Jacobs

Northwest Pipe Company
Portland Plant
ECSI No. 138

Dioxin/Furan Stormwater Sampling Work Plan

Final

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Northwest Pipe Company

Contents

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Acronyms and Abbreviations

°C	degree(s) Celsius
µg/L	microgram(s) per liter
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
IT Slip	Schnitzer International Terminals Slip
LCS	laboratory control sample
MDL	method detection limit
mL	milliliter(s)
MRL	method reporting limit
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
QA	quality assurance
QC	quality control
RAL	remedial action level
RL	reporting limit
ROD	Record of Decision
TSS	total suspended solids

1. Introduction

Jacobs has prepared this Work Plan on behalf of the Northwest Pipe Company's Portland Plant located at 12005 North Burgard Road, Portland, Oregon (Figure 1-1, located at the end of this document). This Work Plan was prepared at the direction of the Oregon Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (EPA) (DEQ 2022, EPA 2022) in response to the presence of two dioxin compounds found in the Schnitzer International Terminals Slip (IT Slip) sediment. In 2021, Northwest Pipe provided background information regarding dioxins and furans and lines of evidence evaluating the ability of the existing stormwater treatment system at the Portland Plant to remove dioxins and furans, if present (*Response to DEQ Questions on Dioxins* prepared for Northwest Pipe Company by Haute-Géologie, LLC, 2021). Although appreciative of the lines of evidence and detail presented in the response memorandum, DEQ and EPA have required additional laboratory analytical data to supplement the evidence provided. This Work Plan proposes the methodology and data evaluation to evaluate the performance of Northwest Pipe Company's Aquip stormwater treatment system to remove dioxins and furans, if present, from stormwater at the Portland Plant.

2. Background

Two dioxin compounds (1,2,3,7,8-pentachlorodibenzo-p-dioxin [1,2,3,7,8-PeCDD] and 2,3,7,8-tetrachlorodibenzodioxin [2,3,7,8-TCDD]) have been detected in sediment near Outfall 18 of the IT Slip at concentrations greater than the remedial action levels (RALs) for sediment in the Record Of Decision (ROD) for the Portland Harbor Superfund Site (EPA 2017), as amended by the Explanation of Significant Differences (EPA 2019) and two separate errata (EPA 2018 and 2020). As a result, EPA and DEQ are requiring stormwater effluent sampling for all dioxin and furan congeners listed in the ROD and Joint Source Control Strategy.

This section summarizes the nature of dioxins and furans and Northwest Pipe Company's Aquip stormwater treatment system at the Portland site, as well as the range of source control measures implemented by Northwest Pipe Company to control potential contaminants and prevent them from leaving the site via the stormwater pathway.

2.1 Nature of Dioxins and Furans

Dioxins and furans are known to be ubiquitous in the environment and originate from a wide variety of processes and activities (ATSDR 1998) present in an industrial setting, such as the following:

"…the manufacture of chlorinated intermediates and pesticides, during smelting of metals, in the incineration of municipal, medical, and industrial wastes, and from the production of bleached wood pulp and paper. [Dioxins] CDDs are also found in emissions from the combustion of various other sources, including coal-fired or oil-fired power plants, wood burning, and home heating systems. Generally, the more highly chlorinated CDDs are the most abundant congeners present in the emissions from these combustion sources. CDDs also occur in other combustion products (e.g., cigarette smoke), automobile exhaust from cars running on leaded gasoline with chlorine scavengers and to a lesser extent from cars running on unleaded gasoline, and diesel exhaust. CDDs/[furans] CDFs can form during the synthesis and combustion of chlorine-containing materials, such as polyvinylchloride (PVC), in the presence of naturally occurring phenols, vegetation treated with phenoxy acetic acid herbicides, paper and wood treated with chlorophenols, and pesticide-treated wastes."

These processes are known to have occurred within Portland Harbor and can transport particles through the air. Historical fires have occurred in the IT Slip drainage basin that may have been related to the potential formation of dioxins and furans. For example, on June 17, 1961, a fire destroyed most of the former Oregon Shipbuilding Assembly Building. Other facilities within the IT Slip drainage basin also have been subject to large fires. This included the Schnitzer Steel Recycling Yard fire in July1997 (United States Coast Guard 1997), where firefighting water, mixed with waste oil, was reported to have flowed through scrapped automobile bodies and into the storm drain, as well as the fire at the Schnitzer Steel Yard reported in August 2017 (Oregonian 2017). In addition to the more recent fires, there were historical fires at the shipyard in 1944 (Oregonian 1944) and in 1945, where numerous buildings were destroyed along with the Outfitting Dock (Madera Tribune 1945). However, the manufacturing processes at the Northwest Pipe Facility are not known to produce dioxins and furans (Haute-Géologie, LLC 2021).

2.2 Source Control Measures

Catch basins on the Northwest Pipe Company property are designed to filter, separate, and remove oil and grease and total suspended solids (TSS) from stormwater as it enters the stormwater drainage system. The following source control measures are conducted routinely to aid in reducing the level of particulates suspended in stormwater:

- Contracted regular pavement sweeping
- Installation and maintenance of fabric filters in catch basins
- Regular cleaning of catch basins and stormwater conveyance lines

In addition to these practices, Northwest Pipe Company has implemented more extensive source control efforts, including the following:

- Installation and operation of two state-of-the-art Aquip stormwater treatment systems located at each site outfall, which treat all stormwater runoff before it is discharged to the IT Slip
- Removal of contaminated soil hot spots and capping of all exposed soil at the site
- Routine inspection and repair of the pavement cap
- Relocation of scrap metal bins under cover to prevent contact with precipitation
- Capture and segregation of stormwater in the cement mortar lining area and the fueling area from the remainder of site stormwater
- Modification of the stormwater conveyance system in response to site grading and paving

These efforts are described in more detail in the site's current Source Control Evaluation report (Jacobs 2021).

2.3 Aquip Stormwater Treatment System

The site is equipped with two state-of-the-art Aquip stormwater treatment systems. The Aquip system is a proprietary stormwater treatment system that provides several treatment methods. Aquip targets TSS, metals, biological and chemical oxygen demand, and nutrients in stormwater. It also removes oil that may be entrained in stormwater runoff, and dissolved organic compounds susceptible to carbon adsorption, such as dioxins. The Aquip system components are as follows (StormwateRx 2019):

- **Pre-treatment Chamber –** This chamber allows suspended solids to begin settling out of suspension and removes free oil that may be present in stormwater runoff.

- **Main Treatment Chamber –** The main treatment chamber consists of layers of granular and adsorptive media, including sand and activated carbon, that remove stormwater contaminants, such as metals, particulates, oil, organic compounds, and nutrients.
- **Filtration Chamber –** Within the filtration chamber, contaminant removal occurs through a combination of straining, filtration, complexing, adsorption, absorption, micro-sedimentation, and biological degradation prior to discharge.

StormwateRx reports an 83% decrease in suspended solids as a typical average; however, for the Northwest Pipe system, a 96% reduction has been documented (Jacobs 2021). This represents an underestimate of expected dioxin removal efficiency because the dioxin will also adsorb to the activated carbon in the Aquip filtration media, providing an additional treatment method. Filtration and activated carbon adsorption are particularly well-suited to dioxin removal from stormwater.

3. Stormwater Sampling Methodology

Four effluent samples are required from each of the two Aquip systems with laboratory analysis for dioxins and furans. If the first two sampling events result in concentrations below clean up levels, EPA and DEQ may consider a proposal to suspend the final two sampling event. However, the cleanup level (CUL) for 2,3,7,8-TCDD toxic equivalency (TCDD eq.) of 5.1E-10 µg/L is below technically achievable laboratory reporting limit (RLs) and/or method detection limits (MDLs).[1] Should the results be below the detection level, Northwest Pipe will include an uncertainty evaluation with the report, since the screening levels are below the achievable limits.

3.1 Sampling Frequency and Location

Sampling for dioxins and furans, as required by EPA and DEQ, will be collected from the outlet port of each Aquip filtration system and from separate rain events. DEQ's guidance document for evaluating the stormwater pathway (DEQ 2009, updated 2010) specifies that a sample should be collected during "first flush" conditions. The guidance defines a "first flush" sample as samples collected within the first 30 minutes of stormwater discharge from a facility during a rain event that meets the previously stated criteria. Because of the storage and treatment elements of the site's stormwater system, the concept of "first flush" is moot; however, as noted, samples will be collected during a heavy rain event. A heavy rain event will be defined as a minimum predicted rainfall greater than 0.2 inch during the event, as measured at the City of Portland's HYDRA Rainfall Network Shipyard Rain Gage, number 82, located at 8900 North Sever Road. In addition, samples will be collected following an antecedent dry period of at least 24 hours, as defined by <0.1 inch over the previous 24 hours.

One sample for dioxin and furan analysis will be collected from each system. Results from the first and second sampling events will be evaluated to determine whether third and fourth sampling events can be suspended. If third and fourth samples are required, collections will be from separate rain events.

Prior to sample collection, the sample port will be inspected for dirt or residue. Should any dirt or residue be present, the port will be cleaned using deionized water and wiped with a clean cloth prior to sampling. The pumps in the system vault start automatically to fill the tank and are controlled by a float switch. However, the pumps also can be started manually. The pump between the tanks and the Aquip also can be started manually. Therefore, water from the system will be allowed to flow for a minimum of 5 minutes prior to collection so that a fresh sample from the treatment tank is collected as opposed to a sample

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[1] Attached is documentation from several laboratories identifying their obtainable reporting limits (RLs) and method detection limits (MDLs). A laboratory that can achieve the CULs has not been located. NW Pipe will use the laboratory that offers the closest RL/MDL to the CUL, but note that there is a high likelihood that "ND" results will present a data management gap.

from any piping. All water from the system during flushing and cleaning, if needed, will be routed back into the treatment system. After flushing the system, the flow will be set to the minimum flow needed to maintain a steady stream from the port valve, and the sample will be collected. The selected laboratory will provide the required sample containers. Samples will be handled as described in Section 4, following standard chain-of-custody procedures.

3.2 Sampling Parameters

Samples will be submitted to the selected laboratory for analysis. The laboratory will be requested to provide results using standard turnaround time. The sample containers, preservative requirements, and maximum holding times for individual analyses are shown in Table 3-1. The selected laboratory will be certified under the National Environmental Laboratory Accreditation Program as well as the Oregon Environmental Laboratory Accreditation Program. Portland Harbor ROD RALs included in Table 3-1 for use as screening values were selected from Table 21 of the Portland Harbor ROD (EPA 2017, Errata 2018, Errata #2 2020).

Table 3-1. Sample Containers, Holding Times, and Analytical Methods – Aqueous

Analysis	Method	Container and Minimum Quantity	Preservative	Holding Time	ROD RALs[a] (µg/L)	ROD CUL[b] for Surface Water (µg/L)
2,3,7,8-TCDD	E1613	2 × 1,000-mL, AG	Cool ≤ 6°C; store in dark	1 year to extraction; 1 year to analysis	0.0006	NA
1,2,3,7,8-PeCDD					0.0008	NA
1,2,3,4,7,8-HxCDD					NA	NA
1,2,3,6,7,8-HxCDD					NA	NA
1,2,3,7,8,9-HxCDD					NA	NA
1,2,3,4,6,7,8-HpCDD					NA	NA
OCDD					NA	NA
2,3,7,8-TCDF					NA	NA
1,2,3,7,8-PeCDF					NA	NA
2,3,4,7,8-PeCDF					0.2	NA
1,2,3,4,7,8-HxCDF					NA	NA
1,2,3,6,7,8-HxCDF					NA	NA
1,2,3,7,8,9-HxCDF					NA	NA
2,3,4,6,7,8-HxCDF					NA	NA
1,2,3,4,6,7,8-HpCDF					NA	NA
1,2,3,4,7,8,9-HpCDF					NA	NA
OCDF					NA	NA
Dioxins/Furans (2,3,7,8-TCDD eq)					NA	5.1E-10

[a] ROD values are selected from Table 21 of the Errata for Portland Harbor ROD (EPA 2018). Values were selected for the sitewide RALs.
[b] ROD values are the cleanup levels (CULs) for Surface Water from Table 17 of the Errata for Portland Harbor ROD (EPA 2018).

Table 3-1. Sample Containers, Holding Times, and Analytical Methods – Aqueous

Analysis	Method	Container and Minimum Quantity	Preservative	Holding Time	ROD RALs[a] (µg/L)	ROD CUL[b] for Surface Water (µg/L)

Notes:
-- = not applicable
AG = amber glass
°C = degree(s) Celsius
µg/L = microgram(s) per liter
HpCDD = heptachlorodibenzo-p-dioxin
HxCDD = hexachlorodibenzo-p-dioxin
HpCDF = heptachlorodibenzofuran
HxCDF = hexachlorodibenzofuran
OCDD = octachlorodibenzodioxin
OCDF = octachlorodibenzofuran
PeCDD – pentachlorodibenzo-p-dioxin
PeCDF – pentachlorodibenzofuran
RAL – remedial action level
TCDD – tetrachlorodibenzo-p-dioxin
TCDF – tetrachlorodibenzofuran
mL = milliliter
NA = not applicable

4. Sample Handling and Quality Assurance

A chain-of-custody form will be completed for each sampling event. The original copy will be provided to the laboratory with the sample shipping cooler, and a copy will be retained in the field documentation files. The coolers containing the samples will be sealed with a custody seal any time the coolers are not in an individual’s possession or view before shipping. The custody seals will be signed and dated by a sampling team member.

Samples will be hand-delivered or shipped by an overnight express carrier for delivery to the analytical laboratory. Samples will be shipped for laboratory receipt and analyses within specific holding times.

Disposable sample equipment will not be used, and therefore, no equipment blank is necessary. Volatile organic compounds are not being analyzed, and therefore, no trip blank is required. One blind sample duplicate (labeled SP-FD) will be analyzed for each sample event.

Sample preservation efforts will commence at the time of sample collection and will continue until analyses are performed. After filling, sample containers will be placed promptly in an insulated cooler with ice to maintain the sample temperature at or below 6°C. The ice will be double bagged in plastic storage bags. Coolers will be kept out of direct sunlight. Sample temperatures will be documented upon receipt at the laboratory.

4.1 Field Documentation

Standard field information (typically weather conditions, personnel onsite, sample information and location, and field observations), any deviations from the work plan, and the reason for deviations will be recorded daily in a field logbook. In addition, general observations of samples will be documented in the field logbook or the stormwater sampling worksheets.

Sample labels will be filled out by using waterproof ink. At a minimum, each label will contain the following information:

- Sample identification code (that is, System01-04102022), system identifier, and sample date (MMDDYYY)
- Date and time of sample collection
- Sampler’s signature or initials

4.2 Chain-of-Custody Record

A chain-of-custody form will accompany each sample. The laboratory will provide the chain of custody. All chain-of-custody forms will be signed and dated by the responsible sampling team personnel. The “relinquished by” box will be signed by the responsible sampling team personnel, and the date, time, and air bill number will be noted on the chain-of-custody form. The laboratory will return the executed copy of the chain-of-custody form with the hard copy report. In preparing samples for transport, a chain-of-custody form will be completed with the following information:

- Name and phone number of destination laboratory
- Laboratory contract number
- Name of sample collectors
- Name of person recording the chain of custody
- Name of contact person
- Site location and sample matrix type
- Unique identification for each sample and associated date and time of collection
- Parameters to be analyzed
- Sample transport instructions if required
- Notes regarding filtering of samples if required

The sampler will sign the chain of custody over to the laboratory personnel when samples are retrieved. If samples are to be shipped, the chain-of-custody form will be placed inside the cooler, and custody seals will be placed on the coolers.

5. Laboratory Quality Assurance and Quality Control

All laboratory quality assurance (QA) and quality control (QC) procedures are documented by the laboratory and implemented routinely as a condition of its contract. The procedures are based on the EPA Contract Laboratory Program, ASTM International, and the Association of Official Analytical Chemists. Analytical QC will be performed at a minimum frequency of 10% (that is, one complement of relevant QC tests for every nine field samples analyzed). QC results (for example, percent recovery or relative percent difference) will be provided to Northwest Pipe Company along with field sample results. Routine QC control charts will be maintained and made available to Northwest Pipe Company on request.

5.1 Laboratory Recordkeeping

A laboratory logbook of all analyses performed will include the following:

- Sample preparation technique (for example, dilution or extraction)
- Analytical instruments
- Analytical methods
- Experimental conditions

Analytical results reporting will include the following:

- Sampling site and media
- Dates and times of sampling (recorded on the chain of custody)
- Date of receipt of sample by laboratory
- Date of sample analysis
- Laboratory sample identification number
- Analytical methods
- Measured concentrations

- Method detection limits (MDLs)
- Method reporting limits (MRLs)
- Practical quantitation limits
- Analytical qualifier where applicable

5.2 Method Detection Limits, Reporting Limits, and Instrument Calibration Requirements

The MDL is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Laboratory MDLs will be set in accordance with the EPA's *Definition and Procedure for the Determination of the Method Detection Limit, Revision 2* (2016). Laboratory reporting limits (RLs) will typically be three to eight times the laboratory calculated MDL and will be set according to the laboratory certifying agency and the laboratory QA manual. RLs used by the laboratory must not be greater than the detection limit objectives listed in Table 5-1.

When calibrating instruments, a standard at a concentration equal to or less than the RL must be included in accordance with the analytical method. Reporting requirements are as follows:

- Analytes at concentrations greater than the laboratory's MDL but less than the RL will be flagged as estimated with a "J" qualifier and reported. Analytes that are not detected at or greater than the laboratory's MDL will be reported as not detected at the RL and flagged "U."
- RLs and sample results will be reported to two significant figures if less than 10 µg/L and to three significant figures if 10 µg/L or greater. All QC will be reported to three significant figures.

Table 5-1. Method Detection and Reporting Limit Objectives for Dioxins and Furans by EPA Test Method 1613

Analyte	Reporting Limits – Water (µg/L)
2,3,7,8-TCDD	0.00001
1,2,3,7,8-PeCDD	0.00005
1,2,3,4,7,8-HxCDD	0.00005
1,2,3,6,7,8-HxCDD	0.00005
1,2,3,7,8,9-HxCDD	0.00005
1,2,3,4,6,7,8-HpCDD	0.00005
OCDD	0.0001
2,3,7,8-TCDF	0.00001
1,2,3,7,8-PeCDF	0.00005
2,3,4,7,8-PeCDF	0.00005
1,2,3,4,7,8-HxCDF	0.00005
1,2,3,6,7,8-HxCDF	0.00005
1,2,3,7,8,9-HxCDF	0.00005
2,3,4,6,7,8-HxCDF	0.00005

Table 5-1. Method Detection and Reporting Limit Objectives for Dioxins and Furans by EPA Test Method 1613

Analyte	Reporting Limits – Water (µg/L)
1,2,3,4,6,7,8-HpCDF	0.00005
1,2,3,4,7,8,9-HpCDF	0.00005
OCDF	0.0001
Notes: HpCDD = heptachlorodibenzo-p-dioxin HxCDD = hexachlorodibenzo-p-dioxin HpCDF = heptachlorodibenzofuran HxCDF = hexachlorodibenzofuran OCDD = octachlorodibenzodioxin	OCDF = octachlorodibenzofuran PeCDD –pentachlorodibenzo-p-dioxin PeCDF – pentachlorodibenzofuran RAL – remedial action level TCDD – tetrachlorodibenzo-p-dioxin TCDF – tetrachlorodibenzofuran

5.2.1 Instrument Calibration

Laboratory instruments will be calibrated by qualified personnel before sample analysis according to the procedures specified in each method. Calibration will be verified at method-specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method, with supplemental requirements defined further in this document for organic methodologies. When multi-point calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples will be diluted, if necessary, to bring analyte responses to within the calibration range. Data that exceed the calibration range will not be reported by the laboratory. The initial calibration curve will be verified as accurate with a standard purchased or prepared from an independent second source. The initial calibration verification involves analyzing a standard containing all target analytes, typically in the middle of the calibration range, each time the initial calibration is performed. Quantitation based on extrapolation is not allowed.

5.2.2 Method Blank

Blanks are used to monitor each preparation or analytical batch for interference or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is an analyte-free matrix (laboratory reagent water for aqueous samples) to which all reagents are added in the same amount or proportions as are added to the samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch. There will be at least one method blank per preparation or analytical batch. If a target analyte is found at a concentration that exceeds the RL, corrective action must be performed to identify and eliminate the contamination source. All associated samples must be re-prepared and reanalyzed after the contamination source has been eliminated.
No analytical data will be corrected for the concentration found in the blank.

5.2.3 Laboratory Control Sample

The laboratory control sample (LCS) will consist of an analyte-free matrix (laboratory reagent water for aqueous samples) spiked with known amounts of analytes that come from a source different from that used for calibration standards. The spike levels will be less than or equal to the midpoint of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation and reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results of all LCSs must be reported. Any LCS recovery outside QC limits affects the accuracy for the entire batch and requires corrective action.

5.2.4 Surrogates and Isotope Dilution Analytes

Surrogates and isotope dilution analytes are organic analytes that behave similarly to the analytes of interest but are not expected to occur naturally in the samples. They are spiked into the standards, samples, and QC samples prior to sample preparation. Recoveries are used to indicate accuracy, method performance, and extraction efficiency. If surrogate recoveries are outside the specified control limits, corrective action must be taken, including sample re-preparation and reanalysis, if appropriate.

5.2.5 Matrix Spike and Matrix Spike Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) are a duplicate pair of samples collected along with an investigatory sample to which the laboratory adds a spike containing the analytes of concern at known concentrations. They are subjected to the same preparation and analytical procedures as the native sample. All target analytes are spiked into the sample. MS recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. An MSD is a second fortified sample matrix. The relative percent difference between the results of the duplicate MS measures the precision of sample results. Only project-specific samples designated on the chain-of-custody form will be spiked. The spike levels will be less than or equal to the midpoint of the calibration range.

5.3 Data Validation

Laboratory analytical data acquired during this investigation will be validated by the Jacobs Project Chemist. EPA Stage 2B data validation will be conducted on 100% of the laboratory data, using laboratory-derived QA/QC limits.

The following items will be reviewed during validation:

- Documentation identifies the laboratory receiving and conducting analyses and includes documentation for all samples submitted by the project or requester for analyses.
- Requested analytical methods were performed, and the analysis dates are present.
- Requested target analytes and units are reported.
- Sampling dates and times, date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH, and temperature) are documented.
- Method dates for handling, preparation, cleanup, and analysis are present, as appropriate.
- Sample-related QC data and QC acceptance criteria (for example, method blanks, surrogate recoveries, laboratory control sample [LCS] recoveries, duplicate analyses, MS/MSD recoveries) are provided and linked to the reported field samples.
- Requested spike analytes or compounds (for example, surrogate or LCS spikes) have been added, as appropriate.
- Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.
- Frequency of QC samples is checked for appropriateness (for example, 1 LCS for every 20 samples in a preparation batch).

6. Health and Safety

Site activities will be conducted according to the site health and safety plan, consistent with 29 *Code of Federal Regulations* 1910, which calls for modified Level D personal protective equipment to be worn during sampling activities (safety glasses with side shields, steel-toed boots, disposable nitrile gloves, and safety vests).

7. Reporting

Analytical data will be validated and reported to DEQ within 60 days following receipt of results from the laboratory. A short data report will be provided that summarizes the analytical results and results that exceed the CULs. In the case that result are below the detection limits, i.e. "ND", the uncertainty associated with reporting limits greater than screening levels will be discussed and incorporated into a weight of evidence evaluation regarding the recontamination potential of the stormwater pathway. The report will also include the laboratory data and field notes. Analytical results will also be provided to DEQ in an Excel electronic format. One data report will be provided following each sampling event unless two sampling events occur within 30 days of each other.

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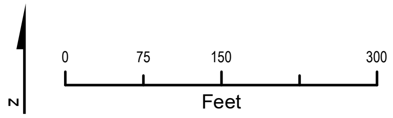
Figure

Document Path: \\PDXFPP01\proj\NorthwestPipeCompany\485880PortHarbSup\GIS\MapFiles\2022\Figure1-1_StormwaterWorkPlan.mxd

VICINITY MAP

LEGEND

- ⊗ Roof Drain Downspout
- ■ Storm Drain
- ─ Approximate Storm Drain Line
- ─ Roof Drain
- ▭ Stormwater Treatment System
- ▭ Cement Mortar Recycle Water System
- ▨ Landscape Planter
- ▤ Trench Drain
- ─ Treatment System Line
- → Surface Flow Direction
- ┅ Drainage Basin Boundary
- ▨ Isolated Drainage Zone (IDZ)
- ─ Railroad Line
- ▭ Leased Property Boundary
- ▭ Northwest Pipe Site Boundary



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Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Figure 1-1. Stormwater System
Northwest Pipe Company
Portland, Oregon