-4		

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dibenzofuran

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	44
Number of Detects	27	Number of Non-Detects	27
Number of Distinct Detects	27	Number of Distinct Non-Detects	17
Minimum Detect	0.0052	Minimum Non-Detect	0.00473
Maximum Detect	0.112	Maximum Non-Detect	0.00507
Variance Detects	7.6848E-4	Percent Non-Detects	50%
Mean Detects	0.0262	SD Detects	0.0277
Median Detects	0.0155	CV Detects	1.059
Skewness Detects	1.804	Kurtosis Detects	2.735
Mean of Logged Detects	-4.079	SD of Logged Detects	0.919

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.741	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.894	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.3	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

KM Mean	0.0155	KM Standard Error of Mean	0.00305
90KM SD	0.022	95% KM (BCA) UCL	0.0191
90% KM (t) UCL	0.0194	90% KM (Percentile Bootstrap) UCL	0.0193
90% KM (z) UCL	0.0194	90% KM Bootstrap t UCL	0.0207
90% KM Chebyshev UCL	0.0246	95% KM Chebyshev UCL	0.0288
97.5% KM Chebyshev UCL	0.0345	99% KM Chebyshev UCL	0.0458

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.146	Anderson-Darling GOF Test
5% A-D Critical Value	0.767	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.172	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics on Detected Data Only**

k hat (MLE)	1.287	k star (bias corrected MLE)	1.169
Theta hat (MLE)	0.0203	Theta star (bias corrected MLE)	0.0224
nu hat (MLE)	69.51	nu star (bias corrected)	63.12
Mean (detects)	0.0262		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0052	Mean	0.0181
Maximum	0.112	Median	0.01
SD	0.0211	CV	1.164
k hat (MLE)	1.664	k star (bias corrected MLE)	1.584
Theta hat (MLE)	0.0109	Theta star (bias corrected MLE)	0.0114
nu hat (MLE)	179.7	nu star (bias corrected)	171
Adjusted Level of Significance (β)	0.0951		
Approximate Chi Square Value (171.04, α)	147.8	Adjusted Chi Square Value (171.04, β)	147.3
90% Gamma Approximate UCL	0.0209	90% Gamma Adjusted UCL	0.021
95% Gamma Approximate UCL	0.0218	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0155	SD (KM)	0.022
Variance (KM)	4.8498E-4	SE of Mean (KM)	0.00305
k hat (KM)	0.492	k star (KM)	0.477
nu hat (KM)	53.17	nu star (KM)	51.55
theta hat (KM)	0.0314	theta star (KM)	0.0324
80% gamma percentile (KM)	0.0253	90% gamma percentile (KM)	0.0422
95% gamma percentile (KM)	0.0603	99% gamma percentile (KM)	0.105

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (51.55, α)	39.04	Adjusted Chi Square Value (51.55, β)	38.8
90% KM Approximate Gamma UCL	0.0204	90% KM Adjusted Gamma UCL	0.0205

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.935	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.147	Lilliefors GOF Test
10% Lilliefors Critical Value	0.153	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.0139	Mean in Log Scale	-5.293
SD in Original Scale	0.023	SD in Log Scale	1.414
90% t UCL (assumes normality of ROS data)	0.018	90% Percentile Bootstrap UCL	0.018
90% BCA Bootstrap UCL	0.0186	90% Bootstrap t UCL	0.0191
90% H-UCL (Log ROS)	0.0215		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.717	KM Geo Mean	0.00895
KM SD (logged)	0.902	90% Critical H Value (KM-Log)	1.664
KM Standard Error of Mean (logged)	0.125	90% H-UCL (KM -Log)	0.0165

KM SD (logged)	0.902	90% Critical H Value (KM-Log)	1.664
KM Standard Error of Mean (logged)	0.125		

DL/2 Statistics		DL/2 Log-Transformed	
DL/2 Normal			
Mean in Original Scale	0.0143	Mean in Log Scale	-5.039
SD in Original Scale	0.0228	SD in Log Scale	1.164
90% t UCL (Assumes normality)	0.0184	90% H-Stat UCL	0.0138
DL/2 is not a recommended method, provided for comparisons and historical reasons			

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalHPAHs

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	54
		Number of Missing Observations	0
Minimum	0.0881	Mean	3.911
Maximum	31.3	Median	0.927
SD	8.025	Std. Error of Mean	1.092
Coefficient of Variation	2.052	Skewness	2.733

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.488	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	0	Lilliefors GOF Test	
Lilliefors Test Statistic	0.386	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.139		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	5.601
90% Student's-t UCL	5.328	90% Modified-t UCL (Johnson-1978)	5.396

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	4.335	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.814	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.22	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.128		

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	0.508	k star (bias corrected MLE)	0.492
Theta hat (MLE)	7.706	Theta star (bias corrected MLE)	7.954
nu hat (MLE)	54.82	nu star (bias corrected)	53.11
MLE Mean (bias corrected)	3.911	MLE Sd (bias corrected)	5.578
		Approximate Chi Square Value (0.1)	40.4
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	40.16

Assuming Gamma Distribution			
90% Approximate Gamma UCL	5.141	90% Adjusted Gamma UCL	5.172

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.932	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.00578	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.111	Data Not Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.11		

Data Not Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-2.429	Mean of logged Data	0.115
Maximum of Logged Data	3.444	SD of logged Data	1.468

Assuming Lognormal Distribution			
90% H-UCL	5.238	90% Chebyshev (MVUE) UCL	5.684
95% Chebyshev (MVUE) UCL	6.824	97.5% Chebyshev (MVUE) UCL	8.406
99% Chebyshev (MVUE) UCL	11.51		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	5.311	90% BCA Bootstrap UCL	5.729
90% Standard Bootstrap UCL	5.33	90% Bootstrap-t UCL	5.867
90% Hall's Bootstrap UCL	5.508	90% Percentile Bootstrap UCL	5.334
90% Chebyshev(Mean, Sd) UCL	7.187	95% Chebyshev(Mean, Sd) UCL	8.671
97.5% Chebyshev(Mean, Sd) UCL	10.73	99% Chebyshev(Mean, Sd) UCL	14.78

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coeffic

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

cPAHs

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	0.0132	Mean	0.638
Maximum	5.4	Median	0.138
SD	1.373	Std. Error of Mean	0.187
Coefficient of Variation	2.153	Skewness	2.795
Normal GOF Test			
Shapiro Wilk Test Statistic	0.472	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.393	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	0.88	90% Adjusted-CLT UCL (Chen-1995)	0.928
		90% Modified-t UCL (Johnson-1978)	0.892
Gamma GOF Test			
A-D Test Statistic	4.798	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.821	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.238	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.128	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.476	k star (bias corrected MLE)	0.462
Theta hat (MLE)	1.341	Theta star (bias corrected MLE)	1.382
nu hat (MLE)	51.37	nu star (bias corrected)	49.85
MLE Mean (bias corrected)	0.638	MLE Sd (bias corrected)	0.939
		Approximate Chi Square Value (0.1)	37.56
Adjusted Level of Significance	0.0951	Adjusted Chi Square Value	37.32
Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.846	90% Adjusted Gamma UCL	0.852
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.00226	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.121	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.11	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-4.328	Mean of logged Data	-1.796
Maximum of Logged Data	1.686	SD of logged Data	1.505
Assuming Lognormal Distribution			
90% H-UCL	0.819	90% Chebyshev (MVUE) UCL	0.899
95% Chebyshev (MVUE) UCL	1.083	97.5% Chebyshev (MVUE) UCL	1.338
99% Chebyshev (MVUE) UCL	1.838		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.877	90% BCA Bootstrap UCL	0.947
90% Standard Bootstrap UCL	0.88	90% Bootstrap-t UCL	0.977
90% Hall's Bootstrap UCL	0.91	90% Percentile Bootstrap UCL	0.884
90% Chebyshev(Mean, Sd) UCL	1.198	95% Chebyshev(Mean, Sd) UCL	1.452
97.5% Chebyshev(Mean, Sd) UCL	1.805	99% Chebyshev(Mean, Sd) UCL	2.497

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coeff

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics

Total Number of Observations	54	Number of Distinct Observations	46
Number of Detects	32	Number of Non-Detects	22
Number of Distinct Detects	32	Number of Distinct Non-Detects	14
Minimum Detect	0.0257	Minimum Non-Detect	0.00477
Maximum Detect	0.189	Maximum Non-Detect	0.00506
Variance Detects	0.00176	Percent Non-Detects	40.74%
Mean Detects	0.0525	SD Detects	0.0419
Median Detects	0.0367	CV Detects	0.798
Skewness Detects	2.543	Kurtosis Detects	5.939
Mean of Logged Detects	-3.127	SD of Logged Detects	0.541

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.612	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.904	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.261	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.18	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0331	KM Standard Error of Mean	0.00546
90KM SD	0.0395	95% KM (BCA) UCL	0.0405
90% KM (t) UCL	0.0402	90% KM (Percentile Bootstrap) UCL	0.0405
90% KM (z) UCL	0.0401	90% KM Bootstrap t UCL	0.0426
90% KM Chebyshev UCL	0.0495	95% KM Chebyshev UCL	0.0569
97.5% KM Chebyshev UCL	0.0672	99% KM Chebyshev UCL	0.0874

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.711	Anderson-Darling GOF Test	
5% A-D Critical Value	0.753	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.236	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.157	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.916	k star (bias corrected MLE)	2.664
Theta hat (MLE)	0.018	Theta star (bias corrected MLE)	0.0197
nu hat (MLE)	186.6	nu star (bias corrected)	170.5
Mean (detects)	0.0525		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0352
Maximum	0.189	Median	0.027
SD	0.0384	CV	1.09
k hat (MLE)	1.45	k star (bias corrected MLE)	1.382
Theta hat (MLE)	0.0243	Theta star (bias corrected MLE)	0.0255
nu hat (MLE)	156.6	nu star (bias corrected)	149.2
Adjusted Level of Significance (β)	0.0951		
Approximate Chi Square Value (149.22, α)	127.5	Adjusted Chi Square Value (149.22, β)	127.1
90% Gamma Approximate UCL	0.0412	90% Gamma Adjusted UCL	0.0413
95% Gamma Approximate UCL	0.0431	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0331	SD (KM)	0.0395
Variance (KM)	0.00156	SE of Mean (KM)	0.00546
k hat (KM)	0.702	k star (KM)	0.675
nu hat (KM)	75.76	nu star (KM)	72.89
theta hat (KM)	0.0471	theta star (KM)	0.049
80% gamma percentile (KM)	0.0544	90% gamma percentile (KM)	0.0837
95% gamma percentile (KM)	0.114	99% gamma percentile (KM)	0.187

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (72.89, α)	57.91	Adjusted Chi Square Value (72.89, β)	57.61
90% KM Approximate Gamma UCL	0.0416	90% KM Adjusted Gamma UCL	0.0418

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.817	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.21	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.142	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0362	Mean in Log Scale	-3.652
SD in Original Scale	0.0378	SD in Log Scale	0.771
90% t UCL (assumes normality of ROS data)	0.0428	90% Percentile Bootstrap UCL	0.0428
90% BCA Bootstrap UCL	0.0443	90% Bootstrap t UCL	0.0452
90% H-UCL (Log ROS)	0.0413		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.031	KM Geo Mean	0.0178
KM SD (logged)	1.164	90% Critical H Value (KM-Log)	0.507
KM Standard Error of Mean (logged)	0.161	90% H-UCL (KM -Log)	0.0379
KM SD (logged)	1.164	90% Critical H Value (KM-Log)	0.507
KM Standard Error of Mean (logged)	0.161		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0321
SD in Original Scale	0.0406
90% t UCL (Assumes normality)	0.0393

DL/2 Log-Transformed

Mean in Log Scale	-4.299
SD in Log Scale	1.486
90% H-Stat UCL	0.065

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:59:52 PM
 From File 90 UCL Input Data_MG_g.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
Number of Detects	6	Number of Non-Detects	12
Number of Distinct Detects	6	Number of Distinct Non-Detects	11
Minimum Detect	0.498	Minimum Non-Detect	0.492
Maximum Detect	3.04	Maximum Non-Detect	0.562
Variance Detects	0.965	Percent Non-Detects	66.67%
Mean Detects	1.1	SD Detects	0.982
Median Detects	0.728	CV Detects	0.894
Skewness Detects	2.119	Kurtosis Detects	4.672
Mean of Logged Detects	-0.146	SD of Logged Detects	0.701

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.695	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.713	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.337	Lilliefors GOF Test
1% Lilliefors Critical Value	0.373	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.696	KM Standard Error of Mean	0.153
90KM SD	0.591	95% KM (BCA) UCL	0.914
90% KM (t) UCL	0.9	90% KM (Percentile Bootstrap) UCL	0.883
90% KM (z) UCL	0.892	90% KM Bootstrap t UCL	1.328
90% KM Chebyshev UCL	1.154	95% KM Chebyshev UCL	1.361
97.5% KM Chebyshev UCL	1.649	99% KM Chebyshev UCL	2.215

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.668	Anderson-Darling GOF Test
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.269	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.225	k star (bias corrected MLE)	1.224
Theta hat (MLE)	0.494	Theta star (bias corrected MLE)	0.899
nu hat (MLE)	26.7	nu star (bias corrected)	14.68
Mean (detects)	1.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.373
Maximum	3.04	Median	0.01
SD	0.75	CV	2.011
k hat (MLE)	0.32	k star (bias corrected MLE)	0.304
Theta hat (MLE)	1.167	Theta star (bias corrected MLE)	1.229
nu hat (MLE)	11.52	nu star (bias corrected)	10.93
Adjusted Level of Significance (β)	0.0838		
Approximate Chi Square Value (10.93, α)	5.528	Adjusted Chi Square Value (10.93, β)	5.243
90% Gamma Approximate UCL	0.738	90% Gamma Adjusted UCL	0.778

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.696	SD (KM)	0.591
Variance (KM)	0.35	SE of Mean (KM)	0.153
k hat (KM)	1.386	k star (KM)	1.192
nu hat (KM)	49.88	nu star (KM)	42.9
theta hat (KM)	0.502	theta star (KM)	0.584
80% gamma percentile (KM)	1.103	90% gamma percentile (KM)	1.535
95% gamma percentile (KM)	1.961	99% gamma percentile (KM)	2.938

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (42.90, α)	31.54	Adjusted Chi Square Value (42.90, β)	30.81
90% KM Approximate Gamma UCL	0.947	90% KM Adjusted Gamma UCL	0.969

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.825	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.826	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.258	Lilliefors GOF Test
10% Lilliefors Critical Value	0.298	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level**Note GOF tests may be unreliable for small sample sizes****Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.47	Mean in Log Scale	-1.305
SD in Original Scale	0.703	SD in Log Scale	0.946
90% t UCL (assumes normality of ROS data)	0.691	90% Percentile Bootstrap UCL	0.676
90% BCA Bootstrap UCL	0.803	90% Bootstrap t UCL	1.038
90% H-UCL (Log ROS)	0.652		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.519	KM Geo Mean	0.595
KM SD (logged)	0.454	90% Critical H Value (KM-Log)	1.48
KM Standard Error of Mean (logged)	0.117	90% H-UCL (KM -Log)	0.777
KM SD (logged)	0.454	90% Critical H Value (KM-Log)	1.48
KM Standard Error of Mean (logged)	0.117		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.538
SD in Original Scale	0.671
90% t UCL (Assumes normality)	0.749

DL/2 Log-Transformed

Mean in Log Scale	-0.955
SD in Log Scale	0.701
90% H-Stat UCL	0.652

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

Recommendation Provided only for 95% Confidence Coefficient

Arsenic**General Statistics**

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	2.91	Mean	4.25
Maximum	5.68	Median	4.155
SD	0.864	Std. Error of Mean	0.204
Coefficient of Variation	0.203	Skewness	0.357

Normal GOF Test

Shapiro Wilk Test Statistic	0.944	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.858	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.117	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	4.522	90% Adjusted-CLT UCL (Chen-1995)	4.523
		90% Modified-t UCL (Johnson-1978)	4.524
Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.257	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.739		
K-S Test Statistic	0.108	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.203	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	25.87	k star (bias corrected MLE)	21.59
Theta hat (MLE)	0.164	Theta star (bias corrected MLE)	0.197
nu hat (MLE)	931.2	nu star (bias corrected)	777.3
MLE Mean (bias corrected)	4.25	MLE Sd (bias corrected)	0.915
		Approximate Chi Square Value (0.1)	727.2
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	723.5
Assuming Gamma Distribution			
90% Approximate Gamma UCL	4.543	90% Adjusted Gamma UCL	4.566
Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.96	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.914		
Lilliefors Test Statistic	0.0972	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.068	Mean of logged Data	1.427
Maximum of Logged Data	1.737	SD of logged Data	0.203
Assuming Lognormal Distribution			
90% H-UCL	4.549	90% Chebyshev (MVUE) UCL	4.865
95% Chebyshev (MVUE) UCL	5.143	97.5% Chebyshev (MVUE) UCL	5.529
99% Chebyshev (MVUE) UCL	6.288		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	4.511	90% BCA Bootstrap UCL	4.52
90% Standard Bootstrap UCL	4.506	90% Bootstrap-t UCL	4.542
90% Hall's Bootstrap UCL	4.527	90% Percentile Bootstrap UCL	4.507
90% Chebyshev(Mean, Sd) UCL	4.861	95% Chebyshev(Mean, Sd) UCL	5.138
97.5% Chebyshev(Mean, Sd) UCL	5.522	99% Chebyshev(Mean, Sd) UCL	6.276
Suggested UCL to Use			
Recommendation Provided only for 95% Confidence Coefficient			

Copper

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	25.8	Mean	47.28
Maximum	185	Median	38.65
SD	35.74	Std. Error of Mean	8.424
Coefficient of Variation	0.756	Skewness	3.728
Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.504	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.858		
Lilliefors Test Statistic	0.312	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 58.52

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 63.37

90% Modified-t UCL (Johnson-1978) 59.75

Gamma GOF Test

A-D Test Statistic 1.706

5% A-D Critical Value 0.743

K-S Test Statistic 0.234

5% K-S Critical Value 0.205

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 3.995

Theta hat (MLE) 11.84

nu hat (MLE) 143.8

MLE Mean (bias corrected) 47.28

Adjusted Level of Significance 0.0838

k star (bias corrected MLE) 3.366

Theta star (bias corrected MLE) 14.05

nu star (bias corrected) 121.2

MLE Sd (bias corrected) 25.77

Approximate Chi Square Value (0.1) 101.7

Adjusted Chi Square Value 100.3

Assuming Gamma Distribution

90% Approximate Gamma UCL 56.34

90% Adjusted Gamma UCL 57.1

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.782

10% Shapiro Wilk Critical Value 0.914

Lilliefors Test Statistic 0.189

10% Lilliefors Critical Value 0.185

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data 3.25

Maximum of Logged Data 5.22

Mean of logged Data 3.726

SD of logged Data 0.446

Assuming Lognormal Distribution

90% H-UCL 53.79

95% Chebyshev (MVUE) UCL 67.05

99% Chebyshev (MVUE) UCL 94.6

90% Chebyshev (MVUE) UCL 60.36

97.5% Chebyshev (MVUE) UCL 76.35

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 58.08

90% Standard Bootstrap UCL 57.77

90% Hall's Bootstrap UCL 111.7

90% Chebyshev(Mean, Sd) UCL 72.56

97.5% Chebyshev(Mean, Sd) UCL 99.89

90% BCA Bootstrap UCL 64.43

90% Bootstrap-t UCL 83.01

90% Percentile Bootstrap UCL 57.9

95% Chebyshev(Mean, Sd) UCL 84

99% Chebyshev(Mean, Sd) UCL 131.1

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations 18

Minimum 17.7

Maximum 175

SD 41.78

Coefficient of Variation 0.594

Number of Distinct Observations 17

Number of Missing Observations 0

Mean 70.37

Median 67.2

Std. Error of Mean 9.848

Skewness 1.413

Normal GOF Test

Shapiro Wilk Test Statistic 0.86

1% Shapiro Wilk Critical Value 0.858

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors Test Statistic	0.189	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Data appear Normal at 1% Significance Level
Data appear Normal at 1% Significance Level		

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	83.5	90% Adjusted-CLT UCL (Chen-1995)	85.33
		90% Modified-t UCL (Johnson-1978)	84.04

Gamma GOF Test			
A-D Test Statistic	0.313	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	3.346	k star (bias corrected MLE)	2.825
Theta hat (MLE)	21.03	Theta star (bias corrected MLE)	24.91
nu hat (MLE)	120.4	nu star (bias corrected)	101.7
MLE Mean (bias corrected)	70.37	MLE Sd (bias corrected)	41.87
		Approximate Chi Square Value (0.1)	83.9
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	82.67

Assuming Gamma Distribution			
90% Approximate Gamma UCL	85.29	90% Adjusted Gamma UCL	86.56

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.969	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.122	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	2.874	Mean of logged Data	4.097
Maximum of Logged Data	5.165	SD of logged Data	0.587

Assuming Lognormal Distribution			
90% H-UCL	89.38	90% Chebyshev (MVUE) UCL	101.4
95% Chebyshev (MVUE) UCL	115.3	97.5% Chebyshev (MVUE) UCL	134.6
99% Chebyshev (MVUE) UCL	172.6		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	82.99	90% BCA Bootstrap UCL	84.24
90% Standard Bootstrap UCL	82.61	90% Bootstrap-t UCL	86.82
90% Hall's Bootstrap UCL	86.64	90% Percentile Bootstrap UCL	82.54
90% Chebyshev(Mean, Sd) UCL	99.91	95% Chebyshev(Mean, Sd) UCL	113.3
97.5% Chebyshev(Mean, Sd) UCL	131.9	99% Chebyshev(Mean, Sd) UCL	168.4

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Mercury

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	0.116	Mean	0.486
Maximum	2.5	Median	0.301
SD	0.56	Std. Error of Mean	0.132
Coefficient of Variation	1.152	Skewness	2.979

Normal GOF Test

Shapiro Wilk Test Statistic	0.633	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.254	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 0.662

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 0.721
90% Modified-t UCL (Johnson-1978) 0.677

Gamma GOF Test

A-D Test Statistic 0.91
5% A-D Critical Value 0.759
K-S Test Statistic 0.193
5% K-S Critical Value 0.208

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE) 1.376
Theta hat (MLE) 0.353
nu hat (MLE) 49.53
MLE Mean (bias corrected) 0.486

Adjusted Level of Significance 0.0838

k star (bias corrected MLE) 1.184
Theta star (bias corrected MLE) 0.411
nu star (bias corrected) 42.61
MLE Sd (bias corrected) 0.447
Approximate Chi Square Value (0.1) 31.29
Adjusted Chi Square Value 30.55

Assuming Gamma Distribution

90% Approximate Gamma UCL 0.662

90% Adjusted Gamma UCL 0.678

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.896
10% Shapiro Wilk Critical Value 0.914
Lilliefors Test Statistic 0.202
10% Lilliefors Critical Value 0.185

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -2.154
Maximum of Logged Data 0.916

Mean of logged Data -1.127
SD of logged Data 0.877

Assuming Lognormal Distribution

90% H-UCL 0.699
95% Chebyshev (MVUE) UCL 0.917
99% Chebyshev (MVUE) UCL 1.5

90% Chebyshev (MVUE) UCL 0.775
97.5% Chebyshev (MVUE) UCL 1.114

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 0.655
90% Standard Bootstrap UCL 0.65
90% Hall's Bootstrap UCL 1.523
90% Chebyshev(Mean, Sd) UCL 0.882
97.5% Chebyshev(Mean, Sd) UCL 1.31

90% BCA Bootstrap UCL 0.736
90% Bootstrap-t UCL 0.832
90% Percentile Bootstrap UCL 0.658
95% Chebyshev(Mean, Sd) UCL 1.061
99% Chebyshev(Mean, Sd) UCL 1.799

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

General Statistics

Total Number of Observations 18

Number of Distinct Observations 17

			Number of Missing Observations	0
Minimum	14.6		Mean	20.02
Maximum	28.4		Median	18.55
SD	3.759		Std. Error of Mean	0.886
Coefficient of Variation	0.188		Skewness	0.845
Normal GOF Test				
Shapiro Wilk Test Statistic	0.921	Shapiro Wilk GOF Test		
1% Shapiro Wilk Critical Value	0.858	Data appear Normal at 1% Significance Level		
Lilliefors Test Statistic	0.238	Lilliefors GOF Test		
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level		
Data appear Approximate Normal at 1% Significance Level				
Assuming Normal Distribution				
90% Normal UCL		90% UCLs (Adjusted for Skewness)		
90% Student's-t UCL	21.2	90% Adjusted-CLT UCL (Chen-1995)	21.28	
		90% Modified-t UCL (Johnson-1978)	21.23	
Gamma GOF Test				
A-D Test Statistic	0.546	Anderson-Darling Gamma GOF Test		
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level		
K-S Test Statistic	0.226	Kolmogorov-Smirnov Gamma GOF Test		
5% K-S Critical Value	0.203	Data Not Gamma Distributed at 5% Significance Level		
Detected data follow Appr. Gamma Distribution at 5% Significance Level				
Gamma Statistics				
k hat (MLE)	31.94	k star (bias corrected MLE)	26.65	
Theta hat (MLE)	0.627	Theta star (bias corrected MLE)	0.751	
nu hat (MLE)	1150	nu star (bias corrected)	959.5	
MLE Mean (bias corrected)	20.02	MLE Sd (bias corrected)	3.877	
		Approximate Chi Square Value (0.1)	903.8	
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	899.7	
Assuming Gamma Distribution				
90% Approximate Gamma UCL	21.25	90% Adjusted Gamma UCL	21.35	
Lognormal GOF Test				
Shapiro Wilk Test Statistic	0.951	Shapiro Wilk Lognormal GOF Test		
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level		
Lilliefors Test Statistic	0.214	Lilliefors Lognormal GOF Test		
10% Lilliefors Critical Value	0.185	Data Not Lognormal at 10% Significance Level		
Data appear Approximate Lognormal at 10% Significance Level				
Lognormal Statistics				
Minimum of Logged Data	2.681	Mean of logged Data	2.981	
Maximum of Logged Data	3.346	SD of logged Data	0.18	
Assuming Lognormal Distribution				
90% H-UCL	21.24	90% Chebyshev (MVUE) UCL	22.57	
95% Chebyshev (MVUE) UCL	23.73	97.5% Chebyshev (MVUE) UCL	25.34	
99% Chebyshev (MVUE) UCL	28.51			
Nonparametric Distribution Free UCL Statistics				
Data appear to follow a Discernible Distribution				
Nonparametric Distribution Free UCLs				
90% CLT UCL	21.15	90% BCA Bootstrap UCL	21.25	
90% Standard Bootstrap UCL	21.14	90% Bootstrap-t UCL	21.37	
90% Hall's Bootstrap UCL	21.31	90% Percentile Bootstrap UCL	21.13	
90% Chebyshev(Mean, Sd) UCL	22.67	95% Chebyshev(Mean, Sd) UCL	23.88	
97.5% Chebyshev(Mean, Sd) UCL	25.55	99% Chebyshev(Mean, Sd) UCL	28.83	

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	58.4	Mean	109.1
Maximum	164	Median	115
SD	27.17	Std. Error of Mean	6.403
Coefficient of Variation	0.249	Skewness	-0.0909

Normal GOF Test

Shapiro Wilk Test Statistic	0.976	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.858	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.114	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	117.7

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	117.2
90% Modified-t UCL (Johnson-1978)	117.7

Gamma GOF Test

A-D Test Statistic	0.371	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.203	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	15.78	k star (bias corrected MLE)	13.19
Theta hat (MLE)	6.915	Theta star (bias corrected MLE)	8.275
nu hat (MLE)	568.2	nu star (bias corrected)	474.8
MLE Mean (bias corrected)	109.1	MLE Sd (bias corrected)	30.05
		Approximate Chi Square Value (0.1)	435.8
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	432.9

Assuming Gamma Distribution

90% Approximate Gamma UCL	118.9	90% Adjusted Gamma UCL	119.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.952	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.157	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.067	Mean of logged Data	4.661
Maximum of Logged Data	5.1	SD of logged Data	0.268

Assuming Lognormal Distribution

90% H-UCL	119.8	90% Chebyshev (MVUE) UCL	130.2
95% Chebyshev (MVUE) UCL	139.7	97.5% Chebyshev (MVUE) UCL	152.8
99% Chebyshev (MVUE) UCL	178.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	117.3	90% BCA Bootstrap UCL	117.1
90% Standard Bootstrap UCL	117.2	90% Bootstrap-t UCL	117.4
90% Hall's Bootstrap UCL	117.4	90% Percentile Bootstrap UCL	117.2
90% Chebyshev(Mean, Sd) UCL	128.3	95% Chebyshev(Mean, Sd) UCL	137
97.5% Chebyshev(Mean, Sd) UCL	149.1	99% Chebyshev(Mean, Sd) UCL	172.8

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be

reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Dioxin/Furan

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	1.9365E-6	Mean	2.2200E-5
Maximum	1.4964E-4	Median	7.8709E-6
SD	3.5538E-5	Std. Error of Mean	8.3764E-6
Coefficient of Variation	N/A	Skewness	3.081
Normal GOF Test			
Shapiro Wilk Test Statistic	0.572	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.31	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	3.3369E-5	90% Adjusted-CLT UCL (Chen-1995)	3.7279E-5
		90% Modified-t UCL (Johnson-1978)	3.4383E-5
Gamma GOF Test			
A-D Test Statistic	1.103	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.774	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.219	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.211	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.836	k star (bias corrected MLE)	0.733
Theta hat (MLE)	2.6566E-5	Theta star (bias corrected MLE)	3.0269E-5
nu hat (MLE)	30.08	nu star (bias corrected)	26.4
MLE Mean (bias corrected)	2.2200E-5	MLE Sd (bias corrected)	2.5922E-5
		Approximate Chi Square Value (0.1)	17.62
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	17.08
Assuming Gamma Distribution			
90% Approximate Gamma UCL	3.3260E-5	90% Adjusted Gamma UCL	3.4312E-5
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.169	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-13.15	Mean of logged Data	-11.42
Maximum of Logged Data	-8.807	SD of logged Data	1.124
Assuming Lognormal Distribution			
90% H-UCL	3.6105E-5	90% Chebyshev (MVUE) UCL	3.7092E-5
95% Chebyshev (MVUE) UCL	4.5038E-5	97.5% Chebyshev (MVUE) UCL	5.6065E-5
99% Chebyshev (MVUE) UCL	7.7727E-5		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	3.2934E-5	90% BCA Bootstrap UCL	3.9579E-5
90% Standard Bootstrap UCL	3.2964E-5	90% Bootstrap-t UCL	4.8604E-5
90% Hall's Bootstrap UCL	7.8026E-5	90% Percentile Bootstrap UCL	3.3679E-5
90% Chebyshev(Mean, Sd) UCL	4.7329E-5	95% Chebyshev(Mean, Sd) UCL	5.8712E-5
97.5% Chebyshev(Mean, Sd) UCL	7.4510E-5	99% Chebyshev(Mean, Sd) UCL	1.0554E-4

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dibenzofuran

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	17
Number of Detects	5	Number of Non-Detects	13
Number of Distinct Detects	5	Number of Distinct Non-Detects	12
Minimum Detect	0.0052	Minimum Non-Detect	0.00483
Maximum Detect	0.0613	Maximum Non-Detect	0.00507
Variance Detects	5.4316E-4	Percent Non-Detects	72.22%
Mean Detects	0.0221	SD Detects	0.0233
Median Detects	0.0143	CV Detects	1.055
Skewness Detects	1.653	Kurtosis Detects	2.719
Mean of Logged Detects	-4.253	SD of Logged Detects	1.053

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.808	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.26	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00962	KM Standard Error of Mean	0.00354
90KM SD	0.0134	95% KM (BCA) UCL	0.0133
90% KM (t) UCL	0.0143	90% KM (Percentile Bootstrap) UCL	0.0139
90% KM (z) UCL	0.0142	90% KM Bootstrap t UCL	0.0189
90% KM Chebyshev UCL	0.0202	95% KM Chebyshev UCL	0.0251
97.5% KM Chebyshev UCL	0.0317	99% KM Chebyshev UCL	0.0448

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.348	Anderson-Darling GOF Test
5% A-D Critical Value	0.689	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	1.278	k star (bias corrected MLE)	0.644
Theta hat (MLE)	0.0173	Theta star (bias corrected MLE)	0.0343
nu hat (MLE)	12.78	nu star (bias corrected)	6.443
Mean (detects)	0.0221		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0052	Mean	0.0134
Maximum	0.0613	Median	0.01
SD	0.0126	CV	0.944
k hat (MLE)	2.765	k star (bias corrected MLE)	2.341
Theta hat (MLE)	0.00483	Theta star (bias corrected MLE)	0.00571
nu hat (MLE)	99.54	nu star (bias corrected)	84.29
Adjusted Level of Significance (β)	0.0838		
Approximate Chi Square Value (84.29, α)	68.14	Adjusted Chi Square Value (84.29, β)	67.03
90% Gamma Approximate UCL	0.0165	90% Gamma Adjusted UCL	0.0168
95% Gamma Approximate UCL	0.0176	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00962	SD (KM)	0.0134
Variance (KM)	1.8045E-4	SE of Mean (KM)	0.00354

k hat (KM)	0.513	k star (KM)	0.465
nu hat (KM)	18.48	nu star (KM)	16.73
theta hat (KM)	0.0188	theta star (KM)	0.0207
80% gamma percentile (KM)	0.0157	90% gamma percentile (KM)	0.0264
95% gamma percentile (KM)	0.0379	99% gamma percentile (KM)	0.0665

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.73, α)	9.877	Adjusted Chi Square Value (16.73, β)	9.483
90% KM Approximate Gamma UCL	0.0163	90% KM Adjusted Gamma UCL	0.017

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.912	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.806	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.229	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0063	Mean in Log Scale	-7.27
SD in Original Scale	0.0151	SD in Log Scale	2.017
90% t UCL (assumes normality of ROS data)	0.0111	90% Percentile Bootstrap UCL	0.0109
90% BCA Bootstrap UCL	0.0139	90% Bootstrap t UCL	0.0183
90% H-UCL (Log ROS)	0.0245		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.033	KM Geo Mean	0.00652
KM SD (logged)	0.693	90% Critical H Value (KM-Log)	1.65
KM Standard Error of Mean (logged)	0.183	90% H-UCL (KM -Log)	0.0109
KM SD (logged)	0.693	90% Critical H Value (KM-Log)	1.65
KM Standard Error of Mean (logged)	0.183		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00793
SD in Original Scale	0.0145
90% t UCL (Assumes normality)	0.0125

DL/2 Log-Transformed

Mean in Log Scale	-5.512
SD in Log Scale	0.952
90% H-Stat UCL	0.00981

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalHPAHs

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	0.0881	Mean	3.151
Maximum	30.2	Median	0.586
SD	7.774	Std. Error of Mean	1.832
Coefficient of Variation	2.467	Skewness	3.114

Normal GOF Test

Shapiro Wilk Test Statistic	0.424	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.464	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL			
90% Student's-t UCL	5.595	90% Adjusted-CLT UCL (Chen-1995)	6.46
		90% Modified-t UCL (Johnson-1978)	5.819

Gamma GOF Test			
A-D Test Statistic	2.888	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.812	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.335	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.217	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	0.444	k star (bias corrected MLE)	0.407
Theta hat (MLE)	7.096	Theta star (bias corrected MLE)	7.741
nu hat (MLE)	15.99	nu star (bias corrected)	14.66
MLE Mean (bias corrected)	3.151	MLE Sd (bias corrected)	4.939
		Approximate Chi Square Value (0.1)	8.286
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	7.929

Assuming Gamma Distribution			
90% Approximate Gamma UCL	5.574	90% Adjusted Gamma UCL	5.826

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.833	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.914	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.239	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.185	Data Not Lognormal at 10% Significance Level
Data Not Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	-2.429	Mean of logged Data	-0.309
Maximum of Logged Data	3.408	SD of logged Data	1.43

Assuming Lognormal Distribution			
90% H-UCL	4.687	90% Chebyshev (MVUE) UCL	4.024
95% Chebyshev (MVUE) UCL	5.011	97.5% Chebyshev (MVUE) UCL	6.381
99% Chebyshev (MVUE) UCL	9.072		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	5.5	90% BCA Bootstrap UCL	7.026
90% Standard Bootstrap UCL	5.452	90% Bootstrap-t UCL	43.53
90% Hall's Bootstrap UCL	22.87	90% Percentile Bootstrap UCL	5.582
90% Chebyshev(Mean, Sd) UCL	8.648	95% Chebyshev(Mean, Sd) UCL	11.14
97.5% Chebyshev(Mean, Sd) UCL	14.59	99% Chebyshev(Mean, Sd) UCL	21.38

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

cPAHs

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	0.0132	Mean	0.509
Maximum	5.13	Median	0.0868
SD	1.297	Std. Error of Mean	0.306
Coefficient of Variation	2.55	Skewness	3.231

Normal GOF Test			Shapiro Wilk GOF Test		
Shapiro Wilk Test Statistic	0.416		Data Not Normal at 1% Significance Level		
1% Shapiro Wilk Critical Value	0.858		Lilliefors GOF Test		
Lilliefors Test Statistic	0.464		Data Not Normal at 1% Significance Level		
1% Lilliefors Critical Value	0.235		Data Not Normal at 1% Significance Level		

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)			
90% Student's-t UCL	0.917	90% Adjusted-CLT UCL (Chen-1995)	1.067		
		90% Modified-t UCL (Johnson-1978)	0.955		

Gamma GOF Test

A-D Test Statistic	2.914	Anderson-Darling Gamma GOF Test			
5% A-D Critical Value	0.816	Data Not Gamma Distributed at 5% Significance Level			
K-S Test Statistic	0.336	Kolmogorov-Smirnov Gamma GOF Test			
5% K-S Critical Value	0.217	Data Not Gamma Distributed at 5% Significance Level			

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.422	k star (bias corrected MLE)	0.389		
Theta hat (MLE)	1.205	Theta star (bias corrected MLE)	1.308		
nu hat (MLE)	15.21	nu star (bias corrected)	14.01		
MLE Mean (bias corrected)	0.509	MLE Sd (bias corrected)	0.816		
		Approximate Chi Square Value (0.1)	7.794		
Adjusted Level of Significance	0.0838	Adjusted Chi Square Value	7.448		

Assuming Gamma Distribution

90% Approximate Gamma UCL	0.914	90% Adjusted Gamma UCL	0.957		

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.834	Shapiro Wilk Lognormal GOF Test			
10% Shapiro Wilk Critical Value	0.914	Data Not Lognormal at 10% Significance Level			
Lilliefors Test Statistic	0.242	Lilliefors Lognormal GOF Test			
10% Lilliefors Critical Value	0.185	Data Not Lognormal at 10% Significance Level			

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.328	Mean of logged Data	-2.22		
Maximum of Logged Data	1.635	SD of logged Data	1.466		

Assuming Lognormal Distribution

90% H-UCL	0.759	90% Chebyshev (MVUE) UCL	0.633
95% Chebyshev (MVUE) UCL	0.791	97.5% Chebyshev (MVUE) UCL	1.009
99% Chebyshev (MVUE) UCL	1.438		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.901	90% BCA Bootstrap UCL	1.201		
90% Standard Bootstrap UCL	0.893	90% Bootstrap-t UCL	7.646		
90% Hall's Bootstrap UCL	3.834	90% Percentile Bootstrap UCL	0.925		
90% Chebyshev(Mean, Sd) UCL	1.426	95% Chebyshev(Mean, Sd) UCL	1.842		
97.5% Chebyshev(Mean, Sd) UCL	2.418	99% Chebyshev(Mean, Sd) UCL	3.551		

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics

Total Number of Observations	18	Number of Distinct Observations	15		

Number of Detects	5	Number of Non-Detects	13
Number of Distinct Detects	5	Number of Distinct Non-Detects	10
Minimum Detect	0.0316	Minimum Non-Detect	0.00481
Maximum Detect	0.189	Maximum Non-Detect	0.00506
Variance Detects	0.00454	Percent Non-Detects	72.22%
Mean Detects	0.0699	SD Detects	0.0674
Median Detects	0.0389	CV Detects	0.964
Skewness Detects	2.118	Kurtosis Detects	4.539
Mean of Logged Detects	-2.929	SD of Logged Detects	0.743

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.671	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.377	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0229	KM Standard Error of Mean	0.0114
90KM SD	0.0431	95% KM (BCA) UCL	0.0349
90% KM (t) UCL	0.038	90% KM (Percentile Bootstrap) UCL	0.0369
90% KM (z) UCL	0.0374	90% KM Bootstrap t UCL	0.0479
90% KM Chebyshev UCL	0.0569	95% KM Chebyshev UCL	0.0724
97.5% KM Chebyshev UCL	0.0938	99% KM Chebyshev UCL	0.136

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.732	Anderson-Darling GOF Test
5% A-D Critical Value	0.684	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.318	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.016	k star (bias corrected MLE)	0.94
Theta hat (MLE)	0.0347	Theta star (bias corrected MLE)	0.0743
nu hat (MLE)	20.16	nu star (bias corrected)	9.396
Mean (detects)	0.0699		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0266
Maximum	0.189	Median	0.01
SD	0.0428	CV	1.606
k hat (MLE)	1.11	k star (bias corrected MLE)	0.962
Theta hat (MLE)	0.024	Theta star (bias corrected MLE)	0.0277
nu hat (MLE)	39.96	nu star (bias corrected)	34.64
Adjusted Level of Significance (β)	0.0838		
Approximate Chi Square Value (34.64, α)	24.49	Adjusted Chi Square Value (34.64, β)	23.84
90% Gamma Approximate UCL	0.0377	90% Gamma Adjusted UCL	0.0387
95% Gamma Approximate UCL	0.0416	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0229	SD (KM)	0.0431
Variance (KM)	0.00186	SE of Mean (KM)	0.0114
k hat (KM)	0.282	k star (KM)	0.272
nu hat (KM)	10.15	nu star (KM)	9.79
theta hat (KM)	0.0812	theta star (KM)	0.0841
80% gamma percentile (KM)	0.0342	90% gamma percentile (KM)	0.0682
95% gamma percentile (KM)	0.108	99% gamma percentile (KM)	0.213

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.79, α)	4.718	Adjusted Chi Square Value (9.79, β)	4.458

90% KM Approximate Gamma UCL 0.0475

90% KM Adjusted Gamma UCL 0.0502

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.806	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.267	Lilliefors GOF Test
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0219	Mean in Log Scale	-4.979
SD in Original Scale	0.0448	SD in Log Scale	1.405
90% t UCL (assumes normality of ROS data)	0.0359	90% Percentile Bootstrap UCL	0.0348
90% BCA Bootstrap UCL	0.0443	90% Bootstrap t UCL	0.0595
90% H-UCL (Log ROS)	0.0415		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.668	KM Geo Mean	0.00939
KM SD (logged)	1.134	90% Critical H Value (KM-Log)	2.068
KM Standard Error of Mean (logged)	0.299	90% H-UCL (KM -Log)	0.0315
KM SD (logged)	1.134	90% Critical H Value (KM-Log)	2.068
KM Standard Error of Mean (logged)	0.299		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0212
SD in Original Scale	0.0451
90% t UCL (Assumes normality)	0.0354

DL/2 Log-Transformed

Mean in Log Scale	-5.148
SD in Log Scale	1.461
90% H-Stat UCL	0.0401

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:58:08 PM
 From File 90 UCL Input Data_MG_d.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	22	Number of Distinct Observations	21
Number of Detects	7	Number of Non-Detects	15
Number of Distinct Detects	7	Number of Distinct Non-Detects	14
Minimum Detect	0.498	Minimum Non-Detect	0.492
Maximum Detect	3.04	Maximum Non-Detect	0.562
Variance Detects	0.831	Percent Non-Detects	68.18%
Mean Detects	1.038	SD Detects	0.912
Median Detects	0.667	CV Detects	0.878
Skewness Detects	2.323	Kurtosis Detects	5.628
Mean of Logged Detects	-0.183	SD of Logged Detects	0.647

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.66	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.334	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.667	KM Standard Error of Mean	0.124
90KM SD	0.539	95% KM (BCA) UCL	0.848
90% KM (t) UCL	0.831	90% KM (Percentile Bootstrap) UCL	0.835
90% KM (z) UCL	0.826	90% KM Bootstrap t UCL	1.181
90% KM Chebyshev UCL	1.04	95% KM Chebyshev UCL	1.208
97.5% KM Chebyshev UCL	1.443	99% KM Chebyshev UCL	1.903

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.768	Anderson-Darling GOF Test
5% A-D Critical Value	0.714	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.423	k star (bias corrected MLE)	1.48
Theta hat (MLE)	0.428	Theta star (bias corrected MLE)	0.701
nu hat (MLE)	33.92	nu star (bias corrected)	20.72
Mean (detects)	1.038		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.337
Maximum	3.04	Median	0.01
SD	0.691	CV	2.05
k hat (MLE)	0.323	k star (bias corrected MLE)	0.309
Theta hat (MLE)	1.044	Theta star (bias corrected MLE)	1.09
nu hat (MLE)	14.2	nu star (bias corrected)	13.6
Adjusted Level of Significance (β)	0.0873		
Approximate Chi Square Value (13.60, α)	7.49	Adjusted Chi Square Value (13.60, β)	7.228
90% Gamma Approximate UCL	0.612	90% Gamma Adjusted UCL	0.634

95% Gamma Approximate UCL 0.728

95% Gamma Adjusted UCL N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.667	SD (KM)	0.539
Variance (KM)	0.291	SE of Mean (KM)	0.124
k hat (KM)	1.53	k star (KM)	1.352
nu hat (KM)	67.33	nu star (KM)	59.49
theta hat (KM)	0.436	theta star (KM)	0.493
80% gamma percentile (KM)	1.044	90% gamma percentile (KM)	1.426
95% gamma percentile (KM)	1.8	99% gamma percentile (KM)	2.65

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (59.49, α)	46.01	Adjusted Chi Square Value (59.49, β)	45.31
90% KM Approximate Gamma UCL	0.863	90% KM Adjusted Gamma UCL	0.876

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.818	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.838	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.214	Lilliefors GOF Test
10% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level**Note GOF tests may be unreliable for small sample sizes****Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.439	Mean in Log Scale	-1.325
SD in Original Scale	0.643	SD in Log Scale	0.886
90% t UCL (assumes normality of ROS data)	0.62	90% Percentile Bootstrap UCL	0.613
90% BCA Bootstrap UCL	0.703	90% Bootstrap t UCL	0.858
90% H-UCL (Log ROS)	0.557		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.539	KM Geo Mean	0.583
KM SD (logged)	0.416	90% Critical H Value (KM-Log)	1.449
KM Standard Error of Mean (logged)	0.0959	90% H-UCL (KM -Log)	0.726
KM SD (logged)	0.416	90% Critical H Value (KM-Log)	1.449
KM Standard Error of Mean (logged)	0.0959		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.506
SD in Original Scale	0.613
90% t UCL (Assumes normality)	0.679

DL/2 Log-Transformed

Mean in Log Scale	-0.985
SD in Log Scale	0.659
90% H-Stat UCL	0.585

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

Recommendation Provided only for 95% Confidence Coefficient

Arsenic**General Statistics**

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	2.84	Mean	4.131
Maximum	5.68	Median	4.06
SD	0.844	Std. Error of Mean	0.18
Coefficient of Variation	0.204	Skewness	0.499

Normal GOF Test

Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.878	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.112	Lilliefors GOF Test
1% Lilliefors Critical Value	0.214	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	4.369	90% Adjusted-CLT UCL (Chen-1995)	4.376
		90% Modified-t UCL (Johnson-1978)	4.373
Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.299	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.741	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.0936	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.185	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	25.72	k star (bias corrected MLE)	22.24
Theta hat (MLE)	0.161	Theta star (bias corrected MLE)	0.186
nu hat (MLE)	1132	nu star (bias corrected)	978.7
MLE Mean (bias corrected)	4.131	MLE Sd (bias corrected)	0.876
		Approximate Chi Square Value (0.1)	922.4
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	919.2
Assuming Gamma Distribution			
90% Approximate Gamma UCL	4.383	90% Adjusted Gamma UCL	4.399
Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.962	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.926	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.0846	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.169	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.044	Mean of logged Data	1.399
Maximum of Logged Data	1.737	SD of logged Data	0.202
Assuming Lognormal Distribution			
90% H-UCL	4.389	90% Chebyshev (MVUE) UCL	4.669
95% Chebyshev (MVUE) UCL	4.912	97.5% Chebyshev (MVUE) UCL	5.25
99% Chebyshev (MVUE) UCL	5.914		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	4.362	90% BCA Bootstrap UCL	4.35
90% Standard Bootstrap UCL	4.355	90% Bootstrap-t UCL	4.38
90% Hall's Bootstrap UCL	4.374	90% Percentile Bootstrap UCL	4.35
90% Chebyshev(Mean, Sd) UCL	4.671	95% Chebyshev(Mean, Sd) UCL	4.915
97.5% Chebyshev(Mean, Sd) UCL	5.255	99% Chebyshev(Mean, Sd) UCL	5.921
Suggested UCL to Use			
Recommendation Provided only for 95% Confidence Coefficient			

Copper

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	17.6	Mean	42.65
Maximum	185	Median	35.7
SD	33.72	Std. Error of Mean	7.189
Coefficient of Variation	0.791	Skewness	3.877
Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.531	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.878	Lilliefors GOF Test	
Lilliefors Test Statistic	0.28	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.214		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 52.16

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 56.1
90% Modified-t UCL (Johnson-1978) 53.15

Gamma GOF Test

A-D Test Statistic 1.332
5% A-D Critical Value 0.748
K-S Test Statistic 0.194
5% K-S Critical Value 0.186

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 3.582
Theta hat (MLE) 11.9
nu hat (MLE) 157.6
MLE Mean (bias corrected) 42.65
Adjusted Level of Significance 0.0873

k star (bias corrected MLE) 3.124
Theta star (bias corrected MLE) 13.65
nu star (bias corrected) 137.5
MLE Sd (bias corrected) 24.13
Approximate Chi Square Value (0.1) 116.7
Adjusted Chi Square Value 115.6

Assuming Gamma Distribution

90% Approximate Gamma UCL 50.24

90% Adjusted Gamma UCL 50.73

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.872
10% Shapiro Wilk Critical Value 0.926
Lilliefors Test Statistic 0.142
10% Lilliefors Critical Value 0.169

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data 2.868
Maximum of Logged Data 5.22

Mean of logged Data 3.607
SD of logged Data 0.481

Assuming Lognormal Distribution

90% H-UCL 48.36
95% Chebyshev (MVUE) UCL 60.18
99% Chebyshev (MVUE) UCL 84.61

90% Chebyshev (MVUE) UCL 54.24
97.5% Chebyshev (MVUE) UCL 68.42

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 51.86
90% Standard Bootstrap UCL 51.98
90% Hall's Bootstrap UCL 99.18
90% Chebyshev(Mean, Sd) UCL 64.21
97.5% Chebyshev(Mean, Sd) UCL 87.54

90% BCA Bootstrap UCL 57.56
90% Bootstrap-t UCL 67.89
90% Percentile Bootstrap UCL 52.88
95% Chebyshev(Mean, Sd) UCL 73.98
99% Chebyshev(Mean, Sd) UCL 114.2

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations 22
Minimum 13.8
Maximum 175
SD 42.69
Coefficient of Variation 0.698

Number of Distinct Observations 21
Number of Missing Observations 0
Mean 61.14
Median 55.4
Std. Error of Mean 9.103
Skewness 1.403

Normal GOF Test

Shapiro Wilk Test Statistic 0.86
1% Shapiro Wilk Critical Value 0.878

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors Test Statistic	0.142	Lilliefors GOF Test
1% Lilliefors Critical Value	0.214	Data appear Normal at 1% Significance Level
Data appear Approximate Normal at 1% Significance Level		

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	74.75
90% Student's-t UCL	73.19	90% Modified-t UCL (Johnson-1978)	73.64

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.281	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.754	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.0965	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.187	Detected data appear Gamma Distributed at 5% Significance Level	

Gamma Statistics			
k hat (MLE)	2.332	k star (bias corrected MLE)	2.044
Theta hat (MLE)	26.22	Theta star (bias corrected MLE)	29.91
nu hat (MLE)	102.6	nu star (bias corrected)	89.94
MLE Mean (bias corrected)	61.14	MLE Sd (bias corrected)	42.77
		Approximate Chi Square Value (0.1)	73.23
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	72.35

Assuming Gamma Distribution			
90% Approximate Gamma UCL	75.09	90% Adjusted Gamma UCL	76.01

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.961	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.926	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.109	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.169	Data appear Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	2.625	Mean of logged Data	3.884
Maximum of Logged Data	5.165	SD of logged Data	0.716

Assuming Lognormal Distribution			
90% H-UCL	81.28	90% Chebyshev (MVUE) UCL	92.37
95% Chebyshev (MVUE) UCL	106.2	97.5% Chebyshev (MVUE) UCL	125.3
99% Chebyshev (MVUE) UCL	162.9		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	72.81	90% BCA Bootstrap UCL	74.01
90% Standard Bootstrap UCL	72.53	90% Bootstrap-t UCL	75.34
90% Hall's Bootstrap UCL	75.81	90% Percentile Bootstrap UCL	73.18
90% Chebyshev(Mean, Sd) UCL	88.45	95% Chebyshev(Mean, Sd) UCL	100.8
97.5% Chebyshev(Mean, Sd) UCL	118	99% Chebyshev(Mean, Sd) UCL	151.7

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Mercury

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	19
		Number of Missing Observations	0
Minimum	0.0928	Mean	0.421
Maximum	2.5	Median	0.197
SD	0.524	Std. Error of Mean	0.112
Coefficient of Variation	1.245	Skewness	3.227

Normal GOF Test

Shapiro Wilk Test Statistic	0.601	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.266	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.214	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 0.568

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 0.619
90% Modified-t UCL (Johnson-1978) 0.581

Gamma GOF Test

A-D Test Statistic 1.276
5% A-D Critical Value 0.764
K-S Test Statistic 0.219
5% K-S Critical Value 0.19

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 1.279
Theta hat (MLE) 0.329
nu hat (MLE) 56.29
MLE Mean (bias corrected) 0.421
Adjusted Level of Significance 0.0873

k star (bias corrected MLE) 1.135
Theta star (bias corrected MLE) 0.371
nu star (bias corrected) 49.94
MLE Sd (bias corrected) 0.395
Approximate Chi Square Value (0.1) 37.64
Adjusted Chi Square Value 37.01

Assuming Gamma Distribution

90% Approximate Gamma UCL 0.558

90% Adjusted Gamma UCL 0.568

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.894
10% Shapiro Wilk Critical Value 0.926
Lilliefors Test Statistic 0.206
10% Lilliefors Critical Value 0.169

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -2.377
Maximum of Logged Data 0.916

Mean of logged Data -1.305
SD of logged Data 0.887

Assuming Lognormal Distribution

90% H-UCL 0.568
95% Chebyshev (MVUE) UCL 0.749
99% Chebyshev (MVUE) UCL 1.207

90% Chebyshev (MVUE) UCL 0.638
97.5% Chebyshev (MVUE) UCL 0.904

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 0.564
90% Standard Bootstrap UCL 0.565
90% Hall's Bootstrap UCL 1.289
90% Chebyshev(Mean, Sd) UCL 0.756
97.5% Chebyshev(Mean, Sd) UCL 1.118

90% BCA Bootstrap UCL 0.635
90% Bootstrap-t UCL 0.714
90% Percentile Bootstrap UCL 0.581
95% Chebyshev(Mean, Sd) UCL 0.907
99% Chebyshev(Mean, Sd) UCL 1.531

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

General Statistics

Total Number of Observations 22

Number of Distinct Observations 20

			Number of Missing Observations	0
Minimum	14.6		Mean	20.15
Maximum	28.4		Median	18.75
SD	3.454		Std. Error of Mean	0.736
Coefficient of Variation	0.171		Skewness	0.759
Normal GOF Test				
Shapiro Wilk Test Statistic	0.944	Shapiro Wilk GOF Test		
1% Shapiro Wilk Critical Value	0.878	Data appear Normal at 1% Significance Level		
Lilliefors Test Statistic	0.197	Lilliefors GOF Test		
1% Lilliefors Critical Value	0.214	Data appear Normal at 1% Significance Level		
Data appear Normal at 1% Significance Level				
Assuming Normal Distribution				
90% Normal UCL		90% UCLs (Adjusted for Skewness)		
90% Student's-t UCL	21.12	90% Adjusted-CLT UCL (Chen-1995)	21.17	
		90% Modified-t UCL (Johnson-1978)	21.14	
Gamma GOF Test				
A-D Test Statistic	0.427	Anderson-Darling Gamma GOF Test		
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level		
K-S Test Statistic	0.187	Kolmogorov-Smirnov Gamma GOF Test		
5% K-S Critical Value	0.185	Data Not Gamma Distributed at 5% Significance Level		
Detected data follow Appr. Gamma Distribution at 5% Significance Level				
Gamma Statistics				
k hat (MLE)	37.39	k star (bias corrected MLE)	32.32	
Theta hat (MLE)	0.539	Theta star (bias corrected MLE)	0.623	
nu hat (MLE)	1645	nu star (bias corrected)	1422	
MLE Mean (bias corrected)	20.15	MLE Sd (bias corrected)	3.543	
		Approximate Chi Square Value (0.1)	1354	
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	1350	
Assuming Gamma Distribution				
90% Approximate Gamma UCL	21.16	90% Adjusted Gamma UCL	21.22	
Lognormal GOF Test				
Shapiro Wilk Test Statistic	0.969	Shapiro Wilk Lognormal GOF Test		
10% Shapiro Wilk Critical Value	0.926	Data appear Lognormal at 10% Significance Level		
Lilliefors Test Statistic	0.177	Lilliefors Lognormal GOF Test		
10% Lilliefors Critical Value	0.169	Data Not Lognormal at 10% Significance Level		
Data appear Approximate Lognormal at 10% Significance Level				
Lognormal Statistics				
Minimum of Logged Data	2.681	Mean of logged Data	2.99	
Maximum of Logged Data	3.346	SD of logged Data	0.166	
Assuming Lognormal Distribution				
90% H-UCL	21.16	90% Chebyshev (MVUE) UCL	22.29	
95% Chebyshev (MVUE) UCL	23.27	97.5% Chebyshev (MVUE) UCL	24.62	
99% Chebyshev (MVUE) UCL	27.28			
Nonparametric Distribution Free UCL Statistics				
Data appear to follow a Discernible Distribution				
Nonparametric Distribution Free UCLs				
90% CLT UCL	21.09	90% BCA Bootstrap UCL	21.13	
90% Standard Bootstrap UCL	21.04	90% Bootstrap-t UCL	21.22	
90% Hall's Bootstrap UCL	21.22	90% Percentile Bootstrap UCL	21.02	
90% Chebyshev(Mean, Sd) UCL	22.35	95% Chebyshev(Mean, Sd) UCL	23.36	
97.5% Chebyshev(Mean, Sd) UCL	24.74	99% Chebyshev(Mean, Sd) UCL	27.47	

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	58.4	Mean	106.1
Maximum	164	Median	109
SD	25.69	Std. Error of Mean	5.477
Coefficient of Variation	0.242	Skewness	0.2

Normal GOF Test

Shapiro Wilk Test Statistic	0.982	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.878	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.093	Lilliefors GOF Test
1% Lilliefors Critical Value	0.214	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	113.3

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	113.3
90% Modified-t UCL (Johnson-1978)	113.4

Gamma GOF Test

A-D Test Statistic	0.239	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.122	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.185	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	17.3	k star (bias corrected MLE)	14.97
Theta hat (MLE)	6.133	Theta star (bias corrected MLE)	7.087
nu hat (MLE)	761.1	nu star (bias corrected)	658.7
MLE Mean (bias corrected)	106.1	MLE Sd (bias corrected)	27.42
		Approximate Chi Square Value (0.1)	612.6
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	610

Assuming Gamma Distribution

90% Approximate Gamma UCL	114.1	90% Adjusted Gamma UCL	114.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.977	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.926	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.134	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.169	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.067	Mean of logged Data	4.635
Maximum of Logged Data	5.1	SD of logged Data	0.251

Assuming Lognormal Distribution

90% H-UCL	114.6	90% Chebyshev (MVUE) UCL	123.4
95% Chebyshev (MVUE) UCL	131.2	97.5% Chebyshev (MVUE) UCL	142
99% Chebyshev (MVUE) UCL	163.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	113.1	90% BCA Bootstrap UCL	113.1
90% Standard Bootstrap UCL	113	90% Bootstrap-t UCL	113.5
90% Hall's Bootstrap UCL	113.4	90% Percentile Bootstrap UCL	113
90% Chebyshev(Mean, Sd) UCL	122.5	95% Chebyshev(Mean, Sd) UCL	130
97.5% Chebyshev(Mean, Sd) UCL	140.3	99% Chebyshev(Mean, Sd) UCL	160.6

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	1.9365E-6	Mean	2.0156E-5
Maximum	1.4964E-4	Median	8.0995E-6
SD	3.2427E-5	Std. Error of Mean	6.9135E-6
Coefficient of Variation	N/A	Skewness	3.402
Normal GOF Test			
Shapiro Wilk Test Statistic	0.542	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.298	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.214	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL 2.9304E-5		90% Adjusted-CLT UCL (Chen-1995) 3.2596E-5	
		90% Modified-t UCL (Johnson-1978) 3.0139E-5	
Gamma GOF Test			
A-D Test Statistic	1.346	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.775	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.225	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.191	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.906	k star (bias corrected MLE)	0.813
Theta hat (MLE)	2.2252E-5	Theta star (bias corrected MLE)	2.4805E-5
nu hat (MLE)	39.85	nu star (bias corrected)	35.75
MLE Mean (bias corrected)	2.0156E-5	MLE Sd (bias corrected)	2.2360E-5
		Approximate Chi Square Value (0.1)	25.43
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	24.93
Assuming Gamma Distribution			
90% Approximate Gamma UCL 2.8333E-5		90% Adjusted Gamma UCL 2.8911E-5	
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.948	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.926	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.157	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.169	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-13.15	Mean of logged Data	-11.46
Maximum of Logged Data	-8.807	SD of logged Data	1.05
Assuming Lognormal Distribution			
90% H-UCL 2.8659E-5		90% Chebyshev (MVUE) UCL 3.1180E-5	
95% Chebyshev (MVUE) UCL 3.7291E-5		97.5% Chebyshev (MVUE) UCL 4.5772E-5	
99% Chebyshev (MVUE) UCL 6.2432E-5			
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL 2.9016E-5		90% BCA Bootstrap UCL 3.3520E-5	
90% Standard Bootstrap UCL 2.8899E-5		90% Bootstrap-t UCL 4.1471E-5	
90% Hall's Bootstrap UCL 6.6370E-5		90% Percentile Bootstrap UCL 2.9669E-5	
90% Chebyshev(Mean, Sd) UCL 4.0896E-5		95% Chebyshev(Mean, Sd) UCL 5.0291E-5	
97.5% Chebyshev(Mean, Sd) UCL 6.3331E-5		99% Chebyshev(Mean, Sd) UCL 8.8945E-5	

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	19
Number of Detects	5	Number of Non-Detects	17
Number of Distinct Detects	5	Number of Distinct Non-Detects	14
Minimum Detect	0.0052	Minimum Non-Detect	0.00473
Maximum Detect	0.0613	Maximum Non-Detect	0.00507
Variance Detects	5.4316E-4	Percent Non-Detects	77.27%
Mean Detects	0.0221	SD Detects	0.0233
Median Detects	0.0143	CV Detects	1.055
Skewness Detects	1.653	Kurtosis Detects	2.719
Mean of Logged Detects	-4.253	SD of Logged Detects	1.053

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.808	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.26	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00868	KM Standard Error of Mean	0.00294
90KM SD	0.0123	95% KM (BCA) UCL	0.0117
90% KM (t) UCL	0.0126	90% KM (Percentile Bootstrap) UCL	0.0122
90% KM (z) UCL	0.0124	90% KM Bootstrap t UCL	0.0158
90% KM Chebyshev UCL	0.0175	95% KM Chebyshev UCL	0.0215
97.5% KM Chebyshev UCL	0.027	99% KM Chebyshev UCL	0.0379

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.348	Anderson-Darling GOF Test
5% A-D Critical Value	0.689	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	1.278	k star (bias corrected MLE)	0.644
Theta hat (MLE)	0.0173	Theta star (bias corrected MLE)	0.0343
nu hat (MLE)	12.78	nu star (bias corrected)	6.443
Mean (detects)	0.0221		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0052	Mean	0.0127
Maximum	0.0613	Median	0.01
SD	0.0114	CV	0.896
k hat (MLE)	3.232	k star (bias corrected MLE)	2.822
Theta hat (MLE)	0.00394	Theta star (bias corrected MLE)	0.00452
nu hat (MLE)	142.2	nu star (bias corrected)	124.1
Adjusted Level of Significance (β)	0.0873		
Approximate Chi Square Value (124.15, α)	104.4	Adjusted Chi Square Value (124.15, β)	103.4
90% Gamma Approximate UCL	0.0152	90% Gamma Adjusted UCL	0.0153
95% Gamma Approximate UCL	0.0159	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00868	SD (KM)	0.0123
Variance (KM)	1.5167E-4	SE of Mean (KM)	0.00294
k hat (KM)	0.496	k star (KM)	0.459
nu hat (KM)	21.83	nu star (KM)	20.19
theta hat (KM)	0.0175	theta star (KM)	0.0189

80% gamma percentile (KM)	0.0142	90% gamma percentile (KM)	0.0239
95% gamma percentile (KM)	0.0344	99% gamma percentile (KM)	0.0603

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.19, α)	12.59	Adjusted Chi Square Value (20.19, β)	12.24
90% KM Approximate Gamma UCL	0.0139	90% KM Adjusted Gamma UCL	0.0143

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.912	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.806	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.229	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00516	Mean in Log Scale	-7.801
SD in Original Scale	0.0138	SD in Log Scale	2.103
90% t UCL (assumes normality of ROS data)	0.00906	90% Percentile Bootstrap UCL	0.00884
90% BCA Bootstrap UCL	0.0112	90% Bootstrap t UCL	0.0156
90% H-UCL (Log ROS)	0.0159		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.104	KM Geo Mean	0.00608
KM SD (logged)	0.644	90% Critical H Value (KM-Log)	1.594
KM Standard Error of Mean (logged)	0.153	90% H-UCL (KM -Log)	0.00935
KM SD (logged)	0.644	90% Critical H Value (KM-Log)	1.594
KM Standard Error of Mean (logged)	0.153		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00693
SD in Original Scale	0.0132
90% t UCL (Assumes normality)	0.0107

DL/2 Log-Transformed

Mean in Log Scale	-5.604
SD in Log Scale	0.88
90% H-Stat UCL	0.00764

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

TotalHPAHs

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	0.0881	Mean	2.606
Maximum	30.2	Median	0.507
SD	7.094	Std. Error of Mean	1.512
Coefficient of Variation	2.722	Skewness	3.482

Normal GOF Test

Shapiro Wilk Test Statistic	0.381	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.462	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.214	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	4.607

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	5.346

Gamma GOF Test

A-D Test Statistic	3.335
5% A-D Critical Value	0.822
K-S Test Statistic	0.337
5% K-S Critical Value	0.198

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE)	0.418	k star (bias corrected MLE)	0.391
Theta hat (MLE)	6.239	Theta star (bias corrected MLE)	6.665
nu hat (MLE)	18.38	nu star (bias corrected)	17.2
MLE Mean (bias corrected)	2.606	MLE Sd (bias corrected)	4.167
		Approximate Chi Square Value (0.1)	10.24
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	9.932

Assuming Gamma Distribution

90% Approximate Gamma UCL	4.376	90% Adjusted Gamma UCL	4.513

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.851
10% Shapiro Wilk Critical Value	0.926
Lilliefors Test Statistic	0.208
10% Lilliefors Critical Value	0.169

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data	-2.429	Mean of logged Data	-0.607
Maximum of Logged Data	3.408	SD of logged Data	1.447

Assuming Lognormal Distribution

90% H-UCL	3.282	90% Chebyshev (MVUE) UCL	3.009
95% Chebyshev (MVUE) UCL	3.727	97.5% Chebyshev (MVUE) UCL	4.725
99% Chebyshev (MVUE) UCL	6.683		

Nonparametric Distribution Free UCL Statistics**Data do not follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL	4.544	90% BCA Bootstrap UCL	5.417
90% Standard Bootstrap UCL	4.491	90% Bootstrap-t UCL	33.08
90% Hall's Bootstrap UCL	18.17	90% Percentile Bootstrap UCL	4.623
90% Chebyshev(Mean, Sd) UCL	7.143	95% Chebyshev(Mean, Sd) UCL	9.198
97.5% Chebyshev(Mean, Sd) UCL	12.05	99% Chebyshev(Mean, Sd) UCL	17.65

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**Please verify the data were collected from random locations.****If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.****cPAHs****General Statistics**

Total Number of Observations	22	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	0.0132	Mean	0.42
Maximum	5.13	Median	0.0765
SD	1.183	Std. Error of Mean	0.252
Coefficient of Variation	2.815	Skewness	3.606

Normal GOF Test

Shapiro Wilk Test Statistic	0.373
1% Shapiro Wilk Critical Value	0.878

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors Test Statistic	0.462	Lilliefors GOF Test
1% Lilliefors Critical Value	0.214	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	0.882
90% Student's-t UCL	0.754	90% Modified-t UCL (Johnson-1978)	0.786

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	3.426	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.826	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.342	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.199	Data Not Gamma Distributed at 5% Significance Level	

Gamma Statistics			
k hat (MLE)	0.399	k star (bias corrected MLE)	0.375
Theta hat (MLE)	1.054	Theta star (bias corrected MLE)	1.122
nu hat (MLE)	17.55	nu star (bias corrected)	16.49
MLE Mean (bias corrected)	0.42	MLE Sd (bias corrected)	0.687
		Approximate Chi Square Value (0.1)	9.687
Adjusted Level of Significance	0.0873	Adjusted Chi Square Value	9.385

Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.715	90% Adjusted Gamma UCL	0.738

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.845	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.926	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.212	Data Not Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.169	Data Not Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	-4.328	Mean of logged Data	-2.518
Maximum of Logged Data	1.635	SD of logged Data	1.474

Assuming Lognormal Distribution			
90% H-UCL	0.518	90% Chebyshev (MVUE) UCL	0.467
95% Chebyshev (MVUE) UCL	0.579	97.5% Chebyshev (MVUE) UCL	0.736
99% Chebyshev (MVUE) UCL	1.042		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	0.743	90% BCA Bootstrap UCL	0.906
90% Standard Bootstrap UCL	0.735	90% Bootstrap-t UCL	5.802
90% Hall's Bootstrap UCL	3.024	90% Percentile Bootstrap UCL	0.76
90% Chebyshev(Mean, Sd) UCL	1.177	95% Chebyshev(Mean, Sd) UCL	1.52
97.5% Chebyshev(Mean, Sd) UCL	1.995	99% Chebyshev(Mean, Sd) UCL	2.93

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	17
Number of Detects	5	Number of Non-Detects	17
Number of Distinct Detects	5	Number of Distinct Non-Detects	12
Minimum Detect	0.0316	Minimum Non-Detect	0.00481

Maximum Detect	0.189	Maximum Non-Detect	0.00506
Variance Detects	0.00454	Percent Non-Detects	77.27%
Mean Detects	0.0699	SD Detects	0.0674
Median Detects	0.0389	CV Detects	0.964
Skewness Detects	2.118	Kurtosis Detects	4.539
Mean of Logged Detects	-2.929	SD of Logged Detects	0.743

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.671	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.377	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0196	KM Standard Error of Mean	0.00944
90KM SD	0.0396	95% KM (BCA) UCL	0.0298
90% KM (t) UCL	0.0321	90% KM (Percentile Bootstrap) UCL	0.0311
90% KM (z) UCL	0.0317	90% KM Bootstrap t UCL	0.0395
90% KM Chebyshev UCL	0.0479	95% KM Chebyshev UCL	0.0607
97.5% KM Chebyshev UCL	0.0785	99% KM Chebyshev UCL	0.114

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.732	Anderson-Darling GOF Test
5% A-D Critical Value	0.684	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.318	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.016	k star (bias corrected MLE)	0.94
Theta hat (MLE)	0.0347	Theta star (bias corrected MLE)	0.0743
nu hat (MLE)	20.16	nu star (bias corrected)	9.396
Mean (detects)	0.0699		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0236
Maximum	0.189	Median	0.01
SD	0.039	CV	1.654
k hat (MLE)	1.185	k star (bias corrected MLE)	1.054
Theta hat (MLE)	0.0199	Theta star (bias corrected MLE)	0.0224
nu hat (MLE)	52.14	nu star (bias corrected)	46.36
Adjusted Level of Significance (β)	0.0873		
Approximate Chi Square Value (46.36, α)	34.53	Adjusted Chi Square Value (46.36, β)	33.93
90% Gamma Approximate UCL	0.0317	90% Gamma Adjusted UCL	0.0323
95% Gamma Approximate UCL	0.0345	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0196	SD (KM)	0.0396
Variance (KM)	0.00157	SE of Mean (KM)	0.00944
k hat (KM)	0.245	k star (KM)	0.242
nu hat (KM)	10.77	nu star (KM)	10.64
theta hat (KM)	0.08	theta star (KM)	0.081
80% gamma percentile (KM)	0.0281	90% gamma percentile (KM)	0.0589
95% gamma percentile (KM)	0.0958	99% gamma percentile (KM)	0.194

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.64, α)	5.318	Adjusted Chi Square Value (10.64, β)	5.102
90% KM Approximate Gamma UCL	0.0392	90% KM Adjusted Gamma UCL	0.0408

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.806	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.267	Lilliefors GOF Test
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level
Detected Data appear Approximate Lognormal at 10% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.018	Mean in Log Scale	-5.341
SD in Original Scale	0.0412	SD in Log Scale	1.463
90% t UCL (assumes normality of ROS data)	0.0296	90% Percentile Bootstrap UCL	0.0288
90% BCA Bootstrap UCL	0.0359	90% Bootstrap t UCL	0.0494
90% H-UCL (Log ROS)	0.03		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.79	KM Geo Mean	0.00831
KM SD (logged)	1.058	90% Critical H Value (KM-Log)	1.956
KM Standard Error of Mean (logged)	0.252	90% H-UCL (KM -Log)	0.0228
KM SD (logged)	1.058	90% Critical H Value (KM-Log)	1.956
KM Standard Error of Mean (logged)	0.252		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0178
SD in Original Scale	0.0412
90% t UCL (Assumes normality)	0.0294

DL/2 Log-Transformed

Mean in Log Scale	-5.304
SD in Log Scale	1.357
90% H-Stat UCL	0.0245

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:56:32 PM
 From File 90 UCL Input Data_MG_b.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	51	Number of Distinct Observations	48
Number of Detects	29	Number of Non-Detects	22
Number of Distinct Detects	29	Number of Distinct Non-Detects	19
Minimum Detect	0.557	Minimum Non-Detect	0.486
Maximum Detect	6.81	Maximum Non-Detect	0.56
Variance Detects	2.335	Percent Non-Detects	43.14%
Mean Detects	2.205	SD Detects	1.528
Median Detects	1.84	CV Detects	0.693
Skewness Detects	1.269	Kurtosis Detects	1.544
Mean of Logged Detects	0.568	SD of Logged Detects	0.687

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.881	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.898	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.144	Lilliefors GOF Test
1% Lilliefors Critical Value	0.189	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.464	KM Standard Error of Mean	0.202
90KM SD	1.417	95% KM (BCA) UCL	1.742
90% KM (t) UCL	1.726	90% KM (Percentile Bootstrap) UCL	1.739
90% KM (z) UCL	1.723	90% KM Bootstrap t UCL	1.768
90% KM Chebyshev UCL	2.069	95% KM Chebyshev UCL	2.344
97.5% KM Chebyshev UCL	2.725	99% KM Chebyshev UCL	3.473

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.338	Anderson-Darling GOF Test
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.111	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.164	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.397	k star (bias corrected MLE)	2.172
Theta hat (MLE)	0.92	Theta star (bias corrected MLE)	1.015
nu hat (MLE)	139	nu star (bias corrected)	126
Mean (detects)	2.205		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.258
Maximum	6.81	Median	0.735
SD	1.585	CV	1.26
k hat (MLE)	0.354	k star (bias corrected MLE)	0.347
Theta hat (MLE)	3.551	Theta star (bias corrected MLE)	3.63
nu hat (MLE)	36.15	nu star (bias corrected)	35.36
Adjusted Level of Significance (β)	0.0948		
Approximate Chi Square Value (35.36, α)	25.1	Adjusted Chi Square Value (35.36, β)	24.9
90% Gamma Approximate UCL	1.773	90% Gamma Adjusted UCL	1.787
95% Gamma Approximate UCL	1.956	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.464	SD (KM)	1.417
Variance (KM)	2.007	SE of Mean (KM)	0.202
k hat (KM)	1.068	k star (KM)	1.018
nu hat (KM)	108.9	nu star (KM)	103.8
theta hat (KM)	1.371	theta star (KM)	1.438
80% gamma percentile (KM)	2.352	90% gamma percentile (KM)	3.356
95% gamma percentile (KM)	4.358	99% gamma percentile (KM)	6.681

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (103.82, α)	85.84	Adjusted Chi Square Value (103.82, β)	85.45
90% KM Approximate Gamma UCL	1.771	90% KM Adjusted Gamma UCL	1.778

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.968	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.937	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0815	Lilliefors GOF Test
10% Lilliefors Critical Value	0.148	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.397	Mean in Log Scale	-0.158
SD in Original Scale	1.479	SD in Log Scale	0.992
90% t UCL (assumes normality of ROS data)	1.666	90% Percentile Bootstrap UCL	1.665
90% BCA Bootstrap UCL	1.686	90% Bootstrap t UCL	1.713
90% H-UCL (Log ROS)	1.782		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0119	KM Geo Mean	1.012
KM SD (logged)	0.817	90% Critical H Value (KM-Log)	1.615
KM Standard Error of Mean (logged)	0.116	90% H-UCL (KM -Log)	1.702
KM SD (logged)	0.817	90% Critical H Value (KM-Log)	1.615
KM Standard Error of Mean (logged)	0.116		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	1.365
SD in Original Scale	1.502
90% t UCL (Assumes normality)	1.639

DL/2 Log-Transformed

Mean in Log Scale	-0.262
SD in Log Scale	1.091
90% H-Stat UCL	1.848

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Arsenic

General Statistics

Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	2.69	Mean	6.605
Maximum	50.1	Median	4.14
SD	7.277	Std. Error of Mean	1.019
Coefficient of Variation	1.102	Skewness	4.625

Normal GOF Test

Shapiro Wilk Test Statistic	0.513	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.295	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	7.929

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	8.383

Gamma GOF Test

A-D Test Statistic	3.868
5% A-D Critical Value	0.762
K-S Test Statistic	0.216
5% K-S Critical Value	0.126

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE)	2.162	k star (bias corrected MLE)	2.048
Theta hat (MLE)	3.055	Theta star (bias corrected MLE)	3.225
nu hat (MLE)	220.5	nu star (bias corrected)	208.9
MLE Mean (bias corrected)	6.605	MLE Sd (bias corrected)	4.616
		Approximate Chi Square Value (0.1)	183.2
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	182.6

Assuming Gamma Distribution

90% Approximate Gamma UCL	7.533	90% Adjusted Gamma UCL	7.557

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.842
10% Shapiro Wilk P Value	4.7485E-7
Lilliefors Test Statistic	0.177
10% Lilliefors Critical Value	0.113

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data	0.99	Mean of logged Data	1.639
Maximum of Logged Data	3.914	SD of logged Data	0.605

Assuming Lognormal Distribution

90% H-UCL	7.026	90% Chebyshev (MVUE) UCL	7.84
95% Chebyshev (MVUE) UCL	8.601	97.5% Chebyshev (MVUE) UCL	9.657
99% Chebyshev (MVUE) UCL	11.73		

Nonparametric Distribution Free UCL Statistics**Data do not follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL	7.911	90% BCA Bootstrap UCL	8.629
90% Standard Bootstrap UCL	7.886	90% Bootstrap-t UCL	9.145
90% Hall's Bootstrap UCL	14.4	90% Percentile Bootstrap UCL	7.899
90% Chebyshev(Mean, Sd) UCL	9.662	95% Chebyshev(Mean, Sd) UCL	11.05
97.5% Chebyshev(Mean, Sd) UCL	12.97	99% Chebyshev(Mean, Sd) UCL	16.74

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**Please verify the data were collected from random locations.****If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.****Chromium****General Statistics**

Total Number of Observations	51	Number of Distinct Observations	37
		Number of Missing Observations	0
Minimum	9.45	Mean	14.15
Maximum	21.7	Median	13.8
SD	2.775	Std. Error of Mean	0.389
Coefficient of Variation	0.196	Skewness	0.728

Normal GOF Test

Shapiro Wilk Test Statistic	0.943
1% Shapiro Wilk P Value	0.0263

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors Test Statistic	0.141	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data appear Normal at 1% Significance Level
Data appear Normal at 1% Significance Level		

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	14.67
90% Student's-t UCL	14.65	90% Modified-t UCL (Johnson-1978)	14.66

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.536	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.748	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.115	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.124	Detected data appear Gamma Distributed at 5% Significance Level	

Gamma Statistics			
k hat (MLE)	27.67	k star (bias corrected MLE)	26.06
Theta hat (MLE)	0.511	Theta star (bias corrected MLE)	0.543
nu hat (MLE)	2822	nu star (bias corrected)	2658
MLE Mean (bias corrected)	14.15	MLE Sd (bias corrected)	2.772
		Approximate Chi Square Value (0.1)	2565
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	2563

Assuming Gamma Distribution			
90% Approximate Gamma UCL	14.66	90% Adjusted Gamma UCL	14.67

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.968	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.304	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.104	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.113	Data appear Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	2.246	Mean of logged Data	2.631
Maximum of Logged Data	3.077	SD of logged Data	0.192

Assuming Lognormal Distribution			
90% H-UCL	14.67	90% Chebyshev (MVUE) UCL	15.29
95% Chebyshev (MVUE) UCL	15.81	97.5% Chebyshev (MVUE) UCL	16.53
99% Chebyshev (MVUE) UCL	17.95		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	14.65	90% BCA Bootstrap UCL	14.66
90% Standard Bootstrap UCL	14.63	90% Bootstrap-t UCL	14.68
90% Hall's Bootstrap UCL	14.67	90% Percentile Bootstrap UCL	14.65
90% Chebyshev(Mean, Sd) UCL	15.31	95% Chebyshev(Mean, Sd) UCL	15.84
97.5% Chebyshev(Mean, Sd) UCL	16.57	99% Chebyshev(Mean, Sd) UCL	18.01

Suggested UCL to Use
Recommendation Provided only for 95% Confidence Coefficient

Copper

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	15	Mean	56.3
Maximum	327	Median	35.4
SD	59.55	Std. Error of Mean	8.339
Coefficient of Variation	1.058	Skewness	2.894

Normal GOF Test

Shapiro Wilk Test Statistic	0.651	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	1.354E-14	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.244	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	67.13	90% Adjusted-CLT UCL (Chen-1995)	69.4
		90% Modified-t UCL (Johnson-1978)	67.69

Gamma GOF Test

A-D Test Statistic	1.852	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.132	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.126	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.657	k star (bias corrected MLE)	1.572
Theta hat (MLE)	33.98	Theta star (bias corrected MLE)	35.81
nu hat (MLE)	169	nu star (bias corrected)	160.4
MLE Mean (bias corrected)	56.3	MLE Sd (bias corrected)	44.9
		Approximate Chi Square Value (0.1)	137.9
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	137.4

Assuming Gamma Distribution

90% Approximate Gamma UCL	65.47	90% Adjusted Gamma UCL	65.71

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.00279	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0961	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.113	Data appear Lognormal at 10% Significance Level	

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	3.699
Maximum of Logged Data	5.79	SD of logged Data	0.76

Assuming Lognormal Distribution

90% H-UCL	63.94	90% Chebyshev (MVUE) UCL	72.57
95% Chebyshev (MVUE) UCL	81.17	97.5% Chebyshev (MVUE) UCL	93.11
99% Chebyshev (MVUE) UCL	116.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	66.98	90% BCA Bootstrap UCL	70.9
90% Standard Bootstrap UCL	67.06	90% Bootstrap-t UCL	71.76
90% Hall's Bootstrap UCL	71.87	90% Percentile Bootstrap UCL	67.2
90% Chebyshev(Mean, Sd) UCL	81.31	95% Chebyshev(Mean, Sd) UCL	92.65
97.5% Chebyshev(Mean, Sd) UCL	108.4	99% Chebyshev(Mean, Sd) UCL	139.3

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,

then contact a statistician to correctly calculate UCLs.

Lead

General Statistics

Total Number of Observations	51	Number of Distinct Observations	50

		Number of Missing Observations	0
Minimum	3.1	Mean	50.35
Maximum	220	Median	39.1
SD	49.16	Std. Error of Mean	6.884
Coefficient of Variation	0.976	Skewness	1.623

Normal GOF Test		
Shapiro Wilk Test Statistic	0.83	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	1.3726E-7	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.182	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	59.29	90% Adjusted-CLT UCL (Chen-1995)	60.29
		90% Modified-t UCL (Johnson-1978)	59.56

		Gamma GOF Test	
A-D Test Statistic	0.384	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.778	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0818	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.128	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	1.072	k star (bias corrected MLE)	1.022
Theta hat (MLE)	46.96	Theta star (bias corrected MLE)	49.26
nu hat (MLE)	109.4	nu star (bias corrected)	104.3
MLE Mean (bias corrected)	50.35	MLE Sd (bias corrected)	49.8
		Approximate Chi Square Value (0.1)	86.25
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	85.87

Assuming Gamma Distribution			
90% Approximate Gamma UCL	60.88	90% Adjusted Gamma UCL	61.15

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.941	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	0.02	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.106	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.113	Data appear Lognormal at 10% Significance Level
Data appear Approximate Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	1.131	Mean of logged Data	3.385
Maximum of Logged Data	5.394	SD of logged Data	1.155

Assuming Lognormal Distribution			
90% H-UCL	78.01	90% Chebyshev (MVUE) UCL	89.75
95% Chebyshev (MVUE) UCL	104.9	97.5% Chebyshev (MVUE) UCL	125.9
99% Chebyshev (MVUE) UCL	167.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	59.18	90% BCA Bootstrap UCL	60.88
90% Standard Bootstrap UCL	59.33	90% Bootstrap-t UCL	61.12
90% Hall's Bootstrap UCL	61.16	90% Percentile Bootstrap UCL	60.01
90% Chebyshev(Mean, Sd) UCL	71.01	95% Chebyshev(Mean, Sd) UCL	80.36
97.5% Chebyshev(Mean, Sd) UCL	93.35	99% Chebyshev(Mean, Sd) UCL	118.9

Suggested UCL to Use
Recommendation Provided only for 95% Confidence Coefficient

Total Number of Observations	51	Number of Distinct Observations	43
Number of Detects	23	Number of Non-Detects	28
Number of Distinct Detects	23	Number of Distinct Non-Detects	22
Minimum Detect	0.0415	Minimum Non-Detect	0.0389
Maximum Detect	0.706	Maximum Non-Detect	0.0448
Variance Detects	0.0328	Percent Non-Detects	54.9%
Mean Detects	0.137	SD Detects	0.181
Median Detects	0.0606	CV Detects	1.326
Skewness Detects	2.613	Kurtosis Detects	6.258
Mean of Logged Detects	-2.454	SD of Logged Detects	0.852

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.562	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.312	Lilliefors GOF Test
1% Lilliefors Critical Value	0.209	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.083	KM Standard Error of Mean	0.0184
90KM SD	0.129	95% KM (BCA) UCL	0.106
90% KM (t) UCL	0.107	90% KM (Percentile Bootstrap) UCL	0.107
90% KM (z) UCL	0.107	90% KM Bootstrap t UCL	0.134
90% KM Chebyshev UCL	0.138	95% KM Chebyshev UCL	0.163
97.5% KM Chebyshev UCL	0.198	99% KM Chebyshev UCL	0.266

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.532	Anderson-Darling GOF Test
5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.186	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.218	k star (bias corrected MLE)	1.088
Theta hat (MLE)	0.112	Theta star (bias corrected MLE)	0.126
nu hat (MLE)	56.01	nu star (bias corrected)	50.04
Mean (detects)	0.137		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0671
Maximum	0.706	Median	0.01
SD	0.136	CV	2.026
k hat (MLE)	0.654	k star (bias corrected MLE)	0.628
Theta hat (MLE)	0.103	Theta star (bias corrected MLE)	0.107
nu hat (MLE)	66.66	nu star (bias corrected)	64.07
Adjusted Level of Significance (β)	0.0948		
Approximate Chi Square Value (64.07, α)	50.06	Adjusted Chi Square Value (64.07, β)	49.77
90% Gamma Approximate UCL	0.0859	90% Gamma Adjusted UCL	0.0864
95% Gamma Approximate UCL	0.0922	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.083	SD (KM)	0.129
Variance (KM)	0.0165	SE of Mean (KM)	0.0184
k hat (KM)	0.418	k star (KM)	0.406
nu hat (KM)	42.6	nu star (KM)	41.43
theta hat (KM)	0.199	theta star (KM)	0.204
80% gamma percentile (KM)	0.134	90% gamma percentile (KM)	0.234
95% gamma percentile (KM)	0.343	99% gamma percentile (KM)	0.618

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (41.43, α)	30.27	Adjusted Chi Square Value (41.43, β)	30.05
90% KM Approximate Gamma UCL	0.114	90% KM Adjusted Gamma UCL	0.114

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.793	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.928	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.227	Lilliefors GOF Test
10% Lilliefors Critical Value	0.165	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.0669	Mean in Log Scale	-3.685
SD in Original Scale	0.136	SD in Log Scale	1.28
90% t UCL (assumes normality of ROS data)	0.0916	90% Percentile Bootstrap UCL	0.0919
90% BCA Bootstrap UCL	0.0991	90% Bootstrap t UCL	0.106
90% H-UCL (Log ROS)	0.0814		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.888	KM Geo Mean	0.0557
KM SD (logged)	0.684	90% Critical H Value (KM-Log)	1.532
KM Standard Error of Mean (logged)	0.098	90% H-UCL (KM -Log)	0.0816
KM SD (logged)	0.684	90% Critical H Value (KM-Log)	1.532
KM Standard Error of Mean (logged)	0.098		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.073
SD in Original Scale	0.134
90% t UCL (Assumes normality)	0.0973

DL/2 Log-Transformed

Mean in Log Scale	-3.234
SD in Log Scale	0.911
90% H-Stat UCL	0.0741

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Data do not follow a Discernible Distribution****Suggested UCL to Use**

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**Please verify the data were collected from random locations.****If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Nickel

General Statistics

Total Number of Observations	51	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	14.2	Mean	17.75
Maximum	24.3	Median	17.7
SD	2.142	Std. Error of Mean	0.3
Coefficient of Variation	0.121	Skewness	0.903

Normal GOF Test

Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	0.0203	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.129	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level**Assuming Normal Distribution****90% Normal UCL**

90% Student's-t UCL	18.13

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	18.16
90% Modified-t UCL (Johnson-1978)	18.14

Gamma GOF Test

A-D Test Statistic	0.597	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.112	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.124	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	73.61	k star (bias corrected MLE)	69.29
Theta hat (MLE)	0.241	Theta star (bias corrected MLE)	0.256
nu hat (MLE)	7508	nu star (bias corrected)	7068
MLE Mean (bias corrected)	17.75	MLE Sd (bias corrected)	2.132
Adjusted Level of Significance		Approximate Chi Square Value (0.1)	6916
		Adjusted Chi Square Value	6912

Assuming Gamma Distribution

90% Approximate Gamma UCL	18.13	90% Adjusted Gamma UCL	18.14

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.965
10% Shapiro Wilk P Value	0.245
Lilliefors Test Statistic	0.106
10% Lilliefors Critical Value	0.113

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.653	Mean of logged Data	2.869
Maximum of Logged Data	3.19	SD of logged Data	0.117

Assuming Lognormal Distribution

90% H-UCL	18.13	90% Chebyshev (MVUE) UCL	18.61
95% Chebyshev (MVUE) UCL	19.01	97.5% Chebyshev (MVUE) UCL	19.56
99% Chebyshev (MVUE) UCL	20.63		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	18.13	90% BCA Bootstrap UCL	18.2
90% Standard Bootstrap UCL	18.14	90% Bootstrap-t UCL	18.2
90% Hall's Bootstrap UCL	18.19	90% Percentile Bootstrap UCL	18.14
90% Chebyshev(Mean, Sd) UCL	18.64	95% Chebyshev(Mean, Sd) UCL	19.05
97.5% Chebyshev(Mean, Sd) UCL	19.62	99% Chebyshev(Mean, Sd) UCL	20.73

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics

Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	44.3	Mean	138.6
Maximum	354	Median	130
SD	76.39	Std. Error of Mean	10.7
Coefficient of Variation	0.551	Skewness	0.693

Normal GOF Test

Shapiro Wilk Test Statistic	0.926
1% Shapiro Wilk P Value	0.00393
Lilliefors Test Statistic	0.109
1% Lilliefors Critical Value	0.143

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	152.5

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	153
90% Modified-t UCL (Johnson-1978)	152.7

Gamma GOF Test

A-D Test Statistic	0.63
5% A-D Critical Value	0.756

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

K-S Test Statistic 0.112 Kolmogorov-Smirnov Gamma GOF Test
 5% K-S Critical Value 0.125 Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	3.258	k star (bias corrected MLE)	3.08
Theta hat (MLE)	42.53	Theta star (bias corrected MLE)	45
nu hat (MLE)	332.3	nu star (bias corrected)	314.1
MLE Mean (bias corrected)	138.6	MLE Sd (bias corrected)	78.97
		Approximate Chi Square Value (0.1)	282.5
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	281.8

Assuming Gamma Distribution			
90% Approximate Gamma UCL	154.1	90% Adjusted Gamma UCL	154.5

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.933	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.00865	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.111	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.113	Data appear Approximate Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	3.791	Mean of logged Data	4.77
Maximum of Logged Data	5.869	SD of logged Data	0.593

Assuming Lognormal Distribution			
90% H-UCL	159.3	90% Chebyshev (MVUE) UCL	177.4
95% Chebyshev (MVUE) UCL	194.3	97.5% Chebyshev (MVUE) UCL	217.8
99% Chebyshev (MVUE) UCL	263.9		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	152.3	90% BCA Bootstrap UCL	153.5
90% Standard Bootstrap UCL	152.3	90% Bootstrap-t UCL	153.1
90% Hall's Bootstrap UCL	153	90% Percentile Bootstrap UCL	152.8
90% Chebyshev(Mean, Sd) UCL	170.7	95% Chebyshev(Mean, Sd) UCL	185.2
97.5% Chebyshev(Mean, Sd) UCL	205.4	99% Chebyshev(Mean, Sd) UCL	245

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dioxin/Furan

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	51
		Number of Missing Observations	0
Minimum	5.1751E-7	Mean	3.2407E-5
Maximum	2.5457E-4	Median	1.5268E-5
SD	5.2370E-5	Std. Error of Mean	7.3333E-6
Coefficient of Variation	N/A	Skewness	3.168

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.591	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	1.110E-16	Lilliefors GOF Test	
Lilliefors Test Statistic	0.271	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level	

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	4.1931E-5	90% Adjusted-CLT UCL (Chen-1995)	4.4128E-5
		90% Modified-t UCL (Johnson-1978)	4.2473E-5

Gamma GOF Test

A-D Test Statistic	0.885	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.809	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.118	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.131	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics		
k hat (MLE)	0.562	k star (bias corrected MLE) 0.542
Theta hat (MLE)	5.7689E-5	Theta star (bias corrected MLE) 5.9816E-5
nu hat (MLE)	57.3	nu star (bias corrected) 55.26
MLE Mean (bias corrected)	3.2407E-5	MLE Sd (bias corrected) 4.4028E-5
		Approximate Chi Square Value (0.1) 42.29
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value 42.03

Assuming Gamma Distribution

90% Approximate Gamma UCL	4.2348E-5	90% Adjusted Gamma UCL	4.2613E-5

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test
Shapiro Wilk Test Statistic	0.908	Data Not Lognormal at 10% Significance Level
10% Shapiro Wilk P Value	5.4099E-4	Lilliefors Lognormal GOF Test
Lilliefors Test Statistic	0.155	Data Not Lognormal at 10% Significance Level
10% Lilliefors Critical Value	0.113	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics		
Minimum of Logged Data	-14.47	Mean of logged Data -11.45
Maximum of Logged Data	-8.276	SD of logged Data 1.752

Assuming Lognormal Distribution

90% H-UCL	8.9833E-5	90% Chebyshev (MVUE) UCL	9.3734E-5
95% Chebyshev (MVUE) UCL	1.1529E-4	97.5% Chebyshev (MVUE) UCL	1.4522E-4
99% Chebyshev (MVUE) UCL	2.0399E-4		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	4.1805E-5	90% BCA Bootstrap UCL	4.4234E-5
90% Standard Bootstrap UCL	4.1535E-5	90% Bootstrap-t UCL	4.6151E-5
90% Hall's Bootstrap UCL	4.4587E-5	90% Percentile Bootstrap UCL	4.1631E-5
90% Chebyshev(Mean, Sd) UCL	5.4407E-5	95% Chebyshev(Mean, Sd) UCL	6.4372E-5
97.5% Chebyshev(Mean, Sd) UCL	7.8203E-5	99% Chebyshev(Mean, Sd) UCL	1.0537E-4

Suggested UCL to Use
Recommendation Provided only for 95% Confidence Coefficient

Dibenzofuran

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	41
Number of Detects	23	Number of Non-Detects	28
Number of Distinct Detects	23	Number of Distinct Non-Detects	19
Minimum Detect	0.005	Minimum Non-Detect	0.00468
Maximum Detect	0.0427	Maximum Non-Detect	0.00508
Variance Detects	1.0335E-4	Percent Non-Detects	54.9%
Mean Detects	0.0115	SD Detects	0.0102
Median Detects	0.00823	CV Detects	0.883
Skewness Detects	2.525	Kurtosis Detects	5.869
Mean of Logged Detects	-4.683	SD of Logged Detects	0.597

Normal GOF Test on Detects Only		Shapiro Wilk GOF Test
Shapiro Wilk Test Statistic	0.61	Detected Data Not Normal at 1% Significance Level
1% Shapiro Wilk Critical Value	0.881	Lilliefors GOF Test
Lilliefors Test Statistic	0.294	Detected Data Not Normal at 1% Significance Level
1% Lilliefors Critical Value	0.209	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00776	KM Standard Error of Mean	0.00107
90KM SD	0.00749	95% KM (BCA) UCL	0.00918
90% KM (t) UCL	0.00916	90% KM (Percentile Bootstrap) UCL	0.00913
90% KM (z) UCL	0.00914	90% KM Bootstrap t UCL	0.0101
90% KM Chebyshev UCL	0.011	95% KM Chebyshev UCL	0.0124
97.5% KM Chebyshev UCL	0.0145	99% KM Chebyshev UCL	0.0184

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.945	Anderson-Darling GOF Test	
5% A-D Critical Value	0.753	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.244	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.183	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.446	k star (bias corrected MLE)	2.156
Theta hat (MLE)	0.00471	Theta star (bias corrected MLE)	0.00534
nu hat (MLE)	112.5	nu star (bias corrected)	99.17
Mean (detects)	0.0115		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	0.0107
Maximum	0.0427	Median	0.01
SD	0.00679	CV	0.635
k hat (MLE)	5.12	k star (bias corrected MLE)	4.831
Theta hat (MLE)	0.00209	Theta star (bias corrected MLE)	0.00221
nu hat (MLE)	522.2	nu star (bias corrected)	492.8
Adjusted Level of Significance (β)	0.0948		
Approximate Chi Square Value (492.81, α)	453	Adjusted Chi Square Value (492.81, β)	452.1
90% Gamma Approximate UCL	0.0116	90% Gamma Adjusted UCL	0.0116
95% Gamma Approximate UCL	0.0119	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00776	SD (KM)	0.00749
Variance (KM)	5.6113E-5	SE of Mean (KM)	0.00107
k hat (KM)	1.074	k star (KM)	1.024
nu hat (KM)	109.6	nu star (KM)	104.5
theta hat (KM)	0.00723	theta star (KM)	0.00758
80% gamma percentile (KM)	0.0125	90% gamma percentile (KM)	0.0178
95% gamma percentile (KM)	0.0231	99% gamma percentile (KM)	0.0353

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (104.48, α)	86.43	Adjusted Chi Square Value (104.48, β)	86.05
90% KM Approximate Gamma UCL	0.00939	90% KM Adjusted Gamma UCL	0.00943

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.836	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.928	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.209	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.165	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00624	Mean in Log Scale	-5.569
SD in Original Scale	0.0083	SD in Log Scale	0.925
90% t UCL (assumes normality of ROS data)	0.00775	90% Percentile Bootstrap UCL	0.00777
90% BCA Bootstrap UCL	0.00812	90% Bootstrap t UCL	0.00842
90% H-UCL (Log ROS)	0.0073		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.056	KM Geo Mean	0.00637
KM SD (logged)	0.518	90% Critical H Value (KM-Log)	1.443
KM Standard Error of Mean (logged)	0.0742	90% H-UCL (KM -Log)	0.0081

KM SD (logged)	0.518	90% Critical H Value (KM-Log)	1.443
KM Standard Error of Mean (logged)	0.0742		

DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00656	Mean in Log Scale	-5.404
SD in Original Scale	0.00813	SD in Log Scale	0.77
90% t UCL (Assumes normality)	0.00804	90% H-Stat UCL	0.00719
DL/2 is not a recommended method, provided for comparisons and historical reasons			

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

TotalHPAHs

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	51
Number of Detects	49	Number of Non-Detects	2
Number of Distinct Detects	49	Number of Distinct Non-Detects	2
Minimum Detect	0.027	Minimum Non-Detect	0.0247
Maximum Detect	3.53	Maximum Non-Detect	0.0249
Variance Detects	0.664	Percent Non-Detects	3.922%
Mean Detects	0.824	SD Detects	0.815
Median Detects	0.616	CV Detects	0.989
Skewness Detects	1.563	Kurtosis Detects	2.273
Mean of Logged Detects	-0.774	SD of Logged Detects	1.256

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.826	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.2	Lilliefors GOF Test
1% Lilliefors Critical Value	0.146	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.793	KM Standard Error of Mean	0.114
90KM SD	0.806	95% KM (BCA) UCL	0.918
90% KM (t) UCL	0.941	90% KM (Percentile Bootstrap) UCL	0.931
90% KM (z) UCL	0.939	90% KM Bootstrap t UCL	0.965
90% KM Chebyshev UCL	1.135	95% KM Chebyshev UCL	1.29
97.5% KM Chebyshev UCL	1.505	99% KM Chebyshev UCL	1.927

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.435	Anderson-Darling GOF Test
5% A-D Critical Value	0.78	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0858	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.13	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.994	k star (bias corrected MLE)	0.947
Theta hat (MLE)	0.829	Theta star (bias corrected MLE)	0.87
nu hat (MLE)	97.45	nu star (bias corrected)	92.81
Mean (detects)	0.824		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.792
Maximum	3.53	Median	0.594
SD	0.814	CV	1.028
k hat (MLE)	0.851	k star (bias corrected MLE)	0.814

Theta hat (MLE)	0.931	Theta star (bias corrected MLE)	0.973
nu hat (MLE)	86.83	nu star (bias corrected)	83.05
Adjusted Level of Significance (β)	0.0948		
Approximate Chi Square Value (83.05, α)	67.02	Adjusted Chi Square Value (83.05, β)	66.69
90% Gamma Approximate UCL	0.982	90% Gamma Adjusted UCL	0.987
95% Gamma Approximate UCL	1.043	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.793	SD (KM)	0.806
Variance (KM)	0.649	SE of Mean (KM)	0.114
k hat (KM)	0.968	k star (KM)	0.924
nu hat (KM)	98.69	nu star (KM)	94.22
theta hat (KM)	0.819	theta star (KM)	0.858
80% gamma percentile (KM)	1.284	90% gamma percentile (KM)	1.861
95% gamma percentile (KM)	2.443	99% gamma percentile (KM)	3.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (94.22, α)	77.11	Adjusted Chi Square Value (94.22, β)	76.75
90% KM Approximate Gamma UCL	0.969	90% KM Adjusted Gamma UCL	0.973

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.955	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.153	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.115	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.793	Mean in Log Scale	-0.891
SD in Original Scale	0.814	SD in Log Scale	1.361
90% t UCL (assumes normality of ROS data)	0.941	90% Percentile Bootstrap UCL	0.937
90% BCA Bootstrap UCL	0.943	90% Bootstrap t UCL	0.966
90% H-UCL (Log ROS)	1.534		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.889	KM Geo Mean	0.411
KM SD (logged)	1.344	90% Critical H Value (KM-Log)	2.027
KM Standard Error of Mean (logged)	0.19	90% H-UCL (KM -Log)	1.491
KM SD (logged)	1.344	90% Critical H Value (KM-Log)	2.027
KM Standard Error of Mean (logged)	0.19		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.792
SD in Original Scale	0.814
90% t UCL (Assumes normality)	0.94

DL/2 Log-Transformed

Mean in Log Scale	-0.916
SD in Log Scale	1.42
90% H-Stat UCL	1.669

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

cPAHs

General Statistics

Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	0.00566	Mean	0.122
Maximum	0.566	Median	0.0823
SD	0.137	Std. Error of Mean	0.0192
Coefficient of Variation	1.119	Skewness	1.724

Normal GOF Test

Shapiro Wilk Test Statistic	0.781
1% Shapiro Wilk P Value	1.1493E-9

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors Test Statistic	0.221	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	0.15
90% Student's-t UCL	0.147	90% Modified-t UCL (Johnson-1978)	0.148

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.57	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.788	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.105	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.129	Detected data appear Gamma Distributed at 5% Significance Level	

Gamma Statistics			
k hat (MLE)	0.85	k star (bias corrected MLE)	0.813
Theta hat (MLE)	0.144	Theta star (bias corrected MLE)	0.15
nu hat (MLE)	86.74	nu star (bias corrected)	82.97
MLE Mean (bias corrected)	0.122	MLE Sd (bias corrected)	0.136
		Approximate Chi Square Value (0.1)	66.95
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	66.61

Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.152	90% Adjusted Gamma UCL	0.152

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.929	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.00534	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.117	Data Not Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.113	Data Not Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	-5.174	Mean of logged Data	-2.793
Maximum of Logged Data	-0.569	SD of logged Data	1.331

Assuming Lognormal Distribution			
90% H-UCL	0.217	90% Chebyshev (MVUE) UCL	0.247
95% Chebyshev (MVUE) UCL	0.293	97.5% Chebyshev (MVUE) UCL	0.358
99% Chebyshev (MVUE) UCL	0.485		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	0.147	90% BCA Bootstrap UCL	0.15
90% Standard Bootstrap UCL	0.147	90% Bootstrap-t UCL	0.152
90% Hall's Bootstrap UCL	0.151	90% Percentile Bootstrap UCL	0.146
90% Chebyshev(Mean, Sd) UCL	0.18	95% Chebyshev(Mean, Sd) UCL	0.206
97.5% Chebyshev(Mean, Sd) UCL	0.242	99% Chebyshev(Mean, Sd) UCL	0.313

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	44
Number of Detects	26	Number of Non-Detects	25
Number of Distinct Detects	26	Number of Distinct Non-Detects	18
Minimum Detect	0.025	Minimum Non-Detect	0.00465

Maximum Detect	0.186	Maximum Non-Detect	0.0456
Variance Detects	0.00227	Percent Non-Detects	49.02%
Mean Detects	0.0615	SD Detects	0.0477
Median Detects	0.0425	CV Detects	0.775
Skewness Detects	1.764	Kurtosis Detects	2.208
Mean of Logged Detects	-3.001	SD of Logged Detects	0.62

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.726	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.891	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.249	Lilliefors GOF Test
1% Lilliefors Critical Value	0.199	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0339	KM Standard Error of Mean	0.00626
90KM SD	0.0438	95% KM (BCA) UCL	0.0421
90% KM (t) UCL	0.042	90% KM (Percentile Bootstrap) UCL	0.042
90% KM (z) UCL	0.0419	90% KM Bootstrap t UCL	0.0444
90% KM Chebyshev UCL	0.0526	95% KM Chebyshev UCL	0.0611
97.5% KM Chebyshev UCL	0.0729	99% KM Chebyshev UCL	0.0961

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.528	Anderson-Darling GOF Test
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.173	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.508	k star (bias corrected MLE)	2.245
Theta hat (MLE)	0.0245	Theta star (bias corrected MLE)	0.0274
nu hat (MLE)	130.4	nu star (bias corrected)	116.7
Mean (detects)	0.0615		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0363
Maximum	0.186	Median	0.025
SD	0.0426	CV	1.174
k hat (MLE)	1.202	k star (bias corrected MLE)	1.145
Theta hat (MLE)	0.0302	Theta star (bias corrected MLE)	0.0317
nu hat (MLE)	122.6	nu star (bias corrected)	116.7
Adjusted Level of Significance (β)	0.0948		
Approximate Chi Square Value (116.74, α)	97.64	Adjusted Chi Square Value (116.74, β)	97.23
90% Gamma Approximate UCL	0.0434	90% Gamma Adjusted UCL	0.0436
95% Gamma Approximate UCL	0.0456	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0339	SD (KM)	0.0438
Variance (KM)	0.00192	SE of Mean (KM)	0.00626
k hat (KM)	0.598	k star (KM)	0.576
nu hat (KM)	61.03	nu star (KM)	58.77
theta hat (KM)	0.0566	theta star (KM)	0.0588
80% gamma percentile (KM)	0.0558	90% gamma percentile (KM)	0.0889
95% gamma percentile (KM)	0.124	99% gamma percentile (KM)	0.208

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (58.77, α)	45.38	Adjusted Chi Square Value (58.77, β)	45.1
90% KM Approximate Gamma UCL	0.0439	90% KM Adjusted Gamma UCL	0.0441

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.877	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.933	Detected Data Not Lognormal at 10% Significance Level

Lilliefors Test Statistic	0.15	Lilliefors GOF Test
10% Lilliefors Critical Value	0.156	Detected Data appear Lognormal at 10% Significance Level
Detected Data appear Approximate Lognormal at 10% Significance Level		

Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.0367	Mean in Log Scale	-3.763
SD in Original Scale	0.0424	SD in Log Scale	0.915
90% t UCL (assumes normality of ROS data)	0.0444	90% Percentile Bootstrap UCL	0.0444
90% BCA Bootstrap UCL	0.0452	90% Bootstrap t UCL	0.0468
90% H-UCL (Log ROS)	0.0438		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-4.148	KM Geo Mean	0.0158
KM SD (logged)	1.259	90% Critical H Value (KM-Log)	1.954
KM Standard Error of Mean (logged)	0.181	90% H-UCL (KM -Log)	0.0494
KM SD (logged)	1.259	90% Critical H Value (KM-Log)	1.954
KM Standard Error of Mean (logged)	0.181		

DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.033	Mean in Log Scale	-4.43
SD in Original Scale	0.0448	SD in Log Scale	1.567
90% t UCL (Assumes normality)	0.0411	90% H-Stat UCL	0.0666
DL/2 is not a recommended method, provided for comparisons and historical reasons			

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use
Recommendation Provided only for 95% Confidence Coefficient

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 1:00:33 PM
 From File 90 UCL Input Data_MG_h.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
Number of Detects	11	Number of Non-Detects	5
Number of Distinct Detects	11	Number of Distinct Non-Detects	5
Minimum Detect	0.557	Minimum Non-Detect	0.495
Maximum Detect	4.79	Maximum Non-Detect	0.534
Variance Detects	1.807	Percent Non-Detects	31.25%
Mean Detects	1.816	SD Detects	1.344
Median Detects	1.31	CV Detects	0.74
Skewness Detects	1.436	Kurtosis Detects	1.379
Mean of Logged Detects	0.377	SD of Logged Detects	0.684

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.835	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.792	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.217	Lilliefors GOF Test
1% Lilliefors Critical Value	0.291	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.403	KM Standard Error of Mean	0.322
90KM SD	1.226	95% KM (BCA) UCL	1.786
90% KM (t) UCL	1.834	90% KM (Percentile Bootstrap) UCL	1.795
90% KM (z) UCL	1.815	90% KM Bootstrap t UCL	2.028
90% KM Chebyshev UCL	2.368	95% KM Chebyshev UCL	2.805
97.5% KM Chebyshev UCL	3.411	99% KM Chebyshev UCL	4.603

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.317	Anderson-Darling GOF Test
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.149	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.258	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.43	k star (bias corrected MLE)	1.828
Theta hat (MLE)	0.747	Theta star (bias corrected MLE)	0.994
nu hat (MLE)	53.45	nu star (bias corrected)	40.21
Mean (detects)	1.816		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.252
Maximum	4.79	Median	0.98
SD	1.397	CV	1.116
k hat (MLE)	0.458	k star (bias corrected MLE)	0.414
Theta hat (MLE)	2.73	Theta star (bias corrected MLE)	3.022
nu hat (MLE)	14.67	nu star (bias corrected)	13.25
Adjusted Level of Significance (β)	0.0809		
Approximate Chi Square Value (13.25, α)	7.23	Adjusted Chi Square Value (13.25, β)	6.837
90% Gamma Approximate UCL	2.294	90% Gamma Adjusted UCL	2.426
95% Gamma Approximate UCL	2.736	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.403	SD (KM)	1.226
Variance (KM)	1.504	SE of Mean (KM)	0.322
k hat (KM)	1.309	k star (KM)	1.105
nu hat (KM)	41.88	nu star (KM)	35.36
theta hat (KM)	1.072	theta star (KM)	1.27
80% gamma percentile (KM)	2.239	90% gamma percentile (KM)	3.152
95% gamma percentile (KM)	4.058	99% gamma percentile (KM)	6.147

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (35.36, α)	25.1	Adjusted Chi Square Value (35.36, β)	24.33
90% KM Approximate Gamma UCL	1.977	90% KM Adjusted Gamma UCL	2.04

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.876	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.108	Lilliefors GOF Test
10% Lilliefors Critical Value	0.231	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.333	Mean in Log Scale	-0.149
SD in Original Scale	1.324	SD in Log Scale	0.981
90% t UCL (assumes normality of ROS data)	1.777	90% Percentile Bootstrap UCL	1.734
90% BCA Bootstrap UCL	1.821	90% Bootstrap t UCL	1.949
90% H-UCL (Log ROS)	2.278		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0394	KM Geo Mean	1.04
KM SD (logged)	0.737	90% Critical H Value (KM-Log)	1.709
KM Standard Error of Mean (logged)	0.193	90% H-UCL (KM -Log)	1.889
KM SD (logged)	0.737	90% Critical H Value (KM-Log)	1.709
KM Standard Error of Mean (logged)	0.193		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	1.328
SD in Original Scale	1.328
90% t UCL (Assumes normality)	1.773

DL/2 Log-Transformed

Mean in Log Scale	-0.168
SD in Log Scale	1.004
90% H-Stat UCL	2.331

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Arsenic

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	2.69	Mean	5.593
Maximum	15.8	Median	4.675
SD	3.289	Std. Error of Mean	0.822
Coefficient of Variation	0.588	Skewness	2.174

Normal GOF Test

Shapiro Wilk Test Statistic	0.777	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.193	Lilliefors GOF Test
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	6.695

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	6.966

Gamma GOF Test

A-D Test Statistic	0.474
5% A-D Critical Value	0.742
K-S Test Statistic	0.146
5% K-S Critical Value	0.216

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE)	4.297	k star (bias corrected MLE)	3.533
Theta hat (MLE)	1.302	Theta star (bias corrected MLE)	1.583
nu hat (MLE)	137.5	nu star (bias corrected)	113
MLE Mean (bias corrected)	5.593	MLE Sd (bias corrected)	2.976
		Approximate Chi Square Value (0.1)	94.25
Adjusted Level of Significance	0.0809	Adjusted Chi Square Value	92.7

Assuming Gamma Distribution

90% Approximate Gamma UCL	6.708	90% Adjusted Gamma UCL	6.821

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94
10% Shapiro Wilk Critical Value	0.906
Lilliefors Test Statistic	0.113
10% Lilliefors Critical Value	0.196

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data	0.99	Mean of logged Data	1.601
Maximum of Logged Data	2.76	SD of logged Data	0.481

Assuming Lognormal Distribution

90% H-UCL	6.712	90% Chebyshev (MVUE) UCL	7.569
95% Chebyshev (MVUE) UCL	8.498	97.5% Chebyshev (MVUE) UCL	9.786
99% Chebyshev (MVUE) UCL	12.32		

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL	6.647	90% BCA Bootstrap UCL	6.999
90% Standard Bootstrap UCL	6.605	90% Bootstrap-t UCL	7.501
90% Hall's Bootstrap UCL	11.95	90% Percentile Bootstrap UCL	6.638
90% Chebyshev(Mean, Sd) UCL	8.06	95% Chebyshev(Mean, Sd) UCL	9.177
97.5% Chebyshev(Mean, Sd) UCL	10.73	99% Chebyshev(Mean, Sd) UCL	13.77

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Copper**General Statistics**

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	16.2	Mean	51.63
Maximum	229	Median	34.3
SD	51.25	Std. Error of Mean	12.81
Coefficient of Variation	0.993	Skewness	3.064

Normal GOF Test

Shapiro Wilk Test Statistic	0.624
1% Shapiro Wilk Critical Value	0.844
Lilliefors Test Statistic	0.245
1% Lilliefors Critical Value	0.248

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level**Assuming Normal Distribution**

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	68.81	90% Adjusted-CLT UCL (Chen-1995)	75.06
		90% Modified-t UCL (Johnson-1978)	70.44

Gamma GOF Test

A-D Test Statistic	0.686	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.165	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.218	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics

k hat (MLE)	2.016	k star (bias corrected MLE)	1.679
Theta hat (MLE)	25.61	Theta star (bias corrected MLE)	30.74
nu hat (MLE)	64.5	nu star (bias corrected)	53.74
MLE Mean (bias corrected)	51.63	MLE Sd (bias corrected)	39.84
		Approximate Chi Square Value (0.1)	40.96
Adjusted Level of Significance	0.0809	Adjusted Chi Square Value	39.95

Assuming Gamma Distribution

90% Approximate Gamma UCL	67.75	90% Adjusted Gamma UCL	69.45

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.126	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			

Lognormal Statistics

Minimum of Logged Data	2.785	Mean of logged Data	3.676
Maximum of Logged Data	5.434	SD of logged Data	0.689

Assuming Lognormal Distribution

90% H-UCL	67.35	90% Chebyshev (MVUE) UCL	76.01
95% Chebyshev (MVUE) UCL	88.16	97.5% Chebyshev (MVUE) UCL	105
99% Chebyshev (MVUE) UCL	138.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	68.05	90% BCA Bootstrap UCL	77.97
90% Standard Bootstrap UCL	67.72	90% Bootstrap-t UCL	91.68
90% Hall's Bootstrap UCL	149.8	90% Percentile Bootstrap UCL	68.02
90% Chebyshev(Mean, Sd) UCL	90.07	95% Chebyshev(Mean, Sd) UCL	107.5
97.5% Chebyshev(Mean, Sd) UCL	131.6	99% Chebyshev(Mean, Sd) UCL	179.1

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	3.75	Mean	49.42
Maximum	131	Median	35.6
SD	40.72	Std. Error of Mean	10.18
Coefficient of Variation	0.824	Skewness	0.764

Normal GOF Test

Shapiro Wilk Test Statistic	0.903	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.17	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 63.06

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 63.85

90% Modified-t UCL (Johnson-1978) 63.39

Gamma GOF Test

A-D Test Statistic 0.254

5% A-D Critical Value 0.759

K-S Test Statistic 0.11

5% K-S Critical Value 0.22

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 1.259

Theta hat (MLE) 39.26

nu hat (MLE) 40.28

MLE Mean (bias corrected) 49.42

Adjusted Level of Significance 0.0809

k star (bias corrected MLE) 1.064

Theta star (bias corrected MLE) 46.42

nu star (bias corrected) 34.06

MLE Sd (bias corrected) 47.9

Approximate Chi Square Value (0.1) 24

Adjusted Chi Square Value 23.25

Assuming Gamma Distribution

90% Approximate Gamma UCL 70.12

90% Adjusted Gamma UCL 72.4

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.925

10% Shapiro Wilk Critical Value 0.906

Lilliefors Test Statistic 0.156

10% Lilliefors Critical Value 0.196

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data 1.322

Maximum of Logged Data 4.875

Mean of logged Data 3.453

SD of logged Data 1.113

Assuming Lognormal Distribution

90% H-UCL 106.8

95% Chebyshev (MVUE) UCL 130.3

99% Chebyshev (MVUE) UCL 226.3

90% Chebyshev (MVUE) UCL 107

97.5% Chebyshev (MVUE) UCL 162.7

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 62.46

90% Standard Bootstrap UCL 62.23

90% Hall's Bootstrap UCL 63.34

90% Chebyshev(Mean, Sd) UCL 79.96

97.5% Chebyshev(Mean, Sd) UCL 113

90% BCA Bootstrap UCL 63.77

90% Bootstrap-t UCL 64.87

90% Percentile Bootstrap UCL 62.57

95% Chebyshev(Mean, Sd) UCL 93.79

99% Chebyshev(Mean, Sd) UCL 150.7

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Mercury

General Statistics

Total Number of Observations 16

Number of Detects 9

Number of Distinct Detects 9

Minimum Detect 0.0415

Maximum Detect 0.149

Variance Detects 0.00118

Mean Detects 0.0642

Median Detects 0.0479

Skewness Detects 2.248

Mean of Logged Detects -2.835

Number of Distinct Observations 16

Number of Non-Detects 7

Number of Distinct Non-Detects 7

Minimum Non-Detect 0.0394

Maximum Non-Detect 0.0428

Percent Non-Detects 43.75%

SD Detects 0.0343

CV Detects 0.534

Kurtosis Detects 5.339

SD of Logged Detects 0.415

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.696	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.764	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.277	Lilliefors GOF Test
1% Lilliefors Critical Value	0.316	Detected Data appear Normal at 1% Significance Level
Detected Data appear Approximate Normal at 1% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0534	KM Standard Error of Mean	0.00721
90KM SD	0.0272	95% KM (BCA) UCL	0.0622
90% KM (t) UCL	0.0631	90% KM (Percentile Bootstrap) UCL	0.0626
90% KM (z) UCL	0.0627	90% KM Bootstrap t UCL	0.0776
90% KM Chebyshev UCL	0.0751	95% KM Chebyshev UCL	0.0849
97.5% KM Chebyshev UCL	0.0985	99% KM Chebyshev UCL	0.125

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.877	Anderson-Darling GOF Test
5% A-D Critical Value	0.723	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.256	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	5.693	k star (bias corrected MLE)	3.87
Theta hat (MLE)	0.0113	Theta star (bias corrected MLE)	0.0166
nu hat (MLE)	102.5	nu star (bias corrected)	69.65
Mean (detects)	0.0642		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0405
Maximum	0.149	Median	0.0425
SD	0.0374	CV	0.924
k hat (MLE)	1.382	k star (bias corrected MLE)	1.164
Theta hat (MLE)	0.0293	Theta star (bias corrected MLE)	0.0348
nu hat (MLE)	44.22	nu star (bias corrected)	37.26
Adjusted Level of Significance (β)	0.0809		
Approximate Chi Square Value (37.26, α)	26.72	Adjusted Chi Square Value (37.26, β)	25.91
90% Gamma Approximate UCL	0.0565	90% Gamma Adjusted UCL	0.0583
95% Gamma Approximate UCL	0.0622	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0534	SD (KM)	0.0272
Variance (KM)	7.3961E-4	SE of Mean (KM)	0.00721
k hat (KM)	3.858	k star (KM)	3.176
nu hat (KM)	123.5	nu star (KM)	101.6
theta hat (KM)	0.0138	theta star (KM)	0.0168
80% gamma percentile (KM)	0.0757	90% gamma percentile (KM)	0.0936
95% gamma percentile (KM)	0.11	99% gamma percentile (KM)	0.146

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (101.65, α)	83.86	Adjusted Chi Square Value (101.65, β)	82.39
90% KM Approximate Gamma UCL	0.0648	90% KM Adjusted Gamma UCL	0.0659

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.81	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.243	Lilliefors GOF Test
10% Lilliefors Critical Value	0.252	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0454	Mean in Log Scale	-3.284
SD in Original Scale	0.0334	SD in Log Scale	0.607
90% t UCL (assumes normality of ROS data)	0.0566	90% Percentile Bootstrap UCL	0.0559
90% BCA Bootstrap UCL	0.0593	90% Bootstrap t UCL	0.0645
90% H-UCL (Log ROS)	0.0579		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.009	KM Geo Mean	0.0494
KM SD (logged)	0.353	90% Critical H Value (KM-Log)	1.434
KM Standard Error of Mean (logged)	0.0938	90% H-UCL (KM -Log)	0.0599
KM SD (logged)	0.353	90% Critical H Value (KM-Log)	1.434
KM Standard Error of Mean (logged)	0.0938		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0451
SD in Original Scale	0.0337
90% t UCL (Assumes normality)	0.0563

DL/2 Log-Transformed

Mean in Log Scale	-3.299
SD in Log Scale	0.622
90% H-Stat UCL	0.0581

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Nickel

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	14.9	Mean	18.01
Maximum	24.3	Median	17.75
SD	2.472	Std. Error of Mean	0.618
Coefficient of Variation	0.137	Skewness	1.439

Normal GOF Test

Shapiro Wilk Test Statistic	0.865
1% Shapiro Wilk Critical Value	0.844
Lilliefors Test Statistic	0.219
1% Lilliefors Critical Value	0.248

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	18.84

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	18.96
90% Modified-t UCL (Johnson-1978)	18.88

Gamma GOF Test

A-D Test Statistic	0.653
5% A-D Critical Value	0.736
K-S Test Statistic	0.196
5% K-S Critical Value	0.214

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	62.09	k star (bias corrected MLE)	50.49
Theta hat (MLE)	0.29	Theta star (bias corrected MLE)	0.357
nu hat (MLE)	1987	nu star (bias corrected)	1616
MLE Mean (bias corrected)	18.01	MLE Sd (bias corrected)	2.535
		Approximate Chi Square Value (0.1)	1543
Adjusted Level of Significance	0.0809	Adjusted Chi Square Value	1537

Assuming Gamma Distribution

90% Approximate Gamma UCL	18.86	90% Adjusted Gamma UCL	18.94

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.908	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.19	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	2.701	Mean of logged Data	2.883
Maximum of Logged Data	3.19	SD of logged Data	0.129
Assuming Lognormal Distribution			
90% H-UCL	18.83	90% Chebyshev (MVUE) UCL	19.75
95% Chebyshev (MVUE) UCL	20.53	97.5% Chebyshev (MVUE) UCL	21.63
99% Chebyshev (MVUE) UCL	23.78		

Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	18.8	90% BCA Bootstrap UCL	19
90% Standard Bootstrap UCL	18.77	90% Bootstrap-t UCL	19.2
90% Hall's Bootstrap UCL	19.35	90% Percentile Bootstrap UCL	18.76
90% Chebyshev(Mean, Sd) UCL	19.87	95% Chebyshev(Mean, Sd) UCL	20.71
97.5% Chebyshev(Mean, Sd) UCL	21.87	99% Chebyshev(Mean, Sd) UCL	24.16

Suggested UCL to Use
Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics				
Total Number of Observations		16	Number of Distinct Observations	16
			Number of Missing Observations	0
Minimum	44.3		Mean	145.4
Maximum	290		Median	128.5
SD	78.62		Std. Error of Mean	19.65
Coefficient of Variation	0.541		Skewness	0.626
Normal GOF Test				
Shapiro Wilk Test Statistic	0.918	Shapiro Wilk GOF Test		
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level		
Lilliefors Test Statistic	0.147	Lilliefors GOF Test		
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level		
Data appear Normal at 1% Significance Level				
Assuming Normal Distribution				
90% Normal UCL		90% UCLs (Adjusted for Skewness)		
90% Student's-t UCL	171.8	90% Adjusted-CLT UCL (Chen-1995)		172.8
		90% Modified-t UCL (Johnson-1978)		172.3
Gamma GOF Test				
A-D Test Statistic	0.263	Anderson-Darling Gamma GOF Test		
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level		
K-S Test Statistic	0.111	Kolmogorov-Smirnov Gamma GOF Test		
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level		
Detected data appear Gamma Distributed at 5% Significance Level				
Gamma Statistics				
k hat (MLE)	3.533	k star (bias corrected MLE)		2.913
Theta hat (MLE)	41.16	Theta star (bias corrected MLE)		49.94
nu hat (MLE)	113.1	nu star (bias corrected)		93.2
MLE Mean (bias corrected)	145.4	MLE Sd (bias corrected)		85.22
		Approximate Chi Square Value (0.1)		76.19
Adjusted Level of Significance	0.0809	Adjusted Chi Square Value		74.8
Assuming Gamma Distribution				
90% Approximate Gamma UCL	177.9	90% Adjusted Gamma UCL		181.2

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.956	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.115	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	3.791	Mean of logged Data	4.832
Maximum of Logged Data	5.67	SD of logged Data	0.581

Assuming Lognormal Distribution			
90% H-UCL	188.2	90% Chebyshev (MVUE) UCL	213.2
95% Chebyshev (MVUE) UCL	243.3	97.5% Chebyshev (MVUE) UCL	285.1
99% Chebyshev (MVUE) UCL	367.3		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	170.6	90% BCA Bootstrap UCL	171.9
90% Standard Bootstrap UCL	169.8	90% Bootstrap-t UCL	174.2
90% Hall's Bootstrap UCL	172.6	90% Percentile Bootstrap UCL	170.1
90% Chebyshev(Mean, Sd) UCL	204.4	95% Chebyshev(Mean, Sd) UCL	231.1
97.5% Chebyshev(Mean, Sd) UCL	268.2	99% Chebyshev(Mean, Sd) UCL	341

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dioxin/Furan

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	6.7790E-7	Mean	2.6184E-5
Maximum	5.8372E-5	Median	2.8822E-5
SD	1.9886E-5	Std. Error of Mean	4.9715E-6
Coefficient of Variation	N/A	Skewness	-0.0386

Normal GOF Test			Shapiro Wilk GOF Test		
Shapiro Wilk Test Statistic	0.911		Data appear Normal at 1% Significance Level		
1% Shapiro Wilk Critical Value	0.844				
Lilliefors Test Statistic	0.184		Lilliefors GOF Test		
1% Lilliefors Critical Value	0.248		Data appear Normal at 1% Significance Level		
Data appear Normal at 1% Significance Level					

Assuming Normal Distribution			90% UCLs (Adjusted for Skewness)		
90% Normal UCL			90% Adjusted-CLT UCL (Chen-1995)	3.2521E-5	
90% Student's-t UCL	3.2849E-5		90% Modified-t UCL (Johnson-1978)	3.2841E-5	

Gamma GOF Test		
A-D Test Statistic	1.102	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.77	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	Kolmogorov-Smimov Gamma GOF Test
5% K-S Critical Value	0.222	Data Not Gamma Distributed at 5% Significance Level
Data Not Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	0.848	k star (bias corrected MLE)	0.731
Theta hat (MLE)	3.0885E-5	Theta star (bias corrected MLE)	3.5844E-5
nu hat (MLE)	27.13	nu star (bias corrected)	23.38
MLE Mean (bias corrected)	2.6184E-5	MLE Sd (bias corrected)	3.0636E-5
Adjusted Level of Significance	0.0809	Approximate Chi Square Value (0.1)	15.15
		Adjusted Chi Square Value	14.56

Assuming Gamma Distribution

90% Approximate Gamma UCL 4.0395E-5

90% Adjusted Gamma UCL 4.2035E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.801
 10% Shapiro Wilk Critical Value 0.906
 Lilliefors Test Statistic 0.273
 10% Lilliefors Critical Value 0.196

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data -14.2
 Maximum of Logged Data -9.749

Mean of logged Data -11.25
 SD of logged Data 1.592

Assuming Lognormal Distribution

90% H-UCL 1.3864E-4
 95% Chebyshev (MVUE) UCL 1.2033E-4
 99% Chebyshev (MVUE) UCL 2.2345E-4

90% Chebyshev (MVUE) UCL 9.5270E-5
 97.5% Chebyshev (MVUE) UCL 1.5512E-4

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL 3.2556E-5
 90% Standard Bootstrap UCL 3.2349E-5
 90% Hall's Bootstrap UCL 3.2063E-5
 90% Chebyshev(Mean, Sd) UCL 4.1099E-5
 97.5% Chebyshev(Mean, Sd) UCL 5.7231E-5

90% BCA Bootstrap UCL 3.2254E-5
 90% Bootstrap-t UCL 3.2422E-5
 90% Percentile Bootstrap UCL 3.2262E-5
 95% Chebyshev(Mean, Sd) UCL 4.7855E-5
 99% Chebyshev(Mean, Sd) UCL 7.5650E-5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Dibenzofuran**General Statistics**

Total Number of Observations 16
 Number of Detects 10
 Number of Distinct Detects 10
 Minimum Detect 0.005
 Maximum Detect 0.00978
 Variance Detects 2.6290E-6
 Mean Detects 0.007
 Median Detects 0.00673
 Skewness Detects 0.355
 Mean of Logged Detects -4.985

Number of Distinct Observations 16
 Number of Non-Detects 6
 Number of Distinct Non-Detects 6
 Minimum Non-Detect 0.0049
 Maximum Non-Detect 0.00503
 Percent Non-Detects 37.5%
 SD Detects 0.00162
 CV Detects 0.232
 Kurtosis Detects -1.183
 SD of Logged Detects 0.231

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic 0.931
 1% Shapiro Wilk Critical Value 0.781
 Lilliefors Test Statistic 0.17
 1% Lilliefors Critical Value 0.304

Shapiro Wilk GOF Test

Detected Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

KM Mean 0.00622
 90KM SD 0.00158
 90% KM (t) UCL 0.00678
 90% KM (z) UCL 0.00675
 90% KM Chebyshev UCL 0.00747
 97.5% KM Chebyshev UCL 0.00882

KM Standard Error of Mean 4.1744E-4
 95% KM (BCA) UCL 0.00676
 90% KM (Percentile Bootstrap) UCL 0.00676
 90% KM Bootstrap t UCL 0.00686
 95% KM Chebyshev UCL 0.00804
 99% KM Chebyshev UCL 0.0104

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic 0.347
 5% A-D Critical Value 0.725
 K-S Test Statistic 0.18

Anderson-Darling GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov GOF

5% K-S Critical Value 0.266 Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	20.98	k star (bias corrected MLE)	14.75
Theta hat (MLE)	3.3386E-4	Theta star (bias corrected MLE)	4.7479E-4
nu hat (MLE)	419.5	nu star (bias corrected)	295
Mean (detects)	0.007		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	0.00813
Maximum	0.01	Median	0.00842
SD	0.00196	CV	0.241
k hat (MLE)	16.69	k star (bias corrected MLE)	13.6
Theta hat (MLE)	4.8701E-4	Theta star (bias corrected MLE)	5.9756E-4
nu hat (MLE)	534	nu star (bias corrected)	435.2
Adjusted Level of Significance (β)	0.0809		
Approximate Chi Square Value (435.20, α)	397.8	Adjusted Chi Square Value (435.20, β)	394.6
90% Gamma Approximate UCL	0.00889	90% Gamma Adjusted UCL	0.00896
95% Gamma Approximate UCL	0.00912	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00622	SD (KM)	0.00158
Variance (KM)	2.5090E-6	SE of Mean (KM)	4.1744E-4
k hat (KM)	15.4	k star (KM)	12.56
nu hat (KM)	492.9	nu star (KM)	401.8
theta hat (KM)	4.0358E-4	theta star (KM)	4.9507E-4
80% gamma percentile (KM)	0.00763	90% gamma percentile (KM)	0.00854
95% gamma percentile (KM)	0.00936	99% gamma percentile (KM)	0.011

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (401.84, α)	366	Adjusted Chi Square Value (401.84, β)	362.9
90% KM Approximate Gamma UCL	0.00683	90% KM Adjusted Gamma UCL	0.00688

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939
10% Shapiro Wilk Critical Value	0.869
Lilliefors Test Statistic	0.173
10% Lilliefors Critical Value	0.241

Shapiro Wilk GOF Test

Detected Data appear Lognormal at 10% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00583	Mean in Log Scale	-5.198
SD in Original Scale	0.002	SD in Log Scale	0.335
90% t UCL (assumes normality of ROS data)	0.0065	90% Percentile Bootstrap UCL	0.00645
90% BCA Bootstrap UCL	0.00647	90% Bootstrap t UCL	0.00659
90% H-UCL (Log ROS)	0.00662		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.11	KM Geo Mean	0.00604
KM SD (logged)	0.236	90% Critical H Value (KM-Log)	1.376
KM Standard Error of Mean (logged)	0.0623	90% H-UCL (KM -Log)	0.00675
KM SD (logged)	0.236	90% Critical H Value (KM-Log)	1.376
KM Standard Error of Mean (logged)	0.0623		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00531
SD in Original Scale	0.00259
90% t UCL (Assumes normality)	0.00617

DL/2 Log-Transformed

Mean in Log Scale	-5.365
SD in Log Scale	0.537
90% H-Stat UCL	0.0067

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

TotalHPAHs

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	0.0249	Mean	0.697
Maximum	2.15	Median	0.617
SD	0.628	Std. Error of Mean	0.157
Coefficient of Variation	0.902	Skewness	1.139

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.877	Data appear Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.844	Lilliefors GOF Test	
Lilliefors Test Statistic	0.151	Data appear Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	0.907	90% Adjusted-CLT UCL (Chen-1995)	0.93
		90% Modified-t UCL (Johnson-1978)	0.914

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.447	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.765	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.203	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	0.957	k star (bias corrected MLE)	0.819
Theta hat (MLE)	0.728	Theta star (bias corrected MLE)	0.851
nu hat (MLE)	30.61	nu star (bias corrected)	26.21
MLE Mean (bias corrected)	0.697	MLE Sd (bias corrected)	0.77
		Approximate Chi Square Value (0.1)	17.46
Adjusted Level of Significance	0.0809	Adjusted Chi Square Value	16.82

Assuming Gamma Distribution			
90% Approximate Gamma UCL	1.045	90% Adjusted Gamma UCL	1.085

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.884	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.906	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.251	Data Not Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.196	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-3.693	Mean of logged Data	-0.968
Maximum of Logged Data	0.765	SD of logged Data	1.389

Assuming Lognormal Distribution			
90% H-UCL	2.362	90% Chebyshev (MVUE) UCL	1.97
95% Chebyshev (MVUE) UCL	2.455	97.5% Chebyshev (MVUE) UCL	3.129
99% Chebyshev (MVUE) UCL	4.452		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	0.898	90% BCA Bootstrap UCL	0.917
90% Standard Bootstrap UCL	0.893	90% Bootstrap-t UCL	0.957

90% Hall's Bootstrap UCL	0.955	90% Percentile Bootstrap UCL	0.894
90% Chebyshev(Mean, Sd) UCL	1.168	95% Chebyshev(Mean, Sd) UCL	1.381
97.5% Chebyshev(Mean, Sd) UCL	1.677	99% Chebyshev(Mean, Sd) UCL	2.259

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

cPAHs

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	0.00566	Mean	0.112
Maximum	0.398	Median	0.088
SD	0.116	Std. Error of Mean	0.0291
Coefficient of Variation	1.037	Skewness	1.564

Normal GOF Test			
Shapiro Wilk Test Statistic	0.808	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.21	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL		90% Adjusted-CLT UCL (Chen-1995)	0.158
90% Student's-t UCL	0.151	90% Modified-t UCL (Johnson-1978)	0.153

Gamma GOF Test		
A-D Test Statistic	0.372	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.767	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	0.911	k star (bias corrected MLE)	0.782
Theta hat (MLE)	0.123	Theta star (bias corrected MLE)	0.144
nu hat (MLE)	29.16	nu star (bias corrected)	25.03
MLE Mean (bias corrected)	0.112	MLE Sd (bias corrected)	0.127
		Approximate Chi Square Value (0.1)	16.49
Adjusted Level of Significance	0.0809	Adjusted Chi Square Value	15.88

Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.17	90% Adjusted Gamma UCL	0.177

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.916	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.222	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.196	Data Not Lognormal at 10% Significance Level
Data appear Approximate Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	-5.174	Mean of logged Data	-2.828
Maximum of Logged Data	-0.921	SD of logged Data	1.346

Assuming Lognormal Distribution			
90% H-UCL	0.332	90% Chebyshev (MVUE) UCL	0.286
95% Chebyshev (MVUE) UCL	0.356	97.5% Chebyshev (MVUE) UCL	0.452
99% Chebyshev (MVUE) UCL	0.641		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.15	90% BCA Bootstrap UCL	0.156
90% Standard Bootstrap UCL	0.149	90% Bootstrap-t UCL	0.169
90% Hall's Bootstrap UCL	0.179	90% Percentile Bootstrap UCL	0.15
90% Chebyshev(Mean, Sd) UCL	0.2	95% Chebyshev(Mean, Sd) UCL	0.239
97.5% Chebyshev(Mean, Sd) UCL	0.294	99% Chebyshev(Mean, Sd) UCL	0.402

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	15
Number of Detects	10	Number of Non-Detects	6
Number of Distinct Detects	10	Number of Distinct Non-Detects	5
Minimum Detect	0.025	Minimum Non-Detect	0.00484
Maximum Detect	0.178	Maximum Non-Detect	0.00507
Variance Detects	0.00225	Percent Non-Detects	37.5%
Mean Detects	0.0528	SD Detects	0.0475
Median Detects	0.0347	CV Detects	0.898
Skewness Detects	2.478	Kurtosis Detects	6.35
Mean of Logged Detects	-3.164	SD of Logged Detects	0.625

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.634	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.781	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.344	Lilliefors GOF Test
1% Lilliefors Critical Value	0.304	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0348	KM Standard Error of Mean	0.0112
90KM SD	0.0425	95% KM (BCA) UCL	0.0475
90% KM (t) UCL	0.0499	90% KM (Percentile Bootstrap) UCL	0.0495
90% KM (z) UCL	0.0492	90% KM Bootstrap t UCL	0.0651
90% KM Chebyshev UCL	0.0684	95% KM Chebyshev UCL	0.0837
97.5% KM Chebyshev UCL	0.105	99% KM Chebyshev UCL	0.146

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.072	Anderson-Darling GOF Test
5% A-D Critical Value	0.734	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.276	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.269	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.389	k star (bias corrected MLE)	1.739
Theta hat (MLE)	0.0221	Theta star (bias corrected MLE)	0.0304
nu hat (MLE)	47.78	nu star (bias corrected)	34.78
Mean (detects)	0.0528		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0368
Maximum	0.178	Median	0.0268
SD	0.0426	CV	1.157
k hat (MLE)	1.388	k star (bias corrected MLE)	1.17
Theta hat (MLE)	0.0265	Theta star (bias corrected MLE)	0.0314
nu hat (MLE)	44.42	nu star (bias corrected)	37.42

Adjusted Level of Significance (β)	0.0809	Adjusted Chi Square Value (37.42, β)	26.05
Approximate Chi Square Value (37.42, α)	26.85	90% Gamma Adjusted UCL	0.0528
90% Gamma Approximate UCL	0.0513	95% Gamma Adjusted UCL	N/A
95% Gamma Approximate UCL	0.0564		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0348	SD (KM)	0.0425
Variance (KM)	0.00181	SE of Mean (KM)	0.0112
k hat (KM)	0.672	k star (KM)	0.587
nu hat (KM)	21.49	nu star (KM)	18.79
theta hat (KM)	0.0519	theta star (KM)	0.0593
80% gamma percentile (KM)	0.0574	90% gamma percentile (KM)	0.091
95% gamma percentile (KM)	0.126	99% gamma percentile (KM)	0.212

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.79, α)	11.49	Adjusted Chi Square Value (18.79, β)	10.98
90% KM Approximate Gamma UCL	0.057	90% KM Adjusted Gamma UCL	0.0596

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.809
10% Shapiro Wilk Critical Value	0.869
Lilliefors Test Statistic	0.224
10% Lilliefors Critical Value	0.241

Shapiro Wilk GOF Test

Detected Data Not Lognormal at 10% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0365	Mean in Log Scale	-3.739
SD in Original Scale	0.0428	SD in Log Scale	0.911
90% t UCL (assumes normality of ROS data)	0.0508	90% Percentile Bootstrap UCL	0.0498
90% BCA Bootstrap UCL	0.0557	90% Bootstrap t UCL	0.0691
90% H-UCL (Log ROS)	0.0559		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.977	KM Geo Mean	0.0187
KM SD (logged)	1.149	90% Critical H Value (KM-Log)	2.125
KM Standard Error of Mean (logged)	0.303	90% H-UCL (KM -Log)	0.0681
KM SD (logged)	1.149	90% Critical H Value (KM-Log)	2.125
KM Standard Error of Mean (logged)	0.303		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0339
SD in Original Scale	0.0446
90% t UCL (Assumes normality)	0.0489

DL/2 Log-Transformed

Mean in Log Scale	-4.231
SD in Log Scale	1.502
90% H-Stat UCL	0.121

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:58:57 PM
 From File 90 UCL Input Data_MG_e.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	42	Number of Distinct Observations	39
Number of Detects	21	Number of Non-Detects	21
Number of Distinct Detects	21	Number of Distinct Non-Detects	18
Minimum Detect	0.557	Minimum Non-Detect	0.486
Maximum Detect	4.88	Maximum Non-Detect	0.56
Variance Detects	2.014	Percent Non-Detects	50%
Mean Detects	2.034	SD Detects	1.419
Median Detects	1.66	CV Detects	0.698
Skewness Detects	0.834	Kurtosis Detects	-0.63
Mean of Logged Detects	0.472	SD of Logged Detects	0.715

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.863	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.873	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.171	Lilliefors GOF Test
1% Lilliefors Critical Value	0.219	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.26	KM Standard Error of Mean	0.197
90KM SD	1.248	95% KM (BCA) UCL	1.509
90% KM (t) UCL	1.517	90% KM (Percentile Bootstrap) UCL	1.509
90% KM (z) UCL	1.513	90% KM Bootstrap t UCL	1.561
90% KM Chebyshev UCL	1.852	95% KM Chebyshev UCL	2.121
97.5% KM Chebyshev UCL	2.493	99% KM Chebyshev UCL	3.224

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.61	Anderson-Darling GOF Test
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.192	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.255	k star (bias corrected MLE)	1.965
Theta hat (MLE)	0.902	Theta star (bias corrected MLE)	1.035
nu hat (MLE)	94.73	nu star (bias corrected)	82.53
Mean (detects)	2.034		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.022
Maximum	4.88	Median	0.284
SD	1.425	CV	1.395
k hat (MLE)	0.326	k star (bias corrected MLE)	0.318
Theta hat (MLE)	3.137	Theta star (bias corrected MLE)	3.21
nu hat (MLE)	27.37	nu star (bias corrected)	26.74
Adjusted Level of Significance (β)	0.0937		
Approximate Chi Square Value (26.74, α)	17.9	Adjusted Chi Square Value (26.74, β)	17.7
90% Gamma Approximate UCL	1.527	90% Gamma Adjusted UCL	1.544

95% Gamma Approximate UCL 1.713

95% Gamma Adjusted UCL N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.26	SD (KM)	1.248
Variance (KM)	1.558	SE of Mean (KM)	0.197
k hat (KM)	1.019	k star (KM)	0.962
nu hat (KM)	85.6	nu star (KM)	80.82
theta hat (KM)	1.237	theta star (KM)	1.31
80% gamma percentile (KM)	2.034	90% gamma percentile (KM)	2.929
95% gamma percentile (KM)	3.827	99% gamma percentile (KM)	5.918

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (80.82, α)	65.02	Adjusted Chi Square Value (80.82, β)	64.61
90% KM Approximate Gamma UCL	1.567	90% KM Adjusted Gamma UCL	1.576

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.934	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.923	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.143	Lilliefors GOF Test
10% Lilliefors Critical Value	0.173	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	1.144	Mean in Log Scale	-0.457
SD in Original Scale	1.34	SD in Log Scale	1.073
90% t UCL (assumes normality of ROS data)	1.414	90% Percentile Bootstrap UCL	1.404
90% BCA Bootstrap UCL	1.418	90% Bootstrap t UCL	1.459
90% H-UCL (Log ROS)	1.531		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.124	KM Geo Mean	0.883
KM SD (logged)	0.774	90% Critical H Value (KM-Log)	1.609
KM Standard Error of Mean (logged)	0.122	90% H-UCL (KM -Log)	1.448
KM SD (logged)	0.774	90% Critical H Value (KM-Log)	1.609
KM Standard Error of Mean (logged)	0.122		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	1.146
SD in Original Scale	1.338
90% t UCL (Assumes normality)	1.415

DL/2 Log-Transformed

Mean in Log Scale	-0.44
SD in Log Scale	1.05
90% H-Stat UCL	1.505

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

Recommendation Provided only for 95% Confidence Coefficient

Arsenic**General Statistics**

Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	2.69	Mean	4.685
Maximum	15.8	Median	3.74
SD	2.424	Std. Error of Mean	0.374
Coefficient of Variation	0.517	Skewness	2.799

Normal GOF Test

Shapiro Wilk Test Statistic	0.69	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.217	Lilliefors GOF Test
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 5.173

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 5.28

90% Modified-t UCL (Johnson-1978) 5.2

Gamma GOF Test

A-D Test Statistic 2.044

5% A-D Critical Value 0.751

K-S Test Statistic 0.185

5% K-S Critical Value 0.137

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 5.93

Theta hat (MLE) 0.79

nu hat (MLE) 498.1

MLE Mean (bias corrected) 4.685

Adjusted Level of Significance 0.0937

k star (bias corrected MLE) 5.523

Theta star (bias corrected MLE) 0.848

nu star (bias corrected) 463.9

MLE Sd (bias corrected) 1.994

Approximate Chi Square Value (0.1) 425.3

Adjusted Chi Square Value 424.3

Assuming Gamma Distribution

90% Approximate Gamma UCL 5.111

90% Adjusted Gamma UCL 5.123

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.846

10% Shapiro Wilk Critical Value 0.951

Lilliefors Test Statistic 0.169

10% Lilliefors Critical Value 0.124

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data 0.99

Maximum of Logged Data 2.76

Mean of logged Data 1.458

SD of logged Data 0.387

Assuming Lognormal Distribution

90% H-UCL 5.039

95% Chebyshev (MVUE) UCL 5.863

99% Chebyshev (MVUE) UCL 7.454

90% Chebyshev (MVUE) UCL 5.476

97.5% Chebyshev (MVUE) UCL 6.4

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 5.165

90% Standard Bootstrap UCL 5.153

90% Hall's Bootstrap UCL 5.495

90% Chebyshev(Mean, Sd) UCL 5.808

97.5% Chebyshev(Mean, Sd) UCL 7.021

90% BCA Bootstrap UCL 5.293

90% Bootstrap-t UCL 5.358

90% Percentile Bootstrap UCL 5.162

95% Chebyshev(Mean, Sd) UCL 6.316

99% Chebyshev(Mean, Sd) UCL 8.407

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Copper

General Statistics

Total Number of Observations 42

Minimum 15

Maximum 229

SD 36.4

Coefficient of Variation 0.868

Number of Distinct Observations 39

Number of Missing Observations 0

Mean 41.92

Median 30.35

Std. Error of Mean 5.616

Skewness 3.528

Normal GOF Test

Shapiro Wilk Test Statistic 0.636

Shapiro Wilk GOF Test

1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.23	Lilliefors GOF Test
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	49.24	90% Adjusted-CLT UCL (Chen-1995)	51.3
		90% Modified-t UCL (Johnson-1978)	49.75

Gamma GOF Test

A-D Test Statistic	1.2	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.129	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.138	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.401	k star (bias corrected MLE)	2.246
Theta hat (MLE)	17.46	Theta star (bias corrected MLE)	18.67
nu hat (MLE)	201.7	nu star (bias corrected)	188.6
MLE Mean (bias corrected)	41.92	MLE Sd (bias corrected)	27.98
		Approximate Chi Square Value (0.1)	164.2
Adjusted Level of Significance	0.0937	Adjusted Chi Square Value	163.6

Assuming Gamma Distribution

90% Approximate Gamma UCL	48.16	90% Adjusted Gamma UCL	48.35

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.873	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.12	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	3.513
Maximum of Logged Data	5.434	SD of logged Data	0.63

Assuming Lognormal Distribution

90% H-UCL	47.51	90% Chebyshev (MVUE) UCL	53.45
95% Chebyshev (MVUE) UCL	59.23	97.5% Chebyshev (MVUE) UCL	67.24
99% Chebyshev (MVUE) UCL	82.99		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	49.12	90% BCA Bootstrap UCL	51.02
90% Standard Bootstrap UCL	48.94	90% Bootstrap-t UCL	53.76
90% Hall's Bootstrap UCL	85.44	90% Percentile Bootstrap UCL	48.92
90% Chebyshev(Mean, Sd) UCL	58.77	95% Chebyshev(Mean, Sd) UCL	66.4
97.5% Chebyshev(Mean, Sd) UCL	77	99% Chebyshev(Mean, Sd) UCL	97.8

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations	42	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	3.1	Mean	41.61
Maximum	202	Median	29.7
SD	43.21	Std. Error of Mean	6.668

Coefficient of Variation	1.039	Skewness	1.798

Normal GOF Test

Shapiro Wilk Test Statistic	0.779	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.186	Lilliefors GOF Test
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	50.29	90% Adjusted-CLT UCL (Chen-1995)	51.47
		90% Modified-t UCL (Johnson-1978)	50.6

Gamma GOF Test

A-D Test Statistic	0.418	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.777	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0973	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.14	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.04	k star (bias corrected MLE)	0.982
Theta hat (MLE)	40	Theta star (bias corrected MLE)	42.38
nu hat (MLE)	87.36	nu star (bias corrected)	82.46
MLE Mean (bias corrected)	41.61	MLE Sd (bias corrected)	41.99
		Approximate Chi Square Value (0.1)	66.49
Adjusted Level of Significance	0.0937	Adjusted Chi Square Value	66.08

Assuming Gamma Distribution

90% Approximate Gamma UCL	51.6	90% Adjusted Gamma UCL	51.92

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.1	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.131	Mean of logged Data	3.176
Maximum of Logged Data	5.308	SD of logged Data	1.144

Assuming Lognormal Distribution

90% H-UCL	64.6	90% Chebyshev (MVUE) UCL	73.71
95% Chebyshev (MVUE) UCL	86.73	97.5% Chebyshev (MVUE) UCL	104.8
99% Chebyshev (MVUE) UCL	140.3		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	50.15	90% BCA Bootstrap UCL	50.91
90% Standard Bootstrap UCL	49.98	90% Bootstrap-t UCL	51.85
90% Hall's Bootstrap UCL	51.74	90% Percentile Bootstrap UCL	50.37
90% Chebyshev(Mean, Sd) UCL	61.61	95% Chebyshev(Mean, Sd) UCL	70.67
97.5% Chebyshev(Mean, Sd) UCL	83.24	99% Chebyshev(Mean, Sd) UCL	107.9

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

General Statistics

Total Number of Observations	42	Number of Distinct Observations	34
Number of Detects	14	Number of Non-Detects	28
Number of Distinct Detects	14	Number of Distinct Non-Detects	22
Minimum Detect	0.0415	Minimum Non-Detect	0.0389
Maximum Detect	0.149	Maximum Non-Detect	0.0448
Variance Detects	7.8838E-4	Percent Non-Detects	66.67%
Mean Detects	0.0603	SD Detects	0.0281
Median Detects	0.049	CV Detects	0.466
Skewness Detects	2.711	Kurtosis Detects	8.242
Mean of Logged Detects	-2.877	SD of Logged Detects	0.348

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.652	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.825	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.262	Lilliefors GOF Test
1% Lilliefors Critical Value	0.263	Detected Data appear Normal at 1% Significance Level
Detected Data appear Approximate Normal at 1% Significance Level		

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0461	KM Standard Error of Mean	0.00297
90KM SD	0.0186	95% KM (BCA) UCL	0.0504
90% KM (t) UCL	0.05	90% KM (Percentile Bootstrap) UCL	0.0501
90% KM (z) UCL	0.0499	90% KM Bootstrap t UCL	0.0539
90% KM Chebyshev UCL	0.055	95% KM Chebyshev UCL	0.0591
97.5% KM Chebyshev UCL	0.0647	99% KM Chebyshev UCL	0.0757

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.216	Anderson-Darling GOF Test
5% A-D Critical Value	0.736	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.229	Detected data appear Gamma Distributed at 5% Significance Level
Detected data follow Appr. Gamma Distribution at 5% Significance Level		

Gamma Statistics on Detected Data Only

k hat (MLE)	7.571	k star (bias corrected MLE)	5.996
Theta hat (MLE)	0.00796	Theta star (bias corrected MLE)	0.0101
nu hat (MLE)	212	nu star (bias corrected)	167.9
Mean (detects)	0.0603		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0268
Maximum	0.149	Median	0.01
SD	0.0287	CV	1.07
k hat (MLE)	1.378	k star (bias corrected MLE)	1.295
Theta hat (MLE)	0.0195	Theta star (bias corrected MLE)	0.0207
nu hat (MLE)	115.7	nu star (bias corrected)	108.8
Adjusted Level of Significance (β)	0.0937		
Approximate Chi Square Value (108.79, α)	90.36	Adjusted Chi Square Value (108.79, β)	89.89
90% Gamma Approximate UCL	0.0323	90% Gamma Adjusted UCL	0.0324
95% Gamma Approximate UCL	0.034	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0461	SD (KM)	0.0186
Variance (KM)	3.4461E-4	SE of Mean (KM)	0.00297
k hat (KM)	6.166	k star (KM)	5.742
nu hat (KM)	518	nu star (KM)	482.3
theta hat (KM)	0.00748	theta star (KM)	0.00803
80% gamma percentile (KM)	0.061	90% gamma percentile (KM)	0.0718

95% gamma percentile (KM) 0.0816

99% gamma percentile (KM) 0.102

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (482.30, α)	443	Adjusted Chi Square Value (482.30, β)	441.9
90% KM Approximate Gamma UCL	0.0502	90% KM Adjusted Gamma UCL	0.0503

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.795	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.895	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.206	Lilliefors GOF Test
10% Lilliefors Critical Value	0.208	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.0335	Mean in Log Scale	-3.57
SD in Original Scale	0.025	SD in Log Scale	0.548
90% t UCL (assumes normality of ROS data)	0.0385	90% Percentile Bootstrap UCL	0.0383
90% BCA Bootstrap UCL	0.0391	90% Bootstrap t UCL	0.0404
90% H-UCL (Log ROS)	0.0371		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.121	KM Geo Mean	0.0441
KM SD (logged)	0.26	90% Critical H Value (KM-Log)	1.347
KM Standard Error of Mean (logged)	0.0417	90% H-UCL (KM -Log)	0.0482
KM SD (logged)	0.26	90% Critical H Value (KM-Log)	1.347
KM Standard Error of Mean (logged)	0.0417		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.0339
SD in Original Scale	0.0246
90% t UCL (Assumes normality)	0.0389

DL/2 Log-Transformed

Mean in Log Scale	-3.542
SD in Log Scale	0.516
90% H-Stat UCL	0.0372

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

Recommendation Provided only for 95% Confidence Coefficient

Nickel**General Statistics**

Total Number of Observations	42	Number of Distinct Observations	29
		Number of Missing Observations	0
Minimum	14.2	Mean	17.46
Maximum	24.3	Median	17.45
SD	1.986	Std. Error of Mean	0.306
Coefficient of Variation	0.114	Skewness	1.162

Normal GOF Test

Shapiro Wilk Test Statistic	0.886	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.116	Lilliefors GOF Test
1% Lilliefors Critical Value	0.157	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level**Assuming Normal Distribution****90% Normal UCL**

90% Student's-t UCL 17.86

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	17.89
90% Modified-t UCL (Johnson-1978)	17.87

Gamma GOF Test

A-D Test Statistic	0.508	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level

K-S Test Statistic 0.0998 Kolmogorov-Smirnov Gamma GOF Test
 5% K-S Critical Value 0.136 Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	83.99	k star (bias corrected MLE)	78.01
Theta hat (MLE)	0.208	Theta star (bias corrected MLE)	0.224
nu hat (MLE)	7055	nu star (bias corrected)	6553
MLE Mean (bias corrected)	17.46	MLE Sd (bias corrected)	1.977
		Approximate Chi Square Value (0.1)	6407
Adjusted Level of Significance	0.0937	Adjusted Chi Square Value	6402

Assuming Gamma Distribution			
90% Approximate Gamma UCL	17.86	90% Adjusted Gamma UCL	17.87

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.917	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.951	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.096	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.124	Data appear Approximate Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	2.653	Mean of logged Data	2.854
Maximum of Logged Data	3.19	SD of logged Data	0.109

Assuming Lognormal Distribution			
90% H-UCL	17.85	90% Chebyshev (MVUE) UCL	18.34
95% Chebyshev (MVUE) UCL	18.74	97.5% Chebyshev (MVUE) UCL	19.3
99% Chebyshev (MVUE) UCL	20.39		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	17.85	90% BCA Bootstrap UCL	17.87
90% Standard Bootstrap UCL	17.85	90% Bootstrap-t UCL	17.88
90% Hall's Bootstrap UCL	17.91	90% Percentile Bootstrap UCL	17.85
90% Chebyshev(Mean, Sd) UCL	18.38	95% Chebyshev(Mean, Sd) UCL	18.79
97.5% Chebyshev(Mean, Sd) UCL	19.37	99% Chebyshev(Mean, Sd) UCL	20.51

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	44.3	Mean	129.7
Maximum	354	Median	108.5
SD	79.26	Std. Error of Mean	12.23
Coefficient of Variation	0.611	Skewness	0.957

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.848	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.922	Lilliefors GOF Test	
Lilliefors Test Statistic	0.154	Data appear Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.157	Data appear Approximate Normal at 1% Significance Level	

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	145.6	90% Adjusted-CLT UCL (Chen-1995)	146.6
		90% Modified-t UCL (Johnson-1978)	145.9

Gamma GOF Test			
A-D Test Statistic	0.7	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.126	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	2.928	k star (bias corrected MLE)	2.735
Theta hat (MLE)	44.29	Theta star (bias corrected MLE)	47.42
nu hat (MLE)	246	nu star (bias corrected)	229.7
MLE Mean (bias corrected)	129.7	MLE Sd (bias corrected)	78.42
Adjusted Level of Significance	0.0937	Approximate Chi Square Value (0.1)	202.7
		Adjusted Chi Square Value	202

Assuming Gamma Distribution			
90% Approximate Gamma UCL	147	90% Adjusted Gamma UCL	147.5

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.122	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level
Data appear Approximate Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	3.791	Mean of logged Data	4.685
Maximum of Logged Data	5.869	SD of logged Data	0.614

Assuming Lognormal Distribution			
90% H-UCL	151	90% Chebyshev (MVUE) UCL	169.6
95% Chebyshev (MVUE) UCL	187.5	97.5% Chebyshev (MVUE) UCL	212.4
99% Chebyshev (MVUE) UCL	261.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	145.4	90% BCA Bootstrap UCL	146.4
90% Standard Bootstrap UCL	145	90% Bootstrap-t UCL	146.9
90% Hall's Bootstrap UCL	146.4	90% Percentile Bootstrap UCL	146.2
90% Chebyshev(Mean, Sd) UCL	166.4	95% Chebyshev(Mean, Sd) UCL	183
97.5% Chebyshev(Mean, Sd) UCL	206.1	99% Chebyshev(Mean, Sd) UCL	251.4

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dioxin/Furan

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	42
		Number of Missing Observations	0
Minimum	5.1751E-7	Mean	1.6720E-5
Maximum	5.8372E-5	Median	1.2629E-5
SD	1.6355E-5	Std. Error of Mean	2.5237E-6
Coefficient of Variation	N/A	Skewness	0.866
Normal GOF Test			
Shapiro Wilk Test Statistic	0.824	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.161	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			

Assuming Normal Distribution**90% Normal UCL**

90% Student's-t UCL 2.0008E-5

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 2.0195E-5

90% Modified-t UCL (Johnson-1978) 2.0064E-5

Gamma GOF Test

A-D Test Statistic 1.262
 5% A-D Critical Value 0.793
 K-S Test Statistic 0.166
 5% K-S Critical Value 0.142

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE) 0.71
 Theta hat (MLE) 2.3564E-5
 nu hat (MLE) 59.61
 MLE Mean (bias corrected) 1.6720E-5
 Adjusted Level of Significance 0.0937

k star (bias corrected MLE) 0.675
 Theta star (bias corrected MLE) 2.4779E-5
 nu star (bias corrected) 56.68
 MLE Sd (bias corrected) 2.0355E-5
 Approximate Chi Square Value (0.1) 43.54
 Adjusted Chi Square Value 43.21

Assuming Gamma Distribution

90% Approximate Gamma UCL 2.1769E-5

90% Adjusted Gamma UCL 2.1933E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.806
 10% Shapiro Wilk Critical Value 0.951
 Lilliefors Test Statistic 0.182
 10% Lilliefors Critical Value 0.124

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data -14.47
 Maximum of Logged Data -9.749

Mean of logged Data -11.85
 SD of logged Data 1.611

Assuming Lognormal Distribution

90% H-UCL 4.6942E-5
 95% Chebyshev (MVUE) UCL 5.9969E-5
 99% Chebyshev (MVUE) UCL 1.0546E-4

90% Chebyshev (MVUE) UCL 4.8911E-5
 97.5% Chebyshev (MVUE) UCL 7.5317E-5

Nonparametric Distribution Free UCL Statistics**Data do not follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL 1.9955E-5
 90% Standard Bootstrap UCL 1.9909E-5
 90% Hall's Bootstrap UCL 1.9988E-5
 90% Chebyshev(Mean, Sd) UCL 2.4291E-5
 97.5% Chebyshev(Mean, Sd) UCL 3.2481E-5

90% BCA Bootstrap UCL 2.0284E-5
 90% Bootstrap-t UCL 2.0050E-5
 90% Percentile Bootstrap UCL 2.0098E-5
 95% Chebyshev(Mean, Sd) UCL 2.7721E-5
 99% Chebyshev(Mean, Sd) UCL 4.1831E-5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dibenzofuran**General Statistics**

Total Number of Observations 42
 Number of Detects 16
 Number of Distinct Detects 16
 Minimum Detect 0.005
 Maximum Detect 0.0405
 Variance Detects 7.3060E-5
 Mean Detects 0.00921
 Median Detects 0.00687
 Skewness Detects 3.691
 Mean of Logged Detects -4.866

Number of Distinct Observations 34
 Number of Non-Detects 26
 Number of Distinct Non-Detects 19
 Minimum Non-Detect 0.00468
 Maximum Non-Detect 0.00508
 Percent Non-Detects 61.9%
 SD Detects 0.00855
 CV Detects 0.928
 Kurtosis Detects 14.21
 SD of Logged Detects 0.507

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.463	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.844	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.348	Lilliefors GOF Test
1% Lilliefors Critical Value	0.248	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

KM Mean	0.00641	KM Standard Error of Mean	8.8612E-4
90KM SD	0.00556	95% KM (BCA) UCL	0.00762
90% KM (t) UCL	0.00756	90% KM (Percentile Bootstrap) UCL	0.00754
90% KM (z) UCL	0.00755	90% KM Bootstrap t UCL	0.0101
90% KM Chebyshev UCL	0.00907	95% KM Chebyshev UCL	0.0103
97.5% KM Chebyshev UCL	0.0119	99% KM Chebyshev UCL	0.0152

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2	Anderson-Darling GOF Test
5% A-D Critical Value	0.745	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.217	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics on Detected Data Only**

k hat (MLE)	2.966	k star (bias corrected MLE)	2.452
Theta hat (MLE)	0.0031	Theta star (bias corrected MLE)	0.00376
nu hat (MLE)	94.91	nu star (bias corrected)	78.45
Mean (detects)	0.00921		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	0.0097
Maximum	0.0405	Median	0.01
SD	0.00518	CV	0.535
k hat (MLE)	7.453	k star (bias corrected MLE)	6.936
Theta hat (MLE)	0.0013	Theta star (bias corrected MLE)	0.0014
nu hat (MLE)	626	nu star (bias corrected)	582.7
Adjusted Level of Significance (β)	0.0937		
Approximate Chi Square Value (582.66, α)	539.4	Adjusted Chi Square Value (582.66, β)	538.2
90% Gamma Approximate UCL	0.0105	90% Gamma Adjusted UCL	0.0105
95% Gamma Approximate UCL	0.0107	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00641	SD (KM)	0.00556
Variance (KM)	3.0915E-5	SE of Mean (KM)	8.8612E-4
k hat (KM)	1.329	k star (KM)	1.25
nu hat (KM)	111.6	nu star (KM)	105
theta hat (KM)	0.00482	theta star (KM)	0.00513
80% gamma percentile (KM)	0.0101	90% gamma percentile (KM)	0.014
95% gamma percentile (KM)	0.0178	99% gamma percentile (KM)	0.0264

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (104.99, α)	86.9	Adjusted Chi Square Value (104.99, β)	86.43
90% KM Approximate Gamma UCL	0.00774	90% KM Adjusted Gamma UCL	0.00779

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.726	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.906	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.24	Lilliefors GOF Test
10% Lilliefors Critical Value	0.196	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.00472	Mean in Log Scale	-5.727
SD in Original Scale	0.00629	SD in Log Scale	0.77
90% t UCL (assumes normality of ROS data)	0.00599	90% Percentile Bootstrap UCL	0.00598
90% BCA Bootstrap UCL	0.00648	90% Bootstrap t UCL	0.00752
90% H-UCL (Log ROS)	0.00532		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.173	KM Geo Mean	0.00566
KM SD (logged)	0.388	90% Critical H Value (KM-Log)	1.395
KM Standard Error of Mean (logged)	0.0618	90% H-UCL (KM -Log)	0.00665
KM SD (logged)	0.388	90% Critical H Value (KM-Log)	1.395
KM Standard Error of Mean (logged)	0.0618		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00505
SD in Original Scale	0.00614
90% t UCL (Assumes normality)	0.00628

DL/2 Log-Transformed

Mean in Log Scale	-5.566
SD in Log Scale	0.635
90% H-Stat UCL	0.00544

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

TotalHPAHs

General Statistics

Total Number of Observations	42	Number of Distinct Observations	42
Number of Detects	40	Number of Non-Detects	2
Number of Distinct Detects	40	Number of Distinct Non-Detects	2
Minimum Detect	0.027	Minimum Non-Detect	0.0247
Maximum Detect	3.53	Maximum Non-Detect	0.0249
Variance Detects	0.441	Percent Non-Detects	4.762%
Mean Detects	0.61	SD Detects	0.664
Median Detects	0.485	CV Detects	1.089
Skewness Detects	2.685	Kurtosis Detects	9.41
Mean of Logged Detects	-1.053	SD of Logged Detects	1.202

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.733
1% Shapiro Wilk Critical Value	0.919
Lilliefors Test Statistic	0.206
1% Lilliefors Critical Value	0.162

Shapiro Wilk GOF Test

Detected Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.582	KM Standard Error of Mean	0.102
90KM SD	0.652	95% KM (BCA) UCL	0.704
90% KM (t) UCL	0.714	90% KM (Percentile Bootstrap) UCL	0.71
90% KM (z) UCL	0.712	90% KM Bootstrap t UCL	0.767
90% KM Chebyshev UCL	0.887	95% KM Chebyshev UCL	1.026
97.5% KM Chebyshev UCL	1.218	99% KM Chebyshev UCL	1.595

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.655
5% A-D Critical Value	0.778
K-S Test Statistic	0.109
5% K-S Critical Value	0.144

Anderson-Darling GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov GOF

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.031	k star (bias corrected MLE)	0.97
Theta hat (MLE)	0.592	Theta star (bias corrected MLE)	0.629
nu hat (MLE)	82.44	nu star (bias corrected)	77.59

Mean (detects) 0.61

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.581
Maximum	3.53	Median	0.467
SD	0.66	CV	1.136
k hat (MLE)	0.865	k star (bias corrected MLE)	0.819
Theta hat (MLE)	0.672	Theta star (bias corrected MLE)	0.709
nu hat (MLE)	72.65	nu star (bias corrected)	68.79
Adjusted Level of Significance (β)	0.0937		
Approximate Chi Square Value (68.79, α)	54.25	Adjusted Chi Square Value (68.79, β)	53.89
90% Gamma Approximate UCL	0.737	90% Gamma Adjusted UCL	0.742
95% Gamma Approximate UCL	0.788	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.582	SD (KM)	0.652
Variance (KM)	0.425	SE of Mean (KM)	0.102
k hat (KM)	0.797	k star (KM)	0.756
nu hat (KM)	66.92	nu star (KM)	63.47
theta hat (KM)	0.73	theta star (KM)	0.77
80% gamma percentile (KM)	0.953	90% gamma percentile (KM)	1.434
95% gamma percentile (KM)	1.926	99% gamma percentile (KM)	3.094

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (63.47, α)	49.53	Adjusted Chi Square Value (63.47, β)	49.18
90% KM Approximate Gamma UCL	0.746	90% KM Adjusted Gamma UCL	0.751

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.949	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.178	Lilliefors GOF Test
10% Lilliefors Critical Value	0.128	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.582	Mean in Log Scale	-1.186
SD in Original Scale	0.66	SD in Log Scale	1.318
90% t UCL (assumes normality of ROS data)	0.714	90% Percentile Bootstrap UCL	0.713
90% BCA Bootstrap UCL	0.73	90% Bootstrap t UCL	0.766
90% H-UCL (Log ROS)	1.108		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.179	KM Geo Mean	0.308
KM SD (logged)	1.288	90% Critical H Value (KM-Log)	2.019
KM Standard Error of Mean (logged)	0.201	90% H-UCL (KM -Log)	1.058
KM SD (logged)	1.288	90% Critical H Value (KM-Log)	2.019
KM Standard Error of Mean (logged)	0.201		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.581
SD in Original Scale	0.66
90% t UCL (Assumes normality)	0.714

DL/2 Log-Transformed

Mean in Log Scale	-1.212
SD in Log Scale	1.375
90% H-Stat UCL	1.203

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

cPAHs

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	0.00566	Mean	0.089
Maximum	0.566	Median	0.0612
SD	0.112	Std. Error of Mean	0.0173
Coefficient of Variation	1.261	Skewness	2.731
Normal GOF Test			
Shapiro Wilk Test Statistic	0.663	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.235	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	0.112	90% Adjusted-CLT UCL (Chen-1995)	0.116
		90% Modified-t UCL (Johnson-1978)	0.113
Gamma GOF Test			
A-D Test Statistic	0.811	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.784	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.124	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.141	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.876	k star (bias corrected MLE)	0.829
Theta hat (MLE)	0.102	Theta star (bias corrected MLE)	0.107
nu hat (MLE)	73.6	nu star (bias corrected)	69.67
MLE Mean (bias corrected)	0.089	MLE Sd (bias corrected)	0.0977
		Approximate Chi Square Value (0.1)	55.04
Adjusted Level of Significance	0.0937	Adjusted Chi Square Value	54.67
Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.113	90% Adjusted Gamma UCL	0.113
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.136	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.124	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-5.174	Mean of logged Data	-3.089
Maximum of Logged Data	-0.569	SD of logged Data	1.259
Assuming Lognormal Distribution			
90% H-UCL	0.149	90% Chebyshev (MVUE) UCL	0.168
95% Chebyshev (MVUE) UCL	0.2	97.5% Chebyshev (MVUE) UCL	0.244
99% Chebyshev (MVUE) UCL	0.331		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.111	90% BCA Bootstrap UCL	0.118
90% Standard Bootstrap UCL	0.111	90% Bootstrap-t UCL	0.122
90% Hall's Bootstrap UCL	0.123	90% Percentile Bootstrap UCL	0.111
90% Chebyshev(Mean, Sd) UCL	0.141	95% Chebyshev(Mean, Sd) UCL	0.164
97.5% Chebyshev(Mean, Sd) UCL	0.197	99% Chebyshev(Mean, Sd) UCL	0.261

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	35
Number of Detects	18	Number of Non-Detects	24
Number of Distinct Detects	18	Number of Distinct Non-Detects	17
Minimum Detect	0.025	Minimum Non-Detect	0.00465
Maximum Detect	0.178	Maximum Non-Detect	0.00507
Variance Detects	0.0013	Percent Non-Detects	57.14%
Mean Detects	0.0464	SD Detects	0.0361
Median Detects	0.0347	CV Detects	0.777
Skewness Detects	3.212	Kurtosis Detects	11.37
Mean of Logged Detects	-3.223	SD of Logged Detects	0.496

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.577	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.858	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.293	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0226	KM Standard Error of Mean	0.00491
90KM SD	0.0309	95% KM (BCA) UCL	0.0282
90% KM (t) UCL	0.0289	90% KM (Percentile Bootstrap) UCL	0.0287
90% KM (z) UCL	0.0288	90% KM Bootstrap t UCL	0.0329
90% KM Chebyshev UCL	0.0373	95% KM Chebyshev UCL	0.0439
97.5% KM Chebyshev UCL	0.0532	99% KM Chebyshev UCL	0.0714

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.563	Anderson-Darling GOF Test
5% A-D Critical Value	0.744	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.205	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.417	k star (bias corrected MLE)	2.885
Theta hat (MLE)	0.0136	Theta star (bias corrected MLE)	0.0161
nu hat (MLE)	123	nu star (bias corrected)	103.8
Mean (detects)	0.0464		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0256
Maximum	0.178	Median	0.01
SD	0.0295	CV	1.154
k hat (MLE)	1.582	k star (bias corrected MLE)	1.485

Theta hat (MLE)	0.0162	Theta star (bias corrected MLE)	0.0172
nu hat (MLE)	132.9	nu star (bias corrected)	124.7
Adjusted Level of Significance (β)	0.0937		
Approximate Chi Square Value (124.74, α)	105	Adjusted Chi Square Value (124.74, β)	104.5
90% Gamma Approximate UCL	0.0304	90% Gamma Adjusted UCL	0.0306
95% Gamma Approximate UCL	0.032	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0226	SD (KM)	0.0309
Variance (KM)	9.5438E-4	SE of Mean (KM)	0.00491
k hat (KM)	0.533	k star (KM)	0.511
nu hat (KM)	44.77	nu star (KM)	42.9
theta hat (KM)	0.0423	theta star (KM)	0.0442
80% gamma percentile (KM)	0.0371	90% gamma percentile (KM)	0.0607
95% gamma percentile (KM)	0.086	99% gamma percentile (KM)	0.148

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (42.90, α)	31.54	Adjusted Chi Square Value (42.90, β)	31.27
90% KM Approximate Gamma UCL	0.0307	90% KM Adjusted Gamma UCL	0.0309

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.81	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.914	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.174	Lilliefors GOF Test
10% Lilliefors Critical Value	0.185	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0258	Mean in Log Scale	-4.01
SD in Original Scale	0.0295	SD in Log Scale	0.777
90% t UCL (assumes normality of ROS data)	0.0317	90% Percentile Bootstrap UCL	0.0316
90% BCA Bootstrap UCL	0.0333	90% Bootstrap t UCL	0.0361
90% H-UCL (Log ROS)	0.0298		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.451	KM Geo Mean	0.0117
KM SD (logged)	1.109	90% Critical H Value (KM-Log)	1.862
KM Standard Error of Mean (logged)	0.176	90% H-UCL (KM -Log)	0.0298
KM SD (logged)	1.109	90% Critical H Value (KM-Log)	1.862
KM Standard Error of Mean (logged)	0.176		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0213
SD in Original Scale	0.032
90% t UCL (Assumes normality)	0.0277

DL/2 Log-Transformed

Mean in Log Scale	-4.814
SD in Log Scale	1.43
90% H-Stat UCL	0.0365

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/13/2025 9:24:41 AM
 From File 90 UCL Input Data_MG.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	27	Number of Distinct Observations	23
Number of Detects	7	Number of Non-Detects	20
Number of Distinct Detects	7	Number of Distinct Non-Detects	16
Minimum Detect	0.596	Minimum Non-Detect	0.495
Maximum Detect	0.992	Maximum Non-Detect	0.565
Variance Detects	0.0216	Percent Non-Detects	74.07%
Mean Detects	0.737	SD Detects	0.147
Median Detects	0.712	CV Detects	0.199
Skewness Detects	0.808	Kurtosis Detects	-0.186
Mean of Logged Detects	-0.321	SD of Logged Detects	0.193

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.898	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.21	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.558	KM Standard Error of Mean	0.0263
90KM SD	0.127	95% KM (BCA) UCL	0.588
90% KM (t) UCL	0.592	90% KM (Percentile Bootstrap) UCL	0.59
90% KM (z) UCL	0.591	90% KM Bootstrap t UCL	0.595
90% KM Chebyshev UCL	0.637	95% KM Chebyshev UCL	0.673
97.5% KM Chebyshev UCL	0.722	99% KM Chebyshev UCL	0.82

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.365	Anderson-Darling GOF Test
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	30.89	k star (bias corrected MLE)	17.75
Theta hat (MLE)	0.0239	Theta star (bias corrected MLE)	0.0415
nu hat (MLE)	432.5	nu star (bias corrected)	248.5
Mean (detects)	0.737		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.106	Mean	0.348
Maximum	0.992	Median	0.213
SD	0.252	CV	0.723
k hat (MLE)	2.435	k star (bias corrected MLE)	2.189
Theta hat (MLE)	0.143	Theta star (bias corrected MLE)	0.159
nu hat (MLE)	131.5	nu star (bias corrected)	118.2
Adjusted Level of Significance (β)	0.089		

Approximate Chi Square Value (118.20, α)	98.98	Adjusted Chi Square Value (118.20, β)	98.09
90% Gamma Approximate UCL	0.415	90% Gamma Adjusted UCL	0.419
95% Gamma Approximate UCL	0.437	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.558	SD (KM)	0.127
Variance (KM)	0.016	SE of Mean (KM)	0.0263
k hat (KM)	19.39	k star (KM)	17.26
nu hat (KM)	1047	nu star (KM)	931.8
theta hat (KM)	0.0288	theta star (KM)	0.0323
80% gamma percentile (KM)	0.666	90% gamma percentile (KM)	0.735
95% gamma percentile (KM)	0.795	99% gamma percentile (KM)	0.917

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (931.82, α)	876.9	Adjusted Chi Square Value (931.82, β)	874.2
90% KM Approximate Gamma UCL	0.593	90% KM Adjusted Gamma UCL	0.594

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.838	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.213	Lilliefors GOF Test
10% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.445	Mean in Log Scale	-0.881
SD in Original Scale	0.192	SD in Log Scale	0.361
90% t UCL (assumes normality of ROS data)	0.493	90% Percentile Bootstrap UCL	0.494
90% BCA Bootstrap UCL	0.499	90% Bootstrap t UCL	0.504
90% H-UCL (Log ROS)	0.489		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.604	KM Geo Mean	0.546
KM SD (logged)	0.19	90% Critical H Value (KM-Log)	1.341
KM Standard Error of Mean (logged)	0.0396	90% H-UCL (KM -Log)	0.585
KM SD (logged)	0.19	90% Critical H Value (KM-Log)	1.341
KM Standard Error of Mean (logged)	0.0396		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.388
SD in Original Scale	0.222
90% t UCL (Assumes normality)	0.444

DL/2 Log-Transformed

Mean in Log Scale	-1.066
SD in Log Scale	0.46
90% H-Stat UCL	0.437

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Arsenic

General Statistics

Total Number of Observations	27	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	3.07	Mean	5.635
Maximum	8.98	Median	5.36
SD	1.378	Std. Error of Mean	0.265
Coefficient of Variation	0.245	Skewness	0.53

Normal GOF Test

Shapiro Wilk Test Statistic	0.967
1% Shapiro Wilk Critical Value	0.894

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors Test Statistic	0.157	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL			
90% Student's-t UCL	5.983	90% Adjusted-CLT UCL (Chen-1995)	5.994
		90% Modified-t UCL (Johnson-1978)	5.988

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.276		
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.128	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	17.63	k star (bias corrected MLE)	15.7
Theta hat (MLE)	0.32	Theta star (bias corrected MLE)	0.359
nu hat (MLE)	952.1	nu star (bias corrected)	847.7
MLE Mean (bias corrected)	5.635	MLE Sd (bias corrected)	1.422
		Approximate Chi Square Value (0.1)	795.3
Adjusted Level of Significance	0.089	Adjusted Chi Square Value	792.8

Assuming Gamma Distribution			
90% Approximate Gamma UCL	6.005	90% Adjusted Gamma UCL	6.025

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.983		
10% Shapiro Wilk Critical Value	0.935	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.112	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	1.122	Mean of logged Data	1.7
Maximum of Logged Data	2.195	SD of logged Data	0.245

Assuming Lognormal Distribution			
90% H-UCL	6.023	90% Chebyshev (MVUE) UCL	6.441
95% Chebyshev (MVUE) UCL	6.806	97.5% Chebyshev (MVUE) UCL	7.312
99% Chebyshev (MVUE) UCL	8.306		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	5.975	90% BCA Bootstrap UCL	6.003
90% Standard Bootstrap UCL	5.962	90% Bootstrap-t UCL	6.014
90% Hall's Bootstrap UCL	6.013	90% Percentile Bootstrap UCL	5.964
90% Chebyshev(Mean, Sd) UCL	6.43	95% Chebyshev(Mean, Sd) UCL	6.791
97.5% Chebyshev(Mean, Sd) UCL	7.291	99% Chebyshev(Mean, Sd) UCL	8.273

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Chromium

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	25
		Number of Missing Observations	0
Minimum	15.5	Mean	25.59
Maximum	52.3	Median	22
SD	10.35	Std. Error of Mean	1.992
Coefficient of Variation	0.405	Skewness	1.228

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.846	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.894	Lilliefors GOF Test	
Lilliefors Test Statistic	0.188	Data appear Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.194	Data appear Approximate Normal at 1% Significance Level	

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	28.21	90% Adjusted-CLT UCL (Chen-1995)	28.48
		90% Modified-t UCL (Johnson-1978)	28.29

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.963	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.745	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.162	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.168	Detected data follow Appr. Gamma Distribution at 5% Significance Level	

Gamma Statistics			
k hat (MLE)	7.523	k star (bias corrected MLE)	6.712
Theta hat (MLE)	3.402	Theta star (bias corrected MLE)	3.813
nu hat (MLE)	406.2	nu star (bias corrected)	362.4
MLE Mean (bias corrected)	25.59	MLE Sd (bias corrected)	9.879
		Approximate Chi Square Value (0.1)	328.4
Adjusted Level of Significance	0.089	Adjusted Chi Square Value	326.7

Assuming Gamma Distribution			
90% Approximate Gamma UCL	28.25	90% Adjusted Gamma UCL	28.39

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.91	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.935	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.141	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.153	Data appear Approximate Lognormal at 10% Significance Level	

Lognormal Statistics			
Minimum of Logged Data	2.741	Mean of logged Data	3.174
Maximum of Logged Data	3.957	SD of logged Data	0.363

Assuming Lognormal Distribution			
90% H-UCL	28.25	90% Chebyshev (MVUE) UCL	30.95
95% Chebyshev (MVUE) UCL	33.42	97.5% Chebyshev (MVUE) UCL	36.86
99% Chebyshev (MVUE) UCL	43.61		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	28.15	90% BCA Bootstrap UCL	28.73
90% Standard Bootstrap UCL	28.16	90% Bootstrap-t UCL	28.97
90% Hall's Bootstrap UCL	28.74	90% Percentile Bootstrap UCL	28.11
90% Chebyshev(Mean, Sd) UCL	31.57	95% Chebyshev(Mean, Sd) UCL	34.28
97.5% Chebyshev(Mean, Sd) UCL	38.03	99% Chebyshev(Mean, Sd) UCL	45.42

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Copper

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	27
		Number of Missing Observations	0

Minimum	21.6	Mean	80.13
Maximum	344	Median	37.4
SD	81.07	Std. Error of Mean	15.6
Coefficient of Variation	1.012	Skewness	1.911

Normal GOF Test

Shapiro Wilk Test Statistic	0.718
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.274
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	100.6

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	104.2
90% Modified-t UCL (Johnson-1978)	101.6

Gamma GOF Test

A-D Test Statistic	1.908
5% A-D Critical Value	0.763
K-S Test Statistic	0.261
5% K-S Critical Value	0.171

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.52
Theta hat (MLE)	52.72
nu hat (MLE)	82.08
MLE Mean (bias corrected)	80.13
Adjusted Level of Significance	0.089

k star (bias corrected MLE)	1.376
Theta star (bias corrected MLE)	58.24
nu star (bias corrected)	74.29
MLE Sd (bias corrected)	68.31
Approximate Chi Square Value (0.1)	59.16
Adjusted Chi Square Value	58.48

Assuming Gamma Distribution

90% Approximate Gamma UCL	100.6

90% Adjusted Gamma UCL	101.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.87
10% Shapiro Wilk Critical Value	0.935
Lilliefors Test Statistic	0.23
10% Lilliefors Critical Value	0.153

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.073
Maximum of Logged Data	5.841

Mean of logged Data	4.02
SD of logged Data	0.81

Assuming Lognormal Distribution

90% H-UCL	101.3
95% Chebyshev (MVUE) UCL	133.1
99% Chebyshev (MVUE) UCL	206.1

90% Chebyshev (MVUE) UCL	115.3
97.5% Chebyshev (MVUE) UCL	157.7

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	100.1
90% Standard Bootstrap UCL	99.85
90% Hall's Bootstrap UCL	107.3
90% Chebyshev(Mean, Sd) UCL	126.9
97.5% Chebyshev(Mean, Sd) UCL	177.6

90% BCA Bootstrap UCL	106.9
90% Bootstrap-t UCL	108.6
90% Percentile Bootstrap UCL	99.96
95% Chebyshev(Mean, Sd) UCL	148.1
99% Chebyshev(Mean, Sd) UCL	235.4

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Lead

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	25
		Number of Missing Observations	0
Minimum	13.5	Mean	53.31
Maximum	321	Median	31.4
SD	61.1	Std. Error of Mean	11.76
Coefficient of Variation	1.146	Skewness	3.527
Normal GOF Test			
Shapiro Wilk Test Statistic	0.589	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.894	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.257	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.194	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	68.77	90% Adjusted-CLT UCL (Chen-1995)	74.08
		90% Modified-t UCL (Johnson-1978)	70.1
Gamma GOF Test			
A-D Test Statistic	1.245	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.761	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.193	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.171	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.661	k star (bias corrected MLE)	1.501
Theta hat (MLE)	32.1	Theta star (bias corrected MLE)	35.52
nu hat (MLE)	89.67	nu star (bias corrected)	81.04
MLE Mean (bias corrected)	53.31	MLE Sd (bias corrected)	43.52
		Approximate Chi Square Value (0.1)	65.21
Adjusted Level of Significance	0.089	Adjusted Chi Square Value	64.49
Assuming Gamma Distribution			
90% Approximate Gamma UCL	66.25	90% Adjusted Gamma UCL	66.99
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.934	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.935	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.134	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.603	Mean of logged Data	3.646
Maximum of Logged Data	5.771	SD of logged Data	0.743
Assuming Lognormal Distribution			
90% H-UCL	64.19	90% Chebyshev (MVUE) UCL	73.1
95% Chebyshev (MVUE) UCL	83.62	97.5% Chebyshev (MVUE) UCL	98.24
99% Chebyshev (MVUE) UCL	126.9		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	68.38	90% BCA Bootstrap UCL	74.59
90% Standard Bootstrap UCL	68.25	90% Bootstrap-t UCL	85.14

90% Hall's Bootstrap UCL 141.4
 90% Chebyshev(Mean, Sd) UCL 88.59
 97.5% Chebyshev(Mean, Sd) UCL 126.7

90% Percentile Bootstrap UCL 68.97
 95% Chebyshev(Mean, Sd) UCL 104.6
 99% Chebyshev(Mean, Sd) UCL 170.3

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
 then contact a statistician to correctly calculate UCLs.

Mercury

General Statistics

Total Number of Observations	27	Number of Distinct Observations	24
Number of Detects	26	Number of Non-Detects	1
Number of Distinct Detects	23	Number of Distinct Non-Detects	1
Minimum Detect	0.0455	Minimum Non-Detect	0.0438
Maximum Detect	0.369	Maximum Non-Detect	0.0438
Variance Detects	0.00801	Percent Non-Detects	3.704%
Mean Detects	0.141	SD Detects	0.0895
Median Detects	0.129	CV Detects	0.636
Skewness Detects	1.423	Kurtosis Detects	1.402
Mean of Logged Detects	-2.128	SD of Logged Detects	0.58

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.82	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.891	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.244	Lilliefors GOF Test
1% Lilliefors Critical Value	0.199	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.137	KM Standard Error of Mean	0.0173
90KM SD	0.0881	95% KM (BCA) UCL	0.157
90% KM (t) UCL	0.16	90% KM (Percentile Bootstrap) UCL	0.159
90% KM (z) UCL	0.159	90% KM Bootstrap t UCL	0.168
90% KM Chebyshev UCL	0.189	95% KM Chebyshev UCL	0.213
97.5% KM Chebyshev UCL	0.245	99% KM Chebyshev UCL	0.309

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.735	Anderson-Darling GOF Test
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.172	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.138	k star (bias corrected MLE)	2.801
Theta hat (MLE)	0.0449	Theta star (bias corrected MLE)	0.0503
nu hat (MLE)	163.2	nu star (bias corrected)	145.7
Mean (detects)	0.141		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.136
Maximum	0.369	Median	0.128
SD	0.0913	CV	0.671
k hat (MLE)	2.381	k star (bias corrected MLE)	2.141
Theta hat (MLE)	0.0571	Theta star (bias corrected MLE)	0.0635
nu hat (MLE)	128.6	nu star (bias corrected)	115.6

Adjusted Level of Significance (β)	0.089	Adjusted Chi Square Value (115.61, β)	95.72
Approximate Chi Square Value (115.61, α)	96.6	90% Gamma Adjusted UCL	0.164
90% Gamma Approximate UCL	0.163	95% Gamma Adjusted UCL	N/A
95% Gamma Approximate UCL	0.171		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.137	SD (KM)	0.0881
Variance (KM)	0.00776	SE of Mean (KM)	0.0173
k hat (KM)	2.429	k star (KM)	2.184
nu hat (KM)	131.2	nu star (KM)	117.9
theta hat (KM)	0.0565	theta star (KM)	0.0629
80% gamma percentile (KM)	0.203	90% gamma percentile (KM)	0.262
95% gamma percentile (KM)	0.317	99% gamma percentile (KM)	0.439

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (117.92, α)	98.72	Adjusted Chi Square Value (117.92, β)	97.83
90% KM Approximate Gamma UCL	0.164	90% KM Adjusted Gamma UCL	0.165

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.948	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.933	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.137	Lilliefors GOF Test
10% Lilliefors Critical Value	0.156	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.137	Mean in Log Scale	-2.181
SD in Original Scale	0.0904	SD in Log Scale	0.633
90% t UCL (assumes normality of ROS data)	0.16	90% Percentile Bootstrap UCL	0.159
90% BCA Bootstrap UCL	0.162	90% Bootstrap t UCL	0.165
90% H-UCL (Log ROS)	0.168		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.165	KM Geo Mean	0.115
KM SD (logged)	0.589	90% Critical H Value (KM-Log)	1.539
KM Standard Error of Mean (logged)	0.116	90% H-UCL (KM -Log)	0.163
KM SD (logged)	0.589	90% Critical H Value (KM-Log)	1.539
KM Standard Error of Mean (logged)	0.116		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.136
SD in Original Scale	0.0907
90% t UCL (Assumes normality)	0.159

DL/2 Log-Transformed

Mean in Log Scale	-2.191
SD in Log Scale	0.655
90% H-Stat UCL	0.17

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Nickel

General Statistics

Total Number of Observations	27	Number of Distinct Observations	25
		Number of Missing Observations	0
Minimum	14.7	Mean	23.51
Maximum	58.9	Median	21.8
SD	8.535	Std. Error of Mean	1.642
Coefficient of Variation	0.363	Skewness	2.903

Normal GOF Test

Shapiro Wilk Test Statistic	0.724
1% Shapiro Wilk Critical Value	0.894

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors Test Statistic	0.189	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	25.67

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	26.27
90% Modified-t UCL (Johnson-1978)	25.82

Gamma GOF Test

A-D Test Statistic	0.907
5% A-D Critical Value	0.744
K-S Test Statistic	0.131
5% K-S Critical Value	0.168

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.24
Theta hat (MLE)	2.092
nu hat (MLE)	606.8
MLE Mean (bias corrected)	23.51
Adjusted Level of Significance	0.089

k star (bias corrected MLE)	10.01
Theta star (bias corrected MLE)	2.348
nu star (bias corrected)	540.7
MLE Sd (bias corrected)	7.429
Approximate Chi Square Value (0.1)	499.1
Adjusted Chi Square Value	497

Assuming Gamma Distribution

90% Approximate Gamma UCL	25.47

90% Adjusted Gamma UCL	25.58

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.902
10% Shapiro Wilk Critical Value	0.935
Lilliefors Test Statistic	0.122
10% Lilliefors Critical Value	0.153

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.688
Maximum of Logged Data	4.076

Mean of logged Data	3.112
SD of logged Data	0.286

Assuming Lognormal Distribution

90% H-UCL	25.29
95% Chebyshev (MVUE) UCL	29.06
99% Chebyshev (MVUE) UCL	36.35

90% Chebyshev (MVUE) UCL	27.29
97.5% Chebyshev (MVUE) UCL	31.52

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	25.61
90% Standard Bootstrap UCL	25.6
90% Hall's Bootstrap UCL	37.82
90% Chebyshev(Mean, Sd) UCL	28.43
97.5% Chebyshev(Mean, Sd) UCL	33.76

90% BCA Bootstrap UCL	26.33
90% Bootstrap-t UCL	27.51
90% Percentile Bootstrap UCL	25.53
95% Chebyshev(Mean, Sd) UCL	30.67
99% Chebyshev(Mean, Sd) UCL	39.85

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics

Total Number of Observations	27
Minimum	64.7
Maximum	224
SD	41.57
Coefficient of Variation	0.339

Number of Distinct Observations	24
Number of Missing Observations	0
Mean	122.5
Median	122
Std. Error of Mean	8.001
Skewness	0.803

Normal GOF Test		
Shapiro Wilk Test Statistic	0.935	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.894	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.0965	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Data appear Normal at 1% Significance Level
Data appear Normal at 1% Significance Level		

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	133	90% Adjusted-CLT UCL (Chen-1995)	133.6
		90% Modified-t UCL (Johnson-1978)	133.2

Gamma GOF Test		
A-D Test Statistic	0.294	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0951	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	9.542	k star (bias corrected MLE)	8.507
Theta hat (MLE)	12.84	Theta star (bias corrected MLE)	14.4
nu hat (MLE)	515.3	nu star (bias corrected)	459.4
MLE Mean (bias corrected)	122.5	MLE Sd (bias corrected)	42
		Approximate Chi Square Value (0.1)	421
Adjusted Level of Significance	0.089	Adjusted Chi Square Value	419.1

Assuming Gamma Distribution			
90% Approximate Gamma UCL	133.7	90% Adjusted Gamma UCL	134.3

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.971	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.935	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0884	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	4.17	Mean of logged Data	4.755
Maximum of Logged Data	5.412	SD of logged Data	0.332

Assuming Lognormal Distribution			
90% H-UCL	134.4	90% Chebyshev (MVUE) UCL	146.3
95% Chebyshev (MVUE) UCL	157.2	97.5% Chebyshev (MVUE) UCL	172.2
99% Chebyshev (MVUE) UCL	201.7		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	132.7	90% BCA Bootstrap UCL	134.5
90% Standard Bootstrap UCL	132.9	90% Bootstrap-t UCL	135.1
90% Hall's Bootstrap UCL	135	90% Percentile Bootstrap UCL	132.7
90% Chebyshev(Mean, Sd) UCL	146.5	95% Chebyshev(Mean, Sd) UCL	157.4
97.5% Chebyshev(Mean, Sd) UCL	172.4	99% Chebyshev(Mean, Sd) UCL	202.1

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dioxin/Furan

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	27
		Number of Missing Observations	0

Minimum	2.4179E-6	Mean	1.5451E-5
Maximum	2.6287E-5	Median	1.5273E-5
SD	7.2927E-6	Std. Error of Mean	1.4035E-6
Coefficient of Variation	N/A	Skewness	-0.114

Normal GOF Test

Shapiro Wilk Test Statistic	0.946	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.894	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.118	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 1.7297E-5

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 1.7228E-5

90% Modified-t UCL (Johnson-1978) 1.7292E-5

Gamma GOF Test

A-D Test Statistic	0.61	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.111	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.169	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.432	k star (bias corrected MLE)	3.076
Theta hat (MLE)	4.5015E-6	Theta star (bias corrected MLE)	5.0236E-6
nu hat (MLE)	185.4	nu star (bias corrected)	166.1
MLE Mean (bias corrected)	1.5451E-5	MLE Sd (bias corrected)	8.8102E-6
		Approximate Chi Square Value (0.1)	143.2
Adjusted Level of Significance	0.089	Adjusted Chi Square Value	142.1

Assuming Gamma Distribution

90% Approximate Gamma UCL 1.7921E-5

90% Adjusted Gamma UCL 1.8057E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.935	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.139	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-12.93	Mean of logged Data	-11.23
Maximum of Logged Data	-10.55	SD of logged Data	0.631

Assuming Lognormal Distribution

90% H-UCL	1.9649E-5	90% Chebyshev (MVUE) UCL	2.2271E-5
95% Chebyshev (MVUE) UCL	2.5091E-5	97.5% Chebyshev (MVUE) UCL	2.9005E-5
99% Chebyshev (MVUE) UCL	3.6694E-5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	1.7250E-5	90% BCA Bootstrap UCL	1.7226E-5
90% Standard Bootstrap UCL	1.7226E-5	90% Bootstrap-t UCL	1.7208E-5
90% Hall's Bootstrap UCL	1.7154E-5	90% Percentile Bootstrap UCL	1.7192E-5
90% Chebyshev(Mean, Sd) UCL	1.9662E-5	95% Chebyshev(Mean, Sd) UCL	2.1569E-5
97.5% Chebyshev(Mean, Sd) UCL	2.4216E-5	99% Chebyshev(Mean, Sd) UCL	2.9416E-5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

General Statistics

Total Number of Observations	27	Number of Distinct Observations	27
Number of Detects	17	Number of Non-Detects	10
Number of Distinct Detects	17	Number of Distinct Non-Detects	10
Minimum Detect	0.00511	Minimum Non-Detect	0.0047
Maximum Detect	0.0334	Maximum Non-Detect	0.0051
Variance Detects	4.3659E-5	Percent Non-Detects	37.04%
Mean Detects	0.00889	SD Detects	0.00661
Median Detects	0.00734	CV Detects	0.743
Skewness Detects	3.548	Kurtosis Detects	13.64
Mean of Logged Detects	-4.855	SD of Logged Detects	0.455

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.525	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.316	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

KM Mean	0.00734	KM Standard Error of Mean	0.00109
90KM SD	0.00547	95% KM (BCA) UCL	0.00878
90% KM (t) UCL	0.00876	90% KM (Percentile Bootstrap) UCL	0.00879
90% KM (z) UCL	0.00873	90% KM Bootstrap t UCL	0.0108
90% KM Chebyshev UCL	0.0106	95% KM Chebyshev UCL	0.0121
97.5% KM Chebyshev UCL	0.0141	99% KM Chebyshev UCL	0.0181

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.564	Anderson-Darling GOF Test
5% A-D Critical Value	0.743	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.21	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics on Detected Data Only**

k hat (MLE)	3.949	k star (bias corrected MLE)	3.292
Theta hat (MLE)	0.00225	Theta star (bias corrected MLE)	0.0027
nu hat (MLE)	134.3	nu star (bias corrected)	111.9
Mean (detects)	0.00889		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00511	Mean	0.0093
Maximum	0.0334	Median	0.00988
SD	0.00521	CV	0.56
k hat (MLE)	6.066	k star (bias corrected MLE)	5.416
Theta hat (MLE)	0.00153	Theta star (bias corrected MLE)	0.00172
nu hat (MLE)	327.5	nu star (bias corrected)	292.5
Adjusted Level of Significance (β)	0.089		
Approximate Chi Square Value (292.48, α)	261.9	Adjusted Chi Square Value (292.48, β)	260.5
90% Gamma Approximate UCL	0.0104	90% Gamma Adjusted UCL	0.0104
95% Gamma Approximate UCL	0.0107	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00734	SD (KM)	0.00547
Variance (KM)	2.9961E-5	SE of Mean (KM)	0.00109
k hat (KM)	1.797	k star (KM)	1.622
nu hat (KM)	97.01	nu star (KM)	87.57
theta hat (KM)	0.00408	theta star (KM)	0.00452

80% gamma percentile (KM)	0.0113	90% gamma percentile (KM)	0.015
95% gamma percentile (KM)	0.0186	99% gamma percentile (KM)	0.0268

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (87.57, α)	71.09	Adjusted Chi Square Value (87.57, β)	70.34
90% KM Approximate Gamma UCL	0.00904	90% KM Adjusted Gamma UCL	0.00913

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.779	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.91	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.177	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.19	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00663	Mean in Log Scale	-5.236
SD in Original Scale	0.00599	SD in Log Scale	0.619
90% t UCL (assumes normality of ROS data)	0.00814	90% Percentile Bootstrap UCL	0.00814
90% BCA Bootstrap UCL	0.00875	90% Bootstrap t UCL	0.0097
90% H-UCL (Log ROS)	0.00779		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.042	KM Geo Mean	0.00646
KM SD (logged)	0.427	90% Critical H Value (KM-Log)	1.444
KM Standard Error of Mean (logged)	0.0847	90% H-UCL (KM -Log)	0.00799
KM SD (logged)	0.427	90% Critical H Value (KM-Log)	1.444
KM Standard Error of Mean (logged)	0.0847		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00651
SD in Original Scale	0.00607
90% t UCL (Assumes normality)	0.00804

DL/2 Log-Transformed

Mean in Log Scale	-5.282
SD in Log Scale	0.67
90% H-Stat UCL	0.00785

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

TotalHPAHs

General Statistics

Total Number of Observations	27	Number of Distinct Observations	26
		Number of Missing Observations	0
Minimum	0.223	Mean	1.725
Maximum	11.9	Median	1.1
SD	2.264	Std. Error of Mean	0.436
Coefficient of Variation	1.313	Skewness	3.806

Normal GOF Test

Shapiro Wilk Test Statistic	0.55	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.894	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.292	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.194	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	2.297

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	2.511
90% Modified-t UCL (Johnson-1978)	2.351

Gamma GOF Test

A-D Test Statistic	1.098

Anderson-Darling Gamma GOF Test

5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.172	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	1.354	k star (bias corrected MLE)	1.229
Theta hat (MLE)	1.273	Theta star (bias corrected MLE)	1.404
nu hat (MLE)	73.13	nu star (bias corrected)	66.34
MLE Mean (bias corrected)	1.725	MLE Sd (bias corrected)	1.556
		Approximate Chi Square Value (0.1)	52.07
Adjusted Level of Significance	0.089	Adjusted Chi Square Value	51.43

Assuming Gamma Distribution

90% Approximate Gamma UCL	2.197	90% Adjusted Gamma UCL	2.224

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.935	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.136	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.501	Mean of logged Data	0.132
Maximum of Logged Data	2.477	SD of logged Data	0.848

Assuming Lognormal Distribution

90% H-UCL	2.181	90% Chebyshev (MVUE) UCL	2.479
95% Chebyshev (MVUE) UCL	2.874	97.5% Chebyshev (MVUE) UCL	3.423
99% Chebyshev (MVUE) UCL	4.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	2.283	90% BCA Bootstrap UCL	2.607
90% Standard Bootstrap UCL	2.268	90% Bootstrap-t UCL	3.034
90% Hall's Bootstrap UCL	4.967	90% Percentile Bootstrap UCL	2.296
90% Chebyshev(Mean, Sd) UCL	3.031	95% Chebyshev(Mean, Sd) UCL	3.623
97.5% Chebyshev(Mean, Sd) UCL	4.445	99% Chebyshev(Mean, Sd) UCL	6.059

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

cPAHs

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	27
		Number of Missing Observations	0
Minimum	0.0319	Mean	0.268
Maximum	1.75	Median	0.18
SD	0.338	Std. Error of Mean	0.065
Coefficient of Variation	1.258	Skewness	3.58

Normal GOF Test

Shapiro Wilk Test Statistic	0.584	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.894	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.272	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 0.354

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 0.384
90% Modified-t UCL (Johnson-1978) 0.361

Gamma GOF Test

A-D Test Statistic 0.884
5% A-D Critical Value 0.766
K-S Test Statistic 0.172
5% K-S Critical Value 0.172

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 1.357
Theta hat (MLE) 0.198
nu hat (MLE) 73.27
MLE Mean (bias corrected) 0.268

Adjusted Level of Significance 0.089

k star (bias corrected MLE) 1.231
Theta star (bias corrected MLE) 0.218
nu star (bias corrected) 66.46
MLE Sd (bias corrected) 0.242
Approximate Chi Square Value (0.1) 52.18
Adjusted Chi Square Value 51.54

Assuming Gamma Distribution

90% Approximate Gamma UCL 0.342

90% Adjusted Gamma UCL 0.346

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.978
10% Shapiro Wilk Critical Value 0.935
Lilliefors Test Statistic 0.103
10% Lilliefors Critical Value 0.153

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -3.445
Maximum of Logged Data 0.56

Mean of logged Data -1.727
SD of logged Data 0.864

Assuming Lognormal Distribution

90% H-UCL 0.347
95% Chebyshev (MVUE) UCL 0.458
99% Chebyshev (MVUE) UCL 0.72

90% Chebyshev (MVUE) UCL 0.394
97.5% Chebyshev (MVUE) UCL 0.546

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 0.352
90% Standard Bootstrap UCL 0.349
90% Hall's Bootstrap UCL 0.758
90% Chebyshev(Mean, Sd) UCL 0.463
97.5% Chebyshev(Mean, Sd) UCL 0.674

90% BCA Bootstrap UCL 0.396
90% Bootstrap-t UCL 0.445
90% Percentile Bootstrap UCL 0.354
95% Chebyshev(Mean, Sd) UCL 0.552
99% Chebyshev(Mean, Sd) UCL 0.915

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics

Total Number of Observations 27
Number of Detects 25
Number of Distinct Detects 25
Minimum Detect 0.0245

Number of Distinct Observations 27
Number of Non-Detects 2
Number of Distinct Non-Detects 2
Minimum Non-Detect 0.00479

Maximum Detect	2.75	Maximum Non-Detect	0.00504
Variance Detects	0.294	Percent Non-Detects	7.407%
Mean Detects	0.232	SD Detects	0.542
Median Detects	0.0678	CV Detects	2.337
Skewness Detects	4.529	Kurtosis Detects	21.55
Mean of Logged Detects	-2.347	SD of Logged Detects	1.12

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.381	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.886	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.374	Lilliefors GOF Test
1% Lilliefors Critical Value	0.201	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.215	KM Standard Error of Mean	0.101
90KM SD	0.514	95% KM (BCA) UCL	0.335
90% KM (t) UCL	0.348	90% KM (Percentile Bootstrap) UCL	0.339
90% KM (z) UCL	0.345	90% KM Bootstrap t UCL	0.732
90% KM Chebyshev UCL	0.518	95% KM Chebyshev UCL	0.655
97.5% KM Chebyshev UCL	0.846	99% KM Chebyshev UCL	1.22

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.196	Anderson-Darling GOF Test
5% A-D Critical Value	0.79	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.246	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.182	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.685	k star (bias corrected MLE)	0.629
Theta hat (MLE)	0.339	Theta star (bias corrected MLE)	0.368
nu hat (MLE)	34.25	nu star (bias corrected)	31.47
Mean (detects)	0.232		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.215
Maximum	2.75	Median	0.064
SD	0.524	CV	2.433
k hat (MLE)	0.627	k star (bias corrected MLE)	0.582
Theta hat (MLE)	0.344	Theta star (bias corrected MLE)	0.37
nu hat (MLE)	33.87	nu star (bias corrected)	31.44
Adjusted Level of Significance (β)	0.089		
Approximate Chi Square Value (31.44, α)	21.8	Adjusted Chi Square Value (31.44, β)	21.4
90% Gamma Approximate UCL	0.311	90% Gamma Adjusted UCL	0.317
95% Gamma Approximate UCL	0.345	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.215	SD (KM)	0.514
Variance (KM)	0.265	SE of Mean (KM)	0.101
k hat (KM)	0.175	k star (KM)	0.18
nu hat (KM)	9.437	nu star (KM)	9.722
theta hat (KM)	1.23	theta star (KM)	1.194
80% gamma percentile (KM)	0.267	90% gamma percentile (KM)	0.649
95% gamma percentile (KM)	1.138	99% gamma percentile (KM)	2.508

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.72, α)	4.67	Adjusted Chi Square Value (9.72, β)	4.497
90% KM Approximate Gamma UCL	0.448	90% KM Adjusted Gamma UCL	0.465

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904
10% Shapiro Wilk Critical Value	0.931
Lilliefors Test Statistic	0.141
10% Lilliefors Critical Value	0.159

Shapiro Wilk GOF Test

Detected Data Not Lognormal at 10% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.215	Mean in Log Scale	-2.537
SD in Original Scale	0.524	SD in Log Scale	1.276
90% t UCL (assumes normality of ROS data)	0.348	90% Percentile Bootstrap UCL	0.338
90% BCA Bootstrap UCL	0.428	90% Bootstrap t UCL	0.726
90% H-UCL (Log ROS)	0.304		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.568	KM Geo Mean	0.0767
KM SD (logged)	1.316	90% Critical H Value (KM-Log)	2.176
KM Standard Error of Mean (logged)	0.258	90% H-UCL (KM -Log)	0.319
KM SD (logged)	1.316	90% Critical H Value (KM-Log)	2.176
KM Standard Error of Mean (logged)	0.258		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.215
SD in Original Scale	0.524
90% t UCL (Assumes normality)	0.348

DL/2 Log-Transformed

Mean in Log Scale	-2.618
SD in Log Scale	1.454
90% H-Stat UCL	0.407

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:59:19 PM
 From File 90 UCL Input Data_MG_f.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Number of Detects	2	Number of Non-Detects	5
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	0.603	Minimum Non-Detect	0.539
Maximum Detect	0.801	Maximum Non-Detect	0.565
Variance Detects	0.0196	Percent Non-Detects	71.43%
Mean Detects	0.702	SD Detects	0.14
Median Detects	0.702	CV Detects	0.199
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.364	SD of Logged Detects	0.201

Warning: Data set has only 2 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.586	KM Standard Error of Mean	0.0485
90KM SD	0.0907	95% KM (BCA) UCL	N/A
90% KM (t) UCL	0.655	90% KM (Percentile Bootstrap) UCL	N/A
90% KM (z) UCL	0.648	90% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.731	95% KM Chebyshev UCL	0.797
97.5% KM Chebyshev UCL	0.888	99% KM Chebyshev UCL	1.068

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	49.95	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0141	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	199.8	nu star (bias corrected)	N/A
Mean (detects)	0.702		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.586	SD (KM)	0.0907
Variance (KM)	0.00822	SE of Mean (KM)	0.0485
k hat (KM)	41.7	k star (KM)	23.92
nu hat (KM)	583.8	nu star (KM)	334.9
theta hat (KM)	0.014	theta star (KM)	0.0245
80% gamma percentile (KM)	0.683	90% gamma percentile (KM)	0.743
95% gamma percentile (KM)	0.795	99% gamma percentile (KM)	0.899

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (334.95, α)	302.2	Adjusted Level of Significance (β)	0.0549
90% KM Approximate Gamma UCL	0.649	Adjusted Chi Square Value (334.95, β)	294.6
		90% KM Adjusted Gamma UCL	0.666

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.392	Mean in Log Scale	-1.051
SD in Original Scale	0.222	SD in Log Scale	0.492
90% t UCL (assumes normality of ROS data)	0.513	90% Percentile Bootstrap UCL	0.496
90% BCA Bootstrap UCL	0.516	90% Bootstrap t UCL	0.537
90% H-UCL (Log ROS)	0.556		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.545	KM Geo Mean	0.58
KM SD (logged)	0.138	90% Critical H Value (KM-Log)	1.402
KM Standard Error of Mean (logged)	0.0736	90% H-UCL (KM -Log)	0.633
KM SD (logged)	0.138	90% Critical H Value (KM-Log)	1.402
KM Standard Error of Mean (logged)	0.0736		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.397
SD in Original Scale	0.216
90% t UCL (Assumes normality)	0.515

DL/2 Log-Transformed

Mean in Log Scale	-1.025
SD in Log Scale	0.46
90% H-Stat UCL	0.545

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Arsenic

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	3.98	Mean	5.544
Maximum	6.87	Median	5.41
SD	1.055	Std. Error of Mean	0.399
Coefficient of Variation	0.19	Skewness	-0.142

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.95
1% Shapiro Wilk Critical Value	0.73
Lilliefors Test Statistic	0.174
1% Lilliefors Critical Value	0.35

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	6.118

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	6.04
90% Modified-t UCL (Johnson-1978)	6.115

Gamma GOF Test

A-D Test Statistic	0.265
5% A-D Critical Value	0.707
K-S Test Statistic	0.196
5% K-S Critical Value	0.311

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level**Note GOF tests may be unreliable for small sample sizes**

Gamma Statistics			
k hat (MLE)	31.1	k star (bias corrected MLE)	17.87
Theta hat (MLE)	0.178	Theta star (bias corrected MLE)	0.31
nu hat (MLE)	435.4	nu star (bias corrected)	250.1
MLE Mean (bias corrected)	5.544	MLE Sd (bias corrected)	1.312
		Approximate Chi Square Value (0.1)	221.9
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	215.4

Assuming Gamma Distribution

90% Approximate Gamma UCL	6.249	90% Adjusted Gamma UCL	6.437

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946
10% Shapiro Wilk Critical Value	0.838
Lilliefors Test Statistic	0.182
10% Lilliefors Critical Value	0.28

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level**Note GOF tests may be unreliable for small sample sizes****Lognormal Statistics**

Minimum of Logged Data	1.381	Mean of logged Data	1.697
Maximum of Logged Data	1.927	SD of logged Data	0.196

Assuming Lognormal Distribution

90% H-UCL	6.242	90% Chebyshev (MVUE) UCL	6.782
95% Chebyshev (MVUE) UCL	7.342	97.5% Chebyshev (MVUE) UCL	8.119
99% Chebyshev (MVUE) UCL	9.646		

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL	6.055	90% BCA Bootstrap UCL	6.026
90% Standard Bootstrap UCL	6.023	90% Bootstrap-t UCL	6.101
90% Hall's Bootstrap UCL	5.992	90% Percentile Bootstrap UCL	6.004
90% Chebyshev(Mean, Sd) UCL	6.74	95% Chebyshev(Mean, Sd) UCL	7.282
97.5% Chebyshev(Mean, Sd) UCL	8.034	99% Chebyshev(Mean, Sd) UCL	9.511

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Copper**General Statistics**

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	26.8	Mean	69.6
Maximum	180	Median	34.6
SD	59.01	Std. Error of Mean	22.3
Coefficient of Variation	0.848	Skewness	1.382

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.****Normal GOF Test**

Shapiro Wilk Test Statistic	0.784

Shapiro Wilk GOF Test

1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.295	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 101.7

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 106.5

90% Modified-t UCL (Johnson-1978) 103.7

Gamma GOF Test

A-D Test Statistic 0.642

5% A-D Critical Value 0.715

K-S Test Statistic 0.308

5% K-S Critical Value 0.315

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE) 1.987

Theta hat (MLE) 35.03

nu hat (MLE) 27.81

MLE Mean (bias corrected) 69.6

Adjusted Level of Significance 0.0549

k star (bias corrected MLE) 1.23

Theta star (bias corrected MLE) 56.56

nu star (bias corrected) 17.23

MLE Sd (bias corrected) 62.74

Approximate Chi Square Value (0.1) 10.26

Adjusted Chi Square Value 9.005

Assuming Gamma Distribution

90% Approximate Gamma UCL 116.8

90% Adjusted Gamma UCL 133.1

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.844

10% Shapiro Wilk Critical Value 0.838

Lilliefors Test Statistic 0.282

10% Lilliefors Critical Value 0.28

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data 3.288

Maximum of Logged Data 5.193

Mean of logged Data 3.97

SD of logged Data 0.768

Assuming Lognormal Distribution

90% H-UCL 136.1

95% Chebyshev (MVUE) UCL 153.9

99% Chebyshev (MVUE) UCL 264.5

90% Chebyshev (MVUE) UCL 127.1

97.5% Chebyshev (MVUE) UCL 191.3

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL 98.18

90% Standard Bootstrap UCL 96.23

90% Hall's Bootstrap UCL 100.1

90% Chebyshev(Mean, Sd) UCL 136.5

97.5% Chebyshev(Mean, Sd) UCL 208.9

90% BCA Bootstrap UCL 106

90% Bootstrap-t UCL 117.7

90% Percentile Bootstrap UCL 97.86

95% Chebyshev(Mean, Sd) UCL 166.8

99% Chebyshev(Mean, Sd) UCL 291.5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations 7

Number of Distinct Observations 7

Number of Missing Observations 0

Minimum	18.7	Mean	43.2
Maximum	96.2	Median	28.2
SD	30.42	Std. Error of Mean	11.5
Coefficient of Variation	0.704	Skewness	1.182

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.815	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.26	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	59.75

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	61.6
90% Modified-t UCL (Johnson-1978)	60.61

Gamma GOF Test

A-D Test Statistic	0.509	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.247	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	2.769	k star (bias corrected MLE)	1.677
Theta hat (MLE)	15.6	Theta star (bias corrected MLE)	25.76
nu hat (MLE)	38.76	nu star (bias corrected)	23.48
MLE Mean (bias corrected)	43.2	MLE Sd (bias corrected)	33.36
		Approximate Chi Square Value (0.1)	15.24
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	13.67

Assuming Gamma Distribution

90% Approximate Gamma UCL	66.57	90% Adjusted Gamma UCL	74.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.887	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.213	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.929	Mean of logged Data	3.575
Maximum of Logged Data	4.566	SD of logged Data	0.648

Assuming Lognormal Distribution

90% H-UCL	72.69	90% Chebyshev (MVUE) UCL	74
95% Chebyshev (MVUE) UCL	88.25	97.5% Chebyshev (MVUE) UCL	108
99% Chebyshev (MVUE) UCL	146.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	57.94	90% BCA Bootstrap UCL	60.64
90% Standard Bootstrap UCL	57.05	90% Bootstrap-t UCL	64.28

90% Hall's Bootstrap UCL 56.23
 90% Chebyshev(Mean, Sd) UCL 77.7
 97.5% Chebyshev(Mean, Sd) UCL 115

90% Percentile Bootstrap UCL 57.67
 95% Chebyshev(Mean, Sd) UCL 93.32
 99% Chebyshev(Mean, Sd) UCL 157.6

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Mercury

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.0696	Minimum Non-Detect	0.0438
Maximum Detect	0.141	Maximum Non-Detect	0.0438
Variance Detects	0.00112	Percent Non-Detects	14.29%
Mean Detects	0.103	SD Detects	0.0335
Median Detects	0.101	CV Detects	0.326
Skewness Detects	0.0642	Kurtosis Detects	-3.08
Mean of Logged Detects	-2.322	SD of Logged Detects	0.335

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.713	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.299	Lilliefors GOF Test
1% Lilliefors Critical Value	0.373	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0943	KM Standard Error of Mean	0.0145
90KM SD	0.035	95% KM (BCA) UCL	0.113
90% KM (t) UCL	0.115	90% KM (Percentile Bootstrap) UCL	0.112
90% KM (z) UCL	0.113	90% KM Bootstrap t UCL	0.116
90% KM Chebyshev UCL	0.138	95% KM Chebyshev UCL	0.158
97.5% KM Chebyshev UCL	0.185	99% KM Chebyshev UCL	0.239

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.769	Anderson-Darling GOF Test
5% A-D Critical Value	0.698	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	11	k star (bias corrected MLE)	5.612
Theta hat (MLE)	0.00934	Theta star (bias corrected MLE)	0.0183
nu hat (MLE)	132	nu star (bias corrected)	67.35
Mean (detects)	0.103		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0356	Mean	0.0931
Maximum	0.141	Median	0.0746
SD	0.0397	CV	0.427

k hat (MLE)	5.548	k star (bias corrected MLE)	3.265
Theta hat (MLE)	0.0168	Theta star (bias corrected MLE)	0.0285
nu hat (MLE)	77.67	nu star (bias corrected)	45.71
Adjusted Level of Significance (β)	0.0549		
Approximate Chi Square Value (45.71, α)	33.97	Adjusted Chi Square Value (45.71, β)	31.54
90% Gamma Approximate UCL	0.125	90% Gamma Adjusted UCL	0.135
95% Gamma Approximate UCL	0.136	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0943	SD (KM)	0.035
Variance (KM)	0.00123	SE of Mean (KM)	0.0145
k hat (KM)	7.247	k star (KM)	4.237
nu hat (KM)	101.5	nu star (KM)	59.31
theta hat (KM)	0.013	theta star (KM)	0.0223
80% gamma percentile (KM)	0.129	90% gamma percentile (KM)	0.156
95% gamma percentile (KM)	0.18	99% gamma percentile (KM)	0.232

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (59.31, α)	45.85	Adjusted Chi Square Value (59.31, β)	43
90% KM Approximate Gamma UCL	0.122	90% KM Adjusted Gamma UCL	0.13

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.783
10% Shapiro Wilk Critical Value	0.826
Lilliefors Test Statistic	0.293
10% Lilliefors Critical Value	0.298

Shapiro Wilk GOF Test

Detected Data Not Lognormal at 10% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0944	Mean in Log Scale	-2.434
SD in Original Scale	0.0376	SD in Log Scale	0.427
90% t UCL (assumes normality of ROS data)	0.115	90% Percentile Bootstrap UCL	0.112
90% BCA Bootstrap UCL	0.111	90% Bootstrap t UCL	0.118
90% H-UCL (Log ROS)	0.128		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.437	KM Geo Mean	0.0874
KM SD (logged)	0.4	90% Critical H Value (KM-Log)	1.607
KM Standard Error of Mean (logged)	0.165	90% H-UCL (KM -Log)	0.123
KM SD (logged)	0.4	90% Critical H Value (KM-Log)	1.607
KM Standard Error of Mean (logged)	0.165		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0912
SD in Original Scale	0.0432
90% t UCL (Assumes normality)	0.115

DL/2 Log-Transformed

Mean in Log Scale	-2.536
SD in Log Scale	0.644
90% H-Stat UCL	0.16

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Nickel

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	16.3	Mean	21.41
Maximum	27.1	Median	19.7
SD	3.789	Std. Error of Mean	1.432
Coefficient of Variation	0.177	Skewness	0.279

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.246	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	23.48

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	23.36
90% Modified-t UCL (Johnson-1978)	23.5

Gamma GOF Test

A-D Test Statistic	0.33	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	37.42	k star (bias corrected MLE)	21.48
Theta hat (MLE)	0.572	Theta star (bias corrected MLE)	0.997
nu hat (MLE)	523.9	nu star (bias corrected)	300.7
MLE Mean (bias corrected)	21.41	MLE Sd (bias corrected)	4.62
		Approximate Chi Square Value (0.1)	269.8
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	262.6

Assuming Gamma Distribution

90% Approximate Gamma UCL	23.87

90% Adjusted Gamma UCL	24.53

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.947	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.225	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.791	Mean of logged Data	3.051
Maximum of Logged Data	3.3	SD of logged Data	0.177

Assuming Lognormal Distribution

90% H-UCL	23.79	90% Chebyshev (MVUE) UCL	25.72
95% Chebyshev (MVUE) UCL	27.67	97.5% Chebyshev (MVUE) UCL	30.37
99% Chebyshev (MVUE) UCL	35.69		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	23.25	90% BCA Bootstrap UCL	23.27
90% Standard Bootstrap UCL	23.16	90% Bootstrap-t UCL	24.02
90% Hall's Bootstrap UCL	23.4	90% Percentile Bootstrap UCL	23.17
90% Chebyshev(Mean, Sd) UCL	25.71	95% Chebyshev(Mean, Sd) UCL	27.66
97.5% Chebyshev(Mean, Sd) UCL	30.36	99% Chebyshev(Mean, Sd) UCL	35.66

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	80.4	Mean	109
Maximum	151	Median	99.4
SD	25.94	Std. Error of Mean	9.803
Coefficient of Variation	0.238	Skewness	0.748

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.92	Data appear Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.73	Lilliefors GOF Test	
Lilliefors Test Statistic	0.216	Data appear Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.35		

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 123.1

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 123.5

90% Modified-t UCL (Johnson-1978) 123.6

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.302	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.707	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.208	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.311		

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	21.72	k star (bias corrected MLE)	12.51
Theta hat (MLE)	5.018	Theta star (bias corrected MLE)	8.714
nu hat (MLE)	304.1	nu star (bias corrected)	175.1
MLE Mean (bias corrected)	109	MLE Sd (bias corrected)	30.82
		Approximate Chi Square Value (0.1)	151.6
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	146.2

Assuming Gamma Distribution

90% Approximate Gamma UCL 125.9

90% Adjusted Gamma UCL 130.5

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.945	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.838	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.189	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.28		

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics			
Minimum of Logged Data	4.387	Mean of logged Data	4.668
Maximum of Logged Data	5.017	SD of logged Data	0.23

Assuming Lognormal Distribution

90% H-UCL 125.5

90% Chebyshev (MVUE) UCL 137.4

95% Chebyshev (MVUE) UCL 150.3
99% Chebyshev (MVUE) UCL 203.3

97.5% Chebyshev (MVUE) UCL 168.2

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	121.5	90% BCA Bootstrap UCL	122.5
90% Standard Bootstrap UCL	121	90% Bootstrap-t UCL	129.5
90% Hall's Bootstrap UCL	124.1	90% Percentile Bootstrap UCL	121.4
90% Chebyshev(Mean, Sd) UCL	138.4	95% Chebyshev(Mean, Sd) UCL	151.7
97.5% Chebyshev(Mean, Sd) UCL	170.2	99% Chebyshev(Mean, Sd) UCL	206.5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dioxin/Furan

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	6.9537E-6	Mean	1.5972E-5
Maximum	2.6287E-5	Median	1.2795E-5
SD	7.1234E-6	Std. Error of Mean	2.6924E-6
Coefficient of Variation	N/A	Skewness	0.299

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.244	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL 1.9848E-5

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 1.9639E-5

90% Modified-t UCL (Johnson-1978) 1.9899E-5

Gamma GOF Test

A-D Test Statistic	0.314	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	5.563	k star (bias corrected MLE)	3.274
Theta hat (MLE)	2.8708E-6	Theta star (bias corrected MLE)	4.8778E-6
nu hat (MLE)	77.89	nu star (bias corrected)	45.84
MLE Mean (bias corrected)	1.5972E-5	MLE Sd (bias corrected)	8.8265E-6
		Approximate Chi Square Value (0.1)	34.08
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	31.65

Assuming Gamma Distribution

90% Approximate Gamma UCL 2.1485E-5

90% Adjusted Gamma UCL 2.3136E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.943	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.204	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	-11.88	Mean of logged Data	-11.14
Maximum of Logged Data	-10.55	SD of logged Data	0.476

Assuming Lognormal Distribution

90% H-UCL	2.2628E-5	90% Chebyshev (MVUE) UCL	2.4718E-5
95% Chebyshev (MVUE) UCL	2.8655E-5	97.5% Chebyshev (MVUE) UCL	3.4119E-5
99% Chebyshev (MVUE) UCL	4.4852E-5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	1.9422E-5	90% BCA Bootstrap UCL	1.9614E-5
90% Standard Bootstrap UCL	1.9223E-5	90% Bootstrap-t UCL	1.9947E-5
90% Hall's Bootstrap UCL	1.9093E-5	90% Percentile Bootstrap UCL	1.9297E-5
90% Chebyshev(Mean, Sd) UCL	2.4049E-5	95% Chebyshev(Mean, Sd) UCL	2.7707E-5
97.5% Chebyshev(Mean, Sd) UCL	3.2786E-5	99% Chebyshev(Mean, Sd) UCL	4.2761E-5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dibenzofuran

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.00511	Minimum Non-Detect	0.00478
Maximum Detect	0.00776	Maximum Non-Detect	0.00502
Variance Detects	1.5410E-6	Percent Non-Detects	42.86%
Mean Detects	0.00595	SD Detects	0.00124
Median Detects	0.00546	CV Detects	0.209
Skewness Detects	1.721	Kurtosis Detects	2.9
Mean of Logged Detects	-5.14	SD of Logged Detects	0.194

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.792	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.687	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.319	Lilliefors GOF Test
1% Lilliefors Critical Value	0.413	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00545	KM Standard Error of Mean	4.3486E-4
90KM SD	9.9639E-4	95% KM (BCA) UCL	N/A
90% KM (t) UCL	0.00607	90% KM (Percentile Bootstrap) UCL	N/A
90% KM (z) UCL	0.006	90% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00675	95% KM Chebyshev UCL	0.00734
97.5% KM Chebyshev UCL	0.00816	99% KM Chebyshev UCL	0.00977

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.539	Anderson-Darling GOF Test
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	33.78	k star (bias corrected MLE)	8.612
Theta hat (MLE)	1.7599E-4	Theta star (bias corrected MLE)	6.9035E-4
nu hat (MLE)	270.2	nu star (bias corrected)	68.89
Mean (detects)	0.00595		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00511	Mean	0.00768
Maximum	0.01	Median	0.00776
SD	0.00234	CV	0.304
k hat (MLE)	12.05	k star (bias corrected MLE)	6.981
Theta hat (MLE)	6.3761E-4	Theta star (bias corrected MLE)	0.0011
nu hat (MLE)	168.7	nu star (bias corrected)	97.73
Adjusted Level of Significance (β)	0.0549		
Approximate Chi Square Value (97.73, α)	80.3	Adjusted Chi Square Value (97.73, β)	76.46
90% Gamma Approximate UCL	0.00935	90% Gamma Adjusted UCL	N/A
95% Gamma Approximate UCL	0.00989	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00545	SD (KM)	9.9639E-4
Variance (KM)	9.9280E-7	SE of Mean (KM)	4.3486E-4
k hat (KM)	29.87	k star (KM)	17.16
nu hat (KM)	418.2	nu star (KM)	240.3
theta hat (KM)	1.8231E-4	theta star (KM)	3.1727E-4
80% gamma percentile (KM)	0.00651	90% gamma percentile (KM)	0.00718
95% gamma percentile (KM)	0.00777	99% gamma percentile (KM)	0.00896

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (240.30, α)	212.7	Adjusted Chi Square Value (240.30, β)	206.3
90% KM Approximate Gamma UCL	0.00615	90% KM Adjusted Gamma UCL	0.00634

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.816	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.792	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.295	Lilliefors GOF Test
10% Lilliefors Critical Value	0.346	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00485	Mean in Log Scale	-5.374
SD in Original Scale	0.00162	SD in Log Scale	0.322
90% t UCL (assumes normality of ROS data)	0.00573	90% Percentile Bootstrap UCL	0.00556
90% BCA Bootstrap UCL	0.0056	90% Bootstrap t UCL	0.00598
90% H-UCL (Log ROS)	0.00598		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.227	KM Geo Mean	0.00537
KM SD (logged)	0.162	90% Critical H Value (KM-Log)	1.417
KM Standard Error of Mean (logged)	0.0708	90% H-UCL (KM -Log)	0.00597
KM SD (logged)	0.162	90% Critical H Value (KM-Log)	1.417
KM Standard Error of Mean (logged)	0.0708		

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00444	Mean in Log Scale	-5.517
SD in Original Scale	0.00207	SD in Log Scale	0.49
90% t UCL (Assumes normality)	0.00557	90% H-Stat UCL	0.00637

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

TotalHPAHs

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.44	Mean	1.313
Maximum	2.66	Median	1.02
SD	0.911	Std. Error of Mean	0.344
Coefficient of Variation	0.694	Skewness	0.888

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.82		
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.307		
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	1.809	90% Adjusted-CLT UCL (Chen-1995)	1.837
		90% Modified-t UCL (Johnson-1978)	1.828

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.471		
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.238		
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	2.526	k star (bias corrected MLE)	1.539
Theta hat (MLE)	0.52	Theta star (bias corrected MLE)	0.853
nu hat (MLE)	35.37	nu star (bias corrected)	21.54
MLE Mean (bias corrected)	1.313	MLE Sd (bias corrected)	1.059
		Approximate Chi Square Value (0.1)	13.67
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	12.2

Assuming Gamma Distribution			
90% Approximate Gamma UCL	2.069	90% Adjusted Gamma UCL	2.319

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.895		
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.195		
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics			
Minimum of Logged Data	-0.821	Mean of logged Data	0.0617
Maximum of Logged Data	0.978	SD of logged Data	0.709

Assuming Lognormal Distribution			
90% H-UCL	2.428	90% Chebyshev (MVUE) UCL	2.374
95% Chebyshev (MVUE) UCL	2.855	97.5% Chebyshev (MVUE) UCL	3.523
99% Chebyshev (MVUE) UCL	4.835		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	1.754	90% BCA Bootstrap UCL	1.808
90% Standard Bootstrap UCL	1.725	90% Bootstrap-t UCL	2.634
90% Hall's Bootstrap UCL	6.334	90% Percentile Bootstrap UCL	1.737
90% Chebyshev(Mean, Sd) UCL	2.346	95% Chebyshev(Mean, Sd) UCL	2.814
97.5% Chebyshev(Mean, Sd) UCL	3.463	99% Chebyshev(Mean, Sd) UCL	4.738

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

cPAHs

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0711	Mean	0.218
Maximum	0.446	Median	0.165
SD	0.156	Std. Error of Mean	0.0588
Coefficient of Variation	0.713	Skewness	0.9

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.818		
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.291	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution		90% UCLs (Adjusted for Skewness)	
90% Normal UCL			
90% Student's-t UCL	0.303	90% Adjusted-CLT UCL (Chen-1995)	0.308
		90% Modified-t UCL (Johnson-1978)	0.306

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.449		
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.217	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	2.397	k star (bias corrected MLE)	1.465
Theta hat (MLE)	0.0911	Theta star (bias corrected MLE)	0.149

nu hat (MLE)	33.56	nu star (bias corrected)	20.51
MLE Mean (bias corrected)	0.218	MLE Sd (bias corrected)	0.18
		Approximate Chi Square Value (0.1)	12.85
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	11.42

Assuming Gamma Distribution

90% Approximate Gamma UCL	0.348	90% Adjusted Gamma UCL	0.392

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.176	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	-2.644	Mean of logged Data	-1.745
Maximum of Logged Data	-0.807	SD of logged Data	0.729

Assuming Lognormal Distribution

90% H-UCL	0.414	90% Chebyshev (MVUE) UCL	0.399
95% Chebyshev (MVUE) UCL	0.481	97.5% Chebyshev (MVUE) UCL	0.595
99% Chebyshev (MVUE) UCL	0.819		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.294	90% BCA Bootstrap UCL	0.302
90% Standard Bootstrap UCL	0.289	90% Bootstrap-t UCL	0.436
90% Hall's Bootstrap UCL	1.026	90% Percentile Bootstrap UCL	0.292
90% Chebyshev(Mean, Sd) UCL	0.395	95% Chebyshev(Mean, Sd) UCL	0.475
97.5% Chebyshev(Mean, Sd) UCL	0.586	99% Chebyshev(Mean, Sd) UCL	0.804

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

TotalPCBs

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.025	Mean	0.118
Maximum	0.427	Median	0.0567
SD	0.147	Std. Error of Mean	0.0556
Coefficient of Variation	1.249	Skewness	2.015

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.698	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.73	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.361	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.35	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	0.198	90% Adjusted-CLT UCL (Chen-1995)	0.219
		90% Modified-t UCL (Johnson-1978)	0.205

Gamma GOF Test		
A-D Test Statistic	0.644	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Gamma Statistics			
k hat (MLE)	1.087	k star (bias corrected MLE)	0.716
Theta hat (MLE)	0.108	Theta star (bias corrected MLE)	0.164
nu hat (MLE)	15.21	nu star (bias corrected)	10.03
MLE Mean (bias corrected)	0.118	MLE Sd (bias corrected)	0.139
		Approximate Chi Square Value (0.1)	4.885
Adjusted Level of Significance	0.0549	Adjusted Chi Square Value	4.067

Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.242	90% Adjusted Gamma UCL	0.29

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.255	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Lognormal Statistics			
Minimum of Logged Data	-3.688	Mean of logged Data	-2.665
Maximum of Logged Data	-0.851	SD of logged Data	1.036

Assuming Lognormal Distribution			
90% H-UCL	0.344	90% Chebyshev (MVUE) UCL	0.234
95% Chebyshev (MVUE) UCL	0.292	97.5% Chebyshev (MVUE) UCL	0.371
99% Chebyshev (MVUE) UCL	0.528		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	0.189	90% BCA Bootstrap UCL	0.224
90% Standard Bootstrap UCL	0.184	90% Bootstrap-t UCL	0.275
90% Hall's Bootstrap UCL	0.246	90% Percentile Bootstrap UCL	0.189
90% Chebyshev(Mean, Sd) UCL	0.285	95% Chebyshev(Mean, Sd) UCL	0.36
97.5% Chebyshev(Mean, Sd) UCL	0.465	99% Chebyshev(Mean, Sd) UCL	0.671

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:57:07 PM
 From File 90 UCL Input Data_MG_c.xls
 Full Precision OFF
 Confidence Coefficient 90%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	17	Number of Distinct Observations	14
Number of Detects	2	Number of Non-Detects	15
Number of Distinct Detects	2	Number of Distinct Non-Detects	12
Minimum Detect	0.603	Minimum Non-Detect	0.495
Maximum Detect	0.801	Maximum Non-Detect	0.565
Variance Detects	0.0196	Percent Non-Detects	88.24%
Mean Detects	0.702	SD Detects	0.14
Median Detects	0.702	CV Detects	0.199
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.364	SD of Logged Detects	0.201

Warning: Data set has only 2 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.519	KM Standard Error of Mean	0.0257
90KM SD	0.0748	95% KM (BCA) UCL	N/A
90% KM (t) UCL	0.554	90% KM (Percentile Bootstrap) UCL	N/A
90% KM (z) UCL	0.552	90% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.596	95% KM Chebyshev UCL	0.631
97.5% KM Chebyshev UCL	0.68	99% KM Chebyshev UCL	0.775

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	49.95	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0141	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	199.8	nu star (bias corrected)	N/A
Mean (detects)	0.702		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.519	SD (KM)	0.0748
Variance (KM)	0.0056	SE of Mean (KM)	0.0257
k hat (KM)	48.16	k star (KM)	39.7
nu hat (KM)	1637	nu star (KM)	1350
theta hat (KM)	0.0108	theta star (KM)	0.0131
80% gamma percentile (KM)	0.587	90% gamma percentile (KM)	0.627
95% gamma percentile (KM)	0.662	99% gamma percentile (KM)	0.73

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1284	Adjusted Level of Significance (β)	0.0823
90% KM Approximate Gamma UCL	0.546	Adjusted Chi Square Value (N/A, β)	1278
		90% KM Adjusted Gamma UCL	0.548

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.231	Mean in Log Scale	-1.631

SD in Original Scale	0.183	SD in Log Scale	0.517
90% t UCL (assumes normality of ROS data)	0.291	90% Percentile Bootstrap UCL	0.289
90% BCA Bootstrap UCL	0.306	90% Bootstrap t UCL	0.502
90% H-UCL (Log ROS)	0.273		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.663	KM Geo Mean	0.515
KM SD (logged)	0.12	90% Critical H Value (KM-Log)	1.329
KM Standard Error of Mean (logged)	0.0411	90% H-UCL (KM -Log)	0.54
KM SD (logged)	0.12	90% Critical H Value (KM-Log)	1.329
KM Standard Error of Mean (logged)	0.0411		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.315
SD in Original Scale	0.15
90% t UCL (Assumes normality)	0.364

DL/2 Log-Transformed

Mean in Log Scale	-1.219
SD in Log Scale	0.328
90% H-Stat UCL	0.35

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Arsenic

General Statistics

Total Number of Observations	17	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	3.07	Mean	5.637
Maximum	7.63	Median	5.41
SD	1.182	Std. Error of Mean	0.287
Coefficient of Variation	0.21	Skewness	-0.376

Normal GOF Test

Shapiro Wilk Test Statistic	0.967
1% Shapiro Wilk Critical Value	0.851
Lilliefors Test Statistic	0.138
1% Lilliefors Critical Value	0.241

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL

90% Student's-t UCL	6.02

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	5.986
90% Modified-t UCL (Johnson-1978)	6.016

Gamma GOF Test

A-D Test Statistic	0.362
5% A-D Critical Value	0.738
K-S Test Statistic	0.142
5% K-S Critical Value	0.209

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	21.81	k star (bias corrected MLE)	18
Theta hat (MLE)	0.259	Theta star (bias corrected MLE)	0.313
nu hat (MLE)	741.4	nu star (bias corrected)	611.9
MLE Mean (bias corrected)	5.637	MLE Sd (bias corrected)	1.329
		Approximate Chi Square Value (0.1)	567.5
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	563.9

Assuming Gamma Distribution

90% Approximate Gamma UCL	6.078	90% Adjusted Gamma UCL	6.117

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.132	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	1.122	Mean of logged Data	1.706
Maximum of Logged Data	2.032	SD of logged Data	0.229

Assuming Lognormal Distribution			
90% H-UCL	6.116	90% Chebyshev (MVUE) UCL	6.593
95% Chebyshev (MVUE) UCL	7.022	97.5% Chebyshev (MVUE) UCL	7.618
99% Chebyshev (MVUE) UCL	8.788		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	6.004	90% BCA Bootstrap UCL	6.011
90% Standard Bootstrap UCL	5.995	90% Bootstrap-t UCL	6.015
90% Hall's Bootstrap UCL	5.991	90% Percentile Bootstrap UCL	6.011
90% Chebyshev(Mean, Sd) UCL	6.497	95% Chebyshev(Mean, Sd) UCL	6.887
97.5% Chebyshev(Mean, Sd) UCL	7.427	99% Chebyshev(Mean, Sd) UCL	8.489

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Copper

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	21.6	Mean	61.07
Maximum	180	Median	34.6
SD	51.15	Std. Error of Mean	12.41
Coefficient of Variation	0.838	Skewness	1.52

Normal GOF Test		
Shapiro Wilk Test Statistic	0.744	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.293	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	77.65	90% Adjusted-CLT UCL (Chen-1995)	80.23
		90% Modified-t UCL (Johnson-1978)	78.42

Gamma GOF Test		
A-D Test Statistic	1.265	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.749	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.212	Data Not Gamma Distributed at 5% Significance Level
Data Not Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	2.059	k star (bias corrected MLE)	1.735
Theta hat (MLE)	29.66	Theta star (bias corrected MLE)	35.2
nu hat (MLE)	70	nu star (bias corrected)	58.98

MLE Mean (bias corrected)	61.07	MLE Sd (bias corrected)	46.37
		Approximate Chi Square Value (0.1)	45.56
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	44.58

Assuming Gamma Distribution

90% Approximate Gamma UCL	79.06	90% Adjusted Gamma UCL	80.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.86	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.216	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.073	Mean of logged Data	3.85
Maximum of Logged Data	5.193	SD of logged Data	0.703

Assuming Lognormal Distribution

90% H-UCL	80.68	90% Chebyshev (MVUE) UCL	91.21
95% Chebyshev (MVUE) UCL	105.7	97.5% Chebyshev (MVUE) UCL	125.9
99% Chebyshev (MVUE) UCL	165.5		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	76.97	90% BCA Bootstrap UCL	81.95
90% Standard Bootstrap UCL	76.89	90% Bootstrap-t UCL	83.54
90% Hall's Bootstrap UCL	77.76	90% Percentile Bootstrap UCL	78.25
90% Chebyshev(Mean, Sd) UCL	98.29	95% Chebyshev(Mean, Sd) UCL	115.1
97.5% Chebyshev(Mean, Sd) UCL	138.5	99% Chebyshev(Mean, Sd) UCL	184.5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Lead

General Statistics

Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	13.5	Mean	39.69
Maximum	118	Median	24.4
SD	30.42	Std. Error of Mean	7.378
Coefficient of Variation	0.766	Skewness	1.577

Normal GOF Test

Shapiro Wilk Test Statistic	0.793	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.235	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	49.56	90% Adjusted-CLT UCL (Chen-1995)	51.17
		90% Modified-t UCL (Johnson-1978)	50.03

Gamma GOF Test

A-D Test Statistic	0.731	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.211	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.211	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	2.393	k star (bias corrected MLE)	2.01
Theta hat (MLE)	16.58	Theta star (bias corrected MLE)	19.75
nu hat (MLE)	81.38	nu star (bias corrected)	68.35
MLE Mean (bias corrected)	39.69	MLE Sd (bias corrected)	28
		Approximate Chi Square Value (0.1)	53.86
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	52.79

Assuming Gamma Distribution			
90% Approximate Gamma UCL	50.37	90% Adjusted Gamma UCL	51.39

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.93	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.185	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	2.603	Mean of logged Data	3.458
Maximum of Logged Data	4.771	SD of logged Data	0.658

Assuming Lognormal Distribution			
90% H-UCL	51.59	90% Chebyshev (MVUE) UCL	58.47
95% Chebyshev (MVUE) UCL	67.35	97.5% Chebyshev (MVUE) UCL	79.69
99% Chebyshev (MVUE) UCL	103.9		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	49.15	90% BCA Bootstrap UCL	52.12
90% Standard Bootstrap UCL	49.14	90% Bootstrap-t UCL	53.59
90% Hall's Bootstrap UCL	51.14	90% Percentile Bootstrap UCL	49.62
90% Chebyshev(Mean, Sd) UCL	61.83	95% Chebyshev(Mean, Sd) UCL	71.85
97.5% Chebyshev(Mean, Sd) UCL	85.77	99% Chebyshev(Mean, Sd) UCL	113.1

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Mercury

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	15
Number of Detects	16	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.0455	Minimum Non-Detect	0.0438
Maximum Detect	0.141	Maximum Non-Detect	0.0438
Variance Detects	0.00123	Percent Non-Detects	5.882%
Mean Detects	0.093	SD Detects	0.0351
Median Detects	0.0787	CV Detects	0.377
Skewness Detects	0.288	Kurtosis Detects	-1.615
Mean of Logged Detects	-2.445	SD of Logged Detects	0.389

Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.874	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Detected Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.193	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Detected Data appear Normal at 1% Significance Level	
Detected Data appear Normal at 1% Significance Level			

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.0901	KM Standard Error of Mean	0.00875
90KM SD	0.0349	95% KM (BCA) UCL	0.101
90% KM (t) UCL	0.102	90% KM (Percentile Bootstrap) UCL	0.101
90% KM (z) UCL	0.101	90% KM Bootstrap t UCL	0.102

90% KM Chebyshev UCL 0.116
97.5% KM Chebyshev UCL 0.145

95% KM Chebyshev UCL 0.128
99% KM Chebyshev UCL 0.177

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic 0.682
5% A-D Critical Value 0.74
K-S Test Statistic 0.202
5% K-S Critical Value 0.215

Anderson-Darling GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov GOF

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE) 7.363
Theta hat (MLE) 0.0126
nu hat (MLE) 235.6
Mean (detects) 0.093

k star (bias corrected MLE) 6.024
Theta star (bias corrected MLE) 0.0154
nu star (bias corrected) 192.8

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0273	Mean	0.0891
Maximum	0.141	Median	0.076
SD	0.0375	CV	0.421
k hat (MLE)	5.422	k star (bias corrected MLE)	4.505
Theta hat (MLE)	0.0164	Theta star (bias corrected MLE)	0.0198
nu hat (MLE)	184.4	nu star (bias corrected)	153.2
Adjusted Level of Significance (β)	0.0823		
Approximate Chi Square Value (153.16, α)	131.2	Adjusted Chi Square Value (153.16, β)	129.5
90% Gamma Approximate UCL	0.104	90% Gamma Adjusted UCL	0.105
95% Gamma Approximate UCL	0.109	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0901	SD (KM)	0.0349
Variance (KM)	0.00122	SE of Mean (KM)	0.00875
k hat (KM)	6.653	k star (KM)	5.518
nu hat (KM)	226.2	nu star (KM)	187.6
theta hat (KM)	0.0135	theta star (KM)	0.0163
80% gamma percentile (KM)	0.12	90% gamma percentile (KM)	0.141
95% gamma percentile (KM)	0.161	99% gamma percentile (KM)	0.202

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (187.60, α)	163.2	Adjusted Chi Square Value (187.60, β)	161.3
90% KM Approximate Gamma UCL	0.104	90% KM Adjusted Gamma UCL	0.105

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic 0.906
10% Shapiro Wilk Critical Value 0.906
Lilliefors Test Statistic 0.196
10% Lilliefors Critical Value 0.196

Shapiro Wilk GOF Test

Detected Data appear Lognormal at 10% Significance Level

Lilliefors GOF Test

Detected Data Not Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0895	Mean in Log Scale	-2.5
SD in Original Scale	0.0369	SD in Log Scale	0.44
90% t UCL (assumes normality of ROS data)	0.101	90% Percentile Bootstrap UCL	0.101
90% BCA Bootstrap UCL	0.101	90% Bootstrap t UCL	0.102
90% H-UCL (Log ROS)	0.106		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.485	KM Geo Mean	0.0833
KM SD (logged)	0.399	90% Critical H Value (KM-Log)	1.455
KM Standard Error of Mean (logged)	0.1	90% H-UCL (KM -Log)	0.104
KM SD (logged)	0.399	90% Critical H Value (KM-Log)	1.455
KM Standard Error of Mean (logged)	0.1		

DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0888	Mean in Log Scale	-2.526
SD in Original Scale	0.0381	SD in Log Scale	0.503
90% t UCL (Assumes normality)	0.101	90% H-Stat UCL	0.11
DL/2 is not a recommended method, provided for comparisons and historical reasons			

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Nickel

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	14.7	Mean	20.79
Maximum	27.1	Median	19.7
SD	3.954	Std. Error of Mean	0.959
Coefficient of Variation	0.19	Skewness	0.0552

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.939		
1% Shapiro Wilk Critical Value	0.851	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.138	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	22.07	90% Adjusted-CLT UCL (Chen-1995)	22.03
		90% Modified-t UCL (Johnson-1978)	22.07

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.437		
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.149	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.209	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	28.87	k star (bias corrected MLE)	23.81
Theta hat (MLE)	0.72	Theta star (bias corrected MLE)	0.873
nu hat (MLE)	981.5	nu star (bias corrected)	809.6
MLE Mean (bias corrected)	20.79	MLE Sd (bias corrected)	4.26
		Approximate Chi Square Value (0.1)	758.5
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	754.4

Assuming Gamma Distribution			
90% Approximate Gamma UCL	22.19	90% Adjusted Gamma UCL	22.31

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.939		
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.144	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	2.688	Mean of logged Data	3.017
Maximum of Logged Data	3.3	SD of logged Data	0.194

Assuming Lognormal Distribution

90% H-UCL	22.23	90% Chebyshev (MVUE) UCL	23.74
95% Chebyshev (MVUE) UCL	25.07	97.5% Chebyshev (MVUE) UCL	26.92
99% Chebyshev (MVUE) UCL	30.56		

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

90% CLT UCL	22.02	90% BCA Bootstrap UCL	21.92
90% Standard Bootstrap UCL	21.97	90% Bootstrap-t UCL	22.07
90% Hall's Bootstrap UCL	21.99	90% Percentile Bootstrap UCL	21.89
90% Chebyshev(Mean, Sd) UCL	23.67	95% Chebyshev(Mean, Sd) UCL	24.97
97.5% Chebyshev(Mean, Sd) UCL	26.78	99% Chebyshev(Mean, Sd) UCL	30.33

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Zinc

General Statistics

Total Number of Observations	17	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	64.7	Mean	102.9
Maximum	179	Median	92.7
SD	30.85	Std. Error of Mean	7.482
Coefficient of Variation	0.3	Skewness	1.073

Normal GOF Test

Shapiro Wilk Test Statistic	0.912
1% Shapiro Wilk Critical Value	0.851
Lilliefors Test Statistic	0.159
1% Lilliefors Critical Value	0.241

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level**Assuming Normal Distribution****90% Normal UCL**

90% Student's-t UCL	112.9

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995)	113.9
90% Modified-t UCL (Johnson-1978)	113.2

Gamma GOF Test

A-D Test Statistic	0.358
5% A-D Critical Value	0.738
K-S Test Statistic	0.139
5% K-S Critical Value	0.209

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE)	13.13	k star (bias corrected MLE)	10.86
Theta hat (MLE)	7.833	Theta star (bias corrected MLE)	9.477
nu hat (MLE)	446.6	nu star (bias corrected)	369.1
MLE Mean (bias corrected)	102.9	MLE Sd (bias corrected)	31.23
		Approximate Chi Square Value (0.1)	334.7
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	332

Assuming Gamma Distribution

90% Approximate Gamma UCL	113.5

90% Adjusted Gamma UCL	114.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962
10% Shapiro Wilk Critical Value	0.91
Lilliefors Test Statistic	0.124
10% Lilliefors Critical Value	0.19

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.17	Mean of logged Data	4.595
Maximum of Logged Data	5.187	SD of logged Data	0.281

Assuming Lognormal Distribution

90% H-UCL	113.6	90% Chebyshev (MVUE) UCL	123.9
95% Chebyshev (MVUE) UCL	133.6	97.5% Chebyshev (MVUE) UCL	146.9
99% Chebyshev (MVUE) UCL	173.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	112.5	90% BCA Bootstrap UCL	113.7
90% Standard Bootstrap UCL	112.3	90% Bootstrap-t UCL	115.6
90% Hall's Bootstrap UCL	115.3	90% Percentile Bootstrap UCL	112.2
90% Chebyshev(Mean, Sd) UCL	125.3	95% Chebyshev(Mean, Sd) UCL	135.5
97.5% Chebyshev(Mean, Sd) UCL	149.6	99% Chebyshev(Mean, Sd) UCL	177.3

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dioxin/Furan**General Statistics**

Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	2.4179E-6	Mean	1.2000E-5
Maximum	2.6287E-5	Median	1.1445E-5
SD	6.6017E-6	Std. Error of Mean	1.6011E-6
Coefficient of Variation	N/A	Skewness	0.64

Normal GOF Test

Shapiro Wilk Test Statistic	0.954	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.158	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution**90% Normal UCL**

90% Student's-t UCL 1.4140E-5

90% UCLs (Adjusted for Skewness)

90% Adjusted-CLT UCL (Chen-1995) 1.4229E-5
 90% Modified-t UCL (Johnson-1978) 1.4181E-5

Gamma GOF Test

A-D Test Statistic	0.213	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.123	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.211	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.108	k star (bias corrected MLE)	2.598
Theta hat (MLE)	3.8614E-6	Theta star (bias corrected MLE)	4.6181E-6
nu hat (MLE)	105.7	nu star (bias corrected)	88.35
MLE Mean (bias corrected)	1.2000E-5	MLE Sd (bias corrected)	7.4442E-6
		Approximate Chi Square Value (0.1)	71.8
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	70.55

Assuming Gamma Distribution

90% Approximate Gamma UCL 1.4766E-5

90% Adjusted Gamma UCL 1.5026E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level

Lilliefors Test Statistic	0.161	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-12.93	Mean of logged Data	-11.5
Maximum of Logged Data	-10.55	SD of logged Data	0.646

Assuming Lognormal Distribution			
90% H-UCL	1.6219E-5	90% Chebyshev (MVUE) UCL	1.8389E-5
95% Chebyshev (MVUE) UCL	2.1146E-5	97.5% Chebyshev (MVUE) UCL	2.4972E-5
99% Chebyshev (MVUE) UCL	3.2489E-5		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
90% CLT UCL	1.4052E-5	90% BCA Bootstrap UCL	1.4293E-5
90% Standard Bootstrap UCL	1.4000E-5	90% Bootstrap-t UCL	1.4385E-5
90% Hall's Bootstrap UCL	1.4388E-5	90% Percentile Bootstrap UCL	1.4030E-5
90% Chebyshev(Mean, Sd) UCL	1.6803E-5	95% Chebyshev(Mean, Sd) UCL	1.8979E-5
97.5% Chebyshev(Mean, Sd) UCL	2.1999E-5	99% Chebyshev(Mean, Sd) UCL	2.7931E-5

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Dibenzofuran

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
Number of Detects	8	Number of Non-Detects	9
Number of Distinct Detects	8	Number of Distinct Non-Detects	9
Minimum Detect	0.00511	Minimum Non-Detect	0.0047
Maximum Detect	0.0334	Maximum Non-Detect	0.0051
Variance Detects	8.8489E-5	Percent Non-Detects	52.94%
Mean Detects	0.0107	SD Detects	0.00941
Median Detects	0.00788	CV Detects	0.879
Skewness Detects	2.56	Kurtosis Detects	6.844
Mean of Logged Detects	-4.745	SD of Logged Detects	0.612

Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.621	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.749	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.362	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.333	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.00752	KM Standard Error of Mean	0.00175
90KM SD	0.00674	95% KM (BCA) UCL	0.01
90% KM (t) UCL	0.00986	90% KM (Percentile Bootstrap) UCL	0.00977
90% KM (z) UCL	0.00976	90% KM Bootstrap t UCL	0.0152
90% KM Chebyshev UCL	0.0128	95% KM Chebyshev UCL	0.0151
97.5% KM Chebyshev UCL	0.0184	99% KM Chebyshev UCL	0.0249

Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.879	Anderson-Darling GOF Test	
5% A-D Critical Value	0.723	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.275	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only			
k hat (MLE)	2.56	k star (bias corrected MLE)	1.683
Theta hat (MLE)	0.00418	Theta star (bias corrected MLE)	0.00636

nu hat (MLE)	40.96	nu star (bias corrected)	26.93
Mean (detects)	0.0107		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00511	Mean	0.0103
Maximum	0.0334	Median	0.01
SD	0.00623	CV	0.603
k hat (MLE)	5.243	k star (bias corrected MLE)	4.357
Theta hat (MLE)	0.00197	Theta star (bias corrected MLE)	0.00237
nu hat (MLE)	178.3	nu star (bias corrected)	148.1
Adjusted Level of Significance (β)	0.0823		
Approximate Chi Square Value (148.14, α)	126.6	Adjusted Chi Square Value (148.14, β)	124.9
90% Gamma Approximate UCL	0.0121	90% Gamma Adjusted UCL	0.0123
95% Gamma Approximate UCL	0.0126	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00752	SD (KM)	0.00674
Variance (KM)	4.5402E-5	SE of Mean (KM)	0.00175
k hat (KM)	1.247	k star (KM)	1.066
nu hat (KM)	42.38	nu star (KM)	36.24
theta hat (KM)	0.00604	theta star (KM)	0.00706
80% gamma percentile (KM)	0.012	90% gamma percentile (KM)	0.0171
95% gamma percentile (KM)	0.022	99% gamma percentile (KM)	0.0336

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (36.24, α)	25.84	Adjusted Chi Square Value (36.24, β)	25.12
90% KM Approximate Gamma UCL	0.0105	90% KM Adjusted Gamma UCL	0.0109

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.817	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.851	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.225	Lilliefors GOF Test
10% Lilliefors Critical Value	0.265	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00587	Mean in Log Scale	-5.648
SD in Original Scale	0.00779	SD in Log Scale	0.966
90% t UCL (assumes normality of ROS data)	0.0084	90% Percentile Bootstrap UCL	0.00824
90% BCA Bootstrap UCL	0.00934	90% Bootstrap t UCL	0.0115
90% H-UCL (Log ROS)	0.00891		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.071	KM Geo Mean	0.00628
KM SD (logged)	0.498	90% Critical H Value (KM-Log)	1.515
KM Standard Error of Mean (logged)	0.129	90% H-UCL (KM -Log)	0.00858
KM SD (logged)	0.498	90% Critical H Value (KM-Log)	1.515
KM Standard Error of Mean (logged)	0.129		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00633
SD in Original Scale	0.00753
90% t UCL (Assumes normality)	0.00878

DL/2 Log-Transformed

Mean in Log Scale	-5.415
SD in Log Scale	0.767
90% H-Stat UCL	0.0083

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

TotalHPAHs

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	0.223	Mean	1.971
Maximum	11.9	Median	1.02
SD	2.788	Std. Error of Mean	0.676
Coefficient of Variation	1.415	Skewness	3.183
Normal GOF Test			
Shapiro Wilk Test Statistic	0.579	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.285	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.241	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	2.875	90% Adjusted-CLT UCL (Chen-1995)	3.21
		90% Modified-t UCL (Johnson-1978)	2.962
Gamma GOF Test			
A-D Test Statistic	0.799	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.764	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.214	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.077	k star (bias corrected MLE)	0.926
Theta hat (MLE)	1.829	Theta star (bias corrected MLE)	2.127
nu hat (MLE)	36.63	nu star (bias corrected)	31.5
MLE Mean (bias corrected)	1.971	MLE Sd (bias corrected)	2.048
		Approximate Chi Square Value (0.1)	21.85
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	21.19
Assuming Gamma Distribution			
90% Approximate Gamma UCL	2.841	90% Adjusted Gamma UCL	2.93
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.967	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.147	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-1.501	Mean of logged Data	0.147
Maximum of Logged Data	2.477	SD of logged Data	0.987
Assuming Lognormal Distribution			
90% H-UCL	3.039	90% Chebyshev (MVUE) UCL	3.249
95% Chebyshev (MVUE) UCL	3.9	97.5% Chebyshev (MVUE) UCL	4.803
99% Chebyshev (MVUE) UCL	6.576		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
90% CLT UCL	2.837	90% BCA Bootstrap UCL	3.333
90% Standard Bootstrap UCL	2.819	90% Bootstrap-t UCL	4.337
90% Hall's Bootstrap UCL	7.26	90% Percentile Bootstrap UCL	2.91

90% Chebyshev(Mean, Sd) UCL 4
97.5% Chebyshev(Mean, Sd) UCL 6.194

95% Chebyshev(Mean, Sd) UCL 4.919
99% Chebyshev(Mean, Sd) UCL 8.7

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

cPAHs

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	0.0319	Mean	0.306
Maximum	1.75	Median	0.165
SD	0.416	Std. Error of Mean	0.101
Coefficient of Variation	1.361	Skewness	2.964

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.616	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.851	Lilliefors GOF Test	
Lilliefors Test Statistic	0.282	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.241		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution			
90% Normal UCL		90% UCLs (Adjusted for Skewness)	
90% Student's-t UCL	0.441	90% Adjusted-CLT UCL (Chen-1995)	0.487
		90% Modified-t UCL (Johnson-1978)	0.453

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.67	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.765	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.198	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.215		

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	1.067	k star (bias corrected MLE)	0.918
Theta hat (MLE)	0.287	Theta star (bias corrected MLE)	0.333
nu hat (MLE)	36.28	nu star (bias corrected)	31.21
MLE Mean (bias corrected)	0.306	MLE Sd (bias corrected)	0.319
		Approximate Chi Square Value (0.1)	21.61
Adjusted Level of Significance	0.0823	Adjusted Chi Square Value	20.95

Assuming Gamma Distribution			
90% Approximate Gamma UCL	0.442	90% Adjusted Gamma UCL	0.456

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.979	Data appear Lognormal at 10% Significance Level	
10% Shapiro Wilk Critical Value	0.91	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.127	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.19		

Data appear Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-3.445	Mean of logged Data	-1.722
Maximum of Logged Data	0.56	SD of logged Data	1.01

Assuming Lognormal Distribution			
90% H-UCL	0.488	90% Chebyshev (MVUE) UCL	0.517
95% Chebyshev (MVUE) UCL	0.622	97.5% Chebyshev (MVUE) UCL	0.768

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

90% CLT UCL	0.435	90% BCA Bootstrap UCL	0.505
90% Standard Bootstrap UCL	0.432	90% Bootstrap-t UCL	0.62
90% Hall's Bootstrap UCL	1.087	90% Percentile Bootstrap UCL	0.445
90% Chebyshev(Mean, Sd) UCL	0.609	95% Chebyshev(Mean, Sd) UCL	0.746
97.5% Chebyshev(Mean, Sd) UCL	0.936	99% Chebyshev(Mean, Sd) UCL	1.31

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

TotalPCBs

General Statistics

Total Number of Observations	17	Number of Distinct Observations	17
Number of Detects	15	Number of Non-Detects	2
Number of Distinct Detects	15	Number of Distinct Non-Detects	2
Minimum Detect	0.0245	Minimum Non-Detect	0.00479
Maximum Detect	0.558	Maximum Non-Detect	0.00504
Variance Detects	0.0256	Percent Non-Detects	11.76%
Mean Detects	0.123	SD Detects	0.16
Median Detects	0.0502	CV Detects	1.3
Skewness Detects	2.102	Kurtosis Detects	3.751
Mean of Logged Detects	-2.656	SD of Logged Detects	1.009

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.656	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.835	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.314	Lilliefors GOF Test
1% Lilliefors Critical Value	0.255	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.109	KM Standard Error of Mean	0.0377
90KM SD	0.15	95% KM (BCA) UCL	0.153
90% KM (t) UCL	0.16	90% KM (Percentile Bootstrap) UCL	0.16
90% KM (z) UCL	0.157	90% KM Bootstrap t UCL	0.198
90% KM Chebyshev UCL	0.222	95% KM Chebyshev UCL	0.273
97.5% KM Chebyshev UCL	0.345	99% KM Chebyshev UCL	0.484

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.203	Anderson-Darling GOF Test
5% A-D Critical Value	0.763	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.228	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.025	k star (bias corrected MLE)	0.865
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.142
nu hat (MLE)	30.76	nu star (bias corrected)	25.94
Mean (detects)	0.123		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.11
Maximum	0.558	Median	0.0478
SD	0.154	CV	1.405
k hat (MLE)	0.868	k star (bias corrected MLE)	0.754
Theta hat (MLE)	0.126	Theta star (bias corrected MLE)	0.146
nu hat (MLE)	29.52	nu star (bias corrected)	25.65
Adjusted Level of Significance (β)	0.0823		
Approximate Chi Square Value (25.65, α)	17	Adjusted Chi Square Value (25.65, β)	16.42
90% Gamma Approximate UCL	0.166	90% Gamma Adjusted UCL	0.171
95% Gamma Approximate UCL	0.186	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.109	SD (KM)	0.15
Variance (KM)	0.0225	SE of Mean (KM)	0.0377
k hat (KM)	0.529	k star (KM)	0.475
nu hat (KM)	17.99	nu star (KM)	16.15
theta hat (KM)	0.206	theta star (KM)	0.23
80% gamma percentile (KM)	0.179	90% gamma percentile (KM)	0.299
95% gamma percentile (KM)	0.427	99% gamma percentile (KM)	0.745

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.15, α)	9.426	Adjusted Chi Square Value (16.15, β)	9.006
90% KM Approximate Gamma UCL	0.187	90% KM Adjusted Gamma UCL	0.196

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.873	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.901	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.212	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.202	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.109	Mean in Log Scale	-2.928
SD in Original Scale	0.155	SD in Log Scale	1.217
90% t UCL (assumes normality of ROS data)	0.16	90% Percentile Bootstrap UCL	0.157
90% BCA Bootstrap UCL	0.17	90% Bootstrap t UCL	0.207
90% H-UCL (Log ROS)	0.218		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.972	KM Geo Mean	0.0512
KM SD (logged)	1.26	90% Critical H Value (KM-Log)	2.228
KM Standard Error of Mean (logged)	0.316	90% H-UCL (KM -Log)	0.229
KM SD (logged)	1.26	90% Critical H Value (KM-Log)	2.228
KM Standard Error of Mean (logged)	0.316		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.109
SD in Original Scale	0.155
90% t UCL (Assumes normality)	0.159

DL/2 Log-Transformed

Mean in Log Scale	-3.05
SD in Log Scale	1.46
90% H-Stat UCL	0.338

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:47:34 PM
 From File 90 UCL Input Data_MG_a.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	54	Number of Distinct Observations	49
Number of Detects	30	Number of Non-Detects	24
Number of Distinct Detects	29	Number of Distinct Non-Detects	21
Minimum Detect	0.498	Minimum Non-Detect	0.492
Maximum Detect	7.38	Maximum Non-Detect	0.562
Variance Detects	2.412	Percent Non-Detects	44.44%
Mean Detects	1.824	SD Detects	1.553
Median Detects	1.24	CV Detects	0.851
Skewness Detects	1.964	Kurtosis Detects	4.665
Mean of Logged Detects	0.319	SD of Logged Detects	0.744

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.784	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.9	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.205	Lilliefors GOF Test
1% Lilliefors Critical Value	0.185	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.233	KM Standard Error of Mean	0.182
90KM SD	1.316	95% KM (BCA) UCL	1.577
95% KM (t) UCL	1.538	95% KM (Percentile Bootstrap) UCL	1.557
95% KM (z) UCL	1.533	95% KM Bootstrap t UCL	1.649
90% KM Chebyshev UCL	1.779	95% KM Chebyshev UCL	2.027
97.5% KM Chebyshev UCL	2.37	99% KM Chebyshev UCL	3.045

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.823	Anderson-Darling GOF Test
5% A-D Critical Value	0.759	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.158	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.162	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.923	k star (bias corrected MLE)	1.753
Theta hat (MLE)	0.949	Theta star (bias corrected MLE)	1.041
nu hat (MLE)	115.4	nu star (bias corrected)	105.2
Mean (detects)	1.824		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.018
Maximum	7.38	Median	0.53
SD	1.465	CV	1.44
k hat (MLE)	0.355	k star (bias corrected MLE)	0.348
Theta hat (MLE)	2.863	Theta star (bias corrected MLE)	2.924
nu hat (MLE)	38.39	nu star (bias corrected)	37.59
Adjusted Level of Significance (β)	0.0456		
Approximate Chi Square Value (37.59, α)	24.55	Adjusted Chi Square Value (37.59, β)	24.26
95% Gamma Approximate UCL	1.558	95% Gamma Adjusted UCL	1.577

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.233	SD (KM)	1.316
Variance (KM)	1.731	SE of Mean (KM)	0.182
k hat (KM)	0.878	k star (KM)	0.842
nu hat (KM)	94.82	nu star (KM)	90.88
theta hat (KM)	1.404	theta star (KM)	1.465
80% gamma percentile (KM)	2.009	90% gamma percentile (KM)	2.961
95% gamma percentile (KM)	3.928	99% gamma percentile (KM)	6.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (90.88, α)	69.9	Adjusted Chi Square Value (90.88, β)	69.4
95% KM Approximate Gamma UCL	1.603	95% KM Adjusted Gamma UCL	1.615

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.943	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.939	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.123	Lilliefors GOF Test
10% Lilliefors Critical Value	0.146	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.117	Mean in Log Scale	-0.479
SD in Original Scale	1.399	SD in Log Scale	1.063
95% t UCL (assumes normality of ROS data)	1.435	95% Percentile Bootstrap UCL	1.455
95% BCA Bootstrap UCL	1.499	95% Bootstrap t UCL	1.53
95% H-UCL (Log ROS)	1.548		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.136	KM Geo Mean	0.873
KM SD (logged)	0.745	95% Critical H Value (KM-Log)	2.07
KM Standard Error of Mean (logged)	0.103	95% H-UCL (KM -Log)	1.425
KM SD (logged)	0.745	95% Critical H Value (KM-Log)	2.07
KM Standard Error of Mean (logged)	0.103		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	1.128
SD in Original Scale	1.391
95% t UCL (Assumes normality)	1.445

DL/2 Log-Transformed

Mean in Log Scale	-0.424
SD in Log Scale	1.003
95% H-Stat UCL	1.491

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	1.603	95% GROS Approximate Gamma UCL	1.558

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	54	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	2.84	Mean	5.333
Maximum	11.6	Median	4.69
SD	2.106	Std. Error of Mean	0.287
Coefficient of Variation	0.395	Skewness	1.62

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.817	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	1.1043E-8	Lilliefors GOF Test	
Lilliefors Test Statistic	0.173	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	5.812	95% Adjusted-CLT UCL (Chen-1995)	5.872
		95% Modified-t UCL (Johnson-1978)	5.823

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	1.592	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.751	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.13	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.121	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	8.224	k star (bias corrected MLE)	7.78
Theta hat (MLE)	0.648	Theta star (bias corrected MLE)	0.685
nu hat (MLE)	888.2	nu star (bias corrected)	840.2
MLE Mean (bias corrected)	5.333	MLE Sd (bias corrected)	1.912
		Approximate Chi Square Value (0.05)	774
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	772.2

Assuming Gamma Distribution			
95% Approximate Gamma UCL	5.789	95% Adjusted Gamma UCL	5.802

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.93	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.00449	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.107	Data appear Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level	

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	1.044	Mean of logged Data	1.612
Maximum of Logged Data	2.451	SD of logged Data	0.34

Assuming Lognormal Distribution			
95% H-UCL	5.76	90% Chebyshev (MVUE) UCL	6.06
95% Chebyshev (MVUE) UCL	6.402	97.5% Chebyshev (MVUE) UCL	6.876
99% Chebyshev (MVUE) UCL	7.809		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	5.804	95% BCA Bootstrap UCL	5.883
95% Standard Bootstrap UCL	5.802	95% Bootstrap-t UCL	5.926
95% Hall's Bootstrap UCL	5.905	95% Percentile Bootstrap UCL	5.829
90% Chebyshev(Mean, Sd) UCL	6.192	95% Chebyshev(Mean, Sd) UCL	6.582
97.5% Chebyshev(Mean, Sd) UCL	7.122	99% Chebyshev(Mean, Sd) UCL	8.184

Suggested UCL to Use	
95% H-UCL	5.76

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	42
		Number of Missing Observations	0
Minimum	10.9	Mean	16.23
Maximum	26.6	Median	15.15
SD	3.843	Std. Error of Mean	0.523
Coefficient of Variation	0.237	Skewness	0.67

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.929	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	0.00419	Lilliefors GOF Test	
Lilliefors Test Statistic	0.158	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.139		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	17.11	95% Adjusted-CLT UCL (Chen-1995)	17.14
		95% Modified-t UCL (Johnson-1978)	17.11

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.783	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.749	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.131	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.121		

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	19.17	k star (bias corrected MLE)	18.12
Theta hat (MLE)	0.847	Theta star (bias corrected MLE)	0.896
nu hat (MLE)	2070	nu star (bias corrected)	1957
MLE Mean (bias corrected)	16.23	MLE Sd (bias corrected)	3.813
		Approximate Chi Square Value (0.05)	1855
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	1852

Assuming Gamma Distribution			
95% Approximate Gamma UCL	17.12	95% Adjusted Gamma UCL	17.14

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.952	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.0583	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.116	Data Not Lognormal at 10% Significance Level	
10% Lilliefors Critical Value	0.11		

Data Not Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	2.389	Mean of logged Data	2.761
Maximum of Logged Data	3.281	SD of logged Data	0.229

Assuming Lognormal Distribution			
95% H-UCL	17.13	90% Chebyshev (MVUE) UCL	17.76
95% Chebyshev (MVUE) UCL	18.45	97.5% Chebyshev (MVUE) UCL	19.42
99% Chebyshev (MVUE) UCL	21.32		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	17.09	95% BCA Bootstrap UCL	17.15
95% Standard Bootstrap UCL	17.08	95% Bootstrap-t UCL	17.19
95% Hall's Bootstrap UCL	17.15	95% Percentile Bootstrap UCL	17.1
90% Chebyshev(Mean, Sd) UCL	17.8	95% Chebyshev(Mean, Sd) UCL	18.51
97.5% Chebyshev(Mean, Sd) UCL	19.5	99% Chebyshev(Mean, Sd) UCL	21.43

Suggested UCL to Use

95% Student's-t UCL	17.11

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	54
		Number of Missing Observations	0
Minimum	17.6	Mean	66.08
Maximum	226	Median	53.5
SD	44	Std. Error of Mean	5.988
Coefficient of Variation	0.666	Skewness	1.615
Normal GOF Test			
Shapiro Wilk Test Statistic	0.837	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	9.7972E-8	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.204	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	76.11	95% Adjusted-CLT UCL (Chen-1995)	77.34
		95% Modified-t UCL (Johnson-1978)	76.33
Gamma GOF Test			
A-D Test Statistic	0.979	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.135	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.122	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	2.914	k star (bias corrected MLE)	2.764
Theta hat (MLE)	22.68	Theta star (bias corrected MLE)	23.91
nu hat (MLE)	314.7	nu star (bias corrected)	298.5
MLE Mean (bias corrected)	66.08	MLE Sd (bias corrected)	39.75
		Approximate Chi Square Value (0.05)	259.5
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	258.5
Assuming Gamma Distribution			
95% Approximate Gamma UCL	76.02	95% Adjusted Gamma UCL	76.31
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.97	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.338	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0924	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.868	Mean of logged Data	4.01
Maximum of Logged Data	5.421	SD of logged Data	0.593
Assuming Lognormal Distribution			
95% H-UCL	76.99	90% Chebyshev (MVUE) UCL	82.42
95% Chebyshev (MVUE) UCL	90.1	97.5% Chebyshev (MVUE) UCL	100.8
99% Chebyshev (MVUE) UCL	121.7		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	75.93	95% BCA Bootstrap UCL	77.09
95% Standard Bootstrap UCL	75.83	95% Bootstrap-t UCL	78.17
95% Hall's Bootstrap UCL	77.97	95% Percentile Bootstrap UCL	76.51
90% Chebyshev(Mean, Sd) UCL	84.05	95% Chebyshev(Mean, Sd) UCL	92.18
97.5% Chebyshev(Mean, Sd) UCL	103.5	99% Chebyshev(Mean, Sd) UCL	125.7

Suggested UCL to Use

95% H-UCL	76.99

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	51
		Number of Missing Observations	0
Minimum	13.8	Mean	115.1
Maximum	330	Median	81.8
SD	83.57	Std. Error of Mean	11.37
Coefficient of Variation	0.726	Skewness	1.011

Normal GOF Test

Shapiro Wilk Test Statistic	0.879
1% Shapiro Wilk P Value	1.0460E-5
Lilliefors Test Statistic	0.182
1% Lilliefors Critical Value	0.139

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	134.2

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	135.5
95% Modified-t UCL (Johnson-1978)	134.4

Gamma GOF Test

A-D Test Statistic	0.423
5% A-D Critical Value	0.764
K-S Test Statistic	0.0959
5% K-S Critical Value	0.123

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.93	k star (bias corrected MLE)	1.835
Theta hat (MLE)	59.65	Theta star (bias corrected MLE)	62.74
nu hat (MLE)	208.5	nu star (bias corrected)	198.2
MLE Mean (bias corrected)	115.1	MLE Sd (bias corrected)	84.99
		Approximate Chi Square Value (0.05)	166.6
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	165.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	136.9	95% Adjusted Gamma UCL	137.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958
10% Shapiro Wilk P Value	0.103
Lilliefors Test Statistic	0.0842
10% Lilliefors Critical Value	0.11

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.625	Mean of logged Data	4.465
Maximum of Logged Data	5.799	SD of logged Data	0.802

Assuming Lognormal Distribution

95% H-UCL	151.6
95% Chebyshev (MVUE) UCL	182.6
99% Chebyshev (MVUE) UCL	264.2

90% Chebyshev (MVUE) UCL	162.8
97.5% Chebyshev (MVUE) UCL	210.2

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	133.8	95% BCA Bootstrap UCL	136.5
95% Standard Bootstrap UCL	134.1	95% Bootstrap-t UCL	135.9
95% Hall's Bootstrap UCL	135	95% Percentile Bootstrap UCL	135.2
90% Chebyshev(Mean, Sd) UCL	149.3	95% Chebyshev(Mean, Sd) UCL	164.7
97.5% Chebyshev(Mean, Sd) UCL	186.2	99% Chebyshev(Mean, Sd) UCL	228.3

Suggested UCL to Use

95% Approximate Gamma UCL	136.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	54	Number of Distinct Observations	53
		Number of Missing Observations	0
Minimum	0.0928	Mean	0.788
Maximum	5.12	Median	0.603
SD	0.854	Std. Error of Mean	0.116
Coefficient of Variation	1.084	Skewness	3.081

Normal GOF Test

Shapiro Wilk Test Statistic	0.701
1% Shapiro Wilk P Value	1.017E-13
Lilliefors Test Statistic	0.222
1% Lilliefors Critical Value	0.139

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	0.983

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	1.032
95% Modified-t UCL (Johnson-1978)	0.991

Gamma GOF Test

A-D Test Statistic	0.595
5% A-D Critical Value	0.771
K-S Test Statistic	0.105
5% K-S Critical Value	0.124

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.36	k star (bias corrected MLE)	1.297
Theta hat (MLE)	0.58	Theta star (bias corrected MLE)	0.608
nu hat (MLE)	146.9	nu star (bias corrected)	140
MLE Mean (bias corrected)	0.788	MLE Sd (bias corrected)	0.692
		Approximate Chi Square Value (0.05)	113.7
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	113

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.971

95% Adjusted Gamma UCL	0.976

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976
10% Shapiro Wilk P Value	0.557
Lilliefors Test Statistic	0.0922

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

10% Lilliefors Critical Value 0.11 Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.377	Mean of logged Data	-0.649
Maximum of Logged Data	1.633	SD of logged Data	0.917

Assuming Lognormal Distribution

95% H-UCL	1.054	90% Chebyshev (MVUE) UCL	1.127
95% Chebyshev (MVUE) UCL	1.281	97.5% Chebyshev (MVUE) UCL	1.495
99% Chebyshev (MVUE) UCL	1.915		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.979	95% BCA Bootstrap UCL	1.035
95% Standard Bootstrap UCL	0.976	95% Bootstrap-t UCL	1.08
95% Hall's Bootstrap UCL	1.203	95% Percentile Bootstrap UCL	0.986
90% Chebyshev(Mean, Sd) UCL	1.137	95% Chebyshev(Mean, Sd) UCL	1.295
97.5% Chebyshev(Mean, Sd) UCL	1.514	99% Chebyshev(Mean, Sd) UCL	1.945

Suggested UCL to Use

95% Approximate Gamma UCL	0.971

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations	54	Number of Distinct Observations	47
		Number of Missing Observations	0
Minimum	14.6	Mean	20.98
Maximum	29.9	Median	20.55
SD	3.714	Std. Error of Mean	0.505
Coefficient of Variation	0.177	Skewness	0.692

Normal GOF Test

Shapiro Wilk Test Statistic	0.941
1% Shapiro Wilk P Value	0.0158
Lilliefors Test Statistic	0.086
1% Lilliefors Critical Value	0.139

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	21.83

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	21.87
95% Modified-t UCL (Johnson-1978)	21.84

Gamma GOF Test

A-D Test Statistic	0.496
5% A-D Critical Value	0.748
K-S Test Statistic	0.0715
5% K-S Critical Value	0.121

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	34.04	k star (bias corrected MLE)	32.16

Theta hat (MLE)	0.616	Theta star (bias corrected MLE)	0.652
nu hat (MLE)	3677	nu star (bias corrected)	3474
MLE Mean (bias corrected)	20.98	MLE Sd (bias corrected)	3.7
		Approximate Chi Square Value (0.05)	3338
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	3334

Assuming Gamma Distribution

95% Approximate Gamma UCL	21.84	95% Adjusted Gamma UCL	21.86

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.283	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0629	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.681	Mean of logged Data	3.029
Maximum of Logged Data	3.398	SD of logged Data	0.172

Assuming Lognormal Distribution

95% H-UCL	21.85	90% Chebyshev (MVUE) UCL	22.46
95% Chebyshev (MVUE) UCL	23.13	97.5% Chebyshev (MVUE) UCL	24.07
99% Chebyshev (MVUE) UCL	25.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	21.81	95% BCA Bootstrap UCL	21.87
95% Standard Bootstrap UCL	21.81	95% Bootstrap-t UCL	21.94
95% Hall's Bootstrap UCL	21.93	95% Percentile Bootstrap UCL	21.79
90% Chebyshev(Mean, Sd) UCL	22.5	95% Chebyshev(Mean, Sd) UCL	23.19
97.5% Chebyshev(Mean, Sd) UCL	24.14	99% Chebyshev(Mean, Sd) UCL	26.01

Suggested UCL to Use

95% Student's-t UCL	21.83

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	54	Number of Distinct Observations	45
		Number of Missing Observations	0
Minimum	58.4	Mean	142.3
Maximum	371	Median	126.5
SD	57.81	Std. Error of Mean	7.867
Coefficient of Variation	0.406	Skewness	1.449

Normal GOF Test

Shapiro Wilk Test Statistic	0.9	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	1.3240E-4	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.153	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	155.5	95% Adjusted-CLT UCL (Chen-1995)	156.9
		95% Modified-t UCL (Johnson-1978)	155.7

Gamma GOF Test

A-D Test Statistic	0.51	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.116	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.121	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	7.15	k star (bias corrected MLE)	6.765
Theta hat (MLE)	19.9	Theta star (bias corrected MLE)	21.04
nu hat (MLE)	772.2	nu star (bias corrected)	730.6
MLE Mean (bias corrected)	142.3	MLE Sd (bias corrected)	54.72
		Approximate Chi Square Value (0.05)	668.9
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	667.3

Assuming Gamma Distribution			
95% Approximate Gamma UCL	155.4	95% Adjusted Gamma UCL	155.8

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.986	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.895	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0921	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.11	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	4.067	Mean of logged Data	4.886
Maximum of Logged Data	5.916	SD of logged Data	0.376

Assuming Lognormal Distribution			
95% H-UCL	155.9	90% Chebyshev (MVUE) UCL	164.4
95% Chebyshev (MVUE) UCL	174.6	97.5% Chebyshev (MVUE) UCL	188.7
99% Chebyshev (MVUE) UCL	216.4		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	155.3	95% BCA Bootstrap UCL	157.3
95% Standard Bootstrap UCL	155.2	95% Bootstrap-t UCL	157.2
95% Hall's Bootstrap UCL	157.7	95% Percentile Bootstrap UCL	155.7
90% Chebyshev(Mean, Sd) UCL	165.9	95% Chebyshev(Mean, Sd) UCL	176.6
97.5% Chebyshev(Mean, Sd) UCL	191.4	99% Chebyshev(Mean, Sd) UCL	220.6

Suggested UCL to Use	
95% Approximate Gamma UCL	155.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	54
		Number of Missing Observations	0
Minimum	1.9365E-6	Mean	4.7754E-5
Maximum	3.9633E-4	Median	2.1080E-5
SD	7.6020E-5	Std. Error of Mean	1.0345E-5
Coefficient of Variation	N/A	Skewness	2.928

Normal GOF Test			
Shapiro Wilk Test Statistic	0.612	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.282	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level**Assuming Normal Distribution****95% Normal UCL**

95% Student's-t UCL 6.5073E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 6.9174E-5

95% Modified-t UCL (Johnson-1978) 6.5760E-5

Gamma GOF Test

A-D Test Statistic 1.646
 5% A-D Critical Value 0.797
 K-S Test Statistic 0.127
 5% K-S Critical Value 0.126

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE) 0.706
 Theta hat (MLE) 6.7603E-5
 nu hat (MLE) 76.29
 MLE Mean (bias corrected) 4.7754E-5
 Adjusted Level of Significance 0.0456

k star (bias corrected MLE) 0.679
 Theta star (bias corrected MLE) 7.0279E-5
 nu star (bias corrected) 73.39
 MLE Sd (bias corrected) 5.7932E-5
 Approximate Chi Square Value (0.05) 54.66
 Adjusted Chi Square Value 54.22

Assuming Gamma Distribution

95% Approximate Gamma UCL 6.4116E-5

95% Adjusted Gamma UCL 6.4640E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.968
 10% Shapiro Wilk P Value 0.294
 Lilliefors Test Statistic 0.0706
 10% Lilliefors Critical Value 0.11

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data -13.15
 Maximum of Logged Data -7.833

Mean of logged Data -10.8
 SD of logged Data 1.304

Assuming Lognormal Distribution

95% H-UCL 7.7767E-5
 95% Chebyshev (MVUE) UCL 9.1876E-5
 99% Chebyshev (MVUE) UCL 1.5038E-4

90% Chebyshev (MVUE) UCL 7.7657E-5
 97.5% Chebyshev (MVUE) UCL 1.1161E-4

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

95% CLT UCL 6.4770E-5
 95% Standard Bootstrap UCL 6.4637E-5
 95% Hall's Bootstrap UCL 7.0724E-5
 90% Chebyshev(Mean, Sd) UCL 7.8789E-5
 97.5% Chebyshev(Mean, Sd) UCL 1.1236E-4

95% BCA Bootstrap UCL 7.0600E-5
 95% Bootstrap-t UCL 7.2258E-5
 95% Percentile Bootstrap UCL 6.5957E-5
 95% Chebyshev(Mean, Sd) UCL 9.2847E-5
 99% Chebyshev(Mean, Sd) UCL 1.5069E-4

Suggested UCL to Use

95% H-UCL 7.7767E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran**General Statistics**

Total Number of Observations 54
 Number of Detects 27
 Number of Distinct Detects 27
 Minimum Detect 0.0052
 Maximum Detect 0.112

Number of Distinct Observations 44
 Number of Non-Detects 27
 Number of Distinct Non-Detects 17
 Minimum Non-Detect 0.00473
 Maximum Non-Detect 0.00507

Variance Detects	7.6848E-4	Percent Non-Detects	50%
Mean Detects	0.0262	SD Detects	0.0277
Median Detects	0.0155	CV Detects	1.059
Skewness Detects	1.804	Kurtosis Detects	2.735
Mean of Logged Detects	-4.079	SD of Logged Detects	0.919

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.741	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.894	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.3	Lilliefors GOF Test
1% Lilliefors Critical Value	0.194	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0155	KM Standard Error of Mean	0.00305
90KM SD	0.022	95% KM (BCA) UCL	0.0207
95% KM (t) UCL	0.0206	95% KM (Percentile Bootstrap) UCL	0.0206
95% KM (z) UCL	0.0205	95% KM Bootstrap t UCL	0.0228
90% KM Chebyshev UCL	0.0246	95% KM Chebyshev UCL	0.0288
97.5% KM Chebyshev UCL	0.0345	99% KM Chebyshev UCL	0.0458

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.146	Anderson-Darling GOF Test
5% A-D Critical Value	0.767	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.172	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.287	k star (bias corrected MLE)	1.169
Theta hat (MLE)	0.0203	Theta star (bias corrected MLE)	0.0224
nu hat (MLE)	69.51	nu star (bias corrected)	63.12
Mean (detects)	0.0262		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0052	Mean	0.0181
Maximum	0.112	Median	0.01
SD	0.0211	CV	1.164
k hat (MLE)	1.664	k star (bias corrected MLE)	1.584
Theta hat (MLE)	0.0109	Theta star (bias corrected MLE)	0.0114
nu hat (MLE)	179.7	nu star (bias corrected)	171
Adjusted Level of Significance (β)	0.0456		
Approximate Chi Square Value (171.04, α)	141.8	Adjusted Chi Square Value (171.04, β)	141.1
95% Gamma Approximate UCL	0.0218	95% Gamma Adjusted UCL	0.0219

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0155	SD (KM)	0.022
Variance (KM)	4.8498E-4	SE of Mean (KM)	0.00305
k hat (KM)	0.492	k star (KM)	0.477
nu hat (KM)	53.17	nu star (KM)	51.55
theta hat (KM)	0.0314	theta star (KM)	0.0324
80% gamma percentile (KM)	0.0253	90% gamma percentile (KM)	0.0422
95% gamma percentile (KM)	0.0603	99% gamma percentile (KM)	0.105

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (51.55, α)	36.06	Adjusted Chi Square Value (51.55, β)	35.71
95% KM Approximate Gamma UCL	0.0221	95% KM Adjusted Gamma UCL	0.0223

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.935	Detected Data Not Lognormal at 10% Significance Level

Lilliefors Test Statistic	0.147	Lilliefors GOF Test
10% Lilliefors Critical Value	0.153	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.0139	Mean in Log Scale	-5.293
SD in Original Scale	0.023	SD in Log Scale	1.414
95% t UCL (assumes normality of ROS data)	0.0191	95% Percentile Bootstrap UCL	0.0194
95% BCA Bootstrap UCL	0.0202	95% Bootstrap t UCL	0.0208
95% H-UCL (Log ROS)	0.0239		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-4.717	KM Geo Mean	0.00895
KM SD (logged)	0.902	95% Critical H Value (KM-Log)	2.216
KM Standard Error of Mean (logged)	0.125	95% H-UCL (KM -Log)	0.0177
KM SD (logged)	0.902	95% Critical H Value (KM-Log)	2.216
KM Standard Error of Mean (logged)	0.125		

DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0143	Mean in Log Scale	-5.039
SD in Original Scale	0.0228	SD in Log Scale	1.164
95% t UCL (Assumes normality)	0.0195	95% H-Stat UCL	0.0191

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use
 KM H-UCL 0.0177

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
 Please verify the data were collected from random locations.
 If the data were collected using judgmental or other non-random methods,
 then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
 Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
 However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics			
Total Number of Observations	54	Number of Distinct Observations	54
		Number of Missing Observations	0
Minimum	0.0881	Mean	3.911
Maximum	31.3	Median	0.927
SD	8.025	Std. Error of Mean	1.092
Coefficient of Variation	2.052	Skewness	2.733

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.488	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	0	Lilliefors GOF Test	
Lilliefors Test Statistic	0.386	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.139		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution		95% UCLs (Adjusted for Skewness)	
95% Normal UCL		95% Adjusted-CLT UCL (Chen-1995)	6.141
95% Student's-t UCL	5.739	95% Modified-t UCL (Johnson-1978)	5.807

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	4.335	Data Not Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.814		

K-S Test Statistic	0.22	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.128	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	0.508	k star (bias corrected MLE)	0.492
Theta hat (MLE)	7.706	Theta star (bias corrected MLE)	7.954
nu hat (MLE)	54.82	nu star (bias corrected)	53.11
MLE Mean (bias corrected)	3.911	MLE Sd (bias corrected)	5.578
		Approximate Chi Square Value (0.05)	37.36
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	37

Assuming Gamma Distribution

95% Approximate Gamma UCL	5.559	95% Adjusted Gamma UCL	5.613

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	0.00578	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.111	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.11	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.429	Mean of logged Data	0.115
Maximum of Logged Data	3.444	SD of logged Data	1.468

Assuming Lognormal Distribution

95% H-UCL	5.968	90% Chebyshev (MVUE) UCL	5.684
95% Chebyshev (MVUE) UCL	6.824	97.5% Chebyshev (MVUE) UCL	8.406
99% Chebyshev (MVUE) UCL	11.51		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	5.707	95% BCA Bootstrap UCL	6.349
95% Standard Bootstrap UCL	5.732	95% Bootstrap-t UCL	6.648
95% Hall's Bootstrap UCL	5.72	95% Percentile Bootstrap UCL	5.804
90% Chebyshev(Mean, Sd) UCL	7.187	95% Chebyshev(Mean, Sd) UCL	8.671
97.5% Chebyshev(Mean, Sd) UCL	10.73	99% Chebyshev(Mean, Sd) UCL	14.78

Suggested UCL to Use

95% Student's-t UCL	5.739

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs

General Statistics

Total Number of Observations	54	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	0.0132	Mean	0.638
Maximum	5.4	Median	0.138
SD	1.373	Std. Error of Mean	0.187
Coefficient of Variation	2.153	Skewness	2.795

Normal GOF Test

Shapiro Wilk Test Statistic	0.472

Shapiro Wilk GOF Test

1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.393	Lilliefors GOF Test
1% Lilliefors Critical Value	0.139	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.951	95% Adjusted-CLT UCL (Chen-1995)	1.021
		95% Modified-t UCL (Johnson-1978)	0.962

Gamma GOF Test

A-D Test Statistic	4.798	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.821	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.128	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.476	k star (bias corrected MLE)	0.462
Theta hat (MLE)	1.341	Theta star (bias corrected MLE)	1.382
nu hat (MLE)	51.37	nu star (bias corrected)	49.85
MLE Mean (bias corrected)	0.638	MLE Sd (bias corrected)	0.939
		Approximate Chi Square Value (0.05)	34.64
Adjusted Level of Significance	0.0456	Adjusted Chi Square Value	34.29

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.918	95% Adjusted Gamma UCL	0.927

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	0.00226	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.121	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.11	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.328	Mean of logged Data	-1.796
Maximum of Logged Data	1.686	SD of logged Data	1.505

Assuming Lognormal Distribution

95% H-UCL	0.955	90% Chebyshev (MVUE) UCL	0.899
95% Chebyshev (MVUE) UCL	1.083	97.5% Chebyshev (MVUE) UCL	1.338
99% Chebyshev (MVUE) UCL	1.838		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.945	95% BCA Bootstrap UCL	1.056
95% Standard Bootstrap UCL	0.949	95% Bootstrap-t UCL	1.113
95% Hall's Bootstrap UCL	0.941	95% Percentile Bootstrap UCL	0.964
90% Chebyshev(Mean, Sd) UCL	1.198	95% Chebyshev(Mean, Sd) UCL	1.452
97.5% Chebyshev(Mean, Sd) UCL	1.805	99% Chebyshev(Mean, Sd) UCL	2.497

Suggested UCL to Use

95% Student's-t UCL	0.951

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	54	Number of Distinct Observations	46
Number of Detects	32	Number of Non-Detects	22
Number of Distinct Detects	32	Number of Distinct Non-Detects	14
Minimum Detect	0.0257	Minimum Non-Detect	0.00477
Maximum Detect	0.189	Maximum Non-Detect	0.00506
Variance Detects	0.00176	Percent Non-Detects	40.74%
Mean Detects	0.0525	SD Detects	0.0419
Median Detects	0.0367	CV Detects	0.798
Skewness Detects	2.543	Kurtosis Detects	5.939
Mean of Logged Detects	-3.127	SD of Logged Detects	0.541

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.612	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.904	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.261	Lilliefors GOF Test
1% Lilliefors Critical Value	0.18	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

KM Mean	0.0331	KM Standard Error of Mean	0.00546
90KM SD	0.0395	95% KM (BCA) UCL	0.0432
95% KM (t) UCL	0.0422	95% KM (Percentile Bootstrap) UCL	0.0426
95% KM (z) UCL	0.0421	95% KM Bootstrap t UCL	0.0457
90% KM Chebyshev UCL	0.0495	95% KM Chebyshev UCL	0.0569
97.5% KM Chebyshev UCL	0.0672	99% KM Chebyshev UCL	0.0874

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.711	Anderson-Darling GOF Test
5% A-D Critical Value	0.753	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.157	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics on Detected Data Only**

k hat (MLE)	2.916	k star (bias corrected MLE)	2.664
Theta hat (MLE)	0.018	Theta star (bias corrected MLE)	0.0197
nu hat (MLE)	186.6	nu star (bias corrected)	170.5
Mean (detects)	0.0525		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0352
Maximum	0.189	Median	0.027
SD	0.0384	CV	1.09
k hat (MLE)	1.45	k star (bias corrected MLE)	1.382
Theta hat (MLE)	0.0243	Theta star (bias corrected MLE)	0.0255
nu hat (MLE)	156.6	nu star (bias corrected)	149.2
Adjusted Level of Significance (β)	0.0456		
Approximate Chi Square Value (149.22, α)	122	Adjusted Chi Square Value (149.22, β)	121.3
95% Gamma Approximate UCL	0.0431	95% Gamma Adjusted UCL	0.0433

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0331	SD (KM)	0.0395
Variance (KM)	0.00156	SE of Mean (KM)	0.00546
k hat (KM)	0.702	k star (KM)	0.675
nu hat (KM)	75.76	nu star (KM)	72.89
theta hat (KM)	0.0471	theta star (KM)	0.049
80% gamma percentile (KM)	0.0544	90% gamma percentile (KM)	0.0837
95% gamma percentile (KM)	0.114	99% gamma percentile (KM)	0.187

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (72.89, α)	54.23	Adjusted Chi Square Value (72.89, β)	53.79
95% KM Approximate Gamma UCL	0.0445	95% KM Adjusted Gamma UCL	0.0448

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.817	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.21	Lilliefors GOF Test
10% Lilliefors Critical Value	0.142	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0362	Mean in Log Scale	-3.652
SD in Original Scale	0.0378	SD in Log Scale	0.771
95% t UCL (assumes normality of ROS data)	0.0448	95% Percentile Bootstrap UCL	0.0451
95% BCA Bootstrap UCL	0.0472	95% Bootstrap t UCL	0.0487
95% H-UCL (Log ROS)	0.0436		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.031	KM Geo Mean	0.0178
KM SD (logged)	1.164	95% Critical H Value (KM-Log)	2.539
KM Standard Error of Mean (logged)	0.161	95% H-UCL (KM -Log)	0.0525
KM SD (logged)	1.164	95% Critical H Value (KM-Log)	2.539
KM Standard Error of Mean (logged)	0.161		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0321
SD in Original Scale	0.0406
95% t UCL (Assumes normality)	0.0414

DL/2 Log-Transformed

Mean in Log Scale	-4.299
SD in Log Scale	1.486
95% H-Stat UCL	0.075

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	0.0422

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:54:21 PM
 From File 90 UCL Input Data_MG_g.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
Number of Detects	6	Number of Non-Detects	12
Number of Distinct Detects	6	Number of Distinct Non-Detects	11
Minimum Detect	0.498	Minimum Non-Detect	0.492
Maximum Detect	3.04	Maximum Non-Detect	0.562
Variance Detects	0.965	Percent Non-Detects	66.67%
Mean Detects	1.1	SD Detects	0.982
Median Detects	0.728	CV Detects	0.894
Skewness Detects	2.119	Kurtosis Detects	4.672
Mean of Logged Detects	-0.146	SD of Logged Detects	0.701

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.695	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.713	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.337	Lilliefors GOF Test
1% Lilliefors Critical Value	0.373	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.696	KM Standard Error of Mean	0.153
90KM SD	0.591	95% KM (BCA) UCL	1.011
95% KM (t) UCL	0.962	95% KM (Percentile Bootstrap) UCL	0.973
95% KM (z) UCL	0.947	95% KM Bootstrap t UCL	1.68
90% KM Chebyshev UCL	1.154	95% KM Chebyshev UCL	1.361
97.5% KM Chebyshev UCL	1.649	99% KM Chebyshev UCL	2.215

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.668	Anderson-Darling GOF Test
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.269	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.225	k star (bias corrected MLE)	1.224
Theta hat (MLE)	0.494	Theta star (bias corrected MLE)	0.899
nu hat (MLE)	26.7	nu star (bias corrected)	14.68
Mean (detects)	1.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.373
Maximum	3.04	Median	0.01
SD	0.75	CV	2.011
k hat (MLE)	0.32	k star (bias corrected MLE)	0.304
Theta hat (MLE)	1.167	Theta star (bias corrected MLE)	1.229
nu hat (MLE)	11.52	nu star (bias corrected)	10.93
Adjusted Level of Significance (β)	0.0357		

Approximate Chi Square Value (10.93, α)	4.531	Adjusted Chi Square Value (10.93, β)	4.142
95% Gamma Approximate UCL	0.9	95% Gamma Adjusted UCL	0.985

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.696	SD (KM)	0.591
Variance (KM)	0.35	SE of Mean (KM)	0.153
k hat (KM)	1.386	k star (KM)	1.192
nu hat (KM)	49.88	nu star (KM)	42.9
theta hat (KM)	0.502	theta star (KM)	0.584
80% gamma percentile (KM)	1.103	90% gamma percentile (KM)	1.535
95% gamma percentile (KM)	1.961	99% gamma percentile (KM)	2.938

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (42.90, α)	28.89	Adjusted Chi Square Value (42.90, β)	27.78
95% KM Approximate Gamma UCL	1.034	95% KM Adjusted Gamma UCL	1.075

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.825	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.826	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.258	Lilliefors GOF Test
10% Lilliefors Critical Value	0.298	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.47	Mean in Log Scale	-1.305
SD in Original Scale	0.703	SD in Log Scale	0.946
95% t UCL (assumes normality of ROS data)	0.759	95% Percentile Bootstrap UCL	0.762
95% BCA Bootstrap UCL	0.905	95% Bootstrap t UCL	1.253
95% H-UCL (Log ROS)	0.763		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.519	KM Geo Mean	0.595
KM SD (logged)	0.454	95% Critical H Value (KM-Log)	1.978
KM Standard Error of Mean (logged)	0.117	95% H-UCL (KM -Log)	0.82
KM SD (logged)	0.454	95% Critical H Value (KM-Log)	1.978
KM Standard Error of Mean (logged)	0.117		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.538
SD in Original Scale	0.671
95% t UCL (Assumes normality)	0.813

DL/2 Log-Transformed

Mean in Log Scale	-0.955
SD in Log Scale	0.701
95% H-Stat UCL	0.72

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.962

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	2.91	Mean	4.25
Maximum	5.68	Median	4.155

SD	0.864	Std. Error of Mean	0.204
Coefficient of Variation	0.203	Skewness	0.357

Normal GOF Test

Shapiro Wilk Test Statistic	0.944
1% Shapiro Wilk Critical Value	0.858
Lilliefors Test Statistic	0.117
1% Lilliefors Critical Value	0.235

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	4.604

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	4.603
95% Modified-t UCL (Johnson-1978)	4.607

Gamma GOF Test

A-D Test Statistic	0.257
5% A-D Critical Value	0.739
K-S Test Statistic	0.108
5% K-S Critical Value	0.203

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	25.87
Theta hat (MLE)	0.164
nu hat (MLE)	931.2
MLE Mean (bias corrected)	4.25
Adjusted Level of Significance	0.0357

k star (bias corrected MLE)	21.59
Theta star (bias corrected MLE)	0.197
nu star (bias corrected)	777.3
MLE Sd (bias corrected)	0.915
Approximate Chi Square Value (0.05)	713.6
Adjusted Chi Square Value	707.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	4.629

95% Adjusted Gamma UCL	4.668

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.96
10% Shapiro Wilk Critical Value	0.914
Lilliefors Test Statistic	0.0972
10% Lilliefors Critical Value	0.185

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.068
Maximum of Logged Data	1.737

Mean of logged Data	1.427
SD of logged Data	0.203

Assuming Lognormal Distribution

95% H-UCL	4.647
95% Chebyshev (MVUE) UCL	5.143
99% Chebyshev (MVUE) UCL	6.288

90% Chebyshev (MVUE) UCL	4.865
97.5% Chebyshev (MVUE) UCL	5.529

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4.585
95% Standard Bootstrap UCL	4.578
95% Hall's Bootstrap UCL	4.614
90% Chebyshev(Mean, Sd) UCL	4.861
97.5% Chebyshev(Mean, Sd) UCL	5.522

95% BCA Bootstrap UCL	4.588
95% Bootstrap-t UCL	4.632
95% Percentile Bootstrap UCL	4.581
95% Chebyshev(Mean, Sd) UCL	5.138
99% Chebyshev(Mean, Sd) UCL	6.276

Suggested UCL to Use

95% Student's-t UCL	4.604

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics				
Total Number of Observations		18	Number of Distinct Observations 18	
			Number of Missing Observations 0	
Minimum	25.8		Mean	47.28
Maximum	185		Median	38.65
SD	35.74		Std. Error of Mean	8.424
Coefficient of Variation	0.756		Skewness	3.728
Normal GOF Test				
Shapiro Wilk Test Statistic		0.504	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value		0.858	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic		0.312	Lilliefors GOF Test	
1% Lilliefors Critical Value		0.235	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level				
Assuming Normal Distribution				
95% Normal UCL			95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	61.94		95% Adjusted-CLT UCL (Chen-1995)	69.05
			95% Modified-t UCL (Johnson-1978)	63.17
Gamma GOF Test				
A-D Test Statistic		1.706	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value		0.743	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic		0.234	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value		0.205	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level				
Gamma Statistics				
k hat (MLE)	3.995		k star (bias corrected MLE)	3.366
Theta hat (MLE)	11.84		Theta star (bias corrected MLE)	14.05
nu hat (MLE)	143.8		nu star (bias corrected)	121.2
MLE Mean (bias corrected)	47.28		MLE Sd (bias corrected)	25.77
			Approximate Chi Square Value (0.05)	96.75
Adjusted Level of Significance	0.0357		Adjusted Chi Square Value	94.66
Assuming Gamma Distribution				
95% Approximate Gamma UCL	59.22		95% Adjusted Gamma UCL	60.53
Lognormal GOF Test				
Shapiro Wilk Test Statistic		0.782	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value		0.914	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic		0.189	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value		0.185	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level				
Lognormal Statistics				
Minimum of Logged Data	3.25		Mean of logged Data	3.726
Maximum of Logged Data	5.22		SD of logged Data	0.446
Assuming Lognormal Distribution				
95% H-UCL	56.75		90% Chebyshev (MVUE) UCL	60.36
95% Chebyshev (MVUE) UCL	67.05		97.5% Chebyshev (MVUE) UCL	76.35
99% Chebyshev (MVUE) UCL	94.6			
Nonparametric Distribution Free UCL Statistics				
Data do not follow a Discernible Distribution				
Nonparametric Distribution Free UCLs				
95% CLT UCL	61.14		95% BCA Bootstrap UCL	72.56
95% Standard Bootstrap UCL	60.75		95% Bootstrap-t UCL	90.24
95% Hall's Bootstrap UCL	114.5		95% Percentile Bootstrap UCL	63.28
90% Chebyshev(Mean, Sd) UCL	72.56		95% Chebyshev(Mean, Sd) UCL	84
7.5% Chebyshev(Mean, Sd) UCL	99.89		99% Chebyshev(Mean, Sd) UCL	131.1

Suggested UCL to Use

95% Student's-t UCL 61.94

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	17.7	Mean	70.37
Maximum	175	Median	67.2
SD	41.78	Std. Error of Mean	9.848
Coefficient of Variation	0.594	Skewness	1.413
Normal GOF Test			
Shapiro Wilk Test Statistic	0.86	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.858	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.189	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.235	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	87.5	95% Adjusted-CLT UCL (Chen-1995)	90.07
		95% Modified-t UCL (Johnson-1978)	88.04
Gamma GOF Test			
A-D Test Statistic	0.313	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	3.346	k star (bias corrected MLE)	2.825
Theta hat (MLE)	21.03	Theta star (bias corrected MLE)	24.91
nu hat (MLE)	120.4	nu star (bias corrected)	101.7
MLE Mean (bias corrected)	70.37	MLE Sd (bias corrected)	41.87
		Approximate Chi Square Value (0.05)	79.43
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	77.54
Assuming Gamma Distribution			
95% Approximate Gamma UCL	90.09	95% Adjusted Gamma UCL	92.29
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.969	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.122	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.874	Mean of logged Data	4.097
Maximum of Logged Data	5.165	SD of logged Data	0.587
Assuming Lognormal Distribution			
95% H-UCL	96.55	90% Chebyshev (MVUE) UCL	101.4
95% Chebyshev (MVUE) UCL	115.3	97.5% Chebyshev (MVUE) UCL	134.6
99% Chebyshev (MVUE) UCL	172.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	86.57	95% BCA Bootstrap UCL	90.06
95% Standard Bootstrap UCL	86.08	95% Bootstrap-t UCL	93.31
95% Hall's Bootstrap UCL	108.1	95% Percentile Bootstrap UCL	86.95
90% Chebyshev(Mean, Sd) UCL	99.91	95% Chebyshev(Mean, Sd) UCL	113.3
97.5% Chebyshev(Mean, Sd) UCL	131.9	99% Chebyshev(Mean, Sd) UCL	168.4

Suggested UCL to Use

95% Student's-t UCL	87.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	18	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	0.116	Mean	0.486
Maximum	2.5	Median	0.301
SD	0.56	Std. Error of Mean	0.132
Coefficient of Variation	1.152	Skewness	2.979

Normal GOF Test

Shapiro Wilk Test Statistic	0.633
1% Shapiro Wilk Critical Value	0.858
Lilliefors Test Statistic	0.254
1% Lilliefors Critical Value	0.235

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	0.716

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.802
95% Modified-t UCL (Johnson-1978)	0.731

Gamma GOF Test

A-D Test Statistic	0.91
5% A-D Critical Value	0.759
K-S Test Statistic	0.193
5% K-S Critical Value	0.208

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.376	k star (bias corrected MLE)	1.184
Theta hat (MLE)	0.353	Theta star (bias corrected MLE)	0.411
nu hat (MLE)	49.53	nu star (bias corrected)	42.61
MLE Mean (bias corrected)	0.486	MLE Sd (bias corrected)	0.447
		Approximate Chi Square Value (0.05)	28.64
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	27.54

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.723	95% Adjusted Gamma UCL	0.752

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.896
10% Shapiro Wilk Critical Value	0.914
Lilliefors Test Statistic	0.202
10% Lilliefors Critical Value	0.185

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.154	Mean of logged Data	-1.127

Maximum of Logged Data 0.916

SD of logged Data 0.877

Assuming Lognormal Distribution

95% H-UCL	0.804	90% Chebyshev (MVUE) UCL	0.775
95% Chebyshev (MVUE) UCL	0.917	97.5% Chebyshev (MVUE) UCL	1.114
99% Chebyshev (MVUE) UCL	1.5		

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

95% CLT UCL	0.703	95% BCA Bootstrap UCL	0.818
95% Standard Bootstrap UCL	0.696	95% Bootstrap-t UCL	0.924
95% Hall's Bootstrap UCL	1.565	95% Percentile Bootstrap UCL	0.726
90% Chebyshev(Mean, Sd) UCL	0.882	95% Chebyshev(Mean, Sd) UCL	1.061
97.5% Chebyshev(Mean, Sd) UCL	1.31	99% Chebyshev(Mean, Sd) UCL	1.799

Suggested UCL to Use

95% Adjusted Gamma UCL	0.752

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel**General Statistics**

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	14.6	Mean	20.02
Maximum	28.4	Median	18.55
SD	3.759	Std. Error of Mean	0.886
Coefficient of Variation	0.188	Skewness	0.845

Normal GOF Test

Shapiro Wilk Test Statistic	0.921
1% Shapiro Wilk Critical Value	0.858
Lilliefors Test Statistic	0.238
1% Lilliefors Critical Value	0.235

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level**Assuming Normal Distribution****95% Normal UCL**

95% Student's-t UCL	21.56

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	21.66
95% Modified-t UCL (Johnson-1978)	21.59

Gamma GOF Test

A-D Test Statistic	0.546
5% A-D Critical Value	0.739
K-S Test Statistic	0.226
5% K-S Critical Value	0.203

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level**Gamma Statistics**

k hat (MLE)	31.94	k star (bias corrected MLE)	26.65
Theta hat (MLE)	0.627	Theta star (bias corrected MLE)	0.751
nu hat (MLE)	1150	nu star (bias corrected)	959.5

MLE Mean (bias corrected)	20.02	MLE Sd (bias corrected)	3.877
		Approximate Chi Square Value (0.05)	888.6
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	882.1

Assuming Gamma Distribution

95% Approximate Gamma UCL	21.61	95% Adjusted Gamma UCL	21.77

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.951
10% Shapiro Wilk Critical Value	0.914
Lilliefors Test Statistic	0.214
10% Lilliefors Critical Value	0.185

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.681	Mean of logged Data	2.981
Maximum of Logged Data	3.346	SD of logged Data	0.18

Assuming Lognormal Distribution

95% H-UCL	21.64	90% Chebyshev (MVUE) UCL	22.57
95% Chebyshev (MVUE) UCL	23.73	97.5% Chebyshev (MVUE) UCL	25.34
99% Chebyshev (MVUE) UCL	28.51		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	21.47	95% BCA Bootstrap UCL	21.68
95% Standard Bootstrap UCL	21.46	95% Bootstrap-t UCL	21.85
95% Hall's Bootstrap UCL	21.73	95% Percentile Bootstrap UCL	21.51
90% Chebyshev(Mean, Sd) UCL	22.67	95% Chebyshev(Mean, Sd) UCL	23.88
97.5% Chebyshev(Mean, Sd) UCL	25.55	99% Chebyshev(Mean, Sd) UCL	28.83

Suggested UCL to Use

95% Student's-t UCL	21.56

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	58.4	Mean	109.1
Maximum	164	Median	115
SD	27.17	Std. Error of Mean	6.403
Coefficient of Variation	0.249	Skewness	-0.0909

Normal GOF Test

Shapiro Wilk Test Statistic	0.976
1% Shapiro Wilk Critical Value	0.858
Lilliefors Test Statistic	0.114
1% Lilliefors Critical Value	0.235

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	120.3

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	119.5
95% Modified-t UCL (Johnson-1978)	120.3

Gamma GOF Test		
A-D Test Statistic	0.371	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.203	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	15.78	k star (bias corrected MLE)	13.19
Theta hat (MLE)	6.915	Theta star (bias corrected MLE)	8.275
nu hat (MLE)	568.2	nu star (bias corrected)	474.8
MLE Mean (bias corrected)	109.1	MLE Sd (bias corrected)	30.05
		Approximate Chi Square Value (0.05)	425.3
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	420.8

Assuming Gamma Distribution			
95% Approximate Gamma UCL	121.8	95% Adjusted Gamma UCL	123.1

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.952	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.157	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	4.067	Mean of logged Data	4.661
Maximum of Logged Data	5.1	SD of logged Data	0.268

Assuming Lognormal Distribution			
95% H-UCL	123.4	90% Chebyshev (MVUE) UCL	130.2
95% Chebyshev (MVUE) UCL	139.7	97.5% Chebyshev (MVUE) UCL	152.8
99% Chebyshev (MVUE) UCL	178.6		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	119.7	95% BCA Bootstrap UCL	119.1
95% Standard Bootstrap UCL	119.5	95% Bootstrap-t UCL	119.8
95% Hall's Bootstrap UCL	119.6	95% Percentile Bootstrap UCL	119.4
90% Chebyshev(Mean, Sd) UCL	128.3	95% Chebyshev(Mean, Sd) UCL	137
97.5% Chebyshev(Mean, Sd) UCL	149.1	99% Chebyshev(Mean, Sd) UCL	172.8

Suggested UCL to Use	
95% Student's-t UCL	120.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Dioxin/Furan

General Statistics			
Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	1.9365E-6	Mean	2.2200E-5
Maximum	1.4964E-4	Median	7.8709E-6
SD	3.5538E-5	Std. Error of Mean	8.3764E-6
Coefficient of Variation	N/A	Skewness	3.081

Normal GOF Test

Shapiro Wilk Test Statistic 0.572
 1% Shapiro Wilk Critical Value 0.858
 Lilliefors Test Statistic 0.31
 1% Lilliefors Critical Value 0.235

Data Not Normal at 1% Significance Level

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 3.6771E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 4.2478E-5

95% Modified-t UCL (Johnson-1978) 3.7785E-5

Gamma GOF Test

A-D Test Statistic 1.103
 5% A-D Critical Value 0.774
 K-S Test Statistic 0.219
 5% K-S Critical Value 0.211

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 0.836
 Theta hat (MLE) 2.6566E-5
 nu hat (MLE) 30.08
 MLE Mean (bias corrected) 2.2200E-5
 Adjusted Level of Significance 0.0357

k star (bias corrected MLE) 0.733
 Theta star (bias corrected MLE) 3.0269E-5
 nu star (bias corrected) 26.4
 MLE Sd (bias corrected) 2.5922E-5
 Approximate Chi Square Value (0.05) 15.69
 Adjusted Chi Square Value 14.9

Assuming Gamma Distribution

95% Approximate Gamma UCL 3.7357E-5

95% Adjusted Gamma UCL 3.9339E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.949
 10% Shapiro Wilk Critical Value 0.914
 Lilliefors Test Statistic 0.169
 10% Lilliefors Critical Value 0.185

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -13.15
 Maximum of Logged Data -8.807

Mean of logged Data -11.42
 SD of logged Data 1.124

Assuming Lognormal Distribution

95% H-UCL 4.4486E-5
 95% Chebyshev (MVUE) UCL 4.5038E-5
 99% Chebyshev (MVUE) UCL 7.7727E-5

90% Chebyshev (MVUE) UCL 3.7092E-5
 97.5% Chebyshev (MVUE) UCL 5.6065E-5

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL 3.5978E-5
 95% Standard Bootstrap UCL 3.6015E-5
 95% Hall's Bootstrap UCL 8.4244E-5
 90% Chebyshev(Mean, Sd) UCL 4.7329E-5
 97.5% Chebyshev(Mean, Sd) UCL 7.4510E-5

95% BCA Bootstrap UCL 4.5658E-5
 95% Bootstrap-t UCL 5.9974E-5
 95% Percentile Bootstrap UCL 3.7772E-5
 95% Chebyshev(Mean, Sd) UCL 5.8712E-5
 99% Chebyshev(Mean, Sd) UCL 1.0554E-4

Suggested UCL to Use

95% H-UCL 4.4486E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations 18

Number of Distinct Observations 17

Number of Detects	5	Number of Non-Detects	13
Number of Distinct Detects	5	Number of Distinct Non-Detects	12
Minimum Detect	0.0052	Minimum Non-Detect	0.00483
Maximum Detect	0.0613	Maximum Non-Detect	0.00507
Variance Detects	5.4316E-4	Percent Non-Detects	72.22%
Mean Detects	0.0221	SD Detects	0.0233
Median Detects	0.0143	CV Detects	1.055
Skewness Detects	1.653	Kurtosis Detects	2.719
Mean of Logged Detects	-4.253	SD of Logged Detects	1.053

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.808	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.26	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00962	KM Standard Error of Mean	0.00354
90KM SD	0.0134	95% KM (BCA) UCL	0.0155
95% KM (t) UCL	0.0158	95% KM (Percentile Bootstrap) UCL	0.0159
95% KM (z) UCL	0.0154	95% KM Bootstrap t UCL	0.0258
90% KM Chebyshev UCL	0.0202	95% KM Chebyshev UCL	0.0251
97.5% KM Chebyshev UCL	0.0317	99% KM Chebyshev UCL	0.0448

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.348	Anderson-Darling GOF Test
5% A-D Critical Value	0.689	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	1.278	k star (bias corrected MLE)	0.644
Theta hat (MLE)	0.0173	Theta star (bias corrected MLE)	0.0343
nu hat (MLE)	12.78	nu star (bias corrected)	6.443
Mean (detects)	0.0221		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0052	Mean	0.0134
Maximum	0.0613	Median	0.01
SD	0.0126	CV	0.944
k hat (MLE)	2.765	k star (bias corrected MLE)	2.341
Theta hat (MLE)	0.00483	Theta star (bias corrected MLE)	0.00571
nu hat (MLE)	99.54	nu star (bias corrected)	84.29
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (84.29, α)	64.13	Adjusted Chi Square Value (84.29, β)	62.44
95% Gamma Approximate UCL	0.0176	95% Gamma Adjusted UCL	0.018

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00962	SD (KM)	0.0134
Variance (KM)	1.8045E-4	SE of Mean (KM)	0.00354
k hat (KM)	0.513	k star (KM)	0.465
nu hat (KM)	18.48	nu star (KM)	16.73
theta hat (KM)	0.0188	theta star (KM)	0.0207
80% gamma percentile (KM)	0.0157	90% gamma percentile (KM)	0.0264
95% gamma percentile (KM)	0.0379	99% gamma percentile (KM)	0.0665

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.73, α)	8.48	Adjusted Chi Square Value (16.73, β)	7.921
95% KM Approximate Gamma UCL	0.019	95% KM Adjusted Gamma UCL	0.0203

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.912	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.806	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.229	Lilliefors GOF Test
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0063	Mean in Log Scale	-7.27
SD in Original Scale	0.0151	SD in Log Scale	2.017
95% t UCL (assumes normality of ROS data)	0.0125	95% Percentile Bootstrap UCL	0.0125
95% BCA Bootstrap UCL	0.0155	95% Bootstrap t UCL	0.0282
95% H-UCL (Log ROS)	0.0445		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.033	KM Geo Mean	0.00652
KM SD (logged)	0.693	95% Critical H Value (KM-Log)	2.23
KM Standard Error of Mean (logged)	0.183	95% H-UCL (KM -Log)	0.0121
KM SD (logged)	0.693	95% Critical H Value (KM-Log)	2.23
KM Standard Error of Mean (logged)	0.183		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00793
SD in Original Scale	0.0145
95% t UCL (Assumes normality)	0.0139

DL/2 Log-Transformed

Mean in Log Scale	-5.512
SD in Log Scale	0.952
95% H-Stat UCL	0.0115

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0158

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	0.0881	Mean	3.151
Maximum	30.2	Median	0.586
SD	7.774	Std. Error of Mean	1.832
Coefficient of Variation	2.467	Skewness	3.114

Normal GOF Test

Shapiro Wilk Test Statistic	0.424	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.464	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 6.339

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 7.602

95% Modified-t UCL (Johnson-1978) 6.563

Gamma GOF Test

A-D Test Statistic 2.888

5% A-D Critical Value 0.812

K-S Test Statistic 0.335

5% K-S Critical Value 0.217

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE) 0.444

Theta hat (MLE) 7.096

nu hat (MLE) 15.99

MLE Mean (bias corrected) 3.151

Adjusted Level of Significance 0.0357

k star (bias corrected MLE) 0.407

Theta star (bias corrected MLE) 7.741

nu star (bias corrected) 14.66

MLE Sd (bias corrected) 4.939

Approximate Chi Square Value (0.05) 7.024

Adjusted Chi Square Value 6.521

Assuming Gamma Distribution

95% Approximate Gamma UCL 6.577

95% Adjusted Gamma UCL 7.083

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.833

10% Shapiro Wilk Critical Value 0.914

Lilliefors Test Statistic 0.239

10% Lilliefors Critical Value 0.185

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data -2.429

Maximum of Logged Data 3.408

Mean of logged Data -0.309

SD of logged Data 1.43

Assuming Lognormal Distribution

95% H-UCL 6.437

95% Chebyshev (MVUE) UCL 5.011

99% Chebyshev (MVUE) UCL 9.072

90% Chebyshev (MVUE) UCL 4.024

97.5% Chebyshev (MVUE) UCL 6.381

Nonparametric Distribution Free UCL Statistics**Data do not follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

95% CLT UCL 6.165

95% Standard Bootstrap UCL 6.104

95% Hall's Bootstrap UCL 28.69

90% Chebyshev(Mean, Sd) UCL 8.648

97.5% Chebyshev(Mean, Sd) UCL 14.59

95% BCA Bootstrap UCL 8.2

95% Bootstrap-t UCL 53.83

95% Percentile Bootstrap UCL 6.534

95% Chebyshev(Mean, Sd) UCL 11.14

99% Chebyshev(Mean, Sd) UCL 21.38

Suggested UCL to Use

95% Student's-t UCL 6.339

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**Please verify the data were collected from random locations.****If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs**General Statistics**

Total Number of Observations 18

Number of Distinct Observations 18

Number of Missing Observations 0

Minimum	0.0132	Mean	0.509
Maximum	5.13	Median	0.0868
SD	1.297	Std. Error of Mean	0.306
Coefficient of Variation	2.55	Skewness	3.231

Normal GOF Test

Shapiro Wilk Test Statistic	0.416	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.464	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	1.041

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	1.261
95% Modified-t UCL (Johnson-1978)	1.08

Gamma GOF Test

A-D Test Statistic	2.914	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.816	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.336	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.217	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.422	k star (bias corrected MLE)	0.389
Theta hat (MLE)	1.205	Theta star (bias corrected MLE)	1.308
nu hat (MLE)	15.21	nu star (bias corrected)	14.01
MLE Mean (bias corrected)	0.509	MLE Sd (bias corrected)	0.816
		Approximate Chi Square Value (0.05)	6.575
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	6.091

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.084	95% Adjusted Gamma UCL	1.17

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.834	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.914	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.242	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.185	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.328	Mean of logged Data	-2.22
Maximum of Logged Data	1.635	SD of logged Data	1.466

Assuming Lognormal Distribution

95% H-UCL	1.058	90% Chebyshev (MVUE) UCL	0.633
95% Chebyshev (MVUE) UCL	0.791	97.5% Chebyshev (MVUE) UCL	1.009
99% Chebyshev (MVUE) UCL	1.438		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1.012	95% BCA Bootstrap UCL	1.372
95% Standard Bootstrap UCL	1.002	95% Bootstrap-t UCL	9.547
95% Hall's Bootstrap UCL	5.155	95% Percentile Bootstrap UCL	1.07
90% Chebyshev(Mean, Sd) UCL	1.426	95% Chebyshev(Mean, Sd) UCL	1.842
97.5% Chebyshev(Mean, Sd) UCL	2.418	99% Chebyshev(Mean, Sd) UCL	3.551

Suggested UCL to Use

95% Student's-t UCL	1.041

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics

Total Number of Observations	18	Number of Distinct Observations	15
Number of Detects	5	Number of Non-Detects	13
Number of Distinct Detects	5	Number of Distinct Non-Detects	10
Minimum Detect	0.0316	Minimum Non-Detect	0.00481
Maximum Detect	0.189	Maximum Non-Detect	0.00506
Variance Detects	0.00454	Percent Non-Detects	72.22%
Mean Detects	0.0699	SD Detects	0.0674
Median Detects	0.0389	CV Detects	0.964
Skewness Detects	2.118	Kurtosis Detects	4.539
Mean of Logged Detects	-2.929	SD of Logged Detects	0.743

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.671	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.377	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0229	KM Standard Error of Mean	0.0114
90KM SD	0.0431	95% KM (BCA) UCL	0.0429
95% KM (t) UCL	0.0426	95% KM (Percentile Bootstrap) UCL	0.0423
95% KM (z) UCL	0.0416	95% KM Bootstrap t UCL	0.0533
90% KM Chebyshev UCL	0.0569	95% KM Chebyshev UCL	0.0724
97.5% KM Chebyshev UCL	0.0938	99% KM Chebyshev UCL	0.136

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.732	Anderson-Darling GOF Test
5% A-D Critical Value	0.684	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.318	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.016	k star (bias corrected MLE)	0.94
Theta hat (MLE)	0.0347	Theta star (bias corrected MLE)	0.0743
nu hat (MLE)	20.16	nu star (bias corrected)	9.396
Mean (detects)	0.0699		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0266
Maximum	0.189	Median	0.01
SD	0.0428	CV	1.606
k hat (MLE)	1.11	k star (bias corrected MLE)	0.962
Theta hat (MLE)	0.024	Theta star (bias corrected MLE)	0.0277
nu hat (MLE)	39.96	nu star (bias corrected)	34.64
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (34.64, α)	22.17	Adjusted Chi Square Value (34.64, β)	21.22
95% Gamma Approximate UCL	0.0416	95% Gamma Adjusted UCL	0.0435

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0229	SD (KM)	0.0431
Variance (KM)	0.00186	SE of Mean (KM)	0.0114
k hat (KM)	0.282	k star (KM)	0.272
nu hat (KM)	10.15	nu star (KM)	9.79
theta hat (KM)	0.0812	theta star (KM)	0.0841
80% gamma percentile (KM)	0.0342	90% gamma percentile (KM)	0.0682
95% gamma percentile (KM)	0.108	99% gamma percentile (KM)	0.213

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.79, α)	3.811	Adjusted Chi Square Value (9.79, β)	3.459
95% KM Approximate Gamma UCL	0.0588	95% KM Adjusted Gamma UCL	0.0647

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.806	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.267	Lilliefors GOF Test
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level**Note GOF tests may be unreliable for small sample sizes****Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.0219	Mean in Log Scale	-4.979
SD in Original Scale	0.0448	SD in Log Scale	1.405
95% t UCL (assumes normality of ROS data)	0.0402	95% Percentile Bootstrap UCL	0.0407
95% BCA Bootstrap UCL	0.05	95% Bootstrap t UCL	0.0712
95% H-UCL (Log ROS)	0.0564		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.668	KM Geo Mean	0.00939
KM SD (logged)	1.134	95% Critical H Value (KM-Log)	2.838
KM Standard Error of Mean (logged)	0.299	95% H-UCL (KM -Log)	0.039
KM SD (logged)	1.134	95% Critical H Value (KM-Log)	2.838
KM Standard Error of Mean (logged)	0.299		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.0212
SD in Original Scale	0.0451
95% t UCL (Assumes normality)	0.0397

DL/2 Log-Transformed

Mean in Log Scale	-5.148
SD in Log Scale	1.461
95% H-Stat UCL	0.0557

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

95% KM (t) UCL	0.0426

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:52:18 PM
 From File 90 UCL Input Data_MG_d.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	22	Number of Distinct Observations	21
Number of Detects	7	Number of Non-Detects	15
Number of Distinct Detects	7	Number of Distinct Non-Detects	14
Minimum Detect	0.498	Minimum Non-Detect	0.492
Maximum Detect	3.04	Maximum Non-Detect	0.562
Variance Detects	0.831	Percent Non-Detects	68.18%
Mean Detects	1.038	SD Detects	0.912
Median Detects	0.667	CV Detects	0.878
Skewness Detects	2.323	Kurtosis Detects	5.628
Mean of Logged Detects	-0.183	SD of Logged Detects	0.647

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.66	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.334	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.667	KM Standard Error of Mean	0.124
90KM SD	0.539	95% KM (BCA) UCL	0.917
95% KM (t) UCL	0.881	95% KM (Percentile Bootstrap) UCL	0.895
95% KM (z) UCL	0.871	95% KM Bootstrap t UCL	1.399
90% KM Chebyshev UCL	1.04	95% KM Chebyshev UCL	1.208
97.5% KM Chebyshev UCL	1.443	99% KM Chebyshev UCL	1.903

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.768	Anderson-Darling GOF Test
5% A-D Critical Value	0.714	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.423	k star (bias corrected MLE)	1.48
Theta hat (MLE)	0.428	Theta star (bias corrected MLE)	0.701
nu hat (MLE)	33.92	nu star (bias corrected)	20.72
Mean (detects)	1.038		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.337
Maximum	3.04	Median	0.01
SD	0.691	CV	2.05
k hat (MLE)	0.323	k star (bias corrected MLE)	0.309
Theta hat (MLE)	1.044	Theta star (bias corrected MLE)	1.09
nu hat (MLE)	14.2	nu star (bias corrected)	13.6
Adjusted Level of Significance (β)	0.0386		

Approximate Chi Square Value (13.60, α)	6.299	Adjusted Chi Square Value (13.60, β)	5.93
95% Gamma Approximate UCL	0.728	95% Gamma Adjusted UCL	0.773

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.667	SD (KM)	0.539
Variance (KM)	0.291	SE of Mean (KM)	0.124
k hat (KM)	1.53	k star (KM)	1.352
nu hat (KM)	67.33	nu star (KM)	59.49
theta hat (KM)	0.436	theta star (KM)	0.493
80% gamma percentile (KM)	1.044	90% gamma percentile (KM)	1.426
95% gamma percentile (KM)	1.8	99% gamma percentile (KM)	2.65

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (59.49, α)	42.75	Adjusted Chi Square Value (59.49, β)	41.69
95% KM Approximate Gamma UCL	0.928	95% KM Adjusted Gamma UCL	0.952

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.818	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.838	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.214	Lilliefors GOF Test
10% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.439	Mean in Log Scale	-1.325
SD in Original Scale	0.643	SD in Log Scale	0.886
95% t UCL (assumes normality of ROS data)	0.674	95% Percentile Bootstrap UCL	0.674
95% BCA Bootstrap UCL	0.798	95% Bootstrap t UCL	1.023
95% H-UCL (Log ROS)	0.63		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.539	KM Geo Mean	0.583
KM SD (logged)	0.416	95% Critical H Value (KM-Log)	1.925
KM Standard Error of Mean (logged)	0.0959	95% H-UCL (KM -Log)	0.758
KM SD (logged)	0.416	95% Critical H Value (KM-Log)	1.925
KM Standard Error of Mean (logged)	0.0959		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.506
SD in Original Scale	0.613
95% t UCL (Assumes normality)	0.73

DL/2 Log-Transformed

Mean in Log Scale	-0.985
SD in Log Scale	0.659
95% H-Stat UCL	0.633

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.881

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	2.84	Mean	4.131
Maximum	5.68	Median	4.06

SD	0.844	Std. Error of Mean	0.18
Coefficient of Variation	0.204	Skewness	0.499

Normal GOF Test

Shapiro Wilk Test Statistic	0.941
1% Shapiro Wilk Critical Value	0.878
Lilliefors Test Statistic	0.112
1% Lilliefors Critical Value	0.214

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	4.441

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	4.448
95% Modified-t UCL (Johnson-1978)	4.444

Gamma GOF Test

A-D Test Statistic	0.299
5% A-D Critical Value	0.741
K-S Test Statistic	0.0936
5% K-S Critical Value	0.185

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	25.72	k star (bias corrected MLE)	22.24
Theta hat (MLE)	0.161	Theta star (bias corrected MLE)	0.186
nu hat (MLE)	1132	nu star (bias corrected)	978.7
MLE Mean (bias corrected)	4.131	MLE Sd (bias corrected)	0.876
Adjusted Level of Significance	0.0386	Approximate Chi Square Value (0.05)	907.1
		Adjusted Chi Square Value	901.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	4.458

95% Adjusted Gamma UCL	4.483

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962
10% Shapiro Wilk Critical Value	0.926
Lilliefors Test Statistic	0.0846
10% Lilliefors Critical Value	0.169

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.044	Mean of logged Data	1.399
Maximum of Logged Data	1.737	SD of logged Data	0.202

Assuming Lognormal Distribution

95% H-UCL	4.472
95% Chebyshev (MVUE) UCL	4.912
99% Chebyshev (MVUE) UCL	5.914

90% Chebyshev (MVUE) UCL	4.669
97.5% Chebyshev (MVUE) UCL	5.25

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4.427	95% BCA Bootstrap UCL	4.423
95% Standard Bootstrap UCL	4.419	95% Bootstrap-t UCL	4.467
95% Hall's Bootstrap UCL	4.456	95% Percentile Bootstrap UCL	4.422
90% Chebyshev(Mean, Sd) UCL	4.671	95% Chebyshev(Mean, Sd) UCL	4.915
97.5% Chebyshev(Mean, Sd) UCL	5.255	99% Chebyshev(Mean, Sd) UCL	5.921

Suggested UCL to Use

95% Student's-t UCL	4.441

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics				
Total Number of Observations		22	Number of Distinct Observations 22	
			Number of Missing Observations 0	
Minimum	17.6		Mean	42.65
Maximum	185		Median	35.7
SD	33.72		Std. Error of Mean	7.189
Coefficient of Variation	0.791		Skewness	3.877
Normal GOF Test				
Shapiro Wilk Test Statistic		0.531	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value		0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic		0.28	Lilliefors GOF Test	
1% Lilliefors Critical Value		0.214	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level				
Assuming Normal Distribution				
95% Normal UCL			95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	55.02		95% Adjusted-CLT UCL (Chen-1995)	60.82
			95% Modified-t UCL (Johnson-1978)	56.01
Gamma GOF Test				
A-D Test Statistic		1.332	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value		0.748	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic		0.194	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value		0.186	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level				
Gamma Statistics				
k hat (MLE)	3.582		k star (bias corrected MLE)	3.124
Theta hat (MLE)	11.9		Theta star (bias corrected MLE)	13.65
nu hat (MLE)	157.6		nu star (bias corrected)	137.5
MLE Mean (bias corrected)	42.65		MLE Sd (bias corrected)	24.13
			Approximate Chi Square Value (0.05)	111.4
Adjusted Level of Significance	0.0386		Adjusted Chi Square Value	109.6
Assuming Gamma Distribution				
95% Approximate Gamma UCL	52.64		95% Adjusted Gamma UCL	53.48
Lognormal GOF Test				
Shapiro Wilk Test Statistic		0.872	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value		0.926	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic		0.142	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value		0.169	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level				
Lognormal Statistics				
Minimum of Logged Data	2.868		Mean of logged Data	3.607
Maximum of Logged Data	5.22		SD of logged Data	0.481
Assuming Lognormal Distribution				
95% H-UCL	50.92		90% Chebyshev (MVUE) UCL	54.24
95% Chebyshev (MVUE) UCL	60.18		97.5% Chebyshev (MVUE) UCL	68.42
99% Chebyshev (MVUE) UCL	84.61			
Nonparametric Distribution Free UCL Statistics				
Data appear to follow a Discernible Distribution				
Nonparametric Distribution Free UCLs				
95% CLT UCL	54.47		95% BCA Bootstrap UCL	63.25
95% Standard Bootstrap UCL	54.62		95% Bootstrap-t UCL	72.98
95% Hall's Bootstrap UCL	101.5		95% Percentile Bootstrap UCL	56.88
90% Chebyshev(Mean, Sd) UCL	64.21		95% Chebyshev(Mean, Sd) UCL	73.98
7.5% Chebyshev(Mean, Sd) UCL	87.54		99% Chebyshev(Mean, Sd) UCL	114.2

Suggested UCL to Use

95% H-UCL 50.92

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	13.8	Mean	61.14
Maximum	175	Median	55.4
SD	42.69	Std. Error of Mean	9.103
Coefficient of Variation	0.698	Skewness	1.403

Normal GOF Test			
Shapiro Wilk Test Statistic	0.86	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.142	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.214	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			

Assuming Normal Distribution		95% UCLs (Adjusted for Skewness)	
95% Normal UCL		95% Adjusted-CLT UCL (Chen-1995)	79.02
95% Student's-t UCL	76.8	95% Modified-t UCL (Johnson-1978)	77.26

Gamma GOF Test		
A-D Test Statistic	0.281	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0965	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.187	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	2.332	k star (bias corrected MLE)	2.044
Theta hat (MLE)	26.22	Theta star (bias corrected MLE)	29.91
nu hat (MLE)	102.6	nu star (bias corrected)	89.94
MLE Mean (bias corrected)	61.14	MLE Sd (bias corrected)	42.77
		Approximate Chi Square Value (0.05)	69.07
Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	67.7

Assuming Gamma Distribution			
95% Approximate Gamma UCL	79.61	95% Adjusted Gamma UCL	81.22

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.961	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.926	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.109	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.169	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	2.625	Mean of logged Data	3.884
Maximum of Logged Data	5.165	SD of logged Data	0.716

Assuming Lognormal Distribution			
95% H-UCL	88.87	90% Chebyshev (MVUE) UCL	92.37
95% Chebyshev (MVUE) UCL	106.2	97.5% Chebyshev (MVUE) UCL	125.3
99% Chebyshev (MVUE) UCL	162.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	76.11	95% BCA Bootstrap UCL	78.05
95% Standard Bootstrap UCL	75.76	95% Bootstrap-t UCL	80.83
95% Hall's Bootstrap UCL	86.62	95% Percentile Bootstrap UCL	76.61
90% Chebyshev(Mean, Sd) UCL	88.45	95% Chebyshev(Mean, Sd) UCL	100.8
97.5% Chebyshev(Mean, Sd) UCL	118	99% Chebyshev(Mean, Sd) UCL	151.7

Suggested UCL to Use

95% Student's-t UCL	76.8

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	22	Number of Distinct Observations	19
		Number of Missing Observations	0
Minimum	0.0928	Mean	0.421
Maximum	2.5	Median	0.197
SD	0.524	Std. Error of Mean	0.112
Coefficient of Variation	1.245	Skewness	3.227

Normal GOF Test

Shapiro Wilk Test Statistic	0.601
1% Shapiro Wilk Critical Value	0.878
Lilliefors Test Statistic	0.266
1% Lilliefors Critical Value	0.214

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	0.613

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.686
95% Modified-t UCL (Johnson-1978)	0.626

Gamma GOF Test

A-D Test Statistic	1.276
5% A-D Critical Value	0.764
K-S Test Statistic	0.219
5% K-S Critical Value	0.19

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.279	k star (bias corrected MLE)	1.135
Theta hat (MLE)	0.329	Theta star (bias corrected MLE)	0.371
nu hat (MLE)	56.29	nu star (bias corrected)	49.94
MLE Mean (bias corrected)	0.421	MLE Sd (bias corrected)	0.395
		Approximate Chi Square Value (0.05)	34.72
Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	33.77

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.605	95% Adjusted Gamma UCL	0.622

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.894
10% Shapiro Wilk Critical Value	0.926
Lilliefors Test Statistic	0.206
10% Lilliefors Critical Value	0.169

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-2.377	Mean of logged Data	-1.305
Maximum of Logged Data	0.916	SD of logged Data	0.887

Assuming Lognormal Distribution			
95% H-UCL	0.643	90% Chebyshev (MVUE) UCL	0.638
95% Chebyshev (MVUE) UCL	0.749	97.5% Chebyshev (MVUE) UCL	0.904
99% Chebyshev (MVUE) UCL	1.207		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	0.604	95% BCA Bootstrap UCL	0.709
95% Standard Bootstrap UCL	0.606	95% Bootstrap-t UCL	0.792
95% Hall's Bootstrap UCL	1.328	95% Percentile Bootstrap UCL	0.631
90% Chebyshev(Mean, Sd) UCL	0.756	95% Chebyshev(Mean, Sd) UCL	0.907
97.5% Chebyshev(Mean, Sd) UCL	1.118	99% Chebyshev(Mean, Sd) UCL	1.531

Suggested UCL to Use	
95% Student's-t UCL	0.613

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	14.6	Mean	20.15
Maximum	28.4	Median	18.75
SD	3.454	Std. Error of Mean	0.736
Coefficient of Variation	0.171	Skewness	0.759

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.944	Data appear Normal at 1% Significance Level	
1% Shapiro Wilk Critical Value	0.878	Lilliefors GOF Test	
Lilliefors Test Statistic	0.197	Data appear Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.214		

Data appear Normal at 1% Significance Level

Assuming Normal Distribution		95% UCLs (Adjusted for Skewness)	
95% Normal UCL		95% Adjusted-CLT UCL (Chen-1995)	21.48
95% Student's-t UCL	21.41	95% Modified-t UCL (Johnson-1978)	21.43

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.427	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.742	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.187	Data Not Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.185		

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics			
k hat (MLE)	37.39	k star (bias corrected MLE)	32.32
Theta hat (MLE)	0.539	Theta star (bias corrected MLE)	0.623
nu hat (MLE)	1645	nu star (bias corrected)	1422

MLE Mean (bias corrected)	20.15	MLE Sd (bias corrected)	3.543
		Approximate Chi Square Value (0.05)	1336
Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	1329

Assuming Gamma Distribution

95% Approximate Gamma UCL	21.45	95% Adjusted Gamma UCL	21.55

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.969
10% Shapiro Wilk Critical Value	0.926
Lilliefors Test Statistic	0.177
10% Lilliefors Critical Value	0.169

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.681	Mean of logged Data	2.99
Maximum of Logged Data	3.346	SD of logged Data	0.166

Assuming Lognormal Distribution

95% H-UCL	21.48	90% Chebyshev (MVUE) UCL	22.29
95% Chebyshev (MVUE) UCL	23.27	97.5% Chebyshev (MVUE) UCL	24.62
99% Chebyshev (MVUE) UCL	27.28		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	21.36	95% BCA Bootstrap UCL	21.45
95% Standard Bootstrap UCL	21.3	95% Bootstrap-t UCL	21.58
95% Hall's Bootstrap UCL	21.54	95% Percentile Bootstrap UCL	21.27
90% Chebyshev(Mean, Sd) UCL	22.35	95% Chebyshev(Mean, Sd) UCL	23.36
97.5% Chebyshev(Mean, Sd) UCL	24.74	99% Chebyshev(Mean, Sd) UCL	27.47

Suggested UCL to Use

95% Student's-t UCL	21.41

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	22	Number of Distinct Observations	20
		Number of Missing Observations	0
Minimum	58.4	Mean	106.1
Maximum	164	Median	109
SD	25.69	Std. Error of Mean	5.477
Coefficient of Variation	0.242	Skewness	0.2

Normal GOF Test

Shapiro Wilk Test Statistic	0.982
1% Shapiro Wilk Critical Value	0.878
Lilliefors Test Statistic	0.093
1% Lilliefors Critical Value	0.214

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	115.5	95% Adjusted-CLT UCL (Chen-1995)	115.3
		95% Modified-t UCL (Johnson-1978)	115.6

Gamma GOF Test

A-D Test Statistic	0.239
5% A-D Critical Value	0.741

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

K-S Test Statistic	0.122	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.185	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	17.3	k star (bias corrected MLE)	14.97
Theta hat (MLE)	6.133	Theta star (bias corrected MLE)	7.087
nu hat (MLE)	761.1	nu star (bias corrected)	658.7
MLE Mean (bias corrected)	106.1	MLE Sd (bias corrected)	27.42
		Approximate Chi Square Value (0.05)	600.1
Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	596

Assuming Gamma Distribution			
95% Approximate Gamma UCL	116.4	95% Adjusted Gamma UCL	117.3

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.977	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.926	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.134	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.169	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	4.067	Mean of logged Data	4.635
Maximum of Logged Data	5.1	SD of logged Data	0.251

Assuming Lognormal Distribution			
95% H-UCL	117.4	90% Chebyshev (MVUE) UCL	123.4
95% Chebyshev (MVUE) UCL	131.2	97.5% Chebyshev (MVUE) UCL	142
99% Chebyshev (MVUE) UCL	163.3		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	115.1	95% BCA Bootstrap UCL	115.2
95% Standard Bootstrap UCL	115	95% Bootstrap-t UCL	115.8
95% Hall's Bootstrap UCL	115.6	95% Percentile Bootstrap UCL	115
90% Chebyshev(Mean, Sd) UCL	122.5	95% Chebyshev(Mean, Sd) UCL	130
97.5% Chebyshev(Mean, Sd) UCL	140.3	99% Chebyshev(Mean, Sd) UCL	160.6

Suggested UCL to Use	
95% Student's-t UCL	115.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	1.9365E-6	Mean	2.0156E-5
Maximum	1.4964E-4	Median	8.0995E-6
SD	3.2427E-5	Std. Error of Mean	6.9135E-6
Coefficient of Variation	N/A	Skewness	3.402

Normal GOF Test			
Shapiro Wilk Test Statistic	0.542	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.298	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.214	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 3.2052E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 3.6885E-5

95% Modified-t UCL (Johnson-1978) 3.2888E-5

Gamma GOF Test

A-D Test Statistic 1.346
5% A-D Critical Value 0.775
K-S Test Statistic 0.225
5% K-S Critical Value 0.191

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 0.906
Theta hat (MLE) 2.2252E-5
nu hat (MLE) 39.85
MLE Mean (bias corrected) 2.0156E-5

Adjusted Level of Significance 0.0386

k star (bias corrected MLE) 0.813
Theta star (bias corrected MLE) 2.4805E-5
nu star (bias corrected) 35.75
MLE Sd (bias corrected) 2.2360E-5
Approximate Chi Square Value (0.05) 23.07
Adjusted Chi Square Value 22.31

Assuming Gamma Distribution

95% Approximate Gamma UCL 3.1237E-5

95% Adjusted Gamma UCL 3.2301E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.948
10% Shapiro Wilk Critical Value 0.926
Lilliefors Test Statistic 0.157
10% Lilliefors Critical Value 0.169

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -13.15
Maximum of Logged Data -8.807

Mean of logged Data -11.46
SD of logged Data 1.05

Assuming Lognormal Distribution

95% H-UCL 3.3677E-5
95% Chebyshev (MVUE) UCL 3.7291E-5
99% Chebyshev (MVUE) UCL 6.2432E-5

90% Chebyshev (MVUE) UCL 3.1180E-5
97.5% Chebyshev (MVUE) UCL 4.5772E-5

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL 3.1527E-5
95% Standard Bootstrap UCL 3.1378E-5
95% Hall's Bootstrap UCL 7.1924E-5
90% Chebyshev(Mean, Sd) UCL 4.0896E-5
97.5% Chebyshev(Mean, Sd) UCL 6.3331E-5

95% BCA Bootstrap UCL 3.8422E-5
95% Bootstrap-t UCL 4.9481E-5
95% Percentile Bootstrap UCL 3.2604E-5
95% Chebyshev(Mean, Sd) UCL 5.0291E-5
99% Chebyshev(Mean, Sd) UCL 8.8945E-5

Suggested UCL to Use

95% H-UCL 3.3677E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations 22
Number of Detects 5
Number of Distinct Detects 5
Minimum Detect 0.0052
Maximum Detect 0.0613
Variance Detects 5.4316E-4
Mean Detects 0.0221

Number of Distinct Observations 19
Number of Non-Detects 17
Number of Distinct Non-Detects 14
Minimum Non-Detect 0.00473
Maximum Non-Detect 0.00507
Percent Non-Detects 77.27%
SD Detects 0.0233

Median Detects	0.0143	CV Detects	1.055
Skewness Detects	1.653	Kurtosis Detects	2.719
Mean of Logged Detects	-4.253	SD of Logged Detects	1.053

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.808	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.26	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00868	KM Standard Error of Mean	0.00294
90KM SD	0.0123	95% KM (BCA) UCL	0.0134
95% KM (t) UCL	0.0137	95% KM (Percentile Bootstrap) UCL	0.0135
95% KM (z) UCL	0.0135	95% KM Bootstrap t UCL	0.0219
90% KM Chebyshev UCL	0.0175	95% KM Chebyshev UCL	0.0215
97.5% KM Chebyshev UCL	0.027	99% KM Chebyshev UCL	0.0379

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.348	Anderson-Darling GOF Test
5% A-D Critical Value	0.689	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	1.278	k star (bias corrected MLE)	0.644
Theta hat (MLE)	0.0173	Theta star (bias corrected MLE)	0.0343
nu hat (MLE)	12.78	nu star (bias corrected)	6.443
Mean (detects)	0.0221		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0052	Mean	0.0127
Maximum	0.0613	Median	0.01
SD	0.0114	CV	0.896
k hat (MLE)	3.232	k star (bias corrected MLE)	2.822
Theta hat (MLE)	0.00394	Theta star (bias corrected MLE)	0.00452
nu hat (MLE)	142.2	nu star (bias corrected)	124.1
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (124.15, α)	99.41	Adjusted Chi Square Value (124.15, β)	97.76
95% Gamma Approximate UCL	0.0159	95% Gamma Adjusted UCL	0.0162

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00868	SD (KM)	0.0123
Variance (KM)	1.5167E-4	SE of Mean (KM)	0.00294
k hat (KM)	0.496	k star (KM)	0.459
nu hat (KM)	21.83	nu star (KM)	20.19
theta hat (KM)	0.0175	theta star (KM)	0.0189
80% gamma percentile (KM)	0.0142	90% gamma percentile (KM)	0.0239
95% gamma percentile (KM)	0.0344	99% gamma percentile (KM)	0.0603

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.19, α)	10.99	Adjusted Chi Square Value (20.19, β)	10.48
95% KM Approximate Gamma UCL	0.0159	95% KM Adjusted Gamma UCL	0.0167

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.912	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.806	Detected Data appear Lognormal at 10% Significance Level

Lilliefors Test Statistic	0.229	Lilliefors GOF Test
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00516	Mean in Log Scale	-7.801
SD in Original Scale	0.0138	SD in Log Scale	2.103
95% t UCL (assumes normality of ROS data)	0.0102	95% Percentile Bootstrap UCL	0.0102
95% BCA Bootstrap UCL	0.0135	95% Bootstrap t UCL	0.023
95% H-UCL (Log ROS)	0.0277		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.104	KM Geo Mean	0.00608
KM SD (logged)	0.644	95% Critical H Value (KM-Log)	2.141
KM Standard Error of Mean (logged)	0.153	95% H-UCL (KM -Log)	0.0101
KM SD (logged)	0.644	95% Critical H Value (KM-Log)	2.141
KM Standard Error of Mean (logged)	0.153		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00693
SD in Original Scale	0.0132
95% t UCL (Assumes normality)	0.0118

DL/2 Log-Transformed

Mean in Log Scale	-5.604
SD in Log Scale	0.88
95% H-Stat UCL	0.00864

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0137

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	0.0881	Mean	2.606
Maximum	30.2	Median	0.507
SD	7.094	Std. Error of Mean	1.512
Coefficient of Variation	2.722	Skewness	3.482

Normal GOF Test

Shapiro Wilk Test Statistic	0.381
1% Shapiro Wilk Critical Value	0.878
Lilliefors Test Statistic	0.462
1% Lilliefors Critical Value	0.214

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	5.208

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	6.293
95% Modified-t UCL (Johnson-1978)	5.395

Gamma GOF Test

A-D Test Statistic	3.335

Anderson-Darling Gamma GOF Test

5% A-D Critical Value	0.822	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.337	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.198	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	0.418	k star (bias corrected MLE)	0.391
Theta hat (MLE)	6.239	Theta star (bias corrected MLE)	6.665
nu hat (MLE)	18.38	nu star (bias corrected)	17.2
MLE Mean (bias corrected)	2.606	MLE Sd (bias corrected)	4.167
		Approximate Chi Square Value (0.05)	8.818
Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	8.371

Assuming Gamma Distribution

95% Approximate Gamma UCL	5.084	95% Adjusted Gamma UCL	5.355

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.851	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.926	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.208	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.169	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.429	Mean of logged Data	-0.607
Maximum of Logged Data	3.408	SD of logged Data	1.447

Assuming Lognormal Distribution

95% H-UCL	4.339	90% Chebyshev (MVUE) UCL	3.009
95% Chebyshev (MVUE) UCL	3.727	97.5% Chebyshev (MVUE) UCL	4.725
99% Chebyshev (MVUE) UCL	6.683		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	5.093	95% BCA Bootstrap UCL	6.671
95% Standard Bootstrap UCL	5.025	95% Bootstrap-t UCL	41.92
95% Hall's Bootstrap UCL	22.83	95% Percentile Bootstrap UCL	5.282
90% Chebyshev(Mean, Sd) UCL	7.143	95% Chebyshev(Mean, Sd) UCL	9.198
97.5% Chebyshev(Mean, Sd) UCL	12.05	99% Chebyshev(Mean, Sd) UCL	17.65

Suggested UCL to Use

95% Student's-t UCL	5.208

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs

General Statistics			
Total Number of Observations	22	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	0.0132	Mean	0.42
Maximum	5.13	Median	0.0765
SD	1.183	Std. Error of Mean	0.252
Coefficient of Variation	2.815	Skewness	3.606

Normal GOF Test

Shapiro Wilk Test Statistic	0.373	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.878	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.462	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.214	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.854	95% Adjusted-CLT UCL (Chen-1995)	1.042
		95% Modified-t UCL (Johnson-1978)	0.887

Gamma GOF Test

A-D Test Statistic	3.426	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.826	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.342	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.199	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.399	k star (bias corrected MLE)	0.375
Theta hat (MLE)	1.054	Theta star (bias corrected MLE)	1.122
nu hat (MLE)	17.55	nu star (bias corrected)	16.49
MLE Mean (bias corrected)	0.42	MLE Sd (bias corrected)	0.687
		Approximate Chi Square Value (0.05)	8.306
Adjusted Level of Significance	0.0386	Adjusted Chi Square Value	7.874

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.834	95% Adjusted Gamma UCL	0.88

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.845	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.926	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.212	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.169	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.328	Mean of logged Data	-2.518
Maximum of Logged Data	1.635	SD of logged Data	1.474

Assuming Lognormal Distribution

95% H-UCL	0.691	90% Chebyshev (MVUE) UCL	0.467
95% Chebyshev (MVUE) UCL	0.579	97.5% Chebyshev (MVUE) UCL	0.736
99% Chebyshev (MVUE) UCL	1.042		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.835	95% BCA Bootstrap UCL	1.114
95% Standard Bootstrap UCL	0.824	95% Bootstrap-t UCL	7.457
95% Hall's Bootstrap UCL	4.15	95% Percentile Bootstrap UCL	0.875
90% Chebyshev(Mean, Sd) UCL	1.177	95% Chebyshev(Mean, Sd) UCL	1.52
97.5% Chebyshev(Mean, Sd) UCL	1.995	99% Chebyshev(Mean, Sd) UCL	2.93

Suggested UCL to Use

95% Student's-t UCL	0.854

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics

Total Number of Observations	22	Number of Distinct Observations	17
Number of Detects	5	Number of Non-Detects	17
Number of Distinct Detects	5	Number of Distinct Non-Detects	12
Minimum Detect	0.0316	Minimum Non-Detect	0.00481
Maximum Detect	0.189	Maximum Non-Detect	0.00506
Variance Detects	0.00454	Percent Non-Detects	77.27%
Mean Detects	0.0699	SD Detects	0.0674
Median Detects	0.0389	CV Detects	0.964
Skewness Detects	2.118	Kurtosis Detects	4.539
Mean of Logged Detects	-2.929	SD of Logged Detects	0.743

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.671	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.686	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.377	Lilliefors GOF Test
1% Lilliefors Critical Value	0.396	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level**Note GOF tests may be unreliable for small sample sizes****Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

KM Mean	0.0196	KM Standard Error of Mean	0.00944
90KM SD	0.0396	95% KM (BCA) UCL	0.0365
95% KM (t) UCL	0.0358	95% KM (Percentile Bootstrap) UCL	0.036
95% KM (z) UCL	0.0351	95% KM Bootstrap t UCL	0.044
90% KM Chebyshev UCL	0.0479	95% KM Chebyshev UCL	0.0607
97.5% KM Chebyshev UCL	0.0785	99% KM Chebyshev UCL	0.114

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.732	Anderson-Darling GOF Test
5% A-D Critical Value	0.684	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.318	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level**Note GOF tests may be unreliable for small sample sizes****Gamma Statistics on Detected Data Only**

k hat (MLE)	2.016	k star (bias corrected MLE)	0.94
Theta hat (MLE)	0.0347	Theta star (bias corrected MLE)	0.0743
nu hat (MLE)	20.16	nu star (bias corrected)	9.396
Mean (detects)	0.0699		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0236
Maximum	0.189	Median	0.01
SD	0.039	CV	1.654
k hat (MLE)	1.185	k star (bias corrected MLE)	1.054
Theta hat (MLE)	0.0199	Theta star (bias corrected MLE)	0.0224
nu hat (MLE)	52.14	nu star (bias corrected)	46.36
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (46.36, α)	31.74	Adjusted Chi Square Value (46.36, β)	30.84
95% Gamma Approximate UCL	0.0345	95% Gamma Adjusted UCL	0.0355

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0196	SD (KM)	0.0396
Variance (KM)	0.00157	SE of Mean (KM)	0.00944
k hat (KM)	0.245	k star (KM)	0.242
nu hat (KM)	10.77	nu star (KM)	10.64

theta hat (KM)	0.08	theta star (KM)	0.081
80% gamma percentile (KM)	0.0281	90% gamma percentile (KM)	0.0589
95% gamma percentile (KM)	0.0958	99% gamma percentile (KM)	0.194

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.64, α)	4.344	Adjusted Chi Square Value (10.64, β)	4.047
95% KM Approximate Gamma UCL	0.048	95% KM Adjusted Gamma UCL	0.0515

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.806	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.267	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.319	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.018	Mean in Log Scale	-5.341
SD in Original Scale	0.0412	SD in Log Scale	1.463
95% t UCL (assumes normality of ROS data)	0.0331	95% Percentile Bootstrap UCL	0.0332
95% BCA Bootstrap UCL	0.0425	95% Bootstrap t UCL	0.0587
95% H-UCL (Log ROS)	0.0398		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.79	KM Geo Mean	0.00831
KM SD (logged)	1.058	95% Critical H Value (KM-Log)	2.663
KM Standard Error of Mean (logged)	0.252	95% H-UCL (KM -Log)	0.0269
KM SD (logged)	1.058	95% Critical H Value (KM-Log)	2.663
KM Standard Error of Mean (logged)	0.252		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0178	Mean in Log Scale	-5.304
SD in Original Scale	0.0412	SD in Log Scale	1.357
95% t UCL (Assumes normality)	0.0329	95% H-Stat UCL	0.0314

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0358

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:49:41 PM
 From File 90 UCL Input Data_MG_b.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	51	Number of Distinct Observations	48
Number of Detects	29	Number of Non-Detects	22
Number of Distinct Detects	29	Number of Distinct Non-Detects	19
Minimum Detect	0.557	Minimum Non-Detect	0.486
Maximum Detect	6.81	Maximum Non-Detect	0.56
Variance Detects	2.335	Percent Non-Detects	43.14%
Mean Detects	2.205	SD Detects	1.528
Median Detects	1.84	CV Detects	0.693
Skewness Detects	1.269	Kurtosis Detects	1.544
Mean of Logged Detects	0.568	SD of Logged Detects	0.687

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.881	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.898	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.144	Lilliefors GOF Test
1% Lilliefors Critical Value	0.189	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.464	KM Standard Error of Mean	0.202
90KM SD	1.417	95% KM (BCA) UCL	1.822
95% KM (t) UCL	1.802	95% KM (Percentile Bootstrap) UCL	1.807
95% KM (z) UCL	1.796	95% KM Bootstrap t UCL	1.867
90% KM Chebyshev UCL	2.069	95% KM Chebyshev UCL	2.344
97.5% KM Chebyshev UCL	2.725	99% KM Chebyshev UCL	3.473

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.338	Anderson-Darling GOF Test
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.111	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.164	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.397	k star (bias corrected MLE)	2.172
Theta hat (MLE)	0.92	Theta star (bias corrected MLE)	1.015
nu hat (MLE)	139	nu star (bias corrected)	126
Mean (detects)	2.205		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.258
Maximum	6.81	Median	0.735
SD	1.585	CV	1.26
k hat (MLE)	0.354	k star (bias corrected MLE)	0.347
Theta hat (MLE)	3.551	Theta star (bias corrected MLE)	3.63
nu hat (MLE)	36.15	nu star (bias corrected)	35.36
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (35.36, α)	22.75	Adjusted Chi Square Value (35.36, β)	22.46
95% Gamma Approximate UCL	1.956	95% Gamma Adjusted UCL	1.981

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.464	SD (KM)	1.417
Variance (KM)	2.007	SE of Mean (KM)	0.202
k hat (KM)	1.068	k star (KM)	1.018
nu hat (KM)	108.9	nu star (KM)	103.8
theta hat (KM)	1.371	theta star (KM)	1.438
80% gamma percentile (KM)	2.352	90% gamma percentile (KM)	3.356
95% gamma percentile (KM)	4.358	99% gamma percentile (KM)	6.681

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (103.82, α)	81.31	Adjusted Chi Square Value (103.82, β)	80.73
95% KM Approximate Gamma UCL	1.869	95% KM Adjusted Gamma UCL	1.882

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.968	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.937	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0815	Lilliefors GOF Test
10% Lilliefors Critical Value	0.148	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	1.397	Mean in Log Scale	-0.158
SD in Original Scale	1.479	SD in Log Scale	0.992
95% t UCL (assumes normality of ROS data)	1.744	95% Percentile Bootstrap UCL	1.735
95% BCA Bootstrap UCL	1.768	95% Bootstrap t UCL	1.824
95% H-UCL (Log ROS)	1.927		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0119	KM Geo Mean	1.012
KM SD (logged)	0.817	95% Critical H Value (KM-Log)	2.127
KM Standard Error of Mean (logged)	0.116	95% H-UCL (KM -Log)	1.806
KM SD (logged)	0.817	95% Critical H Value (KM-Log)	2.127
KM Standard Error of Mean (logged)	0.116		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	1.365
SD in Original Scale	1.502
95% t UCL (Assumes normality)	1.718

DL/2 Log-Transformed

Mean in Log Scale	-0.262
SD in Log Scale	1.091
95% H-Stat UCL	2.023

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

95% KM (t) UCL	1.802

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic**General Statistics**

Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	2.69	Mean	6.605
Maximum	50.1	Median	4.14
SD	7.277	Std. Error of Mean	1.019
Coefficient of Variation	1.102	Skewness	4.625

Normal GOF Test		
Shapiro Wilk Test Statistic	0.513	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.295	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	8.313	95% Adjusted-CLT UCL (Chen-1995)	8.987
		95% Modified-t UCL (Johnson-1978)	8.423

Gamma GOF Test		
A-D Test Statistic	3.868	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.762	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.126	Data Not Gamma Distributed at 5% Significance Level
Data Not Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	2.162	k star (bias corrected MLE)	2.048
Theta hat (MLE)	3.055	Theta star (bias corrected MLE)	3.225
nu hat (MLE)	220.5	nu star (bias corrected)	208.9
MLE Mean (bias corrected)	6.605	MLE Sd (bias corrected)	4.616
		Approximate Chi Square Value (0.05)	176.5
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	175.6

Assuming Gamma Distribution			
95% Approximate Gamma UCL	7.82	95% Adjusted Gamma UCL	7.859

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.842	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	4.7485E-7	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.177	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.113	Data Not Lognormal at 10% Significance Level
Data Not Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	0.99	Mean of logged Data	1.639
Maximum of Logged Data	3.914	SD of logged Data	0.605

Assuming Lognormal Distribution			
95% H-UCL	7.31	90% Chebyshev (MVUE) UCL	7.84
95% Chebyshev (MVUE) UCL	8.601	97.5% Chebyshev (MVUE) UCL	9.657
99% Chebyshev (MVUE) UCL	11.73		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	8.282	95% BCA Bootstrap UCL	9.276
95% Standard Bootstrap UCL	8.249	95% Bootstrap-t UCL	9.814
95% Hall's Bootstrap UCL	15	95% Percentile Bootstrap UCL	8.369
90% Chebyshev(Mean, Sd) UCL	9.662	95% Chebyshev(Mean, Sd) UCL	11.05
97.5% Chebyshev(Mean, Sd) UCL	12.97	99% Chebyshev(Mean, Sd) UCL	16.74

Suggested UCL to Use	
95% Student's-t UCL	8.313

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	37
		Number of Missing Observations	0
Minimum	9.45	Mean	14.15
Maximum	21.7	Median	13.8
SD	2.775	Std. Error of Mean	0.389
Coefficient of Variation	0.196	Skewness	0.728
Normal GOF Test			
Shapiro Wilk Test Statistic	0.943	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0.0263	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.141	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.143	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	14.8	95% Adjusted-CLT UCL (Chen-1995)	14.83
		95% Modified-t UCL (Johnson-1978)	14.81
Gamma GOF Test			
A-D Test Statistic	0.536	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.115	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.124	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	27.67	k star (bias corrected MLE)	26.06
Theta hat (MLE)	0.511	Theta star (bias corrected MLE)	0.543
nu hat (MLE)	2822	nu star (bias corrected)	2658
MLE Mean (bias corrected)	14.15	MLE Sd (bias corrected)	2.772
		Approximate Chi Square Value (0.05)	2539
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	2536
Assuming Gamma Distribution			
95% Approximate Gamma UCL	14.81	95% Adjusted Gamma UCL	14.83
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.304	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.104	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.113	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.246	Mean of logged Data	2.631
Maximum of Logged Data	3.077	SD of logged Data	0.192
Assuming Lognormal Distribution			
95% H-UCL	14.82	90% Chebyshev (MVUE) UCL	15.29
95% Chebyshev (MVUE) UCL	15.81	97.5% Chebyshev (MVUE) UCL	16.53
99% Chebyshev (MVUE) UCL	17.95		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	14.79	95% BCA Bootstrap UCL	14.8
95% Standard Bootstrap UCL	14.77	95% Bootstrap-t UCL	14.83
95% Hall's Bootstrap UCL	14.84	95% Percentile Bootstrap UCL	14.78

90% Chebyshev(Mean, Sd) UCL 15.31
97.5% Chebyshev(Mean, Sd) UCL 16.57

95% Chebyshev(Mean, Sd) UCL 15.84
99% Chebyshev(Mean, Sd) UCL 18.01

Suggested UCL to Use

95% Student's-t UCL 14.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

General Statistics

Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	15	Mean	56.3
Maximum	327	Median	35.4
SD	59.55	Std. Error of Mean	8.339
Coefficient of Variation	1.058	Skewness	2.894

Normal GOF Test

Shapiro Wilk Test Statistic 0.651
1% Shapiro Wilk P Value 1.354E-14
Lilliefors Test Statistic 0.244
1% Lilliefors Critical Value 0.143

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 70.27

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 73.62
95% Modified-t UCL (Johnson-1978) 70.84

Gamma GOF Test

A-D Test Statistic 1.852
5% A-D Critical Value 0.766
K-S Test Statistic 0.132
5% K-S Critical Value 0.126

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.657	k star (bias corrected MLE)	1.572
Theta hat (MLE)	33.98	Theta star (bias corrected MLE)	35.81
nu hat (MLE)	169	nu star (bias corrected)	160.4
MLE Mean (bias corrected)	56.3	MLE Sd (bias corrected)	44.9
		Approximate Chi Square Value (0.05)	132.1
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	131.3

Assuming Gamma Distribution

95% Approximate Gamma UCL 68.35

95% Adjusted Gamma UCL 68.74

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.923
10% Shapiro Wilk P Value 0.00279
Lilliefors Test Statistic 0.0961
10% Lilliefors Critical Value 0.113

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	3.699
Maximum of Logged Data	5.79	SD of logged Data	0.76

Assuming Lognormal Distribution

95% H-UCL 67.46
95% Chebyshev (MVUE) UCL 81.17
99% Chebyshev (MVUE) UCL 116.6

90% Chebyshev (MVUE) UCL 72.57
97.5% Chebyshev (MVUE) UCL 93.11

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	70.01	95% BCA Bootstrap UCL	75.33
95% Standard Bootstrap UCL	70.12	95% Bootstrap-t UCL	77.24
95% Hall's Bootstrap UCL	77.38	95% Percentile Bootstrap UCL	71.33
90% Chebyshev(Mean, Sd) UCL	81.31	95% Chebyshev(Mean, Sd) UCL	92.65
97.5% Chebyshev(Mean, Sd) UCL	108.4	99% Chebyshev(Mean, Sd) UCL	139.3

Suggested UCL to Use

95% H-UCL 67.46

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics

Total Number of Observations	51	Number of Distinct Observations	50
		Number of Missing Observations	0
Minimum	3.1	Mean	50.35
Maximum	220	Median	39.1
SD	49.16	Std. Error of Mean	6.884
Coefficient of Variation	0.976	Skewness	1.623

Normal GOF Test

Shapiro Wilk Test Statistic	0.83
1% Shapiro Wilk P Value	1.3726E-7
Lilliefors Test Statistic	0.182
1% Lilliefors Critical Value	0.143

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 61.89

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	63.35
95% Modified-t UCL (Johnson-1978)	62.15

Gamma GOF Test

A-D Test Statistic	0.384
5% A-D Critical Value	0.778
K-S Test Statistic	0.0818
5% K-S Critical Value	0.128

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.072	k star (bias corrected MLE)	1.022
Theta hat (MLE)	46.96	Theta star (bias corrected MLE)	49.26
nu hat (MLE)	109.4	nu star (bias corrected)	104.3
MLE Mean (bias corrected)	50.35	MLE Sd (bias corrected)	49.8
		Approximate Chi Square Value (0.05)	81.71
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	81.13

Assuming Gamma Distribution

95% Approximate Gamma UCL 64.26

95% Adjusted Gamma UCL 64.72

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.941

Shapiro Wilk Lognormal GOF Test

10% Shapiro Wilk P Value	0.02	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.106	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.113	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	1.131	Mean of logged Data	3.385
Maximum of Logged Data	5.394	SD of logged Data	1.155

Assuming Lognormal Distribution			
95% H-UCL	86.11	90% Chebyshev (MVUE) UCL	89.75
95% Chebyshev (MVUE) UCL	104.9	97.5% Chebyshev (MVUE) UCL	125.9
99% Chebyshev (MVUE) UCL	167.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	61.68	95% BCA Bootstrap UCL	63.79
95% Standard Bootstrap UCL	61.88	95% Bootstrap-t UCL	64.44
95% Hall's Bootstrap UCL	64.62	95% Percentile Bootstrap UCL	62.7
90% Chebyshev(Mean, Sd) UCL	71.01	95% Chebyshev(Mean, Sd) UCL	80.36
97.5% Chebyshev(Mean, Sd) UCL	93.35	99% Chebyshev(Mean, Sd) UCL	118.9

Suggested UCL to Use
95% Approximate Gamma UCL 64.26

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	43
Number of Detects	23	Number of Non-Detects	28
Number of Distinct Detects	23	Number of Distinct Non-Detects	22
Minimum Detect	0.0415	Minimum Non-Detect	0.0389
Maximum Detect	0.706	Maximum Non-Detect	0.0448
Variance Detects	0.0328	Percent Non-Detects	54.9%
Mean Detects	0.137	SD Detects	0.181
Median Detects	0.0606	CV Detects	1.326
Skewness Detects	2.613	Kurtosis Detects	6.258
Mean of Logged Detects	-2.454	SD of Logged Detects	0.852

Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.562	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.312	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.209	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.083	KM Standard Error of Mean	0.0184
90KM SD	0.129	95% KM (BCA) UCL	0.117
95% KM (t) UCL	0.114	95% KM (Percentile Bootstrap) UCL	0.116
95% KM (z) UCL	0.113	95% KM Bootstrap t UCL	0.169
90% KM Chebyshev UCL	0.138	95% KM Chebyshev UCL	0.163
97.5% KM Chebyshev UCL	0.198	99% KM Chebyshev UCL	0.266

Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	2.532	Anderson-Darling GOF Test	
5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.273	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.186	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.218	k star (bias corrected MLE)	1.088
Theta hat (MLE)	0.112	Theta star (bias corrected MLE)	0.126
nu hat (MLE)	56.01	nu star (bias corrected)	50.04
Mean (detects)	0.137		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0671
Maximum	0.706	Median	0.01
SD	0.136	CV	2.026
k hat (MLE)	0.654	k star (bias corrected MLE)	0.628
Theta hat (MLE)	0.103	Theta star (bias corrected MLE)	0.107
nu hat (MLE)	66.66	nu star (bias corrected)	64.07
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (64.07, α)	46.66	Adjusted Chi Square Value (64.07, β)	46.22
95% Gamma Approximate UCL	0.0922	95% Gamma Adjusted UCL	0.093

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.083	SD (KM)	0.129
Variance (KM)	0.0165	SE of Mean (KM)	0.0184
k hat (KM)	0.418	k star (KM)	0.406
nu hat (KM)	42.6	nu star (KM)	41.43
theta hat (KM)	0.199	theta star (KM)	0.204
80% gamma percentile (KM)	0.134	90% gamma percentile (KM)	0.234
95% gamma percentile (KM)	0.343	99% gamma percentile (KM)	0.618

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (41.43, α)	27.67	Adjusted Chi Square Value (41.43, β)	27.35
95% KM Approximate Gamma UCL	0.124	95% KM Adjusted Gamma UCL	0.126

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.793	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.928	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.227	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.165	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0669	Mean in Log Scale	-3.685
SD in Original Scale	0.136	SD in Log Scale	1.28
95% t UCL (assumes normality of ROS data)	0.0988	95% Percentile Bootstrap UCL	0.101
95% BCA Bootstrap UCL	0.109	95% Bootstrap t UCL	0.138
95% H-UCL (Log ROS)	0.0915		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.888	KM Geo Mean	0.0557
KM SD (logged)	0.684	95% Critical H Value (KM-Log)	2.012
KM Standard Error of Mean (logged)	0.098	95% H-UCL (KM -Log)	0.0855
KM SD (logged)	0.684	95% Critical H Value (KM-Log)	2.012
KM Standard Error of Mean (logged)	0.098		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.073
SD in Original Scale	0.134
95% t UCL (Assumes normality)	0.104

DL/2 Log-Transformed

Mean in Log Scale	-3.234
SD in Log Scale	0.911
95% H-Stat UCL	0.0794

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL 0.114

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	14.2	Mean	17.75
Maximum	24.3	Median	17.7
SD	2.142	Std. Error of Mean	0.3
Coefficient of Variation	0.121	Skewness	0.903
Normal GOF Test			
Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0.0203	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.129	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.143	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	18.25	95% Adjusted-CLT UCL (Chen-1995)	18.28
		95% Modified-t UCL (Johnson-1978)	18.25
Gamma GOF Test			
A-D Test Statistic	0.597	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.112	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.124	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	73.61	k star (bias corrected MLE)	69.29
Theta hat (MLE)	0.241	Theta star (bias corrected MLE)	0.256
nu hat (MLE)	7508	nu star (bias corrected)	7068
MLE Mean (bias corrected)	17.75	MLE Sd (bias corrected)	2.132
		Approximate Chi Square Value (0.05)	6873
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	6868
Assuming Gamma Distribution			
95% Approximate Gamma UCL	18.25	95% Adjusted Gamma UCL	18.26
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.965	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0.245	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.106	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.113	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.653	Mean of logged Data	2.869
Maximum of Logged Data	3.19	SD of logged Data	0.117
Assuming Lognormal Distribution			

95% H-UCL	18.25	90% Chebyshev (MVUE) UCL	18.61
95% Chebyshev (MVUE) UCL	19.01	97.5% Chebyshev (MVUE) UCL	19.56
99% Chebyshev (MVUE) UCL	20.63		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	18.24	95% BCA Bootstrap UCL	18.33
95% Standard Bootstrap UCL	18.25	95% Bootstrap-t UCL	18.36
95% Hall's Bootstrap UCL	18.38	95% Percentile Bootstrap UCL	18.26
90% Chebyshev(Mean, Sd) UCL	18.64	95% Chebyshev(Mean, Sd) UCL	19.05
97.5% Chebyshev(Mean, Sd) UCL	19.62	99% Chebyshev(Mean, Sd) UCL	20.73

Suggested UCL to Use

95% Student's-t UCL	18.25

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	44.3	Mean	138.6
Maximum	354	Median	130
SD	76.39	Std. Error of Mean	10.7
Coefficient of Variation	0.551	Skewness	0.693

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.926	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	0.00393	Lilliefors GOF Test	
Lilliefors Test Statistic	0.109	Data appear Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.143		

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	156.5	95% Adjusted-CLT UCL (Chen-1995)	157.3
		95% Modified-t UCL (Johnson-1978)	156.7

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.63	Detected data appear Gamma Distributed at 5% Significance Level	
5% A-D Critical Value	0.756	Kolmogorov-Smirnov Gamma GOF Test	
K-S Test Statistic	0.112	Detected data appear Gamma Distributed at 5% Significance Level	
5% K-S Critical Value	0.125		

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	3.258	k star (bias corrected MLE)	3.08
Theta hat (MLE)	42.53	Theta star (bias corrected MLE)	45
nu hat (MLE)	332.3	nu star (bias corrected)	314.1
MLE Mean (bias corrected)	138.6	MLE Sd (bias corrected)	78.97
		Approximate Chi Square Value (0.05)	274.1
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	273

Assuming Gamma Distribution

95% Approximate Gamma UCL	158.8	95% Adjusted Gamma UCL	159.5

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.933	Data Not Lognormal at 10% Significance Level	
10% Shapiro Wilk P Value	0.00865	Lilliefors Lognormal GOF Test	
Lilliefors Test Statistic	0.111		

10% Lilliefors Critical Value 0.113 Data appear Lognormal at 10% Significance Level
Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	3.791	Mean of logged Data	4.77
Maximum of Logged Data	5.869	SD of logged Data	0.593

Assuming Lognormal Distribution			
95% H-UCL	165.5	90% Chebyshev (MVUE) UCL	177.4
95% Chebyshev (MVUE) UCL	194.3	97.5% Chebyshev (MVUE) UCL	217.8
99% Chebyshev (MVUE) UCL	263.9		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	156.2	95% BCA Bootstrap UCL	157.8
95% Standard Bootstrap UCL	156.2	95% Bootstrap-t UCL	157.2
95% Hall's Bootstrap UCL	156.8	95% Percentile Bootstrap UCL	157.1
90% Chebyshev(Mean, Sd) UCL	170.7	95% Chebyshev(Mean, Sd) UCL	185.2
97.5% Chebyshev(Mean, Sd) UCL	205.4	99% Chebyshev(Mean, Sd) UCL	245

Suggested UCL to Use	
95% Student's-t UCL	156.5

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	51
		Number of Missing Observations	0
Minimum	5.1751E-7	Mean	3.2407E-5
Maximum	2.5457E-4	Median	1.5268E-5
SD	5.2370E-5	Std. Error of Mean	7.3333E-6
Coefficient of Variation	N/A	Skewness	3.168

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.591	Data Not Normal at 1% Significance Level	
1% Shapiro Wilk P Value	1.110E-16	Lilliefors GOF Test	
Lilliefors Test Statistic	0.271	Data Not Normal at 1% Significance Level	
1% Lilliefors Critical Value	0.143		

Data Not Normal at 1% Significance Level

Assuming Normal Distribution		95% UCLs (Adjusted for Skewness)	
95% Normal UCL		95% Adjusted-CLT UCL (Chen-1995)	4.7946E-5
95% Student's-t UCL	4.4697E-5	95% Modified-t UCL (Johnson-1978)	4.5239E-5

Gamma GOF Test		
A-D Test Statistic	0.885	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.809	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.118	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.131	Detected data appear Gamma Distributed at 5% Significance Level
Detected data follow Appr. Gamma Distribution at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	0.562	k star (bias corrected MLE)	0.542
Theta hat (MLE)	5.7689E-5	Theta star (bias corrected MLE)	5.9816E-5
nu hat (MLE)	57.3	nu star (bias corrected)	55.26

MLE Mean (bias corrected) 3.2407E-5	MLE Sd (bias corrected) 4.4028E-5
Adjusted Level of Significance 0.0453	Approximate Chi Square Value (0.05) 39.18
	Adjusted Chi Square Value 38.78

Assuming Gamma Distribution

95% Approximate Gamma UCL 4.5710E-5	95% Adjusted Gamma UCL 4.6175E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.908
10% Shapiro Wilk P Value	5.4099E-4
Lilliefors Test Statistic	0.155
10% Lilliefors Critical Value	0.113

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-14.47	Mean of logged Data	-11.45
Maximum of Logged Data	-8.276	SD of logged Data	1.752

Assuming Lognormal Distribution

95% H-UCL 1.0949E-4	90% Chebyshev (MVUE) UCL 9.3734E-5
95% Chebyshev (MVUE) UCL 1.1529E-4	97.5% Chebyshev (MVUE) UCL 1.4522E-4
99% Chebyshev (MVUE) UCL 2.0399E-4	

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL 4.4469E-5	95% BCA Bootstrap UCL 4.8249E-5
95% Standard Bootstrap UCL 4.4123E-5	95% Bootstrap-t UCL 5.2230E-5
95% Hall's Bootstrap UCL 5.5161E-5	95% Percentile Bootstrap UCL 4.4991E-5
90% Chebyshev(Mean, Sd) UCL 5.4407E-5	95% Chebyshev(Mean, Sd) UCL 6.4372E-5
97.5% Chebyshev(Mean, Sd) UCL 7.8203E-5	99% Chebyshev(Mean, Sd) UCL 1.0537E-4

Suggested UCL to Use

95% Approximate Gamma UCL 4.5710E-5

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations	51	Number of Distinct Observations	41
Number of Detects	23	Number of Non-Detects	28
Number of Distinct Detects	23	Number of Distinct Non-Detects	19
Minimum Detect	0.005	Minimum Non-Detect	0.00468
Maximum Detect	0.0427	Maximum Non-Detect	0.00508
Variance Detects	1.0335E-4	Percent Non-Detects	54.9%
Mean Detects	0.0115	SD Detects	0.0102
Median Detects	0.00823	CV Detects	0.883
Skewness Detects	2.525	Kurtosis Detects	5.869
Mean of Logged Detects	-4.683	SD of Logged Detects	0.597

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.61
1% Shapiro Wilk Critical Value	0.881
Lilliefors Test Statistic	0.294
1% Lilliefors Critical Value	0.209

Shapiro Wilk GOF Test

Detected Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean 0.00776	KM Standard Error of Mean 0.00107

90KM SD	0.00749	95% KM (BCA) UCL	0.00988
95% KM (t) UCL	0.00956	95% KM (Percentile Bootstrap) UCL	0.00965
95% KM (z) UCL	0.00953	95% KM Bootstrap t UCL	0.0118
90% KM Chebyshev UCL	0.011	95% KM Chebyshev UCL	0.0124
97.5% KM Chebyshev UCL	0.0145	99% KM Chebyshev UCL	0.0184

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.945	Anderson-Darling GOF Test
5% A-D Critical Value	0.753	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.183	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.446	k star (bias corrected MLE)	2.156
Theta hat (MLE)	0.00471	Theta star (bias corrected MLE)	0.00534
nu hat (MLE)	112.5	nu star (bias corrected)	99.17
Mean (detects)	0.0115		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	0.0107
Maximum	0.0427	Median	0.01
SD	0.00679	CV	0.635
k hat (MLE)	5.12	k star (bias corrected MLE)	4.831
Theta hat (MLE)	0.00209	Theta star (bias corrected MLE)	0.00221
nu hat (MLE)	522.2	nu star (bias corrected)	492.8
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (492.81, α)	442.3	Adjusted Chi Square Value (492.81, β)	440.9
95% Gamma Approximate UCL	0.0119	95% Gamma Adjusted UCL	0.0119

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00776	SD (KM)	0.00749
Variance (KM)	5.6113E-5	SE of Mean (KM)	0.00107
k hat (KM)	1.074	k star (KM)	1.024
nu hat (KM)	109.6	nu star (KM)	104.5
theta hat (KM)	0.00723	theta star (KM)	0.00758
80% gamma percentile (KM)	0.0125	90% gamma percentile (KM)	0.0178
95% gamma percentile (KM)	0.0231	99% gamma percentile (KM)	0.0353

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (104.48, α)	81.89	Adjusted Chi Square Value (104.48, β)	81.31
95% KM Approximate Gamma UCL	0.00991	95% KM Adjusted Gamma UCL	0.00998

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.836	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.928	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.209	Lilliefors GOF Test
10% Lilliefors Critical Value	0.165	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00624	Mean in Log Scale	-5.569
SD in Original Scale	0.0083	SD in Log Scale	0.925
95% t UCL (assumes normality of ROS data)	0.00819	95% Percentile Bootstrap UCL	0.0083
95% BCA Bootstrap UCL	0.00883	95% Bootstrap t UCL	0.00975
95% H-UCL (Log ROS)	0.00784		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.056	KM Geo Mean	0.00637
KM SD (logged)	0.518	95% Critical H Value (KM-Log)	1.888
KM Standard Error of Mean (logged)	0.0742	95% H-UCL (KM -Log)	0.00837

KM SD (logged)	0.518	95% Critical H Value (KM-Log)	1.888
KM Standard Error of Mean (logged)	0.0742		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.00656	Mean in Log Scale	-5.404
SD in Original Scale	0.00813	SD in Log Scale	0.77
95% t UCL (Assumes normality)	0.00846	95% H-Stat UCL	0.00759

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL 0.00956

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics

Total Number of Observations	51	Number of Distinct Observations	51
Number of Detects	49	Number of Non-Detects	2
Number of Distinct Detects	49	Number of Distinct Non-Detects	2
Minimum Detect	0.027	Minimum Non-Detect	0.0247
Maximum Detect	3.53	Maximum Non-Detect	0.0249
Variance Detects	0.664	Percent Non-Detects	3.922%
Mean Detects	0.824	SD Detects	0.815
Median Detects	0.616	CV Detects	0.989
Skewness Detects	1.563	Kurtosis Detects	2.273
Mean of Logged Detects	-0.774	SD of Logged Detects	1.256

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.826	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.2	Lilliefors GOF Test
1% Lilliefors Critical Value	0.146	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.793	KM Standard Error of Mean	0.114
90KM SD	0.806	95% KM (BCA) UCL	0.966
95% KM (t) UCL	0.984	95% KM (Percentile Bootstrap) UCL	0.974
95% KM (z) UCL	0.98	95% KM Bootstrap t UCL	1.032
90% KM Chebyshev UCL	1.135	95% KM Chebyshev UCL	1.29
97.5% KM Chebyshev UCL	1.505	99% KM Chebyshev UCL	1.927

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.435	Anderson-Darling GOF Test
5% A-D Critical Value	0.78	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0858	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.13	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.994	k star (bias corrected MLE)	0.947
Theta hat (MLE)	0.829	Theta star (bias corrected MLE)	0.87
nu hat (MLE)	97.45	nu star (bias corrected)	92.81
Mean (detects)	0.824		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.792
Maximum	3.53	Median	0.594
SD	0.814	CV	1.028
k hat (MLE)	0.851	k star (bias corrected MLE)	0.814
Theta hat (MLE)	0.931	Theta star (bias corrected MLE)	0.973
nu hat (MLE)	86.83	nu star (bias corrected)	83.05
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (83.05, α)	63.05	Adjusted Chi Square Value (83.05, β)	62.54
95% Gamma Approximate UCL	1.043	95% Gamma Adjusted UCL	1.052

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.793	SD (KM)	0.806
Variance (KM)	0.649	SE of Mean (KM)	0.114
k hat (KM)	0.968	k star (KM)	0.924
nu hat (KM)	98.69	nu star (KM)	94.22
theta hat (KM)	0.819	theta star (KM)	0.858
80% gamma percentile (KM)	1.284	90% gamma percentile (KM)	1.861
95% gamma percentile (KM)	2.443	99% gamma percentile (KM)	3.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (94.22, α)	72.83	Adjusted Chi Square Value (94.22, β)	72.29
95% KM Approximate Gamma UCL	1.025	95% KM Adjusted Gamma UCL	1.033

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.955	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.153	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.115	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.793	Mean in Log Scale	-0.891
SD in Original Scale	0.814	SD in Log Scale	1.361
95% t UCL (assumes normality of ROS data)	0.984	95% Percentile Bootstrap UCL	0.974
95% BCA Bootstrap UCL	0.983	95% Bootstrap t UCL	1.032
95% H-UCL (Log ROS)	1.745		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.889	KM Geo Mean	0.411
KM SD (logged)	1.344	95% Critical H Value (KM-Log)	2.69
KM Standard Error of Mean (logged)	0.19	95% H-UCL (KM -Log)	1.692
KM SD (logged)	1.344	95% Critical H Value (KM-Log)	2.69
KM Standard Error of Mean (logged)	0.19		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.792
SD in Original Scale	0.814
95% t UCL (Assumes normality)	0.983

DL/2 Log-Transformed

Mean in Log Scale	-0.916
SD in Log Scale	1.42
95% H-Stat UCL	1.917

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	1.025

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	51	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	0.00566	Mean	0.122
Maximum	0.566	Median	0.0823
SD	0.137	Std. Error of Mean	0.0192
Coefficient of Variation	1.119	Skewness	1.724

Normal GOF Test		
Shapiro Wilk Test Statistic	0.781	Shapiro Wilk GOF Test
1% Shapiro Wilk P Value	1.1493E-9	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.221	Lilliefors GOF Test
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.154	95% Adjusted-CLT UCL (Chen-1995)	0.159
		95% Modified-t UCL (Johnson-1978)	0.155

Gamma GOF Test		
A-D Test Statistic	0.57	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.788	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.105	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.129	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	0.85	k star (bias corrected MLE)	0.813
Theta hat (MLE)	0.144	Theta star (bias corrected MLE)	0.15
nu hat (MLE)	86.74	nu star (bias corrected)	82.97
MLE Mean (bias corrected)	0.122	MLE Sd (bias corrected)	0.136
		Approximate Chi Square Value (0.05)	62.98
Adjusted Level of Significance	0.0453	Adjusted Chi Square Value	62.47

Assuming Gamma Distribution			
95% Approximate Gamma UCL	0.161	95% Adjusted Gamma UCL	0.162

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk P Value	0.00534	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.117	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.113	Data Not Lognormal at 10% Significance Level
Data Not Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	-5.174	Mean of logged Data	-2.793
Maximum of Logged Data	-0.569	SD of logged Data	1.331

Assuming Lognormal Distribution			
95% H-UCL	0.246	90% Chebyshev (MVUE) UCL	0.247
95% Chebyshev (MVUE) UCL	0.293	97.5% Chebyshev (MVUE) UCL	0.358
99% Chebyshev (MVUE) UCL	0.485		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	0.154	95% BCA Bootstrap UCL	0.16
95% Standard Bootstrap UCL	0.154	95% Bootstrap-t UCL	0.162
95% Hall's Bootstrap UCL	0.159	95% Percentile Bootstrap UCL	0.154
90% Chebyshev(Mean, Sd) UCL	0.18	95% Chebyshev(Mean, Sd) UCL	0.206
97.5% Chebyshev(Mean, Sd) UCL	0.242	99% Chebyshev(Mean, Sd) UCL	0.313

Suggested UCL to Use	
95% Approximate Gamma UCL	0.161

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics

Total Number of Observations	51	Number of Distinct Observations	44
Number of Detects	26	Number of Non-Detects	25
Number of Distinct Detects	26	Number of Distinct Non-Detects	18
Minimum Detect	0.025	Minimum Non-Detect	0.00465
Maximum Detect	0.186	Maximum Non-Detect	0.0456
Variance Detects	0.00227	Percent Non-Detects	49.02%
Mean Detects	0.0615	SD Detects	0.0477
Median Detects	0.0425	CV Detects	0.775
Skewness Detects	1.764	Kurtosis Detects	2.208
Mean of Logged Detects	-3.001	SD of Logged Detects	0.62

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.726	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.891	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.249	Lilliefors GOF Test
1% Lilliefors Critical Value	0.199	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0339	KM Standard Error of Mean	0.00626
90KM SD	0.0438	95% KM (BCA) UCL	0.0448
95% KM (t) UCL	0.0444	95% KM (Percentile Bootstrap) UCL	0.0443
95% KM (z) UCL	0.0442	95% KM Bootstrap t UCL	0.0477
90% KM Chebyshev UCL	0.0526	95% KM Chebyshev UCL	0.0611
97.5% KM Chebyshev UCL	0.0729	99% KM Chebyshev UCL	0.0961

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.528	Anderson-Darling GOF Test
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.173	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.508	k star (bias corrected MLE)	2.245
Theta hat (MLE)	0.0245	Theta star (bias corrected MLE)	0.0274
nu hat (MLE)	130.4	nu star (bias corrected)	116.7
Mean (detects)	0.0615		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0363
Maximum	0.186	Median	0.025
SD	0.0426	CV	1.174
k hat (MLE)	1.202	k star (bias corrected MLE)	1.145
Theta hat (MLE)	0.0302	Theta star (bias corrected MLE)	0.0317
nu hat (MLE)	122.6	nu star (bias corrected)	116.7
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (116.74, α)	92.8	Adjusted Chi Square Value (116.74, β)	92.18

95% Gamma Approximate UCL 0.0456

95% Gamma Adjusted UCL 0.0459

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0339	SD (KM)	0.0438
Variance (KM)	0.00192	SE of Mean (KM)	0.00626
k hat (KM)	0.598	k star (KM)	0.576
nu hat (KM)	61.03	nu star (KM)	58.77
theta hat (KM)	0.0566	theta star (KM)	0.0588
80% gamma percentile (KM)	0.0558	90% gamma percentile (KM)	0.0889
95% gamma percentile (KM)	0.124	99% gamma percentile (KM)	0.208

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (58.77, α)	42.15	Adjusted Chi Square Value (58.77, β)	41.74
95% KM Approximate Gamma UCL	0.0472	95% KM Adjusted Gamma UCL	0.0477

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.877	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.933	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.15	Lilliefors GOF Test
10% Lilliefors Critical Value	0.156	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.0367	Mean in Log Scale	-3.763
SD in Original Scale	0.0424	SD in Log Scale	0.915
95% t UCL (assumes normality of ROS data)	0.0466	95% Percentile Bootstrap UCL	0.0465
95% BCA Bootstrap UCL	0.0483	95% Bootstrap t UCL	0.0498
95% H-UCL (Log ROS)	0.047		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.148	KM Geo Mean	0.0158
KM SD (logged)	1.259	95% Critical H Value (KM-Log)	2.591
KM Standard Error of Mean (logged)	0.181	95% H-UCL (KM -Log)	0.0554
KM SD (logged)	1.259	95% Critical H Value (KM-Log)	2.591
KM Standard Error of Mean (logged)	0.181		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.033
SD in Original Scale	0.0448
95% t UCL (Assumes normality)	0.0435

DL/2 Log-Transformed

Mean in Log Scale	-4.43
SD in Log Scale	1.567
95% H-Stat UCL	0.0785

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Lognormal Distributed at 10% Significance Level****Suggested UCL to Use**

KM H-UCL 0.0554

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:54:55 PM
 From File 90 UCL Input Data_MG_h.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
Number of Detects	11	Number of Non-Detects	5
Number of Distinct Detects	11	Number of Distinct Non-Detects	5
Minimum Detect	0.557	Minimum Non-Detect	0.495
Maximum Detect	4.79	Maximum Non-Detect	0.534
Variance Detects	1.807	Percent Non-Detects	31.25%
Mean Detects	1.816	SD Detects	1.344
Median Detects	1.31	CV Detects	0.74
Skewness Detects	1.436	Kurtosis Detects	1.379
Mean of Logged Detects	0.377	SD of Logged Detects	0.684

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.835	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.792	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.217	Lilliefors GOF Test
1% Lilliefors Critical Value	0.291	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.403	KM Standard Error of Mean	0.322
90KM SD	1.226	95% KM (BCA) UCL	1.951
95% KM (t) UCL	1.967	95% KM (Percentile Bootstrap) UCL	1.924
95% KM (z) UCL	1.932	95% KM Bootstrap t UCL	2.339
90% KM Chebyshev UCL	2.368	95% KM Chebyshev UCL	2.805
97.5% KM Chebyshev UCL	3.411	99% KM Chebyshev UCL	4.603

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.317	Anderson-Darling GOF Test
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.149	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.258	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.43	k star (bias corrected MLE)	1.828
Theta hat (MLE)	0.747	Theta star (bias corrected MLE)	0.994
nu hat (MLE)	53.45	nu star (bias corrected)	40.21
Mean (detects)	1.816		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.252
Maximum	4.79	Median	0.98
SD	1.397	CV	1.116
k hat (MLE)	0.458	k star (bias corrected MLE)	0.414
Theta hat (MLE)	2.73	Theta star (bias corrected MLE)	3.022
nu hat (MLE)	14.67	nu star (bias corrected)	13.25
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (13.25, α)	6.063	Adjusted Chi Square Value (13.25, β)	5.518
95% Gamma Approximate UCL	2.736	95% Gamma Adjusted UCL	3.006

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.403	SD (KM)	1.226
Variance (KM)	1.504	SE of Mean (KM)	0.322
k hat (KM)	1.309	k star (KM)	1.105
nu hat (KM)	41.88	nu star (KM)	35.36
theta hat (KM)	1.072	theta star (KM)	1.27
80% gamma percentile (KM)	2.239	90% gamma percentile (KM)	3.152
95% gamma percentile (KM)	4.058	99% gamma percentile (KM)	6.147

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (35.36, α)	22.76	Adjusted Chi Square Value (35.36, β)	21.61
95% KM Approximate Gamma UCL	2.18	95% KM Adjusted Gamma UCL	2.296

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.876	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.108	Lilliefors GOF Test
10% Lilliefors Critical Value	0.231	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	1.333	Mean in Log Scale	-0.149
SD in Original Scale	1.324	SD in Log Scale	0.981
95% t UCL (assumes normality of ROS data)	1.913	95% Percentile Bootstrap UCL	1.869
95% BCA Bootstrap UCL	2.011	95% Bootstrap t UCL	2.284
95% H-UCL (Log ROS)	2.742		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0394	KM Geo Mean	1.04
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.327
KM Standard Error of Mean (logged)	0.193	95% H-UCL (KM -Log)	2.125
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.327
KM Standard Error of Mean (logged)	0.193		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	1.328
SD in Original Scale	1.328
95% t UCL (Assumes normality)	1.91

DL/2 Log-Transformed

Mean in Log Scale	-0.168
SD in Log Scale	1.004
95% H-Stat UCL	2.826

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Normal Distributed at 1% Significance Level****Suggested UCL to Use**

95% KM (t) UCL	1.967

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic**General Statistics**

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	2.69	Mean	5.593
Maximum	15.8	Median	4.675
SD	3.289	Std. Error of Mean	0.822
Coefficient of Variation	0.588	Skewness	2.174

Normal GOF Test

Shapiro Wilk Test Statistic	0.777
1% Shapiro Wilk Critical Value	0.844

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors Test Statistic	0.193	Lilliefors GOF Test
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	7.035	95% Adjusted-CLT UCL (Chen-1995)	7.423
		95% Modified-t UCL (Johnson-1978)	7.109

Gamma GOF Test

A-D Test Statistic	0.474	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.146	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.297	k star (bias corrected MLE)	3.533
Theta hat (MLE)	1.302	Theta star (bias corrected MLE)	1.583
nu hat (MLE)	137.5	nu star (bias corrected)	113
MLE Mean (bias corrected)	5.593	MLE Sd (bias corrected)	2.976
		Approximate Chi Square Value (0.05)	89.5
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	87.12

Assuming Gamma Distribution

95% Approximate Gamma UCL	7.064	95% Adjusted Gamma UCL	7.258

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.113	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.99	Mean of logged Data	1.601
Maximum of Logged Data	2.76	SD of logged Data	0.481

Assuming Lognormal Distribution

95% H-UCL	7.159	90% Chebyshev (MVUE) UCL	7.569
95% Chebyshev (MVUE) UCL	8.498	97.5% Chebyshev (MVUE) UCL	9.786
99% Chebyshev (MVUE) UCL	12.32		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	6.946	95% BCA Bootstrap UCL	7.479
95% Standard Bootstrap UCL	6.892	95% Bootstrap-t UCL	8.049
95% Hall's Bootstrap UCL	13.27	95% Percentile Bootstrap UCL	6.961
90% Chebyshev(Mean, Sd) UCL	8.06	95% Chebyshev(Mean, Sd) UCL	9.177
97.5% Chebyshev(Mean, Sd) UCL	10.73	99% Chebyshev(Mean, Sd) UCL	13.77

Suggested UCL to Use

95% Student's-t UCL	7.035

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	16.2	Mean	51.63
Maximum	229	Median	34.3
SD	51.25	Std. Error of Mean	12.81
Coefficient of Variation	0.993	Skewness	3.064

Normal GOF Test		
Shapiro Wilk Test Statistic	0.624	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.245	Lilliefors GOF Test
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level
Data appear Approximate Normal at 1% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	74.09	95% Adjusted-CLT UCL (Chen-1995)	83.19
		95% Modified-t UCL (Johnson-1978)	75.73

Gamma GOF Test		
A-D Test Statistic	0.686	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.165	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.218	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	2.016	k star (bias corrected MLE)	1.679
Theta hat (MLE)	25.61	Theta star (bias corrected MLE)	30.74
nu hat (MLE)	64.5	nu star (bias corrected)	53.74
MLE Mean (bias corrected)	51.63	MLE Sd (bias corrected)	39.84
		Approximate Chi Square Value (0.05)	37.9
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	36.39

Assuming Gamma Distribution			
95% Approximate Gamma UCL	73.21	95% Adjusted Gamma UCL	76.26

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.126	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	2.785	Mean of logged Data	3.676
Maximum of Logged Data	5.434	SD of logged Data	0.689

Assuming Lognormal Distribution			
95% H-UCL	74.92	90% Chebyshev (MVUE) UCL	76.01
95% Chebyshev (MVUE) UCL	88.16	97.5% Chebyshev (MVUE) UCL	105
99% Chebyshev (MVUE) UCL	138.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	72.71	95% BCA Bootstrap UCL	88.8
95% Standard Bootstrap UCL	72.28	95% Bootstrap-t UCL	102
95% Hall's Bootstrap UCL	154.6	95% Percentile Bootstrap UCL	74.35
90% Chebyshev(Mean, Sd) UCL	90.07	95% Chebyshev(Mean, Sd) UCL	107.5
97.5% Chebyshev(Mean, Sd) UCL	131.6	99% Chebyshev(Mean, Sd) UCL	179.1

Suggested UCL to Use	
95% Student's-t UCL	74.09

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	3.75	Mean	49.42
Maximum	131	Median	35.6
SD	40.72	Std. Error of Mean	10.18
Coefficient of Variation	0.824	Skewness	0.764
Normal GOF Test			
Shapiro Wilk Test Statistic	0.903	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.17	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	67.26	95% Adjusted-CLT UCL (Chen-1995)	68.24
		95% Modified-t UCL (Johnson-1978)	67.59
Gamma GOF Test			
A-D Test Statistic	0.254	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.759	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.11	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.22	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.259	k star (bias corrected MLE)	1.064
Theta hat (MLE)	39.26	Theta star (bias corrected MLE)	46.42
nu hat (MLE)	40.28	nu star (bias corrected)	34.06
MLE Mean (bias corrected)	49.42	MLE Sd (bias corrected)	47.9
		Approximate Chi Square Value (0.05)	21.71
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	20.6
Assuming Gamma Distribution			
95% Approximate Gamma UCL	77.52	95% Adjusted Gamma UCL	81.73
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.925	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.156	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.322	Mean of logged Data	3.453
Maximum of Logged Data	4.875	SD of logged Data	1.113
Assuming Lognormal Distribution			
95% H-UCL	134.3	90% Chebyshev (MVUE) UCL	107
95% Chebyshev (MVUE) UCL	130.3	97.5% Chebyshev (MVUE) UCL	162.7
99% Chebyshev (MVUE) UCL	226.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	66.16	95% BCA Bootstrap UCL	68.49
95% Standard Bootstrap UCL	65.86	95% Bootstrap-t UCL	70.85
95% Hall's Bootstrap UCL	67.23	95% Percentile Bootstrap UCL	67
90% Chebyshev(Mean, Sd) UCL	79.96	95% Chebyshev(Mean, Sd) UCL	93.79
97.5% Chebyshev(Mean, Sd) UCL	113	99% Chebyshev(Mean, Sd) UCL	150.7

Suggested UCL to Use

95% Student's-t UCL	67.26

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
Number of Detects	9	Number of Non-Detects	7
Number of Distinct Detects	9	Number of Distinct Non-Detects	7
Minimum Detect	0.0415	Minimum Non-Detect	0.0394
Maximum Detect	0.149	Maximum Non-Detect	0.0428
Variance Detects	0.00118	Percent Non-Detects	43.75%
Mean Detects	0.0642	SD Detects	0.0343
Median Detects	0.0479	CV Detects	0.534
Skewness Detects	2.248	Kurtosis Detects	5.339
Mean of Logged Detects	-2.835	SD of Logged Detects	0.415

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.696	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.764	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.277	Lilliefors GOF Test
1% Lilliefors Critical Value	0.316	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0534	KM Standard Error of Mean	0.00721
90KM SD	0.0272	95% KM (BCA) UCL	0.0667
95% KM (t) UCL	0.0661	95% KM (Percentile Bootstrap) UCL	0.0658
95% KM (z) UCL	0.0653	95% KM Bootstrap t UCL	0.089
90% KM Chebyshev UCL	0.0751	95% KM Chebyshev UCL	0.0849
97.5% KM Chebyshev UCL	0.0985	99% KM Chebyshev UCL	0.125

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.877	Anderson-Darling GOF Test
5% A-D Critical Value	0.723	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.256	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	5.693	k star (bias corrected MLE)	3.87
Theta hat (MLE)	0.0113	Theta star (bias corrected MLE)	0.0166
nu hat (MLE)	102.5	nu star (bias corrected)	69.65
Mean (detects)	0.0642		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0405
Maximum	0.149	Median	0.0425
SD	0.0374	CV	0.924
k hat (MLE)	1.382	k star (bias corrected MLE)	1.164
Theta hat (MLE)	0.0293	Theta star (bias corrected MLE)	0.0348
nu hat (MLE)	44.22	nu star (bias corrected)	37.26
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (37.26, α)	24.29	Adjusted Chi Square Value (37.26, β)	23.1
95% Gamma Approximate UCL	0.0622	95% Gamma Adjusted UCL	0.0654

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0534	SD (KM)	0.0272
Variance (KM)	7.3961E-4	SE of Mean (KM)	0.00721
k hat (KM)	3.858	k star (KM)	3.176
nu hat (KM)	123.5	nu star (KM)	101.6
theta hat (KM)	0.0138	theta star (KM)	0.0168
80% gamma percentile (KM)	0.0757	90% gamma percentile (KM)	0.0936
95% gamma percentile (KM)	0.11	99% gamma percentile (KM)	0.146

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (101.65, α)	79.39	Adjusted Chi Square Value (101.65, β)	77.15
95% KM Approximate Gamma UCL	0.0684	95% KM Adjusted Gamma UCL	0.0704

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.81	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.243	Lilliefors GOF Test
10% Lilliefors Critical Value	0.252	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0454	Mean in Log Scale	-3.284
SD in Original Scale	0.0334	SD in Log Scale	0.607
95% t UCL (assumes normality of ROS data)	0.06	95% Percentile Bootstrap UCL	0.0593
95% BCA Bootstrap UCL	0.0643	95% Bootstrap t UCL	0.07
95% H-UCL (Log ROS)	0.0633		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.009	KM Geo Mean	0.0494
KM SD (logged)	0.353	95% Critical H Value (KM-Log)	1.914
KM Standard Error of Mean (logged)	0.0938	95% H-UCL (KM -Log)	0.0626
KM SD (logged)	0.353	95% Critical H Value (KM-Log)	1.914
KM Standard Error of Mean (logged)	0.0938		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0451
SD in Original Scale	0.0337
95% t UCL (Assumes normality)	0.0598

DL/2 Log-Transformed

Mean in Log Scale	-3.299
SD in Log Scale	0.622
95% H-Stat UCL	0.0637

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0661

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics				
Total Number of Observations		16	Number of Distinct Observations 15	
			Number of Missing Observations 0	
Minimum	14.9		Mean	18.01
Maximum	24.3		Median	17.75
SD	2.472		Std. Error of Mean	0.618
Coefficient of Variation	0.137		Skewness	1.439
Normal GOF Test				
Shapiro Wilk Test Statistic	0.865	Shapiro Wilk GOF Test		
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level		
Lilliefors Test Statistic	0.219	Lilliefors GOF Test		
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level		
Data appear Normal at 1% Significance Level				
Assuming Normal Distribution				
95% Normal UCL		95% UCLs (Adjusted for Skewness)		
95% Student's-t UCL	19.1	95% Adjusted-CLT UCL (Chen-1995)		19.27
		95% Modified-t UCL (Johnson-1978)		19.13
Gamma GOF Test				
A-D Test Statistic	0.653	Anderson-Darling Gamma GOF Test		
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level		
K-S Test Statistic	0.196	Kolmogorov-Smirnov Gamma GOF Test		
5% K-S Critical Value	0.214	Detected data appear Gamma Distributed at 5% Significance Level		
Detected data appear Gamma Distributed at 5% Significance Level				
Gamma Statistics				
k hat (MLE)	62.09	k star (bias corrected MLE)		50.49
Theta hat (MLE)	0.29	Theta star (bias corrected MLE)		0.357
nu hat (MLE)	1987	nu star (bias corrected)		1616
MLE Mean (bias corrected)	18.01	MLE Sd (bias corrected)		2.535
		Approximate Chi Square Value (0.05)		1523
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value		1513
Assuming Gamma Distribution				
95% Approximate Gamma UCL	19.1	95% Adjusted Gamma UCL		19.23
Lognormal GOF Test				
Shapiro Wilk Test Statistic	0.908	Shapiro Wilk Lognormal GOF Test		
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level		
Lilliefors Test Statistic	0.19	Lilliefors Lognormal GOF Test		
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level		
Data appear Lognormal at 10% Significance Level				
Lognormal Statistics				
Minimum of Logged Data	2.701	Mean of logged Data		2.883
Maximum of Logged Data	3.19	SD of logged Data		0.129
Assuming Lognormal Distribution				
95% H-UCL	19.1	90% Chebyshev (MVUE) UCL		19.75
95% Chebyshev (MVUE) UCL	20.53	97.5% Chebyshev (MVUE) UCL		21.63
99% Chebyshev (MVUE) UCL	23.78			
Nonparametric Distribution Free UCL Statistics				
Data appear to follow a Discernible Distribution				
Nonparametric Distribution Free UCLs				
95% CLT UCL	19.03	95% BCA Bootstrap UCL		19.28
95% Standard Bootstrap UCL	18.98	95% Bootstrap-t UCL		19.68
95% Hall's Bootstrap UCL	21.17	95% Percentile Bootstrap UCL		19.01
90% Chebyshev(Mean, Sd) UCL	19.87	95% Chebyshev(Mean, Sd) UCL		20.71
7.5% Chebyshev(Mean, Sd) UCL	21.87	99% Chebyshev(Mean, Sd) UCL		24.16

Suggested UCL to Use

95% Student's-t UCL 19.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	44.3	Mean	145.4
Maximum	290	Median	128.5
SD	78.62	Std. Error of Mean	19.65
Coefficient of Variation	0.541	Skewness	0.626
Normal GOF Test			
Shapiro Wilk Test Statistic	0.918	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.147	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	179.9	95% Adjusted-CLT UCL (Chen-1995)	181.1
		95% Modified-t UCL (Johnson-1978)	180.4
Gamma GOF Test			
A-D Test Statistic	0.263	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.111	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	3.533	k star (bias corrected MLE)	2.913
Theta hat (MLE)	41.16	Theta star (bias corrected MLE)	49.94
nu hat (MLE)	113.1	nu star (bias corrected)	93.2
MLE Mean (bias corrected)	145.4	MLE Sd (bias corrected)	85.22
		Approximate Chi Square Value (0.05)	71.94
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	69.81
Assuming Gamma Distribution			
95% Approximate Gamma UCL	188.4	95% Adjusted Gamma UCL	194.2
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.956	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.115	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	3.791	Mean of logged Data	4.832
Maximum of Logged Data	5.67	SD of logged Data	0.581
Assuming Lognormal Distribution			
95% H-UCL	204.5	90% Chebyshev (MVUE) UCL	213.2
95% Chebyshev (MVUE) UCL	243.3	97.5% Chebyshev (MVUE) UCL	285.1
99% Chebyshev (MVUE) UCL	367.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	177.8	95% BCA Bootstrap UCL	180
95% Standard Bootstrap UCL	176.7	95% Bootstrap-t UCL	184
95% Hall's Bootstrap UCL	179.7	95% Percentile Bootstrap UCL	177.3
90% Chebyshev(Mean, Sd) UCL	204.4	95% Chebyshev(Mean, Sd) UCL	231.1
97.5% Chebyshev(Mean, Sd) UCL	268.2	99% Chebyshev(Mean, Sd) UCL	341

Suggested UCL to Use

95% Student's-t UCL	179.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	6.7790E-7	Mean	2.6184E-5
Maximum	5.8372E-5	Median	2.8822E-5
SD	1.9886E-5	Std. Error of Mean	4.9715E-6
Coefficient of Variation	N/A	Skewness	-0.0386

Normal GOF Test

Shapiro Wilk Test Statistic	0.911
1% Shapiro Wilk Critical Value	0.844
Lilliefors Test Statistic	0.184
1% Lilliefors Critical Value	0.248

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	3.4900E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.4310E-5
95% Modified-t UCL (Johnson-1978)	3.4892E-5

Gamma GOF Test

A-D Test Statistic	1.102
5% A-D Critical Value	0.77
K-S Test Statistic	0.239
5% K-S Critical Value	0.222

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.848	k star (bias corrected MLE)	0.731
Theta hat (MLE)	3.0885E-5	Theta star (bias corrected MLE)	3.5844E-5
nu hat (MLE)	27.13	nu star (bias corrected)	23.38
MLE Mean (bias corrected)	2.6184E-5	MLE Sd (bias corrected)	3.0636E-5
Adjusted Level of Significance	0.0335	Approximate Chi Square Value (0.05)	13.38
		Adjusted Chi Square Value	12.52

Assuming Gamma Distribution

95% Approximate Gamma UCL	4.5763E-5

95% Adjusted Gamma UCL	4.8891E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.801
10% Shapiro Wilk Critical Value	0.906
Lilliefors Test Statistic	0.273
10% Lilliefors Critical Value	0.196

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-14.2	Mean of logged Data	-11.25
Maximum of Logged Data	-9.749	SD of logged Data	1.592

Assuming Lognormal Distribution

95% H-UCL 2.1353E-4
 95% Chebyshev (MVUE) UCL 1.2033E-4
 99% Chebyshev (MVUE) UCL 2.2345E-4

90% Chebyshev (MVUE) UCL 9.5270E-5
 97.5% Chebyshev (MVUE) UCL 1.5512E-4

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL 3.4362E-5
 95% Standard Bootstrap UCL 3.4096E-5
 95% Hall's Bootstrap UCL 3.4074E-5
 90% Chebyshev(Mean, Sd) UCL 4.1099E-5
 97.5% Chebyshev(Mean, Sd) UCL 5.7231E-5

95% BCA Bootstrap UCL 3.4182E-5
 95% Bootstrap-t UCL 3.5002E-5
 95% Percentile Bootstrap UCL 3.4227E-5
 95% Chebyshev(Mean, Sd) UCL 4.7855E-5
 99% Chebyshev(Mean, Sd) UCL 7.5650E-5

Suggested UCL to Use

95% Student's-t UCL 3.4900E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Dibenzofuran**General Statistics**

Total Number of Observations	16	Number of Distinct Observations	16
Number of Detects	10	Number of Non-Detects	6
Number of Distinct Detects	10	Number of Distinct Non-Detects	6
Minimum Detect	0.005	Minimum Non-Detect	0.0049
Maximum Detect	0.00978	Maximum Non-Detect	0.00503
Variance Detects	2.6290E-6	Percent Non-Detects	37.5%
Mean Detects	0.007	SD Detects	0.00162
Median Detects	0.00673	CV Detects	0.232
Skewness Detects	0.355	Kurtosis Detects	-1.183
Mean of Logged Detects	-4.985	SD of Logged Detects	0.231

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic 0.931
 1% Shapiro Wilk Critical Value 0.781
 Lilliefors Test Statistic 0.17
 1% Lilliefors Critical Value 0.304

Shapiro Wilk GOF Test

Detected Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00622	KM Standard Error of Mean	4.1744E-4
90KM SD	0.00158	95% KM (BCA) UCL	0.00688
95% KM (t) UCL	0.00695	95% KM (Percentile Bootstrap) UCL	0.00687
95% KM (z) UCL	0.0069	95% KM Bootstrap t UCL	0.00707
90% KM Chebyshev UCL	0.00747	95% KM Chebyshev UCL	0.00804
97.5% KM Chebyshev UCL	0.00882	99% KM Chebyshev UCL	0.0104

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic 0.347
 5% A-D Critical Value 0.725
 K-S Test Statistic 0.18
 5% K-S Critical Value 0.266

Anderson-Darling GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov GOF

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE) 20.98
 Theta hat (MLE) 3.3386E-4
 nu hat (MLE) 419.5

k star (bias corrected MLE) 14.75
 Theta star (bias corrected MLE) 4.7479E-4
 nu star (bias corrected) 295

Mean (detects) 0.007

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	0.00813
Maximum	0.01	Median	0.00842
SD	0.00196	CV	0.241
k hat (MLE)	16.69	k star (bias corrected MLE)	13.6
Theta hat (MLE)	4.8701E-4	Theta star (bias corrected MLE)	5.9756E-4
nu hat (MLE)	534	nu star (bias corrected)	435.2
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (435.20, α)	387.8	Adjusted Chi Square Value (435.20, β)	382.8
95% Gamma Approximate UCL	0.00912	95% Gamma Adjusted UCL	0.00924

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00622	SD (KM)	0.00158
Variance (KM)	2.5090E-6	SE of Mean (KM)	4.1744E-4
k hat (KM)	15.4	k star (KM)	12.56
nu hat (KM)	492.9	nu star (KM)	401.8
theta hat (KM)	4.0358E-4	theta star (KM)	4.9507E-4
80% gamma percentile (KM)	0.00763	90% gamma percentile (KM)	0.00854
95% gamma percentile (KM)	0.00936	99% gamma percentile (KM)	0.011

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (401.84, α)	356.4	Adjusted Chi Square Value (401.84, β)	351.5
95% KM Approximate Gamma UCL	0.00701	95% KM Adjusted Gamma UCL	0.00711

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.869	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.173	Lilliefors GOF Test
10% Lilliefors Critical Value	0.241	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00583	Mean in Log Scale	-5.198
SD in Original Scale	0.002	SD in Log Scale	0.335
95% t UCL (assumes normality of ROS data)	0.00671	95% Percentile Bootstrap UCL	0.00663
95% BCA Bootstrap UCL	0.00667	95% Bootstrap t UCL	0.00681
95% H-UCL (Log ROS)	0.00689		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.11	KM Geo Mean	0.00604
KM SD (logged)	0.236	95% Critical H Value (KM-Log)	1.824
KM Standard Error of Mean (logged)	0.0623	95% H-UCL (KM -Log)	0.00694
KM SD (logged)	0.236	95% Critical H Value (KM-Log)	1.824
KM Standard Error of Mean (logged)	0.0623		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00531
SD in Original Scale	0.00259
95% t UCL (Assumes normality)	0.00644

DL/2 Log-Transformed

Mean in Log Scale	-5.365
SD in Log Scale	0.537
95% H-Stat UCL	0.00722

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00695

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	0.0249	Mean	0.697
Maximum	2.15	Median	0.617
SD	0.628	Std. Error of Mean	0.157
Coefficient of Variation	0.902	Skewness	1.139
Normal GOF Test			
Shapiro Wilk Test Statistic	0.877	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.151	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.972	95% Adjusted-CLT UCL (Chen-1995)	1.002
		95% Modified-t UCL (Johnson-1978)	0.979
Gamma GOF Test			
A-D Test Statistic	0.447	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.765	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.203	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.957	k star (bias corrected MLE)	0.819
Theta hat (MLE)	0.728	Theta star (bias corrected MLE)	0.851
nu hat (MLE)	30.61	nu star (bias corrected)	26.21
MLE Mean (bias corrected)	0.697	MLE Sd (bias corrected)	0.77
		Approximate Chi Square Value (0.05)	15.54
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	14.61
Assuming Gamma Distribution			
95% Approximate Gamma UCL	1.175	95% Adjusted Gamma UCL	1.25
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.906	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.251	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.196	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-3.693	Mean of logged Data	-0.968
Maximum of Logged Data	0.765	SD of logged Data	1.389
Assuming Lognormal Distribution			
95% H-UCL	3.309	90% Chebyshev (MVUE) UCL	1.97
95% Chebyshev (MVUE) UCL	2.455	97.5% Chebyshev (MVUE) UCL	3.129
99% Chebyshev (MVUE) UCL	4.452		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	0.955	95% BCA Bootstrap UCL	0.983
95% Standard Bootstrap UCL	0.948	95% Bootstrap-t UCL	1.062

95% Hall's Bootstrap UCL	1.157	95% Percentile Bootstrap UCL	0.959
90% Chebyshev(Mean, Sd) UCL	1.168	95% Chebyshev(Mean, Sd) UCL	1.381
97.5% Chebyshev(Mean, Sd) UCL	1.677	99% Chebyshev(Mean, Sd) UCL	2.259

Suggested UCL to Use

95% Student's-t UCL	0.972

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	0.00566	Mean	0.112
Maximum	0.398	Median	0.088
SD	0.116	Std. Error of Mean	0.0291
Coefficient of Variation	1.037	Skewness	1.564

Normal GOF Test			
Shapiro Wilk Test Statistic	0.808	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.21	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.163	95% Adjusted-CLT UCL (Chen-1995)	0.172
		95% Modified-t UCL (Johnson-1978)	0.165

Gamma GOF Test		
A-D Test Statistic	0.372	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.767	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	0.911	k star (bias corrected MLE)	0.782
Theta hat (MLE)	0.123	Theta star (bias corrected MLE)	0.144
nu hat (MLE)	29.16	nu star (bias corrected)	25.03
MLE Mean (bias corrected)	0.112	MLE Sd (bias corrected)	0.127
		Approximate Chi Square Value (0.05)	14.63
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	13.73

Assuming Gamma Distribution			
95% Approximate Gamma UCL	0.192	95% Adjusted Gamma UCL	0.205

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.916	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.222	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.196	Data Not Lognormal at 10% Significance Level
Data appear Approximate Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	-5.174	Mean of logged Data	-2.828
Maximum of Logged Data	-0.921	SD of logged Data	1.346

Assuming Lognormal Distribution			
95% H-UCL	0.456	90% Chebyshev (MVUE) UCL	0.286
95% Chebyshev (MVUE) UCL	0.356	97.5% Chebyshev (MVUE) UCL	0.452

99% Chebyshev (MVUE) UCL 0.641

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.16	95% BCA Bootstrap UCL	0.17
95% Standard Bootstrap UCL	0.159	95% Bootstrap-t UCL	0.197
95% Hall's Bootstrap UCL	0.406	95% Percentile Bootstrap UCL	0.161
90% Chebyshev(Mean, Sd) UCL	0.2	95% Chebyshev(Mean, Sd) UCL	0.239
97.5% Chebyshev(Mean, Sd) UCL	0.294	99% Chebyshev(Mean, Sd) UCL	0.402

Suggested UCL to Use

95% Student's-t UCL 0.163

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
Number of Detects	10	Number of Non-Detects	6
Number of Distinct Detects	10	Number of Distinct Non-Detects	5
Minimum Detect	0.025	Minimum Non-Detect	0.00484
Maximum Detect	0.178	Maximum Non-Detect	0.00507
Variance Detects	0.00225	Percent Non-Detects	37.5%
Mean Detects	0.0528	SD Detects	0.0475
Median Detects	0.0347	CV Detects	0.898
Skewness Detects	2.478	Kurtosis Detects	6.35
Mean of Logged Detects	-3.164	SD of Logged Detects	0.625

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.634	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.781	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.344	Lilliefors GOF Test
1% Lilliefors Critical Value	0.304	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0348	KM Standard Error of Mean	0.0112
90KM SD	0.0425	95% KM (BCA) UCL	0.0542
95% KM (t) UCL	0.0545	95% KM (Percentile Bootstrap) UCL	0.0541
95% KM (z) UCL	0.0533	95% KM Bootstrap t UCL	0.0759
90% KM Chebyshev UCL	0.0684	95% KM Chebyshev UCL	0.0837
97.5% KM Chebyshev UCL	0.105	99% KM Chebyshev UCL	0.146

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.072	Anderson-Darling GOF Test
5% A-D Critical Value	0.734	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.276	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.269	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.389	k star (bias corrected MLE)	1.739
Theta hat (MLE)	0.0221	Theta star (bias corrected MLE)	0.0304

nu hat (MLE)	47.78	nu star (bias corrected)	34.78
Mean (detects)	0.0528		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0368
Maximum	0.178	Median	0.0268
SD	0.0426	CV	1.157
k hat (MLE)	1.388	k star (bias corrected MLE)	1.17
Theta hat (MLE)	0.0265	Theta star (bias corrected MLE)	0.0314
nu hat (MLE)	44.42	nu star (bias corrected)	37.42
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (37.42, α)	24.42	Adjusted Chi Square Value (37.42, β)	23.23
95% Gamma Approximate UCL	0.0564	95% Gamma Adjusted UCL	0.0593

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0348	SD (KM)	0.0425
Variance (KM)	0.00181	SE of Mean (KM)	0.0112
k hat (KM)	0.672	k star (KM)	0.587
nu hat (KM)	21.49	nu star (KM)	18.79
theta hat (KM)	0.0519	theta star (KM)	0.0593
80% gamma percentile (KM)	0.0574	90% gamma percentile (KM)	0.091
95% gamma percentile (KM)	0.126	99% gamma percentile (KM)	0.212

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.79, α)	9.966	Adjusted Chi Square Value (18.79, β)	9.241
95% KM Approximate Gamma UCL	0.0657	95% KM Adjusted Gamma UCL	0.0709

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.809	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.869	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.224	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.241	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0365	Mean in Log Scale	-3.739
SD in Original Scale	0.0428	SD in Log Scale	0.911
95% t UCL (assumes normality of ROS data)	0.0552	95% Percentile Bootstrap UCL	0.0548
95% BCA Bootstrap UCL	0.0625	95% Bootstrap t UCL	0.0831
95% H-UCL (Log ROS)	0.0659		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.977	KM Geo Mean	0.0187
KM SD (logged)	1.149	95% Critical H Value (KM-Log)	2.94
KM Standard Error of Mean (logged)	0.303	95% H-UCL (KM -Log)	0.0868
KM SD (logged)	1.149	95% Critical H Value (KM-Log)	2.94
KM Standard Error of Mean (logged)	0.303		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0339
SD in Original Scale	0.0446
95% t UCL (Assumes normality)	0.0535

DL/2 Log-Transformed

Mean in Log Scale	-4.231
SD in Log Scale	1.502
95% H-Stat UCL	0.178

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

KM H-UCL	0.0868

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:52:50 PM
 From File 90 UCL Input Data_MG_e.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	42	Number of Distinct Observations	39
Number of Detects	21	Number of Non-Detects	21
Number of Distinct Detects	21	Number of Distinct Non-Detects	18
Minimum Detect	0.557	Minimum Non-Detect	0.486
Maximum Detect	4.88	Maximum Non-Detect	0.56
Variance Detects	2.014	Percent Non-Detects	50%
Mean Detects	2.034	SD Detects	1.419
Median Detects	1.66	CV Detects	0.698
Skewness Detects	0.834	Kurtosis Detects	-0.63
Mean of Logged Detects	0.472	SD of Logged Detects	0.715

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.863	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.873	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.171	Lilliefors GOF Test
1% Lilliefors Critical Value	0.219	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.26	KM Standard Error of Mean	0.197
90KM SD	1.248	95% KM (BCA) UCL	1.596
95% KM (t) UCL	1.592	95% KM (Percentile Bootstrap) UCL	1.585
95% KM (z) UCL	1.585	95% KM Bootstrap t UCL	1.663
90% KM Chebyshev UCL	1.852	95% KM Chebyshev UCL	2.121
97.5% KM Chebyshev UCL	2.493	99% KM Chebyshev UCL	3.224

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.61	Anderson-Darling GOF Test
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.192	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.255	k star (bias corrected MLE)	1.965
Theta hat (MLE)	0.902	Theta star (bias corrected MLE)	1.035
nu hat (MLE)	94.73	nu star (bias corrected)	82.53
Mean (detects)	2.034		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.022
Maximum	4.88	Median	0.284
SD	1.425	CV	1.395
k hat (MLE)	0.326	k star (bias corrected MLE)	0.318
Theta hat (MLE)	3.137	Theta star (bias corrected MLE)	3.21
nu hat (MLE)	27.37	nu star (bias corrected)	26.74
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (26.74, α)	15.95	Adjusted Chi Square Value (26.74, β)	15.66
95% Gamma Approximate UCL	1.713	95% Gamma Adjusted UCL	1.746

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.26	SD (KM)	1.248
Variance (KM)	1.558	SE of Mean (KM)	0.197
k hat (KM)	1.019	k star (KM)	0.962
nu hat (KM)	85.6	nu star (KM)	80.82
theta hat (KM)	1.237	theta star (KM)	1.31
80% gamma percentile (KM)	2.034	90% gamma percentile (KM)	2.929
95% gamma percentile (KM)	3.827	99% gamma percentile (KM)	5.918

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (80.82, α)	61.11	Adjusted Chi Square Value (80.82, β)	60.5
95% KM Approximate Gamma UCL	1.667	95% KM Adjusted Gamma UCL	1.684

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.934	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.923	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.143	Lilliefors GOF Test
10% Lilliefors Critical Value	0.173	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	1.144	Mean in Log Scale	-0.457
SD in Original Scale	1.34	SD in Log Scale	1.073
95% t UCL (assumes normality of ROS data)	1.492	95% Percentile Bootstrap UCL	1.483
95% BCA Bootstrap UCL	1.513	95% Bootstrap t UCL	1.581
95% H-UCL (Log ROS)	1.695		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.124	KM Geo Mean	0.883
KM SD (logged)	0.774	95% Critical H Value (KM-Log)	2.126
KM Standard Error of Mean (logged)	0.122	95% H-UCL (KM -Log)	1.541
KM SD (logged)	0.774	95% Critical H Value (KM-Log)	2.126
KM Standard Error of Mean (logged)	0.122		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	1.146
SD in Original Scale	1.338
95% t UCL (Assumes normality)	1.494

DL/2 Log-Transformed

Mean in Log Scale	-0.44
SD in Log Scale	1.05
95% H-Stat UCL	1.661

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Normal Distributed at 1% Significance Level****Suggested UCL to Use**

95% KM (t) UCL	1.592

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic**General Statistics**

Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	2.69	Mean	4.685
Maximum	15.8	Median	3.74
SD	2.424	Std. Error of Mean	0.374
Coefficient of Variation	0.517	Skewness	2.799

Normal GOF Test			Shapiro Wilk GOF Test		
Shapiro Wilk Test Statistic	0.69		Data Not Normal at 1% Significance Level		
1% Shapiro Wilk Critical Value	0.922		Lilliefors GOF Test		
Lilliefors Test Statistic	0.217		Data Not Normal at 1% Significance Level		
1% Lilliefors Critical Value	0.157		Data Not Normal at 1% Significance Level		

Assuming Normal Distribution					
95% Normal UCL			95% UCLs (Adjusted for Skewness)		
95% Student's-t UCL	5.315		95% Adjusted-CLT UCL (Chen-1995)	5.473	
			95% Modified-t UCL (Johnson-1978)	5.342	

Gamma GOF Test			Anderson-Darling Gamma GOF Test		
A-D Test Statistic	2.044		Data Not Gamma Distributed at 5% Significance Level		
5% A-D Critical Value	0.751		Kolmogorov-Smirnov Gamma GOF Test		
K-S Test Statistic	0.185		Data Not Gamma Distributed at 5% Significance Level		
5% K-S Critical Value	0.137		Data Not Gamma Distributed at 5% Significance Level		

Gamma Statistics					
k hat (MLE)	5.93		k star (bias corrected MLE)	5.523	
Theta hat (MLE)	0.79		Theta star (bias corrected MLE)	0.848	
nu hat (MLE)	498.1		nu star (bias corrected)	463.9	
MLE Mean (bias corrected)	4.685		MLE Sd (bias corrected)	1.994	
			Approximate Chi Square Value (0.05)	415	
Adjusted Level of Significance	0.0443		Adjusted Chi Square Value	413.3	

Assuming Gamma Distribution					
95% Approximate Gamma UCL	5.238		95% Adjusted Gamma UCL	5.259	

Lognormal GOF Test			Shapiro Wilk Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.846		Data Not Lognormal at 10% Significance Level		
10% Shapiro Wilk Critical Value	0.951		Lilliefors Lognormal GOF Test		
Lilliefors Test Statistic	0.169		Data Not Lognormal at 10% Significance Level		
10% Lilliefors Critical Value	0.124		Data Not Lognormal at 10% Significance Level		

Lognormal Statistics					
Minimum of Logged Data	0.99		Mean of logged Data	1.458	
Maximum of Logged Data	2.76		SD of logged Data	0.387	

Assuming Lognormal Distribution					
95% H-UCL	5.172		90% Chebyshev (MVUE) UCL	5.476	
95% Chebyshev (MVUE) UCL	5.863		97.5% Chebyshev (MVUE) UCL	6.4	
99% Chebyshev (MVUE) UCL	7.454				

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs					
95% CLT UCL	5.301		95% BCA Bootstrap UCL	5.5	
95% Standard Bootstrap UCL	5.286		95% Bootstrap-t UCL	5.63	
95% Hall's Bootstrap UCL	5.93		95% Percentile Bootstrap UCL	5.32	
90% Chebyshev(Mean, Sd) UCL	5.808		95% Chebyshev(Mean, Sd) UCL	6.316	
97.5% Chebyshev(Mean, Sd) UCL	7.021		99% Chebyshev(Mean, Sd) UCL	8.407	

Suggested UCL to Use	
95% Student's-t UCL	5.315

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	15	Mean	41.92
Maximum	229	Median	30.35
SD	36.4	Std. Error of Mean	5.616
Coefficient of Variation	0.868	Skewness	3.528

Normal GOF Test			
Shapiro Wilk Test Statistic	0.636	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.23	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	51.38	95% Adjusted-CLT UCL (Chen-1995)	54.43
		95% Modified-t UCL (Johnson-1978)	51.88

Gamma GOF Test		
A-D Test Statistic	1.2	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.129	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.138	Detected data appear Gamma Distributed at 5% Significance Level
Detected data follow Appr. Gamma Distribution at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	2.401	k star (bias corrected MLE)	2.246
Theta hat (MLE)	17.46	Theta star (bias corrected MLE)	18.67
nu hat (MLE)	201.7	nu star (bias corrected)	188.6
MLE Mean (bias corrected)	41.92	MLE Sd (bias corrected)	27.98
		Approximate Chi Square Value (0.05)	157.9
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	156.9

Assuming Gamma Distribution			
95% Approximate Gamma UCL	50.1	95% Adjusted Gamma UCL	50.42

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.873	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.12	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level
Data appear Approximate Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	2.708	Mean of logged Data	3.513
Maximum of Logged Data	5.434	SD of logged Data	0.63

Assuming Lognormal Distribution			
95% H-UCL	49.82	90% Chebyshev (MVUE) UCL	53.45
95% Chebyshev (MVUE) UCL	59.23	97.5% Chebyshev (MVUE) UCL	67.24
99% Chebyshev (MVUE) UCL	82.99		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	51.16	95% BCA Bootstrap UCL	54.35
95% Standard Bootstrap UCL	50.93	95% Bootstrap-t UCL	56.62
95% Hall's Bootstrap UCL	93.4	95% Percentile Bootstrap UCL	51.72
90% Chebyshev(Mean, Sd) UCL	58.77	95% Chebyshev(Mean, Sd) UCL	66.4
97.5% Chebyshev(Mean, Sd) UCL	77	99% Chebyshev(Mean, Sd) UCL	97.8

Suggested UCL to Use	
95% Adjusted Gamma UCL	50.42

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	3.1	Mean	41.61
Maximum	202	Median	29.7
SD	43.21	Std. Error of Mean	6.668
Coefficient of Variation	1.039	Skewness	1.798
Normal GOF Test			
Shapiro Wilk Test Statistic	0.779	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.186	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	52.83	95% Adjusted-CLT UCL (Chen-1995)	54.55
		95% Modified-t UCL (Johnson-1978)	53.13
Gamma GOF Test			
A-D Test Statistic	0.418	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.777	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0973	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.14	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.04	k star (bias corrected MLE)	0.982
Theta hat (MLE)	40	Theta star (bias corrected MLE)	42.38
nu hat (MLE)	87.36	nu star (bias corrected)	82.46
MLE Mean (bias corrected)	41.61	MLE Sd (bias corrected)	41.99
		Approximate Chi Square Value (0.05)	62.53
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	61.91
Assuming Gamma Distribution			
95% Approximate Gamma UCL	54.86	95% Adjusted Gamma UCL	55.41
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.1	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.131	Mean of logged Data	3.176
Maximum of Logged Data	5.308	SD of logged Data	1.144
Assuming Lognormal Distribution			
95% H-UCL	72.27	90% Chebyshev (MVUE) UCL	73.71
95% Chebyshev (MVUE) UCL	86.73	97.5% Chebyshev (MVUE) UCL	104.8
99% Chebyshev (MVUE) UCL	140.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	52.57	95% BCA Bootstrap UCL	54.01
95% Standard Bootstrap UCL	52.35	95% Bootstrap-t UCL	55.64
95% Hall's Bootstrap UCL	55.69	95% Percentile Bootstrap UCL	53.05
90% Chebyshev(Mean, Sd) UCL	61.61	95% Chebyshev(Mean, Sd) UCL	70.67
97.5% Chebyshev(Mean, Sd) UCL	83.24	99% Chebyshev(Mean, Sd) UCL	107.9

Suggested UCL to Use

95% Adjusted Gamma UCL	55.41

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	42	Number of Distinct Observations	34
Number of Detects	14	Number of Non-Detects	28
Number of Distinct Detects	14	Number of Distinct Non-Detects	22
Minimum Detect	0.0415	Minimum Non-Detect	0.0389
Maximum Detect	0.149	Maximum Non-Detect	0.0448
Variance Detects	7.8838E-4	Percent Non-Detects	66.67%
Mean Detects	0.0603	SD Detects	0.0281
Median Detects	0.049	CV Detects	0.466
Skewness Detects	2.711	Kurtosis Detects	8.242
Mean of Logged Detects	-2.877	SD of Logged Detects	0.348

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.652	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.825	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.262	Lilliefors GOF Test
1% Lilliefors Critical Value	0.263	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0461	KM Standard Error of Mean	0.00297
90KM SD	0.0186	95% KM (BCA) UCL	0.0522
95% KM (t) UCL	0.0511	95% KM (Percentile Bootstrap) UCL	0.0514
95% KM (z) UCL	0.051	95% KM Bootstrap t UCL	0.0567
90% KM Chebyshev UCL	0.055	95% KM Chebyshev UCL	0.0591
97.5% KM Chebyshev UCL	0.0647	99% KM Chebyshev UCL	0.0757

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.216	Anderson-Darling GOF Test
5% A-D Critical Value	0.736	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.229	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.571	k star (bias corrected MLE)	5.996
Theta hat (MLE)	0.00796	Theta star (bias corrected MLE)	0.0101
nu hat (MLE)	212	nu star (bias corrected)	167.9
Mean (detects)	0.0603		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0268
Maximum	0.149	Median	0.01
SD	0.0287	CV	1.07
k hat (MLE)	1.378	k star (bias corrected MLE)	1.295
Theta hat (MLE)	0.0195	Theta star (bias corrected MLE)	0.0207
nu hat (MLE)	115.7	nu star (bias corrected)	108.8
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (108.79, α)	85.71	Adjusted Chi Square Value (108.79, β)	84.99
95% Gamma Approximate UCL	0.034	95% Gamma Adjusted UCL	0.0343

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0461	SD (KM)	0.0186
Variance (KM)	3.4461E-4	SE of Mean (KM)	0.00297
k hat (KM)	6.166	k star (KM)	5.742
nu hat (KM)	518	nu star (KM)	482.3
theta hat (KM)	0.00748	theta star (KM)	0.00803
80% gamma percentile (KM)	0.061	90% gamma percentile (KM)	0.0718
95% gamma percentile (KM)	0.0816	99% gamma percentile (KM)	0.102

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (482.30, α)	432.4	Adjusted Chi Square Value (482.30, β)	430.7
95% KM Approximate Gamma UCL	0.0514	95% KM Adjusted Gamma UCL	0.0516

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.795	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.895	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.206	Lilliefors GOF Test
10% Lilliefors Critical Value	0.208	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0335	Mean in Log Scale	-3.57
SD in Original Scale	0.025	SD in Log Scale	0.548
95% t UCL (assumes normality of ROS data)	0.04	95% Percentile Bootstrap UCL	0.04
95% BCA Bootstrap UCL	0.0411	95% Bootstrap t UCL	0.0433
95% H-UCL (Log ROS)	0.0386		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.121	KM Geo Mean	0.0441
KM SD (logged)	0.26	95% Critical H Value (KM-Log)	1.748
KM Standard Error of Mean (logged)	0.0417	95% H-UCL (KM -Log)	0.049
KM SD (logged)	0.26	95% Critical H Value (KM-Log)	1.748
KM Standard Error of Mean (logged)	0.0417		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.0339
SD in Original Scale	0.0246
95% t UCL (Assumes normality)	0.0403

DL/2 Log-Transformed

Mean in Log Scale	-3.542
SD in Log Scale	0.516
95% H-Stat UCL	0.0386

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0511

When a data set follows an approximate distribution passing only one of the GOF tests, it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	29
		Number of Missing Observations	0
Minimum	14.2	Mean	17.46
Maximum	24.3	Median	17.45
SD	1.986	Std. Error of Mean	0.306
Coefficient of Variation	0.114	Skewness	1.162
Normal GOF Test			
Shapiro Wilk Test Statistic	0.886	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.116	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.157	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	17.97	95% Adjusted-CLT UCL (Chen-1995)	18.02
		95% Modified-t UCL (Johnson-1978)	17.98
Gamma GOF Test			
A-D Test Statistic	0.508	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0998	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.136	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	83.99	k star (bias corrected MLE)	78.01
Theta hat (MLE)	0.208	Theta star (bias corrected MLE)	0.224
nu hat (MLE)	7055	nu star (bias corrected)	6553
MLE Mean (bias corrected)	17.46	MLE Sd (bias corrected)	1.977
		Approximate Chi Square Value (0.05)	6366
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	6359
Assuming Gamma Distribution			
95% Approximate Gamma UCL	17.97	95% Adjusted Gamma UCL	17.99
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.917	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.096	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.653	Mean of logged Data	2.854
Maximum of Logged Data	3.19	SD of logged Data	0.109
Assuming Lognormal Distribution			
95% H-UCL	17.97	90% Chebyshev (MVUE) UCL	18.34
95% Chebyshev (MVUE) UCL	18.74	97.5% Chebyshev (MVUE) UCL	19.3
99% Chebyshev (MVUE) UCL	20.39		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	17.96	95% BCA Bootstrap UCL	17.98
95% Standard Bootstrap UCL	17.96	95% Bootstrap-t UCL	18.03
95% Hall's Bootstrap UCL	18.08	95% Percentile Bootstrap UCL	17.97
90% Chebyshev(Mean, Sd) UCL	18.38	95% Chebyshev(Mean, Sd) UCL	18.79

97.5% Chebyshev(Mean, Sd) UCL 19.37

99% Chebyshev(Mean, Sd) UCL 20.51

Suggested UCL to Use

95% Student's-t UCL 17.97

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	44.3	Mean	129.7
Maximum	354	Median	108.5
SD	79.26	Std. Error of Mean	12.23
Coefficient of Variation	0.611	Skewness	0.957

Normal GOF Test			
Shapiro Wilk Test Statistic	0.848	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.154	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.157	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			

Assuming Normal Distribution		95% UCLs (Adjusted for Skewness)	
95% Normal UCL		95% Adjusted-CLT UCL (Chen-1995)	151.7
95% Student's-t UCL	150.3	95% Modified-t UCL (Johnson-1978)	150.6

Gamma GOF Test		
A-D Test Statistic	0.7	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.126	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	2.928	k star (bias corrected MLE)	2.735
Theta hat (MLE)	44.29	Theta star (bias corrected MLE)	47.42
nu hat (MLE)	246	nu star (bias corrected)	229.7
MLE Mean (bias corrected)	129.7	MLE Sd (bias corrected)	78.42
		Approximate Chi Square Value (0.05)	195.6
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	194.5

Assuming Gamma Distribution		95% Adjusted Gamma UCL	
95% Approximate Gamma UCL	152.3		153.2

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.122	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.124	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	3.791	Mean of logged Data	4.685
Maximum of Logged Data	5.869	SD of logged Data	0.614

Assuming Lognormal Distribution		90% Chebyshev (MVUE) UCL	
95% H-UCL	158.1		169.6

95% Chebyshev (MVUE) UCL 187.5
99% Chebyshev (MVUE) UCL 261.2

97.5% Chebyshev (MVUE) UCL 212.4

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	149.8	95% BCA Bootstrap UCL	150.4
95% Standard Bootstrap UCL	149.4	95% Bootstrap-t UCL	152.2
95% Hall's Bootstrap UCL	152.1	95% Percentile Bootstrap UCL	149.8
90% Chebyshev(Mean, Sd) UCL	166.4	95% Chebyshev(Mean, Sd) UCL	183
97.5% Chebyshev(Mean, Sd) UCL	206.1	99% Chebyshev(Mean, Sd) UCL	251.4

Suggested UCL to Use

95% Student's-t UCL 150.3

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics

Total Number of Observations	42	Number of Distinct Observations	42
		Number of Missing Observations	0
Minimum	5.1751E-7	Mean	1.6720E-5
Maximum	5.8372E-5	Median	1.2629E-5
SD	1.6355E-5	Std. Error of Mean	2.5237E-6
Coefficient of Variation	N/A	Skewness	0.866

Normal GOF Test

Shapiro Wilk Test Statistic 0.824
1% Shapiro Wilk Critical Value 0.922
Lilliefors Test Statistic 0.161
1% Lilliefors Critical Value 0.157

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 2.0967E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 2.1232E-5

95% Modified-t UCL (Johnson-1978) 2.1024E-5

Gamma GOF Test

A-D Test Statistic 1.262
5% A-D Critical Value 0.793
K-S Test Statistic 0.166
5% K-S Critical Value 0.142

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 0.71
Theta hat (MLE) 2.3564E-5
nu hat (MLE) 59.61
MLE Mean (bias corrected) 1.6720E-5

k star (bias corrected MLE) 0.675

Theta star (bias corrected MLE) 2.4779E-5

nu star (bias corrected) 56.68

MLE Sd (bias corrected) 2.0355E-5

Approximate Chi Square Value (0.05) 40.38

Adjusted Chi Square Value 39.89

Adjusted Level of Significance 0.0443

Assuming Gamma Distribution

95% Approximate Gamma UCL 2.3472E-5

95% Adjusted Gamma UCL 2.3761E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.806

Shapiro Wilk Lognormal GOF Test

10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.182	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.124	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-14.47	Mean of logged Data	-11.85
Maximum of Logged Data	-9.749	SD of logged Data	1.611

Assuming Lognormal Distribution			
95% H-UCL	5.7237E-5	90% Chebyshev (MVUE) UCL	4.8911E-5
95% Chebyshev (MVUE) UCL	5.9969E-5	97.5% Chebyshev (MVUE) UCL	7.5317E-5
99% Chebyshev (MVUE) UCL	1.0546E-4		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	2.0872E-5	95% BCA Bootstrap UCL	2.1501E-5
95% Standard Bootstrap UCL	2.0813E-5	95% Bootstrap-t UCL	2.1134E-5
95% Hall's Bootstrap UCL	2.0975E-5	95% Percentile Bootstrap UCL	2.1200E-5
90% Chebyshev(Mean, Sd) UCL	2.4291E-5	95% Chebyshev(Mean, Sd) UCL	2.7721E-5
97.5% Chebyshev(Mean, Sd) UCL	3.2481E-5	99% Chebyshev(Mean, Sd) UCL	4.1831E-5

Suggested UCL to Use
95% Student's-t UCL 2.0967E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	34
Number of Detects	16	Number of Non-Detects	26
Number of Distinct Detects	16	Number of Distinct Non-Detects	19
Minimum Detect	0.005	Minimum Non-Detect	0.00468
Maximum Detect	0.0405	Maximum Non-Detect	0.00508
Variance Detects	7.3060E-5	Percent Non-Detects	61.9%
Mean Detects	0.00921	SD Detects	0.00855
Median Detects	0.00687	CV Detects	0.928
Skewness Detects	3.691	Kurtosis Detects	14.21
Mean of Logged Detects	-4.866	SD of Logged Detects	0.507

Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.463	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.844	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.348	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.248	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.00641	KM Standard Error of Mean	8.8612E-4
90KM SD	0.00556	95% KM (BCA) UCL	0.00819
95% KM (t) UCL	0.0079	95% KM (Percentile Bootstrap) UCL	0.00803
95% KM (z) UCL	0.00787	95% KM Bootstrap t UCL	0.011
90% KM Chebyshev UCL	0.00907	95% KM Chebyshev UCL	0.0103
97.5% KM Chebyshev UCL	0.0119	99% KM Chebyshev UCL	0.0152

Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	2	Anderson-Darling GOF Test	
5% A-D Critical Value	0.745	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.292	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.217	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.966	k star (bias corrected MLE)	2.452
Theta hat (MLE)	0.0031	Theta star (bias corrected MLE)	0.00376
nu hat (MLE)	94.91	nu star (bias corrected)	78.45
Mean (detects)	0.00921		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.005	Mean	0.0097
Maximum	0.0405	Median	0.01
SD	0.00518	CV	0.535
k hat (MLE)	7.453	k star (bias corrected MLE)	6.936
Theta hat (MLE)	0.0013	Theta star (bias corrected MLE)	0.0014
nu hat (MLE)	626	nu star (bias corrected)	582.7
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (582.66, α)	527.7	Adjusted Chi Square Value (582.66, β)	525.8
95% Gamma Approximate UCL	0.0107	95% Gamma Adjusted UCL	0.0107

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00641	SD (KM)	0.00556
Variance (KM)	3.0915E-5	SE of Mean (KM)	8.8612E-4
k hat (KM)	1.329	k star (KM)	1.25
nu hat (KM)	111.6	nu star (KM)	105
theta hat (KM)	0.00482	theta star (KM)	0.00513
80% gamma percentile (KM)	0.0101	90% gamma percentile (KM)	0.014
95% gamma percentile (KM)	0.0178	99% gamma percentile (KM)	0.0264

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (104.99, α)	82.35	Adjusted Chi Square Value (104.99, β)	81.63
95% KM Approximate Gamma UCL	0.00817	95% KM Adjusted Gamma UCL	0.00824

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.726	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.906	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.24	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.196	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00472	Mean in Log Scale	-5.727
SD in Original Scale	0.00629	SD in Log Scale	0.77
95% t UCL (assumes normality of ROS data)	0.00636	95% Percentile Bootstrap UCL	0.00638
95% BCA Bootstrap UCL	0.00719	95% Bootstrap t UCL	0.00824
95% H-UCL (Log ROS)	0.00566		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.173	KM Geo Mean	0.00566
KM SD (logged)	0.388	95% Critical H Value (KM-Log)	1.825
KM Standard Error of Mean (logged)	0.0618	95% H-UCL (KM -Log)	0.00682
KM SD (logged)	0.388	95% Critical H Value (KM-Log)	1.825
KM Standard Error of Mean (logged)	0.0618		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00505
SD in Original Scale	0.00614
95% t UCL (Assumes normality)	0.00664

DL/2 Log-Transformed

Mean in Log Scale	-5.566
SD in Log Scale	0.635
95% H-Stat UCL	0.00571

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL 0.0079

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs**General Statistics**

Total Number of Observations	42	Number of Distinct Observations	42
Number of Detects	40	Number of Non-Detects	2
Number of Distinct Detects	40	Number of Distinct Non-Detects	2
Minimum Detect	0.027	Minimum Non-Detect	0.0247
Maximum Detect	3.53	Maximum Non-Detect	0.0249
Variance Detects	0.441	Percent Non-Detects	4.762%
Mean Detects	0.61	SD Detects	0.664
Median Detects	0.485	CV Detects	1.089
Skewness Detects	2.685	Kurtosis Detects	9.41
Mean of Logged Detects	-1.053	SD of Logged Detects	1.202

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.733	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.919	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.206	Lilliefors GOF Test
1% Lilliefors Critical Value	0.162	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.582	KM Standard Error of Mean	0.102
90KM SD	0.652	95% KM (BCA) UCL	0.759
95% KM (t) UCL	0.753	95% KM (Percentile Bootstrap) UCL	0.757
95% KM (z) UCL	0.749	95% KM Bootstrap t UCL	0.83
90% KM Chebyshev UCL	0.887	95% KM Chebyshev UCL	1.026
97.5% KM Chebyshev UCL	1.218	99% KM Chebyshev UCL	1.595

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.655	Anderson-Darling GOF Test
5% A-D Critical Value	0.778	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.109	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.144	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.031	k star (bias corrected MLE)	0.97
Theta hat (MLE)	0.592	Theta star (bias corrected MLE)	0.629
nu hat (MLE)	82.44	nu star (bias corrected)	77.59
Mean (detects)	0.61		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.581
Maximum	3.53	Median	0.467
SD	0.66	CV	1.136
k hat (MLE)	0.865	k star (bias corrected MLE)	0.819
Theta hat (MLE)	0.672	Theta star (bias corrected MLE)	0.709
nu hat (MLE)	72.65	nu star (bias corrected)	68.79
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (68.79, α)	50.7	Adjusted Chi Square Value (68.79, β)	50.15
95% Gamma Approximate UCL	0.788	95% Gamma Adjusted UCL	0.797

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.582	SD (KM)	0.652
Variance (KM)	0.425	SE of Mean (KM)	0.102
k hat (KM)	0.797	k star (KM)	0.756
nu hat (KM)	66.92	nu star (KM)	63.47
theta hat (KM)	0.73	theta star (KM)	0.77
80% gamma percentile (KM)	0.953	90% gamma percentile (KM)	1.434
95% gamma percentile (KM)	1.926	99% gamma percentile (KM)	3.094

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (63.47, α)	46.15	Adjusted Chi Square Value (63.47, β)	45.62
95% KM Approximate Gamma UCL	0.8	95% KM Adjusted Gamma UCL	0.809

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.949	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.178	Lilliefors GOF Test
10% Lilliefors Critical Value	0.128	Detected Data Not Lognormal at 10% Significance Level

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.582	Mean in Log Scale	-1.186
SD in Original Scale	0.66	SD in Log Scale	1.318
95% t UCL (assumes normality of ROS data)	0.753	95% Percentile Bootstrap UCL	0.752
95% BCA Bootstrap UCL	0.776	95% Bootstrap t UCL	0.831
95% H-UCL (Log ROS)	1.276		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.179	KM Geo Mean	0.308
KM SD (logged)	1.288	95% Critical H Value (KM-Log)	2.694
KM Standard Error of Mean (logged)	0.201	95% H-UCL (KM -Log)	1.212
KM SD (logged)	1.288	95% Critical H Value (KM-Log)	2.694
KM Standard Error of Mean (logged)	0.201		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.581
SD in Original Scale	0.66
95% t UCL (Assumes normality)	0.753

DL/2 Log-Transformed

Mean in Log Scale	-1.212
SD in Log Scale	1.375
95% H-Stat UCL	1.399

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.809

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs

General Statistics

Total Number of Observations	42	Number of Distinct Observations	39
		Number of Missing Observations	0
Minimum	0.00566	Mean	0.089
Maximum	0.566	Median	0.0612
SD	0.112	Std. Error of Mean	0.0173
Coefficient of Variation	1.261	Skewness	2.731

Normal GOF Test		
Shapiro Wilk Test Statistic	0.663	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.235	Lilliefors GOF Test
1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.118	95% Adjusted-CLT UCL (Chen-1995)	0.125
		95% Modified-t UCL (Johnson-1978)	0.119

Gamma GOF Test		
A-D Test Statistic	0.811	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.784	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.124	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.141	Detected data appear Gamma Distributed at 5% Significance Level
Detected data follow Appr. Gamma Distribution at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	0.876	k star (bias corrected MLE)	0.829
Theta hat (MLE)	0.102	Theta star (bias corrected MLE)	0.107
nu hat (MLE)	73.6	nu star (bias corrected)	69.67
MLE Mean (bias corrected)	0.089	MLE Sd (bias corrected)	0.0977
		Approximate Chi Square Value (0.05)	51.46
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	50.9

Assuming Gamma Distribution			
95% Approximate Gamma UCL	0.121	95% Adjusted Gamma UCL	0.122

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.136	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.124	Data Not Lognormal at 10% Significance Level
Data Not Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	-5.174	Mean of logged Data	-3.089
Maximum of Logged Data	-0.569	SD of logged Data	1.259

Assuming Lognormal Distribution			
95% H-UCL	0.17	90% Chebyshev (MVUE) UCL	0.168
95% Chebyshev (MVUE) UCL	0.2	97.5% Chebyshev (MVUE) UCL	0.244
99% Chebyshev (MVUE) UCL	0.331		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	0.117	95% BCA Bootstrap UCL	0.128
95% Standard Bootstrap UCL	0.117	95% Bootstrap-t UCL	0.133
95% Hall's Bootstrap UCL	0.137	95% Percentile Bootstrap UCL	0.119
90% Chebyshev(Mean, Sd) UCL	0.141	95% Chebyshev(Mean, Sd) UCL	0.164
97.5% Chebyshev(Mean, Sd) UCL	0.197	99% Chebyshev(Mean, Sd) UCL	0.261

Suggested UCL to Use	
95% Adjusted Gamma UCL	0.122

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,

it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics			
Total Number of Observations	42	Number of Distinct Observations	35
Number of Detects	18	Number of Non-Detects	24
Number of Distinct Detects	18	Number of Distinct Non-Detects	17
Minimum Detect	0.025	Minimum Non-Detect	0.00465
Maximum Detect	0.178	Maximum Non-Detect	0.00507
Variance Detects	0.0013	Percent Non-Detects	57.14%
Mean Detects	0.0464	SD Detects	0.0361
Median Detects	0.0347	CV Detects	0.777
Skewness Detects	3.212	Kurtosis Detects	11.37
Mean of Logged Detects	-3.223	SD of Logged Detects	0.496

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.577	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.858	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.293	Lilliefors GOF Test
1% Lilliefors Critical Value	0.235	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0226	KM Standard Error of Mean	0.00491
90KM SD	0.0309	95% KM (BCA) UCL	0.0303
95% KM (t) UCL	0.0308	95% KM (Percentile Bootstrap) UCL	0.0303
95% KM (z) UCL	0.0306	95% KM Bootstrap t UCL	0.0362
90% KM Chebyshev UCL	0.0373	95% KM Chebyshev UCL	0.0439
97.5% KM Chebyshev UCL	0.0532	99% KM Chebyshev UCL	0.0714

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.563	Anderson-Darling GOF Test
5% A-D Critical Value	0.744	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.205	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.417	k star (bias corrected MLE)	2.885
Theta hat (MLE)	0.0136	Theta star (bias corrected MLE)	0.0161
nu hat (MLE)	123	nu star (bias corrected)	103.8
Mean (detects)	0.0464		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0256
Maximum	0.178	Median	0.01
SD	0.0295	CV	1.154
k hat (MLE)	1.582	k star (bias corrected MLE)	1.485
Theta hat (MLE)	0.0162	Theta star (bias corrected MLE)	0.0172
nu hat (MLE)	132.9	nu star (bias corrected)	124.7
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (124.74, α)	99.94	Adjusted Chi Square Value (124.74, β)	99.15
95% Gamma Approximate UCL	0.032	95% Gamma Adjusted UCL	0.0322

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0226	SD (KM)	0.0309

Variance (KM)	9.5438E-4	SE of Mean (KM)	0.00491
k hat (KM)	0.533	k star (KM)	0.511
nu hat (KM)	44.77	nu star (KM)	42.9
theta hat (KM)	0.0423	theta star (KM)	0.0442
80% gamma percentile (KM)	0.0371	90% gamma percentile (KM)	0.0607
95% gamma percentile (KM)	0.086	99% gamma percentile (KM)	0.148

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (42.90, α)	28.88	Adjusted Chi Square Value (42.90, β)	28.47
95% KM Approximate Gamma UCL	0.0335	95% KM Adjusted Gamma UCL	0.034

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.81	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.914	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.174	Lilliefors GOF Test
10% Lilliefors Critical Value	0.185	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0258	Mean in Log Scale	-4.01
SD in Original Scale	0.0295	SD in Log Scale	0.777
95% t UCL (assumes normality of ROS data)	0.0334	95% Percentile Bootstrap UCL	0.0335
95% BCA Bootstrap UCL	0.0358	95% Bootstrap t UCL	0.0394
95% H-UCL (Log ROS)	0.0318		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.451	KM Geo Mean	0.0117
KM SD (logged)	1.109	95% Critical H Value (KM-Log)	2.479
KM Standard Error of Mean (logged)	0.176	95% H-UCL (KM -Log)	0.0332
KM SD (logged)	1.109	95% Critical H Value (KM-Log)	2.479
KM Standard Error of Mean (logged)	0.176		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0213	Mean in Log Scale	-4.814
SD in Original Scale	0.032	SD in Log Scale	1.43
95% t UCL (Assumes normality)	0.0296	95% H-Stat UCL	0.0429

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

KM H-UCL	0.0332

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/13/2025 8:10:09 AM
 From File 90 UCL Input Data_MG.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	27	Number of Distinct Observations	23
Number of Detects	7	Number of Non-Detects	20
Number of Distinct Detects	7	Number of Distinct Non-Detects	16
Minimum Detect	0.596	Minimum Non-Detect	0.495
Maximum Detect	0.992	Maximum Non-Detect	0.565
Variance Detects	0.0216	Percent Non-Detects	74.07%
Mean Detects	0.737	SD Detects	0.147
Median Detects	0.712	CV Detects	0.199
Skewness Detects	0.808	Kurtosis Detects	-0.186
Mean of Logged Detects	-0.321	SD of Logged Detects	0.193

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.898	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.21	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.558	KM Standard Error of Mean	0.0263
90KM SD	0.127	95% KM (BCA) UCL	0.601
95% KM (t) UCL	0.603	95% KM (Percentile Bootstrap) UCL	0.601
95% KM (z) UCL	0.601	95% KM Bootstrap t UCL	0.612
90% KM Chebyshev UCL	0.637	95% KM Chebyshev UCL	0.673
97.5% KM Chebyshev UCL	0.722	99% KM Chebyshev UCL	0.82

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.365	Anderson-Darling GOF Test
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	30.89	k star (bias corrected MLE)	17.75
Theta hat (MLE)	0.0239	Theta star (bias corrected MLE)	0.0415

nu hat (MLE) 432.5
Mean (detects) 0.737

nu star (bias corrected) 248.5

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.106	Mean	0.348
Maximum	0.992	Median	0.213
SD	0.252	CV	0.723
k hat (MLE)	2.435	k star (bias corrected MLE)	2.189
Theta hat (MLE)	0.143	Theta star (bias corrected MLE)	0.159
nu hat (MLE)	131.5	nu star (bias corrected)	118.2
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (118.20, α)	94.1	Adjusted Chi Square Value (118.20, β)	92.73
95% Gamma Approximate UCL	0.437	95% Gamma Adjusted UCL	0.443

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.558	SD (KM)	0.127
Variance (KM)	0.016	SE of Mean (KM)	0.0263
k hat (KM)	19.39	k star (KM)	17.26
nu hat (KM)	1047	nu star (KM)	931.8
theta hat (KM)	0.0288	theta star (KM)	0.0323
80% gamma percentile (KM)	0.666	90% gamma percentile (KM)	0.735
95% gamma percentile (KM)	0.795	99% gamma percentile (KM)	0.917

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (931.82, α)	862	Adjusted Chi Square Value (931.82, β)	857.7
95% KM Approximate Gamma UCL	0.603	95% KM Adjusted Gamma UCL	0.606

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.838	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.213	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.445	Mean in Log Scale	-0.881
SD in Original Scale	0.192	SD in Log Scale	0.361
95% t UCL (assumes normality of ROS data)	0.508	95% Percentile Bootstrap UCL	0.508
95% BCA Bootstrap UCL	0.517	95% Bootstrap t UCL	0.529
95% H-UCL (Log ROS)	0.505		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.604	KM Geo Mean	0.546
KM SD (logged)	0.19	95% Critical H Value (KM-Log)	1.756

KM Standard Error of Mean (logged)	0.0396	95% H-UCL (KM -Log)	0.594
KM SD (logged)	0.19	95% Critical H Value (KM-Log)	1.756
KM Standard Error of Mean (logged)	0.0396		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.388
SD in Original Scale	0.222
95% t UCL (Assumes normality)	0.461

DL/2 Log-Transformed

Mean in Log Scale	-1.066
SD in Log Scale	0.46
95% H-Stat UCL	0.456

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.603

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	27	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	3.07	Mean	5.635
Maximum	8.98	Median	5.36
SD	1.378	Std. Error of Mean	0.265
Coefficient of Variation	0.245	Skewness	0.53

Normal GOF Test

Shapiro Wilk Test Statistic	0.967
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.157
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	6.087

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	6.1
95% Modified-t UCL (Johnson-1978)	6.092

Gamma GOF Test

A-D Test Statistic	0.276
5% A-D Critical Value	0.744
K-S Test Statistic	0.128
5% K-S Critical Value	0.168

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	17.63	k star (bias corrected MLE)	15.7
Theta hat (MLE)	0.32	Theta star (bias corrected MLE)	0.359
nu hat (MLE)	952.1	nu star (bias corrected)	847.7
MLE Mean (bias corrected)	5.635	MLE Sd (bias corrected)	1.422
		Approximate Chi Square Value (0.05)	781.1
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	777

Assuming Gamma Distribution			
95% Approximate Gamma UCL	6.115	95% Adjusted Gamma UCL	6.147

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.983	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.935	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.112	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	1.122	Mean of logged Data	1.7
Maximum of Logged Data	2.195	SD of logged Data	0.245

Assuming Lognormal Distribution			
95% H-UCL	6.148	90% Chebyshev (MVUE) UCL	6.441
95% Chebyshev (MVUE) UCL	6.806	97.5% Chebyshev (MVUE) UCL	7.312
99% Chebyshev (MVUE) UCL	8.306		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	6.071	95% BCA Bootstrap UCL	6.103
95% Standard Bootstrap UCL	6.055	95% Bootstrap-t UCL	6.134
95% Hall's Bootstrap UCL	6.134	95% Percentile Bootstrap UCL	6.059
90% Chebyshev(Mean, Sd) UCL	6.43	95% Chebyshev(Mean, Sd) UCL	6.791
97.5% Chebyshev(Mean, Sd) UCL	7.291	99% Chebyshev(Mean, Sd) UCL	8.273

Suggested UCL to Use	
95% Student's-t UCL	6.087

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	25

		Number of Missing Observations	0
Minimum	15.5	Mean	25.59
Maximum	52.3	Median	22
SD	10.35	Std. Error of Mean	1.992
Coefficient of Variation	0.405	Skewness	1.228

Normal GOF Test

Shapiro Wilk Test Statistic	0.846
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.188
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	28.99

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	29.37
95% Modified-t UCL (Johnson-1978)	29.07

Gamma GOF Test

A-D Test Statistic	0.963
5% A-D Critical Value	0.745
K-S Test Statistic	0.162
5% K-S Critical Value	0.168

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.523	k star (bias corrected MLE)	6.712
Theta hat (MLE)	3.402	Theta star (bias corrected MLE)	3.813
nu hat (MLE)	406.2	nu star (bias corrected)	362.4
MLE Mean (bias corrected)	25.59	MLE Sd (bias corrected)	9.879
		Approximate Chi Square Value (0.05)	319.3
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	316.7

Assuming Gamma Distribution

95% Approximate Gamma UCL	29.05	95% Adjusted Gamma UCL	29.29

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.91
10% Shapiro Wilk Critical Value	0.935
Lilliefors Test Statistic	0.141
10% Lilliefors Critical Value	0.153

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.741	Mean of logged Data	3.174
Maximum of Logged Data	3.957	SD of logged Data	0.363

Assuming Lognormal Distribution

95% H-UCL	29.17	90% Chebyshev (MVUE) UCL	30.95
95% Chebyshev (MVUE) UCL	33.42	97.5% Chebyshev (MVUE) UCL	36.86

99% Chebyshev (MVUE) UCL 43.61

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	28.87	95% BCA Bootstrap UCL	29.48
95% Standard Bootstrap UCL	28.89	95% Bootstrap-t UCL	30.06
95% Hall's Bootstrap UCL	29.63	95% Percentile Bootstrap UCL	28.9
90% Chebyshev(Mean, Sd) UCL	31.57	95% Chebyshev(Mean, Sd) UCL	34.28
97.5% Chebyshev(Mean, Sd) UCL	38.03	99% Chebyshev(Mean, Sd) UCL	45.42

Suggested UCL to Use

95% Student's-t UCL 28.99

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

General Statistics

Total Number of Observations	27	Number of Distinct Observations	27
		Number of Missing Observations	0
Minimum	21.6	Mean	80.13
Maximum	344	Median	37.4
SD	81.07	Std. Error of Mean	15.6
Coefficient of Variation	1.012	Skewness	1.911

Normal GOF Test

Shapiro Wilk Test Statistic	0.718
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.274
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 106.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	111.9
95% Modified-t UCL (Johnson-1978)	107.7

Gamma GOF Test

A-D Test Statistic	1.908
5% A-D Critical Value	0.763
K-S Test Statistic	0.261
5% K-S Critical Value	0.171

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE)	1.52	k star (bias corrected MLE)	1.376
Theta hat (MLE)	52.72	Theta star (bias corrected MLE)	58.24
nu hat (MLE)	82.08	nu star (bias corrected)	74.29
MLE Mean (bias corrected)	80.13	MLE Sd (bias corrected)	68.31
		Approximate Chi Square Value (0.05)	55.44
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	54.4

Assuming Gamma Distribution

95% Approximate Gamma UCL	107.4	95% Adjusted Gamma UCL	109.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.87
10% Shapiro Wilk Critical Value	0.935
Lilliefors Test Statistic	0.23
10% Lilliefors Critical Value	0.153

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data	3.073	Mean of logged Data	4.02
Maximum of Logged Data	5.841	SD of logged Data	0.81

Assuming Lognormal Distribution

95% H-UCL	111.2	90% Chebyshev (MVUE) UCL	115.3
95% Chebyshev (MVUE) UCL	133.1	97.5% Chebyshev (MVUE) UCL	157.7
99% Chebyshev (MVUE) UCL	206.1		

Nonparametric Distribution Free UCL Statistics**Data do not follow a Discernible Distribution****Nonparametric Distribution Free UCLs**

95% CLT UCL	105.8	95% BCA Bootstrap UCL	116
95% Standard Bootstrap UCL	105.4	95% Bootstrap-t UCL	120.3
95% Hall's Bootstrap UCL	115.3	95% Percentile Bootstrap UCL	105.8
90% Chebyshev(Mean, Sd) UCL	126.9	95% Chebyshev(Mean, Sd) UCL	148.1
97.5% Chebyshev(Mean, Sd) UCL	177.6	99% Chebyshev(Mean, Sd) UCL	235.4

Suggested UCL to Use

95% Student's-t UCL	106.7

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	25
		Number of Missing Observations	0
Minimum	13.5	Mean	53.31
Maximum	321	Median	31.4
SD	61.1	Std. Error of Mean	11.76
Coefficient of Variation	1.146	Skewness	3.527
Normal GOF Test			
Shapiro Wilk Test Statistic	0.589	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.894	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.257	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.194	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	73.37	95% Adjusted-CLT UCL (Chen-1995)	81.18
		95% Modified-t UCL (Johnson-1978)	74.7
Gamma GOF Test			
A-D Test Statistic	1.245	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.761	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.193	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.171	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.661	k star (bias corrected MLE)	1.501
Theta hat (MLE)	32.1	Theta star (bias corrected MLE)	35.52
nu hat (MLE)	89.67	nu star (bias corrected)	81.04
MLE Mean (bias corrected)	53.31	MLE Sd (bias corrected)	43.52
		Approximate Chi Square Value (0.05)	61.3
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	60.2
Assuming Gamma Distribution			
95% Approximate Gamma UCL	70.48	95% Adjusted Gamma UCL	71.77
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.934	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.935	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.134	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			

Minimum of Logged Data	2.603	Mean of logged Data	3.646
Maximum of Logged Data	5.771	SD of logged Data	0.743

Assuming Lognormal Distribution

95% H-UCL	69.65	90% Chebyshev (MVUE) UCL	73.1
95% Chebyshev (MVUE) UCL	83.62	97.5% Chebyshev (MVUE) UCL	98.24
99% Chebyshev (MVUE) UCL	126.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	72.65	95% BCA Bootstrap UCL	82.73
95% Standard Bootstrap UCL	72.48	95% Bootstrap-t UCL	95.65
95% Hall's Bootstrap UCL	146.8	95% Percentile Bootstrap UCL	73.81
90% Chebyshev(Mean, Sd) UCL	88.59	95% Chebyshev(Mean, Sd) UCL	104.6
97.5% Chebyshev(Mean, Sd) UCL	126.7	99% Chebyshev(Mean, Sd) UCL	170.3

Suggested UCL to Use

95% H-UCL	69.65

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	27	Number of Distinct Observations	24
Number of Detects	26	Number of Non-Detects	1
Number of Distinct Detects	23	Number of Distinct Non-Detects	1
Minimum Detect	0.0455	Minimum Non-Detect	0.0438
Maximum Detect	0.369	Maximum Non-Detect	0.0438
Variance Detects	0.00801	Percent Non-Detects	3.704%
Mean Detects	0.141	SD Detects	0.0895
Median Detects	0.129	CV Detects	0.636
Skewness Detects	1.423	Kurtosis Detects	1.402
Mean of Logged Detects	-2.128	SD of Logged Detects	0.58

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.82	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.891	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.244	Lilliefors GOF Test
1% Lilliefors Critical Value	0.199	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.137	KM Standard Error of Mean	0.0173
90KM SD	0.0881	95% KM (BCA) UCL	0.165
95% KM (t) UCL	0.167	95% KM (Percentile Bootstrap) UCL	0.165
95% KM (z) UCL	0.166	95% KM Bootstrap t UCL	0.179
90% KM Chebyshev UCL	0.189	95% KM Chebyshev UCL	0.213
97.5% KM Chebyshev UCL	0.245	99% KM Chebyshev UCL	0.309

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.735	Anderson-Darling GOF Test
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.172	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level**Gamma Statistics on Detected Data Only**

k hat (MLE)	3.138	k star (bias corrected MLE)	2.801
Theta hat (MLE)	0.0449	Theta star (bias corrected MLE)	0.0503
nu hat (MLE)	163.2	nu star (bias corrected)	145.7
Mean (detects)	0.141		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.136
Maximum	0.369	Median	0.128
SD	0.0913	CV	0.671
k hat (MLE)	2.381	k star (bias corrected MLE)	2.141
Theta hat (MLE)	0.0571	Theta star (bias corrected MLE)	0.0635
nu hat (MLE)	128.6	nu star (bias corrected)	115.6
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (115.61, α)	91.79	Adjusted Chi Square Value (115.61, β)	90.43
95% Gamma Approximate UCL	0.171	95% Gamma Adjusted UCL	0.174

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.137	SD (KM)	0.0881
Variance (KM)	0.00776	SE of Mean (KM)	0.0173
k hat (KM)	2.429	k star (KM)	2.184
nu hat (KM)	131.2	nu star (KM)	117.9
theta hat (KM)	0.0565	theta star (KM)	0.0629
80% gamma percentile (KM)	0.203	90% gamma percentile (KM)	0.262
95% gamma percentile (KM)	0.317	99% gamma percentile (KM)	0.439

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (117.92, α)	93.85	Adjusted Chi Square Value (117.92, β)	92.48
95% KM Approximate Gamma UCL	0.172	95% KM Adjusted Gamma UCL	0.175

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.948	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.933	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.137	Lilliefors GOF Test
10% Lilliefors Critical Value	0.156	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.137	Mean in Log Scale	-2.181
SD in Original Scale	0.0904	SD in Log Scale	0.633
95% t UCL (assumes normality of ROS data)	0.166	95% Percentile Bootstrap UCL	0.166
95% BCA Bootstrap UCL	0.169	95% Bootstrap t UCL	0.176
95% H-UCL (Log ROS)	0.179		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.165	KM Geo Mean	0.115
KM SD (logged)	0.589	95% Critical H Value (KM-Log)	2.051
KM Standard Error of Mean (logged)	0.116	95% H-UCL (KM -Log)	0.173
KM SD (logged)	0.589	95% Critical H Value (KM-Log)	2.051
KM Standard Error of Mean (logged)	0.116		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.136
SD in Original Scale	0.0907
95% t UCL (Assumes normality)	0.166

DL/2 Log-Transformed

Mean in Log Scale	-2.191
SD in Log Scale	0.655
95% H-Stat UCL	0.182

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.175	95% GROS Adjusted Gamma UCL	0.174

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations	27	Number of Distinct Observations	25
		Number of Missing Observations	0
Minimum	14.7	Mean	23.51
Maximum	58.9	Median	21.8
SD	8.535	Std. Error of Mean	1.642
Coefficient of Variation	0.363	Skewness	2.903

Normal GOF Test			
Shapiro Wilk Test Statistic	0.724	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.894	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.189	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.194	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	26.31	95% Adjusted-CLT UCL (Chen-1995)	27.19
		95% Modified-t UCL (Johnson-1978)	26.46
Gamma GOF Test			
A-D Test Statistic	0.907	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.744	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	11.24	k star (bias corrected MLE)	10.01
Theta hat (MLE)	2.092	Theta star (bias corrected MLE)	2.348
nu hat (MLE)	606.8	nu star (bias corrected)	540.7
MLE Mean (bias corrected)	23.51	MLE Sd (bias corrected)	7.429
		Approximate Chi Square Value (0.05)	487.8
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	484.6
Assuming Gamma Distribution			
95% Approximate Gamma UCL	26.06	95% Adjusted Gamma UCL	26.23
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.935	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.122	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.688	Mean of logged Data	3.112
Maximum of Logged Data	4.076	SD of logged Data	0.286
Assuming Lognormal Distribution			
95% H-UCL	25.91	90% Chebyshev (MVUE) UCL	27.29
95% Chebyshev (MVUE) UCL	29.06	97.5% Chebyshev (MVUE) UCL	31.52
99% Chebyshev (MVUE) UCL	36.35		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			

95% CLT UCL	26.21	95% BCA Bootstrap UCL	27.44
95% Standard Bootstrap UCL	26.2	95% Bootstrap-t UCL	28.52
95% Hall's Bootstrap UCL	39.34	95% Percentile Bootstrap UCL	26.23
90% Chebyshev(Mean, Sd) UCL	28.43	95% Chebyshev(Mean, Sd) UCL	30.67
97.5% Chebyshev(Mean, Sd) UCL	33.76	99% Chebyshev(Mean, Sd) UCL	39.85

Suggested UCL to Use

95% Student's-t UCL	26.31

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	27	Number of Distinct Observations	24
		Number of Missing Observations	0
Minimum	64.7	Mean	122.5
Maximum	224	Median	122
SD	41.57	Std. Error of Mean	8.001
Coefficient of Variation	0.339	Skewness	0.803

Normal GOF Test

Shapiro Wilk Test Statistic	0.935
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.0965
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	136.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	137
95% Modified-t UCL (Johnson-1978)	136.3

Gamma GOF Test

A-D Test Statistic	0.294
5% A-D Critical Value	0.744
K-S Test Statistic	0.0951
5% K-S Critical Value	0.168

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.542	k star (bias corrected MLE)	8.507
Theta hat (MLE)	12.84	Theta star (bias corrected MLE)	14.4
nu hat (MLE)	515.3	nu star (bias corrected)	459.4

MLE Mean (bias corrected)	122.5	MLE Sd (bias corrected)	42
		Approximate Chi Square Value (0.05)	410.7
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	407.7

Assuming Gamma Distribution

95% Approximate Gamma UCL	137	95% Adjusted Gamma UCL	138

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.935	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0884	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.153	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.17	Mean of logged Data	4.755
Maximum of Logged Data	5.412	SD of logged Data	0.332

Assuming Lognormal Distribution

95% H-UCL	138.3	90% Chebyshev (MVUE) UCL	146.3
95% Chebyshev (MVUE) UCL	157.2	97.5% Chebyshev (MVUE) UCL	172.2
99% Chebyshev (MVUE) UCL	201.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	135.6	95% BCA Bootstrap UCL	137.6
95% Standard Bootstrap UCL	135.9	95% Bootstrap-t UCL	138.9
95% Hall's Bootstrap UCL	138.9	95% Percentile Bootstrap UCL	135.8
90% Chebyshev(Mean, Sd) UCL	146.5	95% Chebyshev(Mean, Sd) UCL	157.4
97.5% Chebyshev(Mean, Sd) UCL	172.4	99% Chebyshev(Mean, Sd) UCL	202.1

Suggested UCL to Use

95% Student's-t UCL	136.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics

Total Number of Observations	27	Number of Distinct Observations	27
		Number of Missing Observations	0
Minimum	2.4179E-6	Mean	1.5451E-5
Maximum	2.6287E-5	Median	1.5273E-5
SD	7.2927E-6	Std. Error of Mean	1.4035E-6
Coefficient of Variation	N/A	Skewness	-0.114

Normal GOF Test

Shapiro Wilk Test Statistic	0.946
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.118
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level**Assuming Normal Distribution****95% Normal UCL**

95% Student's-t UCL 1.7845E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 1.7727E-5

95% Modified-t UCL (Johnson-1978) 1.7840E-5

Gamma GOF Test

A-D Test Statistic	0.61
5% A-D Critical Value	0.751
K-S Test Statistic	0.111
5% K-S Critical Value	0.169

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level**Gamma Statistics**

k hat (MLE)	3.432
Theta hat (MLE)	4.5015E-6
nu hat (MLE)	185.4
MLE Mean (bias corrected)	1.5451E-5
Adjusted Level of Significance	0.0401

k star (bias corrected MLE)	3.076
Theta star (bias corrected MLE)	5.0236E-6
nu star (bias corrected)	166.1
MLE Sd (bias corrected)	8.8102E-6
Approximate Chi Square Value (0.05)	137.3
Adjusted Chi Square Value	135.6

Assuming Gamma Distribution

95% Approximate Gamma UCL 1.8692E-5

95% Adjusted Gamma UCL 1.8923E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883
10% Shapiro Wilk Critical Value	0.935
Lilliefors Test Statistic	0.139
10% Lilliefors Critical Value	0.153

Shapiro Wilk Lognormal GOF Test

Data Not Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level**Lognormal Statistics**

Minimum of Logged Data	-12.93
Maximum of Logged Data	-10.55

Mean of logged Data	-11.23
SD of logged Data	0.631

Assuming Lognormal Distribution

95% H-UCL	2.0967E-5
95% Chebyshev (MVUE) UCL	2.5091E-5
99% Chebyshev (MVUE) UCL	3.6694E-5

90% Chebyshev (MVUE) UCL	2.2271E-5
97.5% Chebyshev (MVUE) UCL	2.9005E-5

Nonparametric Distribution Free UCL Statistics**Data appear to follow a Discernible Distribution**

Nonparametric Distribution Free UCLs

95% CLT UCL	1.7760E-5	95% BCA Bootstrap UCL	1.7746E-5
95% Standard Bootstrap UCL	1.7729E-5	95% Bootstrap-t UCL	1.7846E-5
95% Hall's Bootstrap UCL	1.7711E-5	95% Percentile Bootstrap UCL	1.7717E-5
90% Chebyshev(Mean, Sd) UCL	1.9662E-5	95% Chebyshev(Mean, Sd) UCL	2.1569E-5
97.5% Chebyshev(Mean, Sd) UCL	2.4216E-5	99% Chebyshev(Mean, Sd) UCL	2.9416E-5

Suggested UCL to Use

95% Student's-t UCL 1.7845E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Dibenzofuran

General Statistics

Total Number of Observations	27	Number of Distinct Observations	27
Number of Detects	17	Number of Non-Detects	10
Number of Distinct Detects	17	Number of Distinct Non-Detects	10
Minimum Detect	0.00511	Minimum Non-Detect	0.0047
Maximum Detect	0.0334	Maximum Non-Detect	0.0051
Variance Detects	4.3659E-5	Percent Non-Detects	37.04%
Mean Detects	0.00889	SD Detects	0.00661
Median Detects	0.00734	CV Detects	0.743
Skewness Detects	3.548	Kurtosis Detects	13.64
Mean of Logged Detects	-4.855	SD of Logged Detects	0.455

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.525	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.316	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00734	KM Standard Error of Mean	0.00109
90KM SD	0.00547	95% KM (BCA) UCL	0.0096
95% KM (t) UCL	0.00919	95% KM (Percentile Bootstrap) UCL	0.00939
95% KM (z) UCL	0.00912	95% KM Bootstrap t UCL	0.0117
90% KM Chebyshev UCL	0.0106	95% KM Chebyshev UCL	0.0121
97.5% KM Chebyshev UCL	0.0141	99% KM Chebyshev UCL	0.0181

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.564	Anderson-Darling GOF Test
5% A-D Critical Value	0.743	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	Kolmogorov-Smirnov GOF

Detected Data Not Gamma Distributed at 5% Significance Level**Gamma Statistics on Detected Data Only**

k hat (MLE)	3.949	k star (bias corrected MLE)	3.292
Theta hat (MLE)	0.00225	Theta star (bias corrected MLE)	0.0027
nu hat (MLE)	134.3	nu star (bias corrected)	111.9
Mean (detects)	0.00889		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00511	Mean	0.0093
Maximum	0.0334	Median	0.00988
SD	0.00521	CV	0.56
k hat (MLE)	6.066	k star (bias corrected MLE)	5.416
Theta hat (MLE)	0.00153	Theta star (bias corrected MLE)	0.00172
nu hat (MLE)	327.5	nu star (bias corrected)	292.5
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (292.48, α)	253.9	Adjusted Chi Square Value (292.48, β)	251.6
95% Gamma Approximate UCL	0.0107	95% Gamma Adjusted UCL	0.0108

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00734	SD (KM)	0.00547
Variance (KM)	2.9961E-5	SE of Mean (KM)	0.00109
k hat (KM)	1.797	k star (KM)	1.622
nu hat (KM)	97.01	nu star (KM)	87.57
theta hat (KM)	0.00408	theta star (KM)	0.00452
80% gamma percentile (KM)	0.0113	90% gamma percentile (KM)	0.015
95% gamma percentile (KM)	0.0186	99% gamma percentile (KM)	0.0268

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (87.57, α)	66.99	Adjusted Chi Square Value (87.57, β)	65.84
95% KM Approximate Gamma UCL	0.00959	95% KM Adjusted Gamma UCL	0.00976

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.779	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.91	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.177	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.19	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Approximate Lognormal at 10% Significance Level**Lognormal ROS Statistics Using Imputed Non-Detects**

Mean in Original Scale	0.00663	Mean in Log Scale	-5.236
SD in Original Scale	0.00599	SD in Log Scale	0.619
95% t UCL (assumes normality of ROS data)	0.00859	95% Percentile Bootstrap UCL	0.00865
95% BCA Bootstrap UCL	0.00964	95% Bootstrap t UCL	0.0104

95% H-UCL (Log ROS) 0.0083

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.042	KM Geo Mean	0.00646
KM SD (logged)	0.427	95% Critical H Value (KM-Log)	1.911
KM Standard Error of Mean (logged)	0.0847	95% H-UCL (KM -Log)	0.0083
KM SD (logged)	0.427	95% Critical H Value (KM-Log)	1.911
KM Standard Error of Mean (logged)	0.0847		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00651
SD in Original Scale	0.00607
95% t UCL (Assumes normality)	0.0085

DL/2 Log-Transformed

Mean in Log Scale	-5.282
SD in Log Scale	0.67
95% H-Stat UCL	0.00842

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

KM H-UCL 0.0083

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics

Total Number of Observations	27	Number of Distinct Observations	26
		Number of Missing Observations	0
Minimum	0.223	Mean	1.725
Maximum	11.9	Median	1.1
SD	2.264	Std. Error of Mean	0.436
Coefficient of Variation	1.313	Skewness	3.806

Normal GOF Test

Shapiro Wilk Test Statistic	0.55
1% Shapiro Wilk Critical Value	0.894
Lilliefors Test Statistic	0.292
1% Lilliefors Critical Value	0.194

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	2.468

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	2.782
95% Modified-t UCL (Johnson-1978)	2.521

Gamma GOF Test

A-D Test Statistic	1.098
5% A-D Critical Value	0.766
K-S Test Statistic	0.208
5% K-S Critical Value	0.172

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.354	k star (bias corrected MLE)	1.229
Theta hat (MLE)	1.273	Theta star (bias corrected MLE)	1.404
nu hat (MLE)	73.13	nu star (bias corrected)	66.34
MLE Mean (bias corrected)	1.725	MLE Sd (bias corrected)	1.556
		Approximate Chi Square Value (0.05)	48.6
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	47.63

Assuming Gamma Distribution

95% Approximate Gamma UCL	2.354	95% Adjusted Gamma UCL	2.402

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967
10% Shapiro Wilk Critical Value	0.935
Lilliefors Test Statistic	0.136
10% Lilliefors Critical Value	0.153

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.501	Mean of logged Data	0.132
Maximum of Logged Data	2.477	SD of logged Data	0.848

Assuming Lognormal Distribution

95% H-UCL	2.41	90% Chebyshev (MVUE) UCL	2.479
95% Chebyshev (MVUE) UCL	2.874	97.5% Chebyshev (MVUE) UCL	3.423
99% Chebyshev (MVUE) UCL	4.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2.441	95% BCA Bootstrap UCL	2.951
95% Standard Bootstrap UCL	2.422	95% Bootstrap-t UCL	3.438
95% Hall's Bootstrap UCL	5.373	95% Percentile Bootstrap UCL	2.521
90% Chebyshev(Mean, Sd) UCL	3.031	95% Chebyshev(Mean, Sd) UCL	3.623
97.5% Chebyshev(Mean, Sd) UCL	4.445	99% Chebyshev(Mean, Sd) UCL	6.059

Suggested UCL to Use

95% H-UCL	2.41

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	27
		Number of Missing Observations	0
Minimum	0.0319	Mean	0.268
Maximum	1.75	Median	0.18
SD	0.338	Std. Error of Mean	0.065
Coefficient of Variation	1.258	Skewness	3.58
Normal GOF Test			
Shapiro Wilk Test Statistic	0.584	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.894	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.272	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.194	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.379	95% Adjusted-CLT UCL (Chen-1995)	0.423
		95% Modified-t UCL (Johnson-1978)	0.387
Gamma GOF Test			
A-D Test Statistic	0.884	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.172	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.172	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.357	k star (bias corrected MLE)	1.231
Theta hat (MLE)	0.198	Theta star (bias corrected MLE)	0.218
nu hat (MLE)	73.27	nu star (bias corrected)	66.46
MLE Mean (bias corrected)	0.268	MLE Sd (bias corrected)	0.242
		Approximate Chi Square Value (0.05)	48.7
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	47.73
Assuming Gamma Distribution			
95% Approximate Gamma UCL	0.366	95% Adjusted Gamma UCL	0.374
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.978	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.935	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.103	Lilliefors Lognormal GOF Test	

10% Lilliefors Critical Value 0.153

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.445	Mean of logged Data	-1.727
Maximum of Logged Data	0.56	SD of logged Data	0.864

Assuming Lognormal Distribution

95% H-UCL	0.384	90% Chebyshev (MVUE) UCL	0.394
95% Chebyshev (MVUE) UCL	0.458	97.5% Chebyshev (MVUE) UCL	0.546
99% Chebyshev (MVUE) UCL	0.72		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.375	95% BCA Bootstrap UCL	0.445
95% Standard Bootstrap UCL	0.372	95% Bootstrap-t UCL	0.507
95% Hall's Bootstrap UCL	0.834	95% Percentile Bootstrap UCL	0.384
90% Chebyshev(Mean, Sd) UCL	0.463	95% Chebyshev(Mean, Sd) UCL	0.552
97.5% Chebyshev(Mean, Sd) UCL	0.674	99% Chebyshev(Mean, Sd) UCL	0.915

Suggested UCL to Use

95% H-UCL	0.384

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics

Total Number of Observations	27	Number of Distinct Observations	27
Number of Detects	25	Number of Non-Detects	2
Number of Distinct Detects	25	Number of Distinct Non-Detects	2
Minimum Detect	0.0245	Minimum Non-Detect	0.00479
Maximum Detect	2.75	Maximum Non-Detect	0.00504
Variance Detects	0.294	Percent Non-Detects	7.407%
Mean Detects	0.232	SD Detects	0.542
Median Detects	0.0678	CV Detects	2.337
Skewness Detects	4.529	Kurtosis Detects	21.55
Mean of Logged Detects	-2.347	SD of Logged Detects	1.12

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.381

Shapiro Wilk GOF Test

1% Shapiro Wilk Critical Value 0.886 Detected Data Not Normal at 1% Significance Level

Lilliefors Test Statistic 0.374 **Lilliefors GOF Test**

1% Lilliefors Critical Value 0.201 Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.215	KM Standard Error of Mean	0.101
90KM SD	0.514	95% KM (BCA) UCL	0.422
95% KM (t) UCL	0.387	95% KM (Percentile Bootstrap) UCL	0.405
95% KM (z) UCL	0.381	95% KM Bootstrap t UCL	0.892
90% KM Chebyshev UCL	0.518	95% KM Chebyshev UCL	0.655
97.5% KM Chebyshev UCL	0.846	99% KM Chebyshev UCL	1.22

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.196	Anderson-Darling GOF Test
5% A-D Critical Value	0.79	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.246	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.182	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.685	k star (bias corrected MLE)	0.629
Theta hat (MLE)	0.339	Theta star (bias corrected MLE)	0.368
nu hat (MLE)	34.25	nu star (bias corrected)	31.47
Mean (detects)	0.232		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.215
Maximum	2.75	Median	0.064
SD	0.524	CV	2.433
k hat (MLE)	0.627	k star (bias corrected MLE)	0.582
Theta hat (MLE)	0.344	Theta star (bias corrected MLE)	0.37
nu hat (MLE)	33.87	nu star (bias corrected)	31.44
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (31.44, α)	19.63	Adjusted Chi Square Value (31.44, β)	19.03
95% Gamma Approximate UCL	0.345	95% Gamma Adjusted UCL	0.356

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.215	SD (KM)	0.514
Variance (KM)	0.265	SE of Mean (KM)	0.101
k hat (KM)	0.175	k star (KM)	0.18
nu hat (KM)	9.437	nu star (KM)	9.722
theta hat (KM)	1.23	theta star (KM)	1.194
80% gamma percentile (KM)	0.267	90% gamma percentile (KM)	0.649
95% gamma percentile (KM)	1.138	99% gamma percentile (KM)	2.508

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.72, α)	3.769	Adjusted Chi Square Value (9.72, β)	3.534
95% KM Approximate Gamma UCL	0.555	95% KM Adjusted Gamma UCL	0.592

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.931	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.141	Lilliefors GOF Test
10% Lilliefors Critical Value	0.159	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.215	Mean in Log Scale	-2.537
SD in Original Scale	0.524	SD in Log Scale	1.276
95% t UCL (assumes normality of ROS data)	0.387	95% Percentile Bootstrap UCL	0.4
95% BCA Bootstrap UCL	0.51	95% Bootstrap t UCL	0.885
95% H-UCL (Log ROS)	0.369		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.568	KM Geo Mean	0.0767
KM SD (logged)	1.316	95% Critical H Value (KM-Log)	2.959
KM Standard Error of Mean (logged)	0.258	95% H-UCL (KM -Log)	0.391
KM SD (logged)	1.316	95% Critical H Value (KM-Log)	2.959
KM Standard Error of Mean (logged)	0.258		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.215	Mean in Log Scale	-2.618
SD in Original Scale	0.524	SD in Log Scale	1.454
95% t UCL (Assumes normality)	0.387	95% H-Stat UCL	0.518

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 10% Significance Level

Suggested UCL to Use

KM H-UCL	0.391

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:53:44 PM
 From File 90 UCL Input Data_MG_f.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Number of Detects	2	Number of Non-Detects	5
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	0.603	Minimum Non-Detect	0.539
Maximum Detect	0.801	Maximum Non-Detect	0.565
Variance Detects	0.0196	Percent Non-Detects	71.43%
Mean Detects	0.702	SD Detects	0.14
Median Detects	0.702	CV Detects	0.199
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.364	SD of Logged Detects	0.201

Warning: Data set has only 2 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.586	KM Standard Error of Mean	0.0485
90KM SD	0.0907	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.68	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.665	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.731	95% KM Chebyshev UCL	0.797
97.5% KM Chebyshev UCL	0.888	99% KM Chebyshev UCL	1.068

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	49.95	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0141	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	199.8	nu star (bias corrected)	N/A
Mean (detects)	0.702		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.586	SD (KM)	0.0907
Variance (KM)	0.00822	SE of Mean (KM)	0.0485
k hat (KM)	41.7	k star (KM)	23.92
nu hat (KM)	583.8	nu star (KM)	334.9
theta hat (KM)	0.014	theta star (KM)	0.0245
80% gamma percentile (KM)	0.683	90% gamma percentile (KM)	0.743
95% gamma percentile (KM)	0.795	99% gamma percentile (KM)	0.899

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (334.95, α)	293.5	Adjusted Level of Significance (β)	0.0158
95% KM Approximate Gamma UCL	0.668	Adjusted Chi Square Value (334.95, β)	281.8
		95% KM Adjusted Gamma UCL	0.696

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.392	Mean in Log Scale	-1.051
SD in Original Scale	0.222	SD in Log Scale	0.492
95% t UCL (assumes normality of ROS data)	0.555	95% Percentile Bootstrap UCL	0.528
95% BCA Bootstrap UCL	0.552	95% Bootstrap t UCL	1.122
95% H-UCL (Log ROS)	0.645		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.545	KM Geo Mean	0.58
KM SD (logged)	0.138	95% Critical H Value (KM-Log)	1.912
KM Standard Error of Mean (logged)	0.0736	95% H-UCL (KM -Log)	0.651
KM SD (logged)	0.138	95% Critical H Value (KM-Log)	1.912
KM Standard Error of Mean (logged)	0.0736		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.397
SD in Original Scale	0.216
95% t UCL (Assumes normality)	0.556

DL/2 Log-Transformed

Mean in Log Scale	-1.025
SD in Log Scale	0.46
95% H-Stat UCL	0.623

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Suggested UCL to Use

Recommendation cannot be provided

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	3.98	Mean	5.544
Maximum	6.87	Median	5.41
SD	1.055	Std. Error of Mean	0.399
Coefficient of Variation	0.19	Skewness	-0.142

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.95
1% Shapiro Wilk Critical Value	0.73
Lilliefors Test Statistic	0.174
1% Lilliefors Critical Value	0.35

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	6.319

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	6.177
95% Modified-t UCL (Johnson-1978)	6.315

Gamma GOF Test

A-D Test Statistic	0.265	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	31.1	k star (bias corrected MLE)	17.87
Theta hat (MLE)	0.178	Theta star (bias corrected MLE)	0.31
nu hat (MLE)	435.4	nu star (bias corrected)	250.1
MLE Mean (bias corrected)	5.544	MLE Sd (bias corrected)	1.312
		Approximate Chi Square Value (0.05)	214.5
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	204.5

Assuming Gamma Distribution

95% Approximate Gamma UCL	6.465	95% Adjusted Gamma UCL	6.781

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.946	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.182	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics			
Minimum of Logged Data	1.381	Mean of logged Data	1.697
Maximum of Logged Data	1.927	SD of logged Data	0.196

Assuming Lognormal Distribution

95% H-UCL	6.522	90% Chebyshev (MVUE) UCL	6.782
95% Chebyshev (MVUE) UCL	7.342	97.5% Chebyshev (MVUE) UCL	8.119
99% Chebyshev (MVUE) UCL	9.646		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	6.2	95% BCA Bootstrap UCL	6.153
95% Standard Bootstrap UCL	6.158	95% Bootstrap-t UCL	6.321
95% Hall's Bootstrap UCL	6.133	95% Percentile Bootstrap UCL	6.149
90% Chebyshev(Mean, Sd) UCL	6.74	95% Chebyshev(Mean, Sd) UCL	7.282
97.5% Chebyshev(Mean, Sd) UCL	8.034	99% Chebyshev(Mean, Sd) UCL	9.511

Suggested UCL to Use

95% Student's-t UCL	6.319

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Copper

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	26.8	Mean	69.6
Maximum	180	Median	34.6
SD	59.01	Std. Error of Mean	22.3
Coefficient of Variation	0.848	Skewness	1.382

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.784	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.295	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	112.9

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	118.7
95% Modified-t UCL (Johnson-1978)	114.9

Gamma GOF Test

A-D Test Statistic	0.642	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.308	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	1.987	k star (bias corrected MLE)	1.23
Theta hat (MLE)	35.03	Theta star (bias corrected MLE)	56.56
nu hat (MLE)	27.81	nu star (bias corrected)	17.23
MLE Mean (bias corrected)	69.6	MLE Sd (bias corrected)	62.74
		Approximate Chi Square Value (0.05)	8.834
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	7.097

Assuming Gamma Distribution

95% Approximate Gamma UCL	135.7	95% Adjusted Gamma UCL	169

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.844	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.282	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.28	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.288	Mean of logged Data	3.97
Maximum of Logged Data	5.193	SD of logged Data	0.768

Assuming Lognormal Distribution

95% H-UCL	186.3	90% Chebyshev (MVUE) UCL	127.1
95% Chebyshev (MVUE) UCL	153.9	97.5% Chebyshev (MVUE) UCL	191.3
99% Chebyshev (MVUE) UCL	264.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	106.3	95% BCA Bootstrap UCL	114.9
95% Standard Bootstrap UCL	103.8	95% Bootstrap-t UCL	208.2
95% Hall's Bootstrap UCL	262.1	95% Percentile Bootstrap UCL	107.1
90% Chebyshev(Mean, Sd) UCL	136.5	95% Chebyshev(Mean, Sd) UCL	166.8
97.5% Chebyshev(Mean, Sd) UCL	208.9	99% Chebyshev(Mean, Sd) UCL	291.5

Suggested UCL to Use

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	18.7	Mean	43.2
Maximum	96.2	Median	28.2
SD	30.42	Std. Error of Mean	11.5
Coefficient of Variation	0.704	Skewness	1.182

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.815		
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.26	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	65.54	95% Adjusted-CLT UCL (Chen-1995)	67.6
		95% Modified-t UCL (Johnson-1978)	66.4

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.509		
5% A-D Critical Value	0.713	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.247	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	2.769	k star (bias corrected MLE)	1.677
Theta hat (MLE)	15.6	Theta star (bias corrected MLE)	25.76
nu hat (MLE)	38.76	nu star (bias corrected)	23.48
MLE Mean (bias corrected)	43.2	MLE Sd (bias corrected)	33.36
		Approximate Chi Square Value (0.05)	13.46
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	11.23

Assuming Gamma Distribution			
95% Approximate Gamma UCL	75.39	95% Adjusted Gamma UCL	90.31

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.887		
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.213	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics			
Minimum of Logged Data	2.929	Mean of logged Data	3.575
Maximum of Logged Data	4.566	SD of logged Data	0.648

Assuming Lognormal Distribution

95% H-UCL	91.82	90% Chebyshev (MVUE) UCL	74
95% Chebyshev (MVUE) UCL	88.25	97.5% Chebyshev (MVUE) UCL	108
99% Chebyshev (MVUE) UCL	146.9		

Nonparametric Distribution Free UCL Statistics Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	62.11	95% BCA Bootstrap UCL	65.6
95% Standard Bootstrap UCL	60.98	95% Bootstrap-t UCL	111.5
95% Hall's Bootstrap UCL	164.2	95% Percentile Bootstrap UCL	62.09
90% Chebyshev(Mean, Sd) UCL	77.7	95% Chebyshev(Mean, Sd) UCL	93.32
97.5% Chebyshev(Mean, Sd) UCL	115	99% Chebyshev(Mean, Sd) UCL	157.6

Suggested UCL to Use

95% Student's-t UCL	65.54

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.0696	Minimum Non-Detect	0.0438
Maximum Detect	0.141	Maximum Non-Detect	0.0438
Variance Detects	0.00112	Percent Non-Detects	14.29%
Mean Detects	0.103	SD Detects	0.0335
Median Detects	0.101	CV Detects	0.326
Skewness Detects	0.0642	Kurtosis Detects	-3.08
Mean of Logged Detects	-2.322	SD of Logged Detects	0.335

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.713	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.299	Lilliefors GOF Test
1% Lilliefors Critical Value	0.373	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0943	KM Standard Error of Mean	0.0145
90KM SD	0.035	95% KM (BCA) UCL	0.117
95% KM (t) UCL	0.122	95% KM (Percentile Bootstrap) UCL	0.116
95% KM (z) UCL	0.118	95% KM Bootstrap t UCL	0.122
90% KM Chebyshev UCL	0.138	95% KM Chebyshev UCL	0.158
97.5% KM Chebyshev UCL	0.185	99% KM Chebyshev UCL	0.239

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.769	Anderson-Darling GOF Test
5% A-D Critical Value	0.698	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	11	k star (bias corrected MLE)	5.612
Theta hat (MLE)	0.00934	Theta star (bias corrected MLE)	0.0183
nu hat (MLE)	132	nu star (bias corrected)	67.35
Mean (detects)	0.103		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0356	Mean	0.0931
Maximum	0.141	Median	0.0746
SD	0.0397	CV	0.427
k hat (MLE)	5.548	k star (bias corrected MLE)	3.265
Theta hat (MLE)	0.0168	Theta star (bias corrected MLE)	0.0285
nu hat (MLE)	77.67	nu star (bias corrected)	45.71
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (45.71, α)	31.2	Adjusted Chi Square Value (45.71, β)	27.63
95% Gamma Approximate UCL	0.136	95% Gamma Adjusted UCL	0.154

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0943	SD (KM)	0.035
Variance (KM)	0.00123	SE of Mean (KM)	0.0145
k hat (KM)	7.247	k star (KM)	4.237
nu hat (KM)	101.5	nu star (KM)	59.31
theta hat (KM)	0.013	theta star (KM)	0.0223
80% gamma percentile (KM)	0.129	90% gamma percentile (KM)	0.156
95% gamma percentile (KM)	0.18	99% gamma percentile (KM)	0.232

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (59.31, α)	42.6	Adjusted Chi Square Value (59.31, β)	38.37
95% KM Approximate Gamma UCL	0.131	95% KM Adjusted Gamma UCL	0.146

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.783	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.826	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.293	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.298	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0944	Mean in Log Scale	-2.434
SD in Original Scale	0.0376	SD in Log Scale	0.427
95% t UCL (assumes normality of ROS data)	0.122	95% Percentile Bootstrap UCL	0.116
95% BCA Bootstrap UCL	0.116	95% Bootstrap t UCL	0.123
95% H-UCL (Log ROS)	0.144		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.437	KM Geo Mean	0.0874
KM SD (logged)	0.4	95% Critical H Value (KM-Log)	2.282
KM Standard Error of Mean (logged)	0.165	95% H-UCL (KM -Log)	0.137
KM SD (logged)	0.4	95% Critical H Value (KM-Log)	2.282
KM Standard Error of Mean (logged)	0.165		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0912	Mean in Log Scale	-2.536
SD in Original Scale	0.0432	SD in Log Scale	0.644
95% t UCL (Assumes normality)	0.123	95% H-Stat UCL	0.202

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.122

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	16.3	Mean	21.41
Maximum	27.1	Median	19.7
SD	3.789	Std. Error of Mean	1.432
Coefficient of Variation	0.177	Skewness	0.279

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.941		
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.246		
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	24.2	95% Adjusted-CLT UCL (Chen-1995)	23.93
		95% Modified-t UCL (Johnson-1978)	24.22

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.33		
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245		
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	37.42	k star (bias corrected MLE)	21.48
Theta hat (MLE)	0.572	Theta star (bias corrected MLE)	0.997
nu hat (MLE)	523.9	nu star (bias corrected)	300.7
MLE Mean (bias corrected)	21.41	MLE Sd (bias corrected)	4.62
		Approximate Chi Square Value (0.05)	261.6
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	250.5

Assuming Gamma Distribution			
95% Approximate Gamma UCL	24.62	95% Adjusted Gamma UCL	25.71

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test	
Shapiro Wilk Test Statistic	0.947		
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.225		
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics			
Minimum of Logged Data	2.791	Mean of logged Data	3.051
Maximum of Logged Data	3.3	SD of logged Data	0.177

Assuming Lognormal Distribution			
95% H-UCL	24.73	90% Chebyshev (MVUE) UCL	25.72
95% Chebyshev (MVUE) UCL	27.67	97.5% Chebyshev (MVUE) UCL	30.37
99% Chebyshev (MVUE) UCL	35.69		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	23.77	95% BCA Bootstrap UCL	23.71
95% Standard Bootstrap UCL	23.66	95% Bootstrap-t UCL	24.72
95% Hall's Bootstrap UCL	23.87	95% Percentile Bootstrap UCL	23.64
90% Chebyshev(Mean, Sd) UCL	25.71	95% Chebyshev(Mean, Sd) UCL	27.66
97.5% Chebyshev(Mean, Sd) UCL	30.36	99% Chebyshev(Mean, Sd) UCL	35.66

Suggested UCL to Use	
95% Student's-t UCL	24.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	80.4	Mean	109
Maximum	151	Median	99.4
SD	25.94	Std. Error of Mean	9.803
Coefficient of Variation	0.238	Skewness	0.748

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.92		
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.216	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			

Assuming Normal Distribution		95% UCLs (Adjusted for Skewness)	
95% Normal UCL			
95% Student's-t UCL	128	95% Adjusted-CLT UCL (Chen-1995)	128.1
		95% Modified-t UCL (Johnson-1978)	128.5

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.302		
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.208	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			

Gamma Statistics			
k hat (MLE)	21.72	k star (bias corrected MLE)	12.51

Theta hat (MLE)	5.018	Theta star (bias corrected MLE)	8.714
nu hat (MLE)	304.1	nu star (bias corrected)	175.1
MLE Mean (bias corrected)	109	MLE Sd (bias corrected)	30.82
		Approximate Chi Square Value (0.05)	145.5
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	137.3

Assuming Gamma Distribution

95% Approximate Gamma UCL	131.2	95% Adjusted Gamma UCL	139

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.189	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.387	Mean of logged Data	4.668
Maximum of Logged Data	5.017	SD of logged Data	0.23

Assuming Lognormal Distribution

95% H-UCL	132.5	90% Chebyshev (MVUE) UCL	137.4
95% Chebyshev (MVUE) UCL	150.3	97.5% Chebyshev (MVUE) UCL	168.2
99% Chebyshev (MVUE) UCL	203.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	125.1	95% BCA Bootstrap UCL	126.4
95% Standard Bootstrap UCL	124.5	95% Bootstrap-t UCL	142.4
95% Hall's Bootstrap UCL	136.7	95% Percentile Bootstrap UCL	124.7
90% Chebyshev(Mean, Sd) UCL	138.4	95% Chebyshev(Mean, Sd) UCL	151.7
97.5% Chebyshev(Mean, Sd) UCL	170.2	99% Chebyshev(Mean, Sd) UCL	206.5

Suggested UCL to Use

95% Student's-t UCL	128

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	6.9537E-6	Mean	1.5972E-5
Maximum	2.6287E-5	Median	1.2795E-5
SD	7.1234E-6	Std. Error of Mean	2.6924E-6
Coefficient of Variation	N/A	Skewness	0.299

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.244	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 2.1203E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 2.0725E-5

95% Modified-t UCL (Johnson-1978) 2.1254E-5

Gamma GOF Test

A-D Test Statistic 0.314

5% A-D Critical Value 0.71

K-S Test Statistic 0.217

5% K-S Critical Value 0.313

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE) 5.563

Theta hat (MLE) 2.8708E-6

nu hat (MLE) 77.89

MLE Mean (bias corrected) 1.5972E-5

k star (bias corrected MLE) 3.274

Theta star (bias corrected MLE) 4.8778E-6

nu star (bias corrected) 45.84

MLE Sd (bias corrected) 8.8265E-6

Approximate Chi Square Value (0.05) 31.31

Adjusted Chi Square Value 27.73

Adjusted Level of Significance 0.0158

Assuming Gamma Distribution

95% Approximate Gamma UCL 2.3386E-5

95% Adjusted Gamma UCL 2.6403E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.943

10% Shapiro Wilk Critical Value 0.838

Lilliefors Test Statistic 0.204

10% Lilliefors Critical Value 0.28

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data -11.88

Maximum of Logged Data -10.55

Mean of logged Data -11.14

SD of logged Data 0.476

Assuming Lognormal Distribution

95% H-UCL 2.6053E-5

95% Chebyshev (MVUE) UCL 2.8655E-5

99% Chebyshev (MVUE) UCL 4.4852E-5

90% Chebyshev (MVUE) UCL 2.4718E-5

97.5% Chebyshev (MVUE) UCL 3.4119E-5

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL 2.0400E-5

95% Standard Bootstrap UCL 2.0145E-5

95% Hall's Bootstrap UCL 1.9844E-5

90% Chebyshev(Mean, Sd) UCL 2.4049E-5

97.5% Chebyshev(Mean, Sd) UCL 3.2786E-5

95% BCA Bootstrap UCL 2.0597E-5

95% Bootstrap-t UCL 2.1976E-5

95% Percentile Bootstrap UCL 2.0237E-5

95% Chebyshev(Mean, Sd) UCL 2.7707E-5

99% Chebyshev(Mean, Sd) UCL 4.2761E-5

Suggested UCL to Use

95% Student's-t UCL 2.1203E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations 7

Number of Detects 4

Number of Distinct Detects 4

Number of Distinct Observations 7

Number of Non-Detects 3

Number of Distinct Non-Detects 3

Minimum Detect	0.00511	Minimum Non-Detect	0.00478
Maximum Detect	0.00776	Maximum Non-Detect	0.00502
Variance Detects	1.5410E-6	Percent Non-Detects	42.86%
Mean Detects	0.00595	SD Detects	0.00124
Median Detects	0.00546	CV Detects	0.209
Skewness Detects	1.721	Kurtosis Detects	2.9
Mean of Logged Detects	-5.14	SD of Logged Detects	0.194

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.792	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.687	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.319	Lilliefors GOF Test
1% Lilliefors Critical Value	0.413	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00545	KM Standard Error of Mean	4.3486E-4
90KM SD	9.9639E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00629	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00616	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00675	95% KM Chebyshev UCL	0.00734
97.5% KM Chebyshev UCL	0.00816	99% KM Chebyshev UCL	0.00977

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.539	Anderson-Darling GOF Test
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	33.78	k star (bias corrected MLE)	8.612
Theta hat (MLE)	1.7599E-4	Theta star (bias corrected MLE)	6.9035E-4
nu hat (MLE)	270.2	nu star (bias corrected)	68.89
Mean (detects)	0.00595		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00511	Mean	0.00768
Maximum	0.01	Median	0.00776
SD	0.00234	CV	0.304
k hat (MLE)	12.05	k star (bias corrected MLE)	6.981
Theta hat (MLE)	6.3761E-4	Theta star (bias corrected MLE)	0.0011
nu hat (MLE)	168.7	nu star (bias corrected)	97.73
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (97.73, α)	75.93	Adjusted Chi Square Value (97.73, β)	70.14
95% Gamma Approximate UCL	0.00989	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00545	SD (KM)	9.9639E-4
Variance (KM)	9.9280E-7	SE of Mean (KM)	4.3486E-4
k hat (KM)	29.87	k star (KM)	17.16
nu hat (KM)	418.2	nu star (KM)	240.3
theta hat (KM)	1.8231E-4	theta star (KM)	3.1727E-4

80% gamma percentile (KM)	0.00651	90% gamma percentile (KM)	0.00718
95% gamma percentile (KM)	0.00777	99% gamma percentile (KM)	0.00896

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (240.30, α)	205.4	Adjusted Chi Square Value (240.30, β)	195.6
95% KM Approximate Gamma UCL	0.00637	95% KM Adjusted Gamma UCL	0.00669

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.816	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.792	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.295	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.346	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00485	Mean in Log Scale	-5.374
SD in Original Scale	0.00162	SD in Log Scale	0.322
95% t UCL (assumes normality of ROS data)	0.00604	95% Percentile Bootstrap UCL	0.00581
95% BCA Bootstrap UCL	0.00584	95% Bootstrap t UCL	0.00627
95% H-UCL (Log ROS)	0.00656		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.227	KM Geo Mean	0.00537
KM SD (logged)	0.162	95% Critical H Value (KM-Log)	1.938
KM Standard Error of Mean (logged)	0.0708	95% H-UCL (KM -Log)	0.00618
KM SD (logged)	0.162	95% Critical H Value (KM-Log)	1.938
KM Standard Error of Mean (logged)	0.0708		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00444
SD in Original Scale	0.00207
95% t UCL (Assumes normality)	0.00596

DL/2 Log-Transformed

Mean in Log Scale	-5.517
SD in Log Scale	0.49
95% H-Stat UCL	0.00738

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.00629

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.44	Mean	1.313
Maximum	2.66	Median	1.02
SD	0.911	Std. Error of Mean	0.344
Coefficient of Variation	0.694	Skewness	0.888

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.82	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	

Lilliefors Test Statistic	0.307	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	1.982

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	2.003
95% Modified-t UCL (Johnson-1978)	2.001

Gamma GOF Test

A-D Test Statistic	0.471
5% A-D Critical Value	0.713
K-S Test Statistic	0.238
5% K-S Critical Value	0.314

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	2.526
Theta hat (MLE)	0.52
nu hat (MLE)	35.37
MLE Mean (bias corrected)	1.313
Adjusted Level of Significance	0.0158

k star (bias corrected MLE)	1.539
Theta star (bias corrected MLE)	0.853
nu star (bias corrected)	21.54
MLE Sd (bias corrected)	1.059
Approximate Chi Square Value (0.05)	12
Adjusted Chi Square Value	9.917

Assuming Gamma Distribution

95% Approximate Gamma UCL	2.358

95% Adjusted Gamma UCL	2.853

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.895
10% Shapiro Wilk Critical Value	0.838
Lilliefors Test Statistic	0.195
10% Lilliefors Critical Value	0.28

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	-0.821
Maximum of Logged Data	0.978

Mean of logged Data	0.0617
SD of logged Data	0.709

Assuming Lognormal Distribution

95% H-UCL	3.19
95% Chebyshev (MVUE) UCL	2.855
99% Chebyshev (MVUE) UCL	4.835

90% Chebyshev (MVUE) UCL	2.374
97.5% Chebyshev (MVUE) UCL	3.523

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1.88
95% Standard Bootstrap UCL	1.842
95% Hall's Bootstrap UCL	7.473
90% Chebyshev(Mean, Sd) UCL	2.346
97.5% Chebyshev(Mean, Sd) UCL	3.463

95% BCA Bootstrap UCL	1.931
95% Bootstrap-t UCL	2.917
95% Percentile Bootstrap UCL	1.845
95% Chebyshev(Mean, Sd) UCL	2.814
99% Chebyshev(Mean, Sd) UCL	4.738

Suggested UCL to Use

95% Student's-t UCL	1.982

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0711	Mean	0.218
Maximum	0.446	Median	0.165
SD	0.156	Std. Error of Mean	0.0588
Coefficient of Variation	0.713	Skewness	0.9

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		
Shapiro Wilk Test Statistic	0.818	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.291	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level
Data appear Normal at 1% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.333	95% Adjusted-CLT UCL (Chen-1995)	0.337
		95% Modified-t UCL (Johnson-1978)	0.336

Gamma GOF Test		
A-D Test Statistic	0.449	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Gamma Statistics			
k hat (MLE)	2.397	k star (bias corrected MLE)	1.465
Theta hat (MLE)	0.0911	Theta star (bias corrected MLE)	0.149
nu hat (MLE)	33.56	nu star (bias corrected)	20.51
MLE Mean (bias corrected)	0.218	MLE Sd (bias corrected)	0.18
		Approximate Chi Square Value (0.05)	11.23
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	9.226

Assuming Gamma Distribution			
95% Approximate Gamma UCL	0.399	95% Adjusted Gamma UCL	0.485

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.9	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.176	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Lognormal Statistics			
Minimum of Logged Data	-2.644	Mean of logged Data	-1.745
Maximum of Logged Data	-0.807	SD of logged Data	0.729

Assuming Lognormal Distribution			
95% H-UCL	0.552	90% Chebyshev (MVUE) UCL	0.399
95% Chebyshev (MVUE) UCL	0.481	97.5% Chebyshev (MVUE) UCL	0.595
99% Chebyshev (MVUE) UCL	0.819		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.315	95% BCA Bootstrap UCL	0.324
95% Standard Bootstrap UCL	0.309	95% Bootstrap-t UCL	0.502
95% Hall's Bootstrap UCL	1.234	95% Percentile Bootstrap UCL	0.309
90% Chebyshev(Mean, Sd) UCL	0.395	95% Chebyshev(Mean, Sd) UCL	0.475
97.5% Chebyshev(Mean, Sd) UCL	0.586	99% Chebyshev(Mean, Sd) UCL	0.804

Suggested UCL to Use

95% Student's-t UCL	0.333

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.025	Mean	0.118
Maximum	0.427	Median	0.0567
SD	0.147	Std. Error of Mean	0.0556
Coefficient of Variation	1.249	Skewness	2.015

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.698	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.73	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.361	Lilliefors GOF Test
1% Lilliefors Critical Value	0.35	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	0.226

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.254
95% Modified-t UCL (Johnson-1978)	0.233

Gamma GOF Test

A-D Test Statistic	0.644	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	1.087	k star (bias corrected MLE)	0.716
Theta hat (MLE)	0.108	Theta star (bias corrected MLE)	0.164
nu hat (MLE)	15.21	nu star (bias corrected)	10.03
MLE Mean (bias corrected)	0.118	MLE Sd (bias corrected)	0.139
		Approximate Chi Square Value (0.05)	3.959
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.895

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.298	95% Adjusted Gamma UCL	0.408

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.255	Lilliefors Lognormal GOF Test

10% Lilliefors Critical Value 0.28

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	-3.688	Mean of logged Data	-2.665
Maximum of Logged Data	-0.851	SD of logged Data	1.036

Assuming Lognormal Distribution

95% H-UCL	0.593	90% Chebyshev (MVUE) UCL	0.234
95% Chebyshev (MVUE) UCL	0.292	97.5% Chebyshev (MVUE) UCL	0.371
99% Chebyshev (MVUE) UCL	0.528		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.209	95% BCA Bootstrap UCL	0.252
95% Standard Bootstrap UCL	0.203	95% Bootstrap-t UCL	0.84
95% Hall's Bootstrap UCL	0.729	95% Percentile Bootstrap UCL	0.213
90% Chebyshev(Mean, Sd) UCL	0.285	95% Chebyshev(Mean, Sd) UCL	0.36
97.5% Chebyshev(Mean, Sd) UCL	0.465	99% Chebyshev(Mean, Sd) UCL	0.671

Suggested UCL to Use

Recommendation cannot be provided

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation ProUCL 5.2 11/14/2025 12:51:45 PM
 From File 90 UCL Input Data_MG_c.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

Antimony

General Statistics

Total Number of Observations	17	Number of Distinct Observations	14
Number of Detects	2	Number of Non-Detects	15
Number of Distinct Detects	2	Number of Distinct Non-Detects	12
Minimum Detect	0.603	Minimum Non-Detect	0.495
Maximum Detect	0.801	Maximum Non-Detect	0.565
Variance Detects	0.0196	Percent Non-Detects	88.24%
Mean Detects	0.702	SD Detects	0.14
Median Detects	0.702	CV Detects	0.199
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.364	SD of Logged Detects	0.201

Warning: Data set has only 2 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.519	KM Standard Error of Mean	0.0257
90KM SD	0.0748	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.564	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.562	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.596	95% KM Chebyshev UCL	0.631
97.5% KM Chebyshev UCL	0.68	99% KM Chebyshev UCL	0.775

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	49.95	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0141	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	199.8	nu star (bias corrected)	N/A
Mean (detects)	0.702		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.519	SD (KM)	0.0748
Variance (KM)	0.0056	SE of Mean (KM)	0.0257
k hat (KM)	48.16	k star (KM)	39.7
nu hat (KM)	1637	nu star (KM)	1350
theta hat (KM)	0.0108	theta star (KM)	0.0131
80% gamma percentile (KM)	0.587	90% gamma percentile (KM)	0.627
95% gamma percentile (KM)	0.662	99% gamma percentile (KM)	0.73

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1265	Adjusted Level of Significance (β)	0.0346
95% KM Approximate Gamma UCL	0.554	Adjusted Chi Square Value (N/A, β)	1257
		95% KM Adjusted Gamma UCL	0.558

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.231	Mean in Log Scale	-1.631

SD in Original Scale	0.183	SD in Log Scale	0.517
95% t UCL (assumes normality of ROS data)	0.309	95% Percentile Bootstrap UCL	0.308
95% BCA Bootstrap UCL	0.335	95% Bootstrap t UCL	0.581
95% H-UCL (Log ROS)	0.292		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.663	KM Geo Mean	0.515
KM SD (logged)	0.12	95% Critical H Value (KM-Log)	1.748
KM Standard Error of Mean (logged)	0.0411	95% H-UCL (KM -Log)	0.547
KM SD (logged)	0.12	95% Critical H Value (KM-Log)	1.748
KM Standard Error of Mean (logged)	0.0411		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.315	Mean in Log Scale	-1.219
SD in Original Scale	0.15	SD in Log Scale	0.328
95% t UCL (Assumes normality)	0.379	95% H-Stat UCL	0.364

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	0.564

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	17	Number of Distinct Observations	15
		Number of Missing Observations	0
Minimum	3.07	Mean	5.637
Maximum	7.63	Median	5.41
SD	1.182	Std. Error of Mean	0.287
Coefficient of Variation	0.21	Skewness	-0.376

Normal GOF Test

Shapiro Wilk Test Statistic	0.967
1% Shapiro Wilk Critical Value	0.851
Lilliefors Test Statistic	0.138
1% Lilliefors Critical Value	0.241

Shapiro Wilk GOF Test

Data appear Normal at 1% Significance Level

Lilliefors GOF Test

Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL	6.138

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	6.081
95% Modified-t UCL (Johnson-1978)	6.133

Gamma GOF Test

A-D Test Statistic	0.362
5% A-D Critical Value	0.738
K-S Test Statistic	0.142
5% K-S Critical Value	0.209

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	21.81	k star (bias corrected MLE)	18
Theta hat (MLE)	0.259	Theta star (bias corrected MLE)	0.313
nu hat (MLE)	741.4	nu star (bias corrected)	611.9
MLE Mean (bias corrected)	5.637	MLE Sd (bias corrected)	1.329
		Approximate Chi Square Value (0.05)	555.5
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	549.9

Assuming Gamma Distribution			
95% Approximate Gamma UCL	6.209	95% Adjusted Gamma UCL	6.273

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.132	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	1.122	Mean of logged Data	1.706
Maximum of Logged Data	2.032	SD of logged Data	0.229

Assuming Lognormal Distribution			
95% H-UCL	6.272	90% Chebyshev (MVUE) UCL	6.593
95% Chebyshev (MVUE) UCL	7.022	97.5% Chebyshev (MVUE) UCL	7.618
99% Chebyshev (MVUE) UCL	8.788		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	6.109	95% BCA Bootstrap UCL	6.1
95% Standard Bootstrap UCL	6.096	95% Bootstrap-t UCL	6.097
95% Hall's Bootstrap UCL	6.071	95% Percentile Bootstrap UCL	6.105
90% Chebyshev(Mean, Sd) UCL	6.497	95% Chebyshev(Mean, Sd) UCL	6.887
97.5% Chebyshev(Mean, Sd) UCL	7.427	99% Chebyshev(Mean, Sd) UCL	8.489

Suggested UCL to Use	
95% Student's-t UCL	6.138

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Copper

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	21.6	Mean	61.07
Maximum	180	Median	34.6
SD	51.15	Std. Error of Mean	12.41
Coefficient of Variation	0.838	Skewness	1.52

Normal GOF Test		
Shapiro Wilk Test Statistic	0.744	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.293	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data Not Normal at 1% Significance Level
Data Not Normal at 1% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	82.73	95% Adjusted-CLT UCL (Chen-1995)	86.36
		95% Modified-t UCL (Johnson-1978)	83.49

Gamma GOF Test			
A-D Test Statistic	1.265	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.749	Data Not Gamma Distributed at 5% Significance Level	

K-S Test Statistic	0.253	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.212	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics		
k hat (MLE)	2.059	k star (bias corrected MLE)
Theta hat (MLE)	29.66	Theta star (bias corrected MLE)
nu hat (MLE)	70	nu star (bias corrected)
MLE Mean (bias corrected)	61.07	MLE Sd (bias corrected)
		Approximate Chi Square Value (0.05)
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value

Assuming Gamma Distribution

95% Approximate Gamma UCL	85.11	95% Adjusted Gamma UCL	88.18

Lognormal GOF Test		Shapiro Wilk Lognormal GOF Test
Shapiro Wilk Test Statistic	0.86	Data Not Lognormal at 10% Significance Level
10% Shapiro Wilk Critical Value	0.91	Lilliefors Lognormal GOF Test
Lilliefors Test Statistic	0.216	Data Not Lognormal at 10% Significance Level
10% Lilliefors Critical Value	0.19	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics		
Minimum of Logged Data	3.073	Mean of logged Data
Maximum of Logged Data	5.193	SD of logged Data

Assuming Lognormal Distribution

95% H-UCL	89.54	90% Chebyshev (MVUE) UCL	91.21
95% Chebyshev (MVUE) UCL	105.7	97.5% Chebyshev (MVUE) UCL	125.9
99% Chebyshev (MVUE) UCL	165.5		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs		
95% CLT UCL	81.48	95% BCA Bootstrap UCL
95% Standard Bootstrap UCL	81.37	95% Bootstrap-t UCL
95% Hall's Bootstrap UCL	87.32	95% Percentile Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL	98.29	95% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL	138.5	99% Chebyshev(Mean, Sd) UCL

Suggested UCL to Use

95% Student's-t UCL	82.73

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics		
Total Number of Observations	17	Number of Distinct Observations
		Number of Missing Observations
Minimum	13.5	Mean
Maximum	118	Median
SD	30.42	Std. Error of Mean
Coefficient of Variation	0.766	Skewness

Normal GOF Test		Shapiro Wilk GOF Test
Shapiro Wilk Test Statistic	0.793	Data Not Normal at 1% Significance Level
1% Shapiro Wilk Critical Value	0.851	Lilliefors GOF Test
Lilliefors Test Statistic	0.235	Data appear Normal at 1% Significance Level
1% Lilliefors Critical Value	0.241	

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	52.58	95% Adjusted-CLT UCL (Chen-1995)	54.85
		95% Modified-t UCL (Johnson-1978)	53.05
Gamma GOF Test			
A-D Test Statistic	0.731	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.211	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.211	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	2.393	k star (bias corrected MLE)	2.01
Theta hat (MLE)	16.58	Theta star (bias corrected MLE)	19.75
nu hat (MLE)	81.38	nu star (bias corrected)	68.35
MLE Mean (bias corrected)	39.69	MLE Sd (bias corrected)	28
		Approximate Chi Square Value (0.05)	50.32
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	48.7
Assuming Gamma Distribution			
95% Approximate Gamma UCL	53.92	95% Adjusted Gamma UCL	55.71
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.93	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.185	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.603	Mean of logged Data	3.458
Maximum of Logged Data	4.771	SD of logged Data	0.658
Assuming Lognormal Distribution			
95% H-UCL	56.72	90% Chebyshev (MVUE) UCL	58.47
95% Chebyshev (MVUE) UCL	67.35	97.5% Chebyshev (MVUE) UCL	79.69
99% Chebyshev (MVUE) UCL	103.9		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	51.83	95% BCA Bootstrap UCL	55.95
95% Standard Bootstrap UCL	51.81	95% Bootstrap-t UCL	60.5
95% Hall's Bootstrap UCL	58.54	95% Percentile Bootstrap UCL	52.57
90% Chebyshev(Mean, Sd) UCL	61.83	95% Chebyshev(Mean, Sd) UCL	71.85
97.5% Chebyshev(Mean, Sd) UCL	85.77	99% Chebyshev(Mean, Sd) UCL	113.1
Suggested UCL to Use			
95% Student's-t UCL	52.58		

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	15
Number of Detects	16	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.0455	Minimum Non-Detect	0.0438

Maximum Detect	0.141	Maximum Non-Detect	0.0438
Variance Detects	0.00123	Percent Non-Detects	5.882%
Mean Detects	0.093	SD Detects	0.0351
Median Detects	0.0787	CV Detects	0.377
Skewness Detects	0.288	Kurtosis Detects	-1.615
Mean of Logged Detects	-2.445	SD of Logged Detects	0.389

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.874	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.844	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.193	Lilliefors GOF Test
1% Lilliefors Critical Value	0.248	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0901	KM Standard Error of Mean	0.00875
90KM SD	0.0349	95% KM (BCA) UCL	0.105
95% KM (t) UCL	0.105	95% KM (Percentile Bootstrap) UCL	0.104
95% KM (z) UCL	0.104	95% KM Bootstrap t UCL	0.106
90% KM Chebyshev UCL	0.116	95% KM Chebyshev UCL	0.128
97.5% KM Chebyshev UCL	0.145	99% KM Chebyshev UCL	0.177

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.682	Anderson-Darling GOF Test
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.363	k star (bias corrected MLE)	6.024
Theta hat (MLE)	0.0126	Theta star (bias corrected MLE)	0.0154
nu hat (MLE)	235.6	nu star (bias corrected)	192.8
Mean (detects)	0.093		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0273	Mean	0.0891
Maximum	0.141	Median	0.076
SD	0.0375	CV	0.421
k hat (MLE)	5.422	k star (bias corrected MLE)	4.505
Theta hat (MLE)	0.0164	Theta star (bias corrected MLE)	0.0198
nu hat (MLE)	184.4	nu star (bias corrected)	153.2
Adjusted Level of Significance (β)	0.0346		
Approximate Chi Square Value (153.16, α)	125.5	Adjusted Chi Square Value (153.16, β)	122.9
95% Gamma Approximate UCL	0.109	95% Gamma Adjusted UCL	0.111

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0901	SD (KM)	0.0349
Variance (KM)	0.00122	SE of Mean (KM)	0.00875
k hat (KM)	6.653	k star (KM)	5.518
nu hat (KM)	226.2	nu star (KM)	187.6
theta hat (KM)	0.0135	theta star (KM)	0.0163
80% gamma percentile (KM)	0.12	90% gamma percentile (KM)	0.141
95% gamma percentile (KM)	0.161	99% gamma percentile (KM)	0.202

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (187.60, α)	156.9	Adjusted Chi Square Value (187.60, β)	154
95% KM Approximate Gamma UCL	0.108	95% KM Adjusted Gamma UCL	0.11

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	Shapiro Wilk GOF Test

10% Shapiro Wilk Critical Value	0.906	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.196	Lilliefors GOF Test
10% Lilliefors Critical Value	0.196	Detected Data Not Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.0895	Mean in Log Scale	-2.5
SD in Original Scale	0.0369	SD in Log Scale	0.44
95% t UCL (assumes normality of ROS data)	0.105	95% Percentile Bootstrap UCL	0.104
95% BCA Bootstrap UCL	0.104	95% Bootstrap t UCL	0.106
95% H-UCL (Log ROS)	0.112		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.485	KM Geo Mean	0.0833
KM SD (logged)	0.399	95% Critical H Value (KM-Log)	1.941
KM Standard Error of Mean (logged)	0.1	95% H-UCL (KM -Log)	0.11
KM SD (logged)	0.399	95% Critical H Value (KM-Log)	1.941
KM Standard Error of Mean (logged)	0.1		

DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0888	Mean in Log Scale	-2.526
SD in Original Scale	0.0381	SD in Log Scale	0.503
95% t UCL (Assumes normality)	0.105	95% H-Stat UCL	0.117

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use
95% KM (t) UCL 0.105

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	14.7	Mean	20.79
Maximum	27.1	Median	19.7
SD	3.954	Std. Error of Mean	0.959
Coefficient of Variation	0.19	Skewness	0.0552

Normal GOF Test		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.939		
1% Shapiro Wilk Critical Value	0.851	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.138	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	22.46	95% Adjusted-CLT UCL (Chen-1995)	22.38
		95% Modified-t UCL (Johnson-1978)	22.46

Gamma GOF Test		Anderson-Darling Gamma GOF Test	
A-D Test Statistic	0.437		
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.149	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.209	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics			
k hat (MLE)	28.87	k star (bias corrected MLE)	23.81
Theta hat (MLE)	0.72	Theta star (bias corrected MLE)	0.873
nu hat (MLE)	981.5	nu star (bias corrected)	809.6
MLE Mean (bias corrected)	20.79	MLE Sd (bias corrected)	4.26
		Approximate Chi Square Value (0.05)	744.6
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	738.1

Assuming Gamma Distribution			
95% Approximate Gamma UCL	22.6	95% Adjusted Gamma UCL	22.8

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.939	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.144	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	2.688	Mean of logged Data	3.017
Maximum of Logged Data	3.3	SD of logged Data	0.194

Assuming Lognormal Distribution			
95% H-UCL	22.7	90% Chebyshev (MVUE) UCL	23.74
95% Chebyshev (MVUE) UCL	25.07	97.5% Chebyshev (MVUE) UCL	26.92
99% Chebyshev (MVUE) UCL	30.56		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	22.37	95% BCA Bootstrap UCL	22.29
95% Standard Bootstrap UCL	22.3	95% Bootstrap-t UCL	22.52
95% Hall's Bootstrap UCL	22.34	95% Percentile Bootstrap UCL	22.25
90% Chebyshev(Mean, Sd) UCL	23.67	95% Chebyshev(Mean, Sd) UCL	24.97
97.5% Chebyshev(Mean, Sd) UCL	26.78	99% Chebyshev(Mean, Sd) UCL	30.33

Suggested UCL to Use	
95% Student's-t UCL	22.46

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	64.7	Mean	102.9
Maximum	179	Median	92.7
SD	30.85	Std. Error of Mean	7.482
Coefficient of Variation	0.3	Skewness	1.073

Normal GOF Test		
Shapiro Wilk Test Statistic	0.912	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.159	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level
Data appear Normal at 1% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	116	95% Adjusted-CLT UCL (Chen-1995)	117.3
		95% Modified-t UCL (Johnson-1978)	116.3

Gamma GOF Test		
A-D Test Statistic	0.358	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.139	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.209	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics		
k hat (MLE)	13.13	k star (bias corrected MLE) 10.86
Theta hat (MLE)	7.833	Theta star (bias corrected MLE) 9.477
nu hat (MLE)	446.6	nu star (bias corrected) 369.1
MLE Mean (bias corrected)	102.9	MLE Sd (bias corrected) 31.23
		Approximate Chi Square Value (0.05) 325.6
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value 321.3

Assuming Gamma Distribution		
95% Approximate Gamma UCL	116.6	95% Adjusted Gamma UCL 118.2

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.962	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.124	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics		
Minimum of Logged Data	4.17	Mean of logged Data 4.595
Maximum of Logged Data	5.187	SD of logged Data 0.281

Assuming Lognormal Distribution		
95% H-UCL	117.2	90% Chebyshev (MVUE) UCL 123.9
95% Chebyshev (MVUE) UCL	133.6	97.5% Chebyshev (MVUE) UCL 146.9
99% Chebyshev (MVUE) UCL	173.1	

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs		
95% CLT UCL	115.2	95% BCA Bootstrap UCL 117
95% Standard Bootstrap UCL	114.9	95% Bootstrap-t UCL 119.9
95% Hall's Bootstrap UCL	120	95% Percentile Bootstrap UCL 115
90% Chebyshev(Mean, Sd) UCL	125.3	95% Chebyshev(Mean, Sd) UCL 135.5
97.5% Chebyshev(Mean, Sd) UCL	149.6	99% Chebyshev(Mean, Sd) UCL 177.3

Suggested UCL to Use	
95% Student's-t UCL	116

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dioxin/Furan

General Statistics		
Total Number of Observations	17	Number of Distinct Observations 17
		Number of Missing Observations 0
Minimum	2.4179E-6	Mean 1.2000E-5
Maximum	2.6287E-5	Median 1.1445E-5
SD	6.6017E-6	Std. Error of Mean 1.6011E-6
Coefficient of Variation	N/A	Skewness 0.64
Normal GOF Test		
Shapiro Wilk Test Statistic	0.954	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data appear Normal at 1% Significance Level

Lilliefors Test Statistic	0.158	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 1.4795E-5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 1.4899E-5

95% Modified-t UCL (Johnson-1978) 1.4836E-5

Gamma GOF Test

A-D Test Statistic 0.213

5% A-D Critical Value 0.745

K-S Test Statistic 0.123

5% K-S Critical Value 0.211

Anderson-Darling Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE) 3.108

Theta hat (MLE) 3.8614E-6

nu hat (MLE) 105.7

MLE Mean (bias corrected) 1.2000E-5

Adjusted Level of Significance 0.0346

k star (bias corrected MLE) 2.598

Theta star (bias corrected MLE) 4.6181E-6

nu star (bias corrected) 88.35

MLE Sd (bias corrected) 7.4442E-6

Approximate Chi Square Value (0.05) 67.68

Adjusted Chi Square Value 65.78

Assuming Gamma Distribution

95% Approximate Gamma UCL 1.5665E-5

95% Adjusted Gamma UCL 1.6116E-5

Lognormal GOF Test

Shapiro Wilk Test Statistic 0.948

10% Shapiro Wilk Critical Value 0.91

Lilliefors Test Statistic 0.161

10% Lilliefors Critical Value 0.19

Shapiro Wilk Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Lilliefors Lognormal GOF Test

Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data -12.93

Maximum of Logged Data -10.55

Mean of logged Data -11.5

SD of logged Data 0.646

Assuming Lognormal Distribution

95% H-UCL 1.7788E-5

95% Chebyshev (MVUE) UCL 2.1146E-5

99% Chebyshev (MVUE) UCL 3.2489E-5

90% Chebyshev (MVUE) UCL 1.8389E-5

97.5% Chebyshev (MVUE) UCL 2.4972E-5

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL 1.4633E-5

95% Standard Bootstrap UCL 1.4567E-5

95% Hall's Bootstrap UCL 1.5086E-5

90% Chebyshev(Mean, Sd) UCL 1.6803E-5

97.5% Chebyshev(Mean, Sd) UCL 2.1999E-5

95% BCA Bootstrap UCL 1.4847E-5

95% Bootstrap-t UCL 1.5041E-5

95% Percentile Bootstrap UCL 1.4588E-5

95% Chebyshev(Mean, Sd) UCL 1.8979E-5

99% Chebyshev(Mean, Sd) UCL 2.7931E-5

Suggested UCL to Use

95% Student's-t UCL 1.4795E-5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenzofuran

General Statistics

Total Number of Observations 17

Number of Detects 8

Number of Distinct Detects 8

Number of Distinct Observations 17

Number of Non-Detects 9

Number of Distinct Non-Detects 9

Minimum Detect	0.00511	Minimum Non-Detect	0.0047
Maximum Detect	0.0334	Maximum Non-Detect	0.0051
Variance Detects	8.8489E-5	Percent Non-Detects	52.94%
Mean Detects	0.0107	SD Detects	0.00941
Median Detects	0.00788	CV Detects	0.879
Skewness Detects	2.56	Kurtosis Detects	6.844
Mean of Logged Detects	-4.745	SD of Logged Detects	0.612

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.621	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.749	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.362	Lilliefors GOF Test
1% Lilliefors Critical Value	0.333	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.00752	KM Standard Error of Mean	0.00175
90KM SD	0.00674	95% KM (BCA) UCL	0.011
95% KM (t) UCL	0.0106	95% KM (Percentile Bootstrap) UCL	0.0107
95% KM (z) UCL	0.0104	95% KM Bootstrap t UCL	0.0172
90% KM Chebyshev UCL	0.0128	95% KM Chebyshev UCL	0.0151
97.5% KM Chebyshev UCL	0.0184	99% KM Chebyshev UCL	0.0249

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.879	Anderson-Darling GOF Test
5% A-D Critical Value	0.723	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.275	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	2.56	k star (bias corrected MLE)	1.683
Theta hat (MLE)	0.00418	Theta star (bias corrected MLE)	0.00636
nu hat (MLE)	40.96	nu star (bias corrected)	26.93
Mean (detects)	0.0107		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00511	Mean	0.0103
Maximum	0.0334	Median	0.01
SD	0.00623	CV	0.603
k hat (MLE)	5.243	k star (bias corrected MLE)	4.357
Theta hat (MLE)	0.00197	Theta star (bias corrected MLE)	0.00237
nu hat (MLE)	178.3	nu star (bias corrected)	148.1
Adjusted Level of Significance (β)	0.0346		
Approximate Chi Square Value (148.14, α)	121	Adjusted Chi Square Value (148.14, β)	118.4
95% Gamma Approximate UCL	0.0126	95% Gamma Adjusted UCL	0.0129

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00752	SD (KM)	0.00674
Variance (KM)	4.5402E-5	SE of Mean (KM)	0.00175
k hat (KM)	1.247	k star (KM)	1.066
nu hat (KM)	42.38	nu star (KM)	36.24
theta hat (KM)	0.00604	theta star (KM)	0.00706
80% gamma percentile (KM)	0.012	90% gamma percentile (KM)	0.0171
95% gamma percentile (KM)	0.022	99% gamma percentile (KM)	0.0336

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (36.24, α)	23.46	Adjusted Chi Square Value (36.24, β)	22.38
95% KM Approximate Gamma UCL	0.0116	95% KM Adjusted Gamma UCL	0.0122

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.817	Shapiro Wilk GOF Test
10% Shapiro Wilk Critical Value	0.851	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.225	Lilliefors GOF Test
10% Lilliefors Critical Value	0.265	Detected Data appear Lognormal at 10% Significance Level
Detected Data appear Approximate Lognormal at 10% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00587	Mean in Log Scale	-5.648
SD in Original Scale	0.00779	SD in Log Scale	0.966
95% t UCL (assumes normality of ROS data)	0.00917	95% Percentile Bootstrap UCL	0.00909
95% BCA Bootstrap UCL	0.0106	95% Bootstrap t UCL	0.0132
95% H-UCL (Log ROS)	0.0106		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.071	KM Geo Mean	0.00628
KM SD (logged)	0.498	95% Critical H Value (KM-Log)	2.033
KM Standard Error of Mean (logged)	0.129	95% H-UCL (KM -Log)	0.00915
KM SD (logged)	0.498	95% Critical H Value (KM-Log)	2.033
KM Standard Error of Mean (logged)	0.129		

DL/2 Statistics**DL/2 Normal**

Mean in Original Scale	0.00633
SD in Original Scale	0.00753
95% t UCL (Assumes normality)	0.00952

DL/2 Log-Transformed

Mean in Log Scale	-5.415
SD in Log Scale	0.767
95% H-Stat UCL	0.00932

DL/2 is not a recommended method, provided for comparisons and historical reasons**Nonparametric Distribution Free UCL Statistics****Detected Data appear Approximate Gamma Distributed at 5% Significance Level****Suggested UCL to Use**

95% KM Adjusted Gamma UCL	0.0122	95% GROS Adjusted Gamma UCL	0.0129

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalHPAHs**General Statistics**

Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	0.223	Mean	1.971
Maximum	11.9	Median	1.02
SD	2.788	Std. Error of Mean	0.676
Coefficient of Variation	1.415	Skewness	3.183

Normal GOF Test

Shapiro Wilk Test Statistic	0.579	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.285	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level**Assuming Normal Distribution****95% Normal UCL**

95% Student's-t UCL	3.151

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.641
95% Modified-t UCL (Johnson-1978)	3.238

Gamma GOF Test

A-D Test Statistic	0.799	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.764	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics			
k hat (MLE)	1.077	k star (bias corrected MLE)	0.926
Theta hat (MLE)	1.829	Theta star (bias corrected MLE)	2.127
nu hat (MLE)	36.63	nu star (bias corrected)	31.5
MLE Mean (bias corrected)	1.971	MLE Sd (bias corrected)	2.048
		Approximate Chi Square Value (0.05)	19.67
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	18.7

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.155	95% Adjusted Gamma UCL	3.32

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.967	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.147	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics			
Minimum of Logged Data	-1.501	Mean of logged Data	0.147
Maximum of Logged Data	2.477	SD of logged Data	0.987

Assuming Lognormal Distribution

95% H-UCL	3.63	90% Chebyshev (MVUE) UCL	3.249
95% Chebyshev (MVUE) UCL	3.9	97.5% Chebyshev (MVUE) UCL	4.803
99% Chebyshev (MVUE) UCL	6.576		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	3.083	95% BCA Bootstrap UCL	3.627
95% Standard Bootstrap UCL	3.06	95% Bootstrap-t UCL	5.33
95% Hall's Bootstrap UCL	7.518	95% Percentile Bootstrap UCL	3.228
90% Chebyshev(Mean, Sd) UCL	4	95% Chebyshev(Mean, Sd) UCL	4.919
97.5% Chebyshev(Mean, Sd) UCL	6.194	99% Chebyshev(Mean, Sd) UCL	8.7

Suggested UCL to Use

95% Adjusted Gamma UCL	3.32

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cPAHs

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	0.0319	Mean	0.306
Maximum	1.75	Median	0.165

SD	0.416	Std. Error of Mean	0.101
Coefficient of Variation	1.361	Skewness	2.964

Normal GOF Test

Shapiro Wilk Test Statistic	0.616	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.282	Lilliefors GOF Test
1% Lilliefors Critical Value	0.241	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.482	95% Adjusted-CLT UCL (Chen-1995)	0.549
		95% Modified-t UCL (Johnson-1978)	0.494

Gamma GOF Test

A-D Test Statistic	0.67	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.765	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.067	k star (bias corrected MLE)	0.918
Theta hat (MLE)	0.287	Theta star (bias corrected MLE)	0.333
nu hat (MLE)	36.28	nu star (bias corrected)	31.21
MLE Mean (bias corrected)	0.306	MLE Sd (bias corrected)	0.319
		Approximate Chi Square Value (0.05)	19.45
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	18.48

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.491	95% Adjusted Gamma UCL	0.517

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.979	Shapiro Wilk Lognormal GOF Test
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.127	Lilliefors Lognormal GOF Test
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.445	Mean of logged Data	-1.722
Maximum of Logged Data	0.56	SD of logged Data	1.01

Assuming Lognormal Distribution

95% H-UCL	0.586	90% Chebyshev (MVUE) UCL	0.517
95% Chebyshev (MVUE) UCL	0.622	97.5% Chebyshev (MVUE) UCL	0.768
99% Chebyshev (MVUE) UCL	1.054		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.472	95% BCA Bootstrap UCL	0.544
95% Standard Bootstrap UCL	0.468	95% Bootstrap-t UCL	0.761
95% Hall's Bootstrap UCL	1.141	95% Percentile Bootstrap UCL	0.491
90% Chebyshev(Mean, Sd) UCL	0.609	95% Chebyshev(Mean, Sd) UCL	0.746
97.5% Chebyshev(Mean, Sd) UCL	0.936	99% Chebyshev(Mean, Sd) UCL	1.31

Suggested UCL to Use

95% Adjusted Gamma UCL	0.517

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPCBs

General Statistics			
Total Number of Observations	17	Number of Distinct Observations	17
Number of Detects	15	Number of Non-Detects	2
Number of Distinct Detects	15	Number of Distinct Non-Detects	2
Minimum Detect	0.0245	Minimum Non-Detect	0.00479
Maximum Detect	0.558	Maximum Non-Detect	0.00504
Variance Detects	0.0256	Percent Non-Detects	11.76%
Mean Detects	0.123	SD Detects	0.16
Median Detects	0.0502	CV Detects	1.3
Skewness Detects	2.102	Kurtosis Detects	3.751
Mean of Logged Detects	-2.656	SD of Logged Detects	1.009

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.656	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.835	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.314	Lilliefors GOF Test
1% Lilliefors Critical Value	0.255	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.109	KM Standard Error of Mean	0.0377
90KM SD	0.15	95% KM (BCA) UCL	0.176
95% KM (t) UCL	0.175	95% KM (Percentile Bootstrap) UCL	0.179
95% KM (z) UCL	0.171	95% KM Bootstrap t UCL	0.277
90% KM Chebyshev UCL	0.222	95% KM Chebyshev UCL	0.273
97.5% KM Chebyshev UCL	0.345	99% KM Chebyshev UCL	0.484

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.203	Anderson-Darling GOF Test
5% A-D Critical Value	0.763	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.228	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.025	k star (bias corrected MLE)	0.865
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.142
nu hat (MLE)	30.76	nu star (bias corrected)	25.94
Mean (detects)	0.123		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
 GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
 For such situations, GROS method may yield incorrect values of UCLs and BTVs
 This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.11
Maximum	0.558	Median	0.0478
SD	0.154	CV	1.405
k hat (MLE)	0.868	k star (bias corrected MLE)	0.754
Theta hat (MLE)	0.126	Theta star (bias corrected MLE)	0.146
nu hat (MLE)	29.52	nu star (bias corrected)	25.65
Adjusted Level of Significance (β)	0.0346		
Approximate Chi Square Value (25.65, α)	15.11	Adjusted Chi Square Value (25.65, β)	14.26
95% Gamma Approximate UCL	0.186	95% Gamma Adjusted UCL	0.197

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.109	SD (KM)	0.15
Variance (KM)	0.0225	SE of Mean (KM)	0.0377

k hat (KM)	0.529	k star (KM)	0.475
nu hat (KM)	17.99	nu star (KM)	16.15
theta hat (KM)	0.206	theta star (KM)	0.23
80% gamma percentile (KM)	0.179	90% gamma percentile (KM)	0.299
95% gamma percentile (KM)	0.427	99% gamma percentile (KM)	0.745

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.15, α)	8.066	Adjusted Chi Square Value (16.15, β)	7.473
95% KM Approximate Gamma UCL	0.219	95% KM Adjusted Gamma UCL	0.236

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.873	Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.901	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.212	Lilliefors GOF Test	
10% Lilliefors Critical Value	0.202	Detected Data Not Lognormal at 10% Significance Level	

Detected Data Not Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.109	Mean in Log Scale	-2.928
SD in Original Scale	0.155	SD in Log Scale	1.217
95% t UCL (assumes normality of ROS data)	0.175	95% Percentile Bootstrap UCL	0.174
95% BCA Bootstrap UCL	0.19	95% Bootstrap t UCL	0.274
95% H-UCL (Log ROS)	0.28		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.972	KM Geo Mean	0.0512
KM SD (logged)	1.26	95% Critical H Value (KM-Log)	3.078
KM Standard Error of Mean (logged)	0.316	95% H-UCL (KM -Log)	0.299
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KM Standard Error of Mean (logged)	0.316		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.109
SD in Original Scale	0.155
95% t UCL (Assumes normality)	0.175

DL/2 Log-Transformed

Mean in Log Scale	-3.05
SD in Log Scale	1.46
95% H-Stat UCL	0.478

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Suggested UCL to Use

95% KM (t) UCL	0.175

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.