Site Assessment Report

Les Schwab Tire Center, 3294 Main Street, Springfield, Oregon

Prepared for:

Les Schwab Tire Centers

December 18, 2024
Project No. M0553.10.001

Prepared by:

Maul Foster & Alongi, Inc.
3140 NE Broadway, Portland, OR 97232

MAUL FOSTER ALONGI

Site Assessment Report

Les Schwab Tire Center, 3294 Main Street, Springfield, Oregon

The material and data in this report were prepared under the supervision and direction of the undersigned.

Maul Foster & Alongi, Inc.

Sean Maloney, GIT
Staff Geologist

EXPIRES: 6/1/2025
This digital seal certifies the signatory and document content.

David Weatherby, RG
Principal Geologist

Contents

Limitations

Figures

Tables

Appendixes

Abbreviations

Apex	Apex Laboratories LLC
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
City	City of Springfield
DEQ	Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
FBI	Friedman & Bruya Inc.
IDW	investigation-derived waste
Krazan	Krazan & Associates, Inc.
MFA	Maul Foster & Alongi, Inc.
PID	photoionization detector
PVC	polyvinyl chloride
RBC	risk-based concentration
UST	underground storage tank
Wood	Wood Environment & Infrastructure Solutions, Inc.

1 Introduction

In June 2022, during construction of a new addition to the tire center building in the southeast corner of the Les Schwab Tire Center located at 3294 Main Street in Springfield, Oregon (the site; see Figure 1-1), contaminated soil was encountered in an excavation associated with a buried, corrugated metal pipe. At the request of Les Schwab, Maul Foster & Alongi (MFA) conducted a soil and groundwater assessment in June and July 2022 to investigate the nature and extent of contamination within the excavation footprint for the building addition. The results of that assessment indicated that the nature and extent of contamination likely extended beyond the excavation footprint for the building addition (MFA 2022).

Subsequently, MFA conducted additional site assessment activities in 2022, 2023, and 2024 to further investigate the nature and extent of contamination at the site. These activities included sampling soil, groundwater, indoor air, and soil vapor at the site. This report describes the additional assessment activities that were completed, presents the results of the assessment activities, describes the nature and extent of contamination and risk of human exposure to site contamination as currently understood, and identifies potential data gaps requiring additional investigation.

1.1 Background

Site Description and History

The site is currently owned and operated by Les Schwab, an automotive tire service center, and consists of multiple commercial buildings, parking lots, and landscaped areas. The site and surrounding area are level and are approximately 479 feet above mean sea level. Historically, the site was used as a gasoline station before it was purchased by Les Schwab in 1969 (Wood Environment & Infrastructure Solutions, Inc. [Wood] 2020.)

Geology and Hydrogeology

Exploratory borings were advanced at the site by Krazan & Associates, Inc. (Krazan) during a Phase II limited subsurface assessment (Krazan 2017). Subsurface soils encountered were described as silt with variable amounts of sand to a depth of approximately 10 feet below ground surface (bgs), below which weathered hard rock was reported. During the subsurface investigations conducted by MFA and reported herein, the hard rock was determined to be rounded gravel. Groundwater, which Krazan assumed to be perched groundwater, was observed in the borings at 5 feet and 8.5 feet bgs (Krazan 2017). MFA observed similar depths to groundwater during its assessment activities. Since MFA encountered rounded gravel rather than bedrock at the site, consistent with the Quaternary alluvium mapped at the site (Madin and Murray 2006), MFA interprets the shallow groundwater as an unconfined aquifer rather than a perched aquifer.

The site is on flat ground, about equidistant from the Willamette River to the south and the McKenzie River to the north. The direction of groundwater flow on the southern portion of the site is to the south.

1.2 Previous Environmental investigations

Previous environmental investigations conducted at the site include the Phase II limited subsurface assessment (Krazan 2017), the Phase I Environmental Site Assessment (ESA) (Wood 2020), and the MFA soil and groundwater assessment (MFA 2022). The findings of each as they relate to environmental conditions at the site are summarized below.

2017 Phase II Limited Subsurface Assessment

This investigation included the collection of soil and soil vapor samples for laboratory analysis from soil borings located within the approximate footprint of the proposed future building. Based on the laboratory results, Krazan concluded that "evidence of heavy oils and gasoline were [sic] noted in soils at concentrations above State of Oregon petroleum hydrocarbon unrestricted use threshold levels for soil." MFA notes that the Oregon Department of Environmental Quality (DEQ) does not have "unrestricted use threshold levels." It appears that Krazan was referring to the DEQ's "risk-based concentrations" (RBCs) for residential exposure to soil and soil vapor intrusion into residential buildings, which are the most protective of the human health RBCs, and in that sense, the most "restrictive." Detected concentrations of petroleum hydrocarbons did exceed the RBCs for residential exposure to soil and soil vapor.

MFA understands that Les Schwab proposes to maintain the current site use as an automotive tire service center into the foreseeable future and has no plans to redevelop the site for residential use. Therefore, comparison of soil and soil vapor data to residential exposure scenarios is inappropriate for the site and overstates the potential risk of exposure by current and future users of the site. RBCs potentially applicable to the current and reasonably likely future site use include:

- Occupational, construction, and excavation worker exposure to soil.
- Volatilization to outdoor air—occupational worker exposure.
- Soil leaching to groundwater—occupational worker exposure.

Based on MFA's review of the soil data provided by Krazan, petroleum hydrocarbon concentrations in soil exceed the soil leaching to groundwater RBCs for occupational worker exposure only. This exposure scenario assumes use of groundwater on site for occupational workers. However, the City of Springfield (City) provides potable water to the site, and Les Schwab currently does not use, and has no plans to use on-site groundwater for occupational workers. Therefore, this exposure pathway is incomplete.

Ethylbenzene was detected in one soil vapor boring at a concentration exceeding DEQ's current (updated in 2023) RBC for soil vapor intrusion into commercial buildings. The soil vapor samples were not analyzed for gasoline-range petroleum hydrocarbons, and Krazan did not analyze groundwater samples. Subsequent assessment by MFA, as described herein, has identified gasoline-range petroleum hydrocarbons in site groundwater and soil vapor at concentrations exceeding the current RBCs for groundwater and soil vapor intrusion into residential and commercial buildings.

2020 Phase I Environmental Site Assessment

The Wood Phase I ESA identified the following two on-site recognized environmental conditions and two off-site recognized environmental conditions:

- The historical presence of one or more gasoline stations on the site.

- The current presence of in-ground hydraulic lifts on the site.
- The former use of an adjoining property to the south as a gasoline station.
- Use of an adjoining property to the west that had a leaking underground storage tank (UST).

2022 Soil and Groundwater Assessment

In 2022, contaminated soil was encountered during construction of a new addition to the existing tire center building in the southeast corner of the site. At the request of Les Schwab, MFA conducted a soil and groundwater assessment in June and July 2022 to further investigate the contamination (MFA, 2022). During the assessment, MFA collected soil samples from the building excavation and deeper test pits advanced into the excavation bottom, and groundwater samples from the test pits. MFA observed petroleum-stained soil, petroleum odors, and a petroleum sheen on the water table in the test pits.

Sample analysis and comparison of the data to applicable RBCs indicated construction and occupational workers at the site are not at risk of exposure to the soil and groundwater contamination. However, subsequent to the 2022 investigation activities, in 2023 DEQ updated its vapor intrusion RBCs and added RBCs for gasoline-range petroleum hydrocarbons in groundwater. The gasoline concentrations in groundwater in two of four test pits exceeded the updated RBC for groundwater vapor intrusion into commercial buildings, and in all four test pits the concentrations exceeded the updated RBC for groundwater vapor intrusion into residential buildings.

Based on the 2022 soil and groundwater assessment, MFA identified multiple data gaps:

- The source of the contamination within the building addition excavation footprint was not known.
- The nature and extent of soil and groundwater contamination outside the building excavation footprint was not known.
- The direction of groundwater flow was not known.
- The potential for off-site human exposure to contaminated groundwater originating from the site was not known.

1.3 Purpose of Site Assessment

Based on the results of the 2022 soil and groundwater assessment, MFA recommended additional soil and groundwater site assessment activities, the purpose of which was to address the data gaps identified above. In addition, owing to DEQ's revision of its vapor intrusion RBCs in May 2023, the purpose of the site assessment was expanded to include assessment of indoor air and soil vapor. The results of these assessment activities are presented in this report.

2 Site Assessment Field Investigations

This section provides a chronological summary of each investigation phase and the general findings of each that lead to completion of additional phases of investigation. Details regarding the field

procedures are described in Section 3. The investigation results, including sample results and risk-based screening of the sample data, are discussed in Section 4.

From October 2022 to March 2024, MFA completed the site assessment in multiple investigation phases. The intent of the first investigation phase completed in October 2022 was to begin addressing the data gaps identified in Section 1.2. However, after completion of the first phase, data gaps remained because the contamination extended beyond the area investigated during the first phase. This together with the revision of the DEQ's vapor intrusion RBCs in May 2023 necessitated multiple phases of investigation, including the addition of soil vapor and indoor air sampling, to assess the extent of contamination and risk of human exposure to it. Based on the previous investigations at the site, chemicals of interest for the site assessment include gasoline-, diesel-, and oil-range petroleum hydrocarbons and the volatile organic compounds benzene, toluene, ethylbenzene, xylene (BTEX) and naphthalene.

2.1 October 2022 Soil and Reconnaissance Groundwater Investigation

In October 2022, MFA conducted a soil and reconnaissance groundwater investigation to further assess the extent of contamination in soil and groundwater beyond the new building footprint. During the investigation, seven soil borings were advanced by Holt Services, Inc. (Holt).

Boring locations B1 through B6 were selected to encompass the area of contamination encountered within the new building excavation footprint, and boring B7 was advanced at a step-out point west of borings B2 and B3 where strong field indicators of contamination were observed. The excavation footprint and boring locations are shown on Figure 2-1. Four borings (B2, B3, B6, and B7) were advanced to 15 feet bgs and the remaining three borings (B1, B4, and B5) were advanced to 20 feet bgs. One soil sample was collected from each boring, and reconnaissance groundwater samples were collected from borings B1, B4, B5, B6, and B7 for laboratory analysis.

Detected chemical concentrations in soil and groundwater were compared to applicable RBCs for various applicable exposure scenarios. Concentrations in soil exceeded the leaching to groundwater RBC for occupational workers, and concentrations in groundwater exceeded the RBCs for occupational worker ingestion and inhalation from tap water, but this exposure pathway is incomplete because groundwater is not used at the site. There were no exceedances of the vapor intrusion RBCs for occupational workers that were applicable at that time, but subsequently updated by DEQ in 2023.

Although chemical concentrations in soil exceeded the leaching-to-groundwater RBC for residential and urban residential exposure, and concentrations in groundwater exceeded the RBCs for the same exposure pathways, it was later determined by Les Schwab that the exposure pathway to off-site receptors is incomplete due to the lack of groundwater use off site, and therefore, there is no risk of exposure.

Data gaps remained following the October 2022 event. The lateral extent of contamination remained undefined, as concentrations of gasoline, diesel, and oil in soil and groundwater remained elevated in borings B2, B3, B4, and B7, to the south and west. These data highlighted the need to address the data gap regarding the groundwater flow direction at the site.

2.2 February and March 2023 Monitoring Well Installation and Sampling

MFA returned to the site with Holt on February 28, 2023, to install four permanent monitoring wells on the site near the location of former reconnaissance borings (see Figure 2-1). The completion details for each well are shown in Appendix A. General well details are described below:

- MW-1: Placed near location of boring B1; total depth of 11 feet.
- MW-2: Placed near location of boring B7; total depth of 11 feet.
- MW-3: Placed near location of boring B4; total depth of 9 feet.
- MW-4: Placed near location of boring B5; total depth of 10.5 feet.

Groundwater samples were collected from wells MW-1 and MW-2 on March 1, 2023. MW-2 was resampled and MW-3 and MW-4 were sampled on March 27, 2024.

Gasoline concentrations in monitoring wells MW-1 and MW-2 increased by an order of magnitude compared to the reconnaissance groundwater samples collected from borings advanced at the same locations during the prior scope of the investigation. As a result, gasoline concentrations at MW-2 exceeded the applicable vapor intrusion RBCs at that time for residential and urban residential receptors. Additionally, the gasoline concentration at MW-2 exceeded the RBC for groundwater in an excavation for the construction and excavation worker exposure scenarios.

Following installation, the monitoring well casing elevations were professionally surveyed so that depth-to-groundwater measurements could be converted to groundwater elevations. The March 2023 depth-to-groundwater measurements were used to determine the direction of groundwater flow on the southern portion of the site. Groundwater was determined to flow southwest toward Main Street (see Figure 2-2).

The groundwater elevation data indicated that B1 and MW-1 are upgradient and B7 and MW-2 are cross gradient of the building addition where contamination was originally encountered. As such, MFA concluded that the contamination detected at these locations may be from some other source north of the building addition, and the lateral extent of contamination remained undefined.

2.3 June 2023 Soil and Reconnaissance Groundwater Investigation

On June 22, 2023, MFA contracted with Holt to advance seven additional borings (B8 through B14) in the west portion of the site, west, north, and south of monitoring well MW-2 (see Figure 2-2).

Four borings (B8, B9, B10, and B11) were advanced to 15 feet bgs and the remaining three borings (B12, B13, and B14) were advanced to 20 feet bgs. One soil sample was collected from each boring, and reconnaissance groundwater samples were collected from borings B8, B12, B13, and B14.

Field indicators of contamination observed together with the soil and groundwater data from these borings indicated that the extent of contamination extended to at least these boring locations, and the source was still unidentified. Additionally, during the site visit on June 22, 2023, MFA received

information from a Les Schwab employee regarding a previously unknown UST allegedly located north of the alignment center building that was purported to have been installed in the 1950s.

On June 22, 2023, MFA was also notified by a utility contractor that a petroleum-like odor had historically been observed within utility vaults near the south site boundary. Groundwater elevations measured on site, relative to documented invert elevations of the City and on-site storm sewer lines, indicated that groundwater intrusion into the storm sewers was possible.

As noted previously, in May 2023, the DEQ updated its RBCs for groundwater vapor intrusion into buildings. RBCs were added for new chemicals including gasoline for commercial buildings, and existing RBCs were lowered. As a result, concentrations of gasoline-range petroleum hydrocarbons in groundwater across much of the site now exceed the updated RBC for groundwater vapor intrusion into commercial buildings, such as those buildings located at the site.

2.4 August 2023 Ground Penetrating Radar, Magnetometer, and Groundwater Intrusion Assessment

On August 3 and 4, 2023, MFA contracted with GeoPotential to conduct a survey using ground-penetrating radar (GPR) and magnetic surveying tools to investigate potential sources of contamination at the site, such as USTs. The need for this was triggered by the Les Schwab employee who indicated a UST is present north of the alignment center. The magnetometer survey encompassed the entire outdoor areas of the site. The GPR survey targeted the area of the purported UST north of the alignment center and the area surrounding the tire center. The GeoPotential report is provided in Appendix B.

The GPR and magnetic surveys did not identify any USTs remaining in place. North of the alignment center, the GPR and magnetic surveys identified an anomaly (see anomaly M2 in the GeoPotential report) that GeoPotential interpreted to be caused by ferric debris in a 6-foot-diameter backfilled excavation about 6 feet deep; this could have been the site of a former, small UST. West of the tire center, the GPR and magnetic surveys identified an anomaly (see anomaly M1 in the GeoPotential report) that GeoPotential interpreted to be caused by a buried 20-foot by 18-foot reinforced concrete slab.

As noted in Section 2.3, MFA was notified by a utility contractor on June 22, 2023, that a petroleum-like odor had historically been observed within utility vaults near the south site boundary. Groundwater elevations measured on site, relative to documented elevations of the on-site and City storm sewer lines, indicated that groundwater intrusion into the storm sewers was possible.

To assess the potential for groundwater intrusion into storm sewers, on August 3, 2023, MFA assessed the extent of the on-site storm sewer infrastructure and measured the bottom elevations of all accessible storm sewer features to determine whether the storm sewer system was constructed above the water table. Depths to groundwater in the permanent monitoring wells MW-1 through MW-4 were measured on the same day and converted to groundwater elevations. A figure showing the storm sewer feature elevations and monitoring well groundwater elevations is included in Appendix C. Based on comparison of the elevations, the storm sewer system was determined to be constructed entirely above the groundwater elevation on the site, and thus it would not be possible for groundwater to enter the on-site storm sewer during the dry season.

No precipitation had occurred since July 25, 2023[1], indicating that flowing water should be absent in the storm sewer. No water flow was observed flowing in the storm sewer system except at the northwest portion of the site where a small amount of water was observed flowing south in a manhole located over a north-south oriented section of storm sewer pipe (shown in blue in Appendix C). The source of the water flow is not known, but based on the sewer pipe elevations relative to groundwater elevations, it cannot be the result of groundwater intrusion. This manhole and storm sewer segment are also located outside the delineated extent of groundwater contamination.

MFA observed the storm sewer for evidence of groundwater intrusion such as groundwater entering pipe joints or cracks, water flowing in the pipes, iron-oxide staining, and iron-oxidizing bacterial growth. MFA also used a photoionization detector (PID) to assess storm sewer catch basins, manholes, and the afore-mentioned utility vaults near the south site boundary for the presence of organic vapors. No evidence of groundwater intrusion was observed during either event and the PID did not detect organic vapors in any of the assessed features. MFA observed the interior of one of the utility vaults and did not observe a sheen on the standing water in the vault.

Since the groundwater intrusion assessment was conducted in August when groundwater elevations are lowest, one additional groundwater intrusion assessment was planned for the latter part of the wet season in March 2024, when groundwater elevations would be higher. That groundwater intrusion assessment event is discussed in Section 2.7.

2.5 September 2023 Indoor Air Vapor Intrusion Assessment

As noted above, chemical concentrations in groundwater samples collected during the prior phases of investigation exceeded the DEQ's updated RBCs for groundwater vapor intrusion into indoor air in commercial buildings. To assess this potential risk of exposure to on-site personnel, MFA completed the next phase of investigation to directly assess vapors in indoor air in the on-site buildings.

Sean Maloney of MFA inspected the interior of each building on August 4, 2023, to determine sampling locations and locate any potential sources of indoor air contamination within the buildings related to the site's operations (e.g., chemical storage containers, stains, or spills).

On September 14, 2023, eight indoor air samples were collected from the three buildings at the site. Indoor air samples were collected from two locations within the truck shop, three locations within the alignment center, and three locations from the retail store/office. Outdoor air samples were collected from the roof near the outside air intakes of the retail office and the alignment center to assess background air quality conditions that might be impacting indoor air. Air sample locations are shown in Figure 2-1.

Gasoline-range petroleum hydrocarbons and naphthalene were detected in the air samples at concentrations exceeding the DEQ's indoor air RBCs at two locations in the truck shop, two locations in the alignment center, and one location in the retail store/office. At the time of this assessment, these locations were upgradient of the delineated extent of contaminated groundwater on site (borings B1 through B14 and monitoring wells MW-1 through MW-4), and therefore it was not known whether the detections and RBC exceedances were due to volatilization from contaminated groundwater. This was considered a data gap that was addressed by the next phase of investigation.

[1] AccuWeather. 2024. https://www.accuweather.com/en/us/eugene/97401/july-weather/330145. Accessed November 11, 2024.

2.6 December 2023 Soil, Reconnaissance Groundwater, and Soil Vapor Investigation

On December 6, 2023, MFA returned to the Site with Holt to advance five additional borings (B15, B16, B17, B18, and B19) in the north portion of the site. Two borings (B15 and B16) were advanced in the vicinity of the purported UST referenced in Section 2.4, two borings (B17 and B18) were advanced north of the truck shop, and one boring (B19) was advanced in the parking lot north of borings B15 and B16 based on field indications of contamination observed at borings B15 and B16. All five borings were advanced to 15 feet bgs. One soil sample and one reconnaissance groundwater sample were collected from each boring.

On December 7, 2023, Holt installed four temporary soil vapor sampling points to assess the potential risk of vapor intrusion into off-site buildings. Soil vapor sampling locations SV-1 and SV-2 were advanced along the western site boundary and sampling locations SV-3 and SV-4 were advanced along the southern site boundary (see Figure 2-1).

2.7 March 2024 Groundwater Intrusion Assessment

On March 18, 2024, MFA returned to the Site to assess the potential for groundwater intrusion into the storm sewer system during the wet season when groundwater elevations were expected to be highest. MFA used the same procedures and assessed the same locations as described for the August 2023 groundwater intrusion assessment in Section 2.4.

No precipitation had occurred in the Eugene area since March 11, 2024[2]. No stormwater was observed flowing in the storm sewer system. Depths to groundwater in the permanent monitoring wells MW-1 through MW-4 were measured on the same day. Based on comparison of the groundwater elevations, the storm sewer system was determined to be constructed entirely above the groundwater elevation on the site, and thus it would not be possible for groundwater to enter the on-site storm sewer system during the wet season. No evidence of groundwater intrusion was observed during either event and the PID did not detect organic vapors in any of the assessed features.

3 Field Investigation Procedures

3.1 Soil Screening and Sampling

Prior to each subsurface investigation, MFA coordinated with public utility locators and private surveyors to assess investigation locations for the presence of underground structures or utilities.

All borings (B1 through B19) were advanced using a direct-push drilling rig operated by Holt. The borings were advanced to depths of either 15 feet bgs or 20 feet bgs depending on soil conditions

[2] AccuWeather. 2024. https://www.accuweather.com/en/us/eugene/97401/july-weather/330145. Accessed November 11, 2024.

and depths to groundwater. At each boring, continuous soil cores were retrieved in 5-foot increments. The cores were observed for field indicators of contamination such as a petroleum sheen, odor, and staining, and representative soil samples from the core was assessed for organic vapors using a PID. Field screening characteristics and general observations, (e.g., soil types, moisture content, depth to groundwater, indicators of contamination, and PID readings) are documented on the boring logs in Appendix A. Since field indicators of petroleum contamination were typically most obvious at or just above the water table, most soil samples were collected at similar depths as the observed contamination. Soil samples were submitted to Apex Laboratories in Tigard, Oregon (Apex) for analysis.

3.2 Groundwater Sampling

At a subset of the soil borings, reconnaissance groundwater samples were collected between 10 and 17.5 feet bgs, depending on the depth to groundwater encountered. A disposable slotted polyvinyl chloride (PVC) screen was placed in each boring and the reconnaissance groundwater samples were collected from the temporary screen using a peristaltic pump and disposable polyethylene tubing.

Four permanent monitoring wells, MW-1 through MW-4, were installed using a direct-push drilling rig operated by Holt. Due to gravel encountered at depth, the 3.25-inch-diameter temporary casing used to install the wells met refusal, and therefore the wells were installed to depths of 9 to 11 feet bgs. Each well consists of a 5-foot-long, 2-inch-diameter, slotted PVC well screen with a 12x20 Colorado silica sand filter pack. Well completion details are included in Appendix A.

Following installation, the monitoring wells were developed at least 24 hours after installation to reduce turbidity and ensure water quality was representative of groundwater conditions in the aquifer. During development. water quality parameters (temperature, pH, specific conductivity, oxidation-reduction potential, dissolved oxygen, and turbidity) were measured using a water-quality meter. Groundwater samples were collected after water quality parameters had stabilized, (i.e., values did not change by more than 10 percent over about 9 minutes). The groundwater samples were submitted to Apex for analysis.

Depths to groundwater were measured at the monitoring wells on March 9, March 27, and August 3, 2023, and March 18, 2024 using an electronic water level meter. The monitoring well top-of-casing elevations were surveyed by K & D Engineering, Inc. on March 14, 2023. The casing elevations were used to convert the groundwater depths to groundwater elevations (see Figure 2-2 for March 9 groundwater elevations).

3.3 Indoor Air Sampling

Each indoor air and roof background air sample was collected using a 6-liter Summa canister equipped with a regulator that collected the sample over an 8-hour work shift. The canisters were prepared and provided by Friedman & Bruya, Inc. in Seattle, Washington (FBI). The canister pressure was monitored throughout the day and the regulator was closed when a slight vacuum remained in the canister. The air samples were submitted to FBI for analysis.

3.4 Soil Vapor Sampling

The soil vapor samples were collected above the water table using a direct-push drilling rig operated by Holt. At each sample location, Holt installed a 4-foot-long stainless steel casing equipped with post-run tubing and an expendable point to allow soil vapor to enter the tubing at the desired depth. Hydrated bentonite was placed around the casing as a surface seal to minimize the potential for ambient air to enter the vapor sampling point. A helium shroud was placed around the sample apparatus during sampling as a leak check.

The samples were collected by attaching a 1-liter Summa canister to the tubing. Each canister was equipped with a regulator that collected the sample over a 5-minute period. The canisters were prepared and provided by FBI. The canister pressure was monitored during the sample period and the regulator was closed when a slight vacuum remained in the canister. The soil vapor samples were submitted to FBI for analysis.

3.5 Groundwater Intrusion Assessments

For both groundwater intrusion assessment events, MFA picked an observation day when no rainfall had occurred for at least 48 hours to ensure stormwater flows would be absent from the storm sewer and not obscure potential evidence of groundwater intrusion into the storm system. MFA observed the storm sewer for evidence of groundwater intrusion such as groundwater entering pipe joints or cracks, water flowing in the pipes, iron-oxide staining, and iron-oxidizing bacterial growth. MFA also used a PID to assess storm sewer catch basins, manholes, and the afore-mentioned utility vaults near the south site boundary for the presence of organic vapors. No evidence of groundwater intrusion was observed during either event, and the PID did not detect organic vapors in any of the assessed features.

4 Results

This section describes the results of the site assessment activities and the current understanding of the delineation of contamination on the site.

4.1 Soil

At all subsurface borings, MFA assessed soil cores for field indicators of contamination. Strong indicators of contamination, including obvious petroleum-like odors and/or elevated PID readings were observed at borings B2, B3, B4, B7, B8, B9, B10, B11, B13, B14, B15, and B19. A slight petroleum-like odor without elevated PID readings was observed at B1 and B12. An elevated PID reading with no odor was observed at B5. No odors or elevated PID readings were observed at B6, B16, B17, and B18. The approximate extent of visual indicators of contamination in soil is shown on Figure 4-1.

Soil sample data are presented on Table 1 and compared to the following RBCs:

- Soil ingestion, dermal contact, and inhalation—occupational, construction, and excavation worker exposure scenarios.
- Soil leaching to groundwater—residential, urban residential, and occupational worker exposure scenarios.

At borings B2, B3, B4, B5, B7, B8, B9, B10, B11, B13, B14, and B15, the gasoline concentration in groundwater exceed the RBC for soil leaching to groundwater for the residential, urban residential, and occupational worker exposure scenarios. The ethylbenzene concentrations in B14 also exceed the residential RBC for soil leaching to groundwater. These scenarios assume shallow groundwater is used for consumption. This is not the case. The City provides water to the site, and Les Schwab currently does not use, and has no plans to use on-site groundwater for occupational workers. Les Schwab also determined that residential properties downgradient (south) of the site are provided water by the City. Therefore, the soil leaching to groundwater pathway is incomplete.

The diesel concentration at 7.5 feet bgs at B15 (near the location of the purported UST) exceed the occupational worker RBC for ingestion, dermal contact, and inhalation. This boring location is under a paved parking area that prevents direct contact with contaminated soil at depth. Therefore this exposure pathway is incomplete. In summary, the soil sample data together with the site conditions and current and future use indicate on-site workers and customers are not at risk of exposure to contamination in soil.

4.2 Groundwater

Groundwater sample data are presented on Table 2 and compared to the following RBCs:

- Groundwater ingestion and inhalation from tap water—residential, urban residential, and occupational worker exposure scenarios.
- Groundwater volatilization to outdoor air—occupational worker exposure scenario.
- Groundwater in an excavation—construction and excavation worker exposure scenarios.
- Groundwater volatilization to indoor air, chronic—residential and commercial exposure scenarios.

Except for B6, B16, and B18, one or more chemical concentrations in groundwater at every other groundwater sample location exceed at least one RBC. Based on the location of borings B6, B16, and B18 (the east, northeast, and northwest portions of the site respectively), MFA believes the on-site extent of contamination has been delineated to the east, northeast, and northwest. The approximate extent of groundwater contamination as defined by residential and commercial RBC exceedances in groundwater is shown on Figure 4-2. The extent of groundwater contamination to the south remains undefined.

The results of the groundwater data screening for each of the above exposure scenarios are described below.

Groundwater Ingestion and Inhalation from Tap Water

Except for B6, B16, and B18, at all other groundwater sample locations, one or more chemical concentrations in groundwater exceed one or more RBCs for ingestion and inhalation of tapwater. This exposure scenario assumes groundwater use is occurring. According to Les Schwab, the site

and surrounding area are provided drinking water by the City and Les Schwab does not use, and has no plans to use on-site groundwater for any purpose. Therefore, this exposure pathway is incomplete.

Groundwater Volatilization to Outdoor Air

Chemical concentrations in groundwater did not exceed the available RBC for groundwater volatilization to outdoor air.

Groundwater in Excavation

The gasoline concentrations in groundwater at MW-2 exceed the RBC for groundwater in an excavation for construction and excavation workers. As noted previously, gasoline concentrations in groundwater at MW-1 and MW-2 increased by an order of magnitude compared to the reconnaissance groundwater samples collected from borings advanced at the same locations during the prior scope of the investigation (B1 and B7). At other boring locations where the gasoline concentrations in groundwater were higher than at B7 and where monitoring wells were not installed to confirm groundwater concentrations (e.g., B8, B12, and B13), it is possible that the extent of groundwater with gasoline concentrations exceeding the RBC for groundwater in excavations could extend beyond the location of MW-2.

Groundwater Volatilization to Indoor Air, Chronic Exposure

Except for borings B6, B16, and B18, one or more chemical concentrations in groundwater at every other sample location exceed the chronic the RBCs for groundwater volatilization to residential indoor air. There is no residential us on site, but residential structures are present west and south of the site. The groundwater flow direction is to the south and the lateral extent of contamination to the west (west of B12) and downgradient extent of contamination to the south remains undefined. Therefore, there is a potential risk of indoor air exposure at residential properties south of the site that should be further assessed.

One or more chemical concentrations in groundwater at MW-1, B4, MW-3, MW-4, B7, MW-2, B8, B12, B13, B14, and B15 exceed the chronic RBCs for groundwater volatilization to commercial indoor air. The indoor air sample results discussed below in Section 4.3 provide additional information relevant to the potential risk of exposure from groundwater volatilization to indoor air.

In summary, future construction and excavation workers on-site are potentially at risk of exposure to groundwater in excavations and on-site workers and customers are potentially at risk of groundwater volatilization into indoor air. In addition, since chemical concentrations in groundwater exceed the RBCs for groundwater vapor intrusion into residential and commercial buildings at the western and southern site boundaries where the extent of groundwater contamination had not yet been delineated, there is a potential risk of vapor intrusion into off-site buildings to the west and south.

4.3 Indoor Air Vapor

The indoor air sample data are presented on Table 3 and are compared to the acute and chronic RBCs for vapor intrusion into commercial buildings. One or more chemicals were detected in every indoor air and outdoor air sample.

The naphthalene concentrations at indoor air samples IA-01 and IA-02 at the truck shop and IA-04 and IA-05 in the alignment center exceed the chronic RBC. However, at borings B17 and B18, located upgradient of the truck shop, naphthalene was not detected in groundwater. Similarly, naphthalene was not detected in groundwater at borings B15, B16, and B19 located upgradient of

the alignment center. Northwest of the alignment center, at B14, naphthalene was detected in groundwater at a concentration less than the RBC for groundwater volatilization into commercial buildings. These data suggest the naphthalene detections in indoor air are not the result of groundwater volatilization into commercial buildings and instead, may be related to ambient conditions associated with existing uses of these buildings. In addition, the detected concentrations of naphthalene are many orders of magnitude less than the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits-Time Weighted Average (PEL-TWA), indicating workers are likely not at risk of exposure to naphthalene.

The gasoline concentration at indoor air sample IA-06 in the tire center exceeds the chronic RBC. At monitoring well MW-1 north of the tire center and monitoring wells MW-3 and MW-4 south of the tire center, gasoline was detected in groundwater at concentrations exceeding the RBC for groundwater volatilization into commercial buildings, suggesting groundwater volatilization into indoor air may be occurring. However, at the other two tire center indoor air samples IA-07 and IA-08, gasoline was detected at concentrations much less than the RBC, suggesting groundwater volatilization into indoor, if occurring, is localized. Since sample IA-06 was located near an open roll-up door where there is adjacent vehicle use, the gasoline detection may be associated with that use. In addition, the concentration of gasoline in sample IA-06 is many orders of magnitude less than the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)-TWA indicating workers and customers are likely not at risk of exposure to gasoline.

In summary, it appears that workers and customers are unlikely to be at risk of exposure from groundwater volatilization to indoor air. However, vapor intrusion can vary seasonally with atmospheric conditions and changes in groundwater elevations.

4.4 Soil Vapor

The soil vapor sample data are presented on Table 4 and are compared to the chronic and acute RBCs for soil volatilization to residential indoor air.

At sample locations SV-1 and SV-2 located along the western site boundary and near off-site residential structures to the west, the chemicals of interest for the site (gasoline, BTEX, and naphthalene) were not detected except for benzene, which was detected in sample SV-01 at a concentration much less than the RBC. This suggests there is a low risk of exposure from soil volatilization to indoor for the structures to the west. Two additional chemicals, acrolein and chloroform, were detected in sample SV-2 at concentrations exceeding the chronic RBC. Acrolein was not detected in any other soil vapor sample and FBI indicated acrolein is commonly detected as a false positive. Chloroform was not detected in soil or groundwater during the summer 2022 assessment of the new building excavation (MFA, 2022) and FBI indicated chloroform is commonly detected in association with drinking water intrusion, either from fresh water or sewer lines, since it is a byproduct of the chlorine treatment of water. As such, neither acrolein nor chloroform appear to be related to the site.

At sample locations SV-3 and SV-4 located along the south site boundary, the gasoline, 1,3-butadiene, ethylbenzene, and naphthalene concentrations at SV3 and the 1,3-butadiene and tetrachloroethene concentrations at SV4 exceed the chronic RBCs. Tetrachloroethene was not detected in soil or groundwater during the summer 2022 assessment of the new building excavation (MFA, 2022). Since the groundwater flow direction at the site is towards the south, the downgradient

extent of groundwater contamination remains undefined, and residential structures are located to the south, the RBC exceedances in groundwater at SV-3 and SV-4 indicate the potential for vapor intrusion risk at the residential structures to the south.

5 Conclusions and Recommendations

Following the initial assessment of the new building excavation in the summer of 2022, (MFA, 2022), MFA has subsequently conducted seven site investigation events from October 2022 to March 2024. The objectives of the investigations were to delineate the extent of contamination in soil, groundwater, soil vapor, and indoor air, and to assess the on-site storm sewer for evidence of groundwater intrusion. These investigations have resulted in the following conclusions:

- Based on the extensive detections of gas, diesel, BTEX, and naphthalene at the site, and the extent of soil and groundwater contamination (see Figures 4-1 and 4-2), the source of the contamination is likely related to the historical presence of one or more gasoline stations on the site.
- Although a Les Schwab employee indicated a previously unknown UST was located north of the alignment center building, a GPR and magnetic survey did not identify any USTs remaining in place.
- The direction of groundwater flow in the southern portion of the site near the tire center is to the south.
- As shown on Figures 4-1 and 4-2, the extent of contamination in soil and groundwater is generally delineated on site but the extent has not been delineated downgradient to the south.
- The soil sample data together with the site conditions and current and future use indicate on-site workers and customers are not at risk of exposure to contamination in soil.
- Future construction and excavation workers on-site are potentially at risk of exposure to groundwater in excavations. This risk can be managed through worker notification of the contamination, and implementation of health and safety measures such as air monitoring and use of personal protective equipment to prevent exposure to the contamination.
- On-site workers and customers are potentially at risk of exposure from groundwater volatilization into indoor air. However, subsequent indoor air sampling at the truck shop, alignment center, and tire center and comparison of the indoor air data to the OSHA PEL-TWAs and ACGIH TLV-TWAs indicate likely there is no risk of exposure.
- The soil vapor data indicate the risk of exposure from vapor intrusion into indoor air is low for structures west of the site.
- The soil vapor and groundwater data indicate there is a potential risk of exposure from vapor intrusion into indoor air for structures south of the site where the downgradient extent of contamination remains undefined.

Based on these conclusions, MFA recommends that Les Schwab consider completing the following assessment activities:

- Delineate the extent of groundwater contamination to the south of the site, including at the residential properties south of Main Street.
- Compare future groundwater data to vapor intrusion RBCs to assess whether there is risk of vapor intrusion exposure at the off-site residential properties.

References

Krazan. 2017. *Phase II Limited Subsurface Assessment, Les Schwab, Springfield, 3294 Main St, Springfield, OR 97478.* Prepared for SFP-E LLC. Krazan & Associates, Inc., Lynnwood, Washington. September 20.

Madin and Murray. 2006. *Preliminary Geologic Map of the Eugene East and Eugene West Quadrangles, Lane County, Oregon.* Oregon Department of Geology and Mineral Industries Open-File Report OFR-06-17.

MFA. 2022. Letter from M. D'Andrea and J. Pace, MFA, to D. Gibson, Les Schwab re: *Results of Soil and Groundwater Assessment, Les Schwab Facility, Springfield, Oregon*. August 25.

Wood. 2020. *Phase I Environmental Site Assessment, Les Schwab, Store No. 27, 3294 Main St, Springfield, OR 97478.* Prepared for Perkins Coie LLP. Wood Environment & Infrastructure Solutions, Inc., Portland, Oregon. February 28.

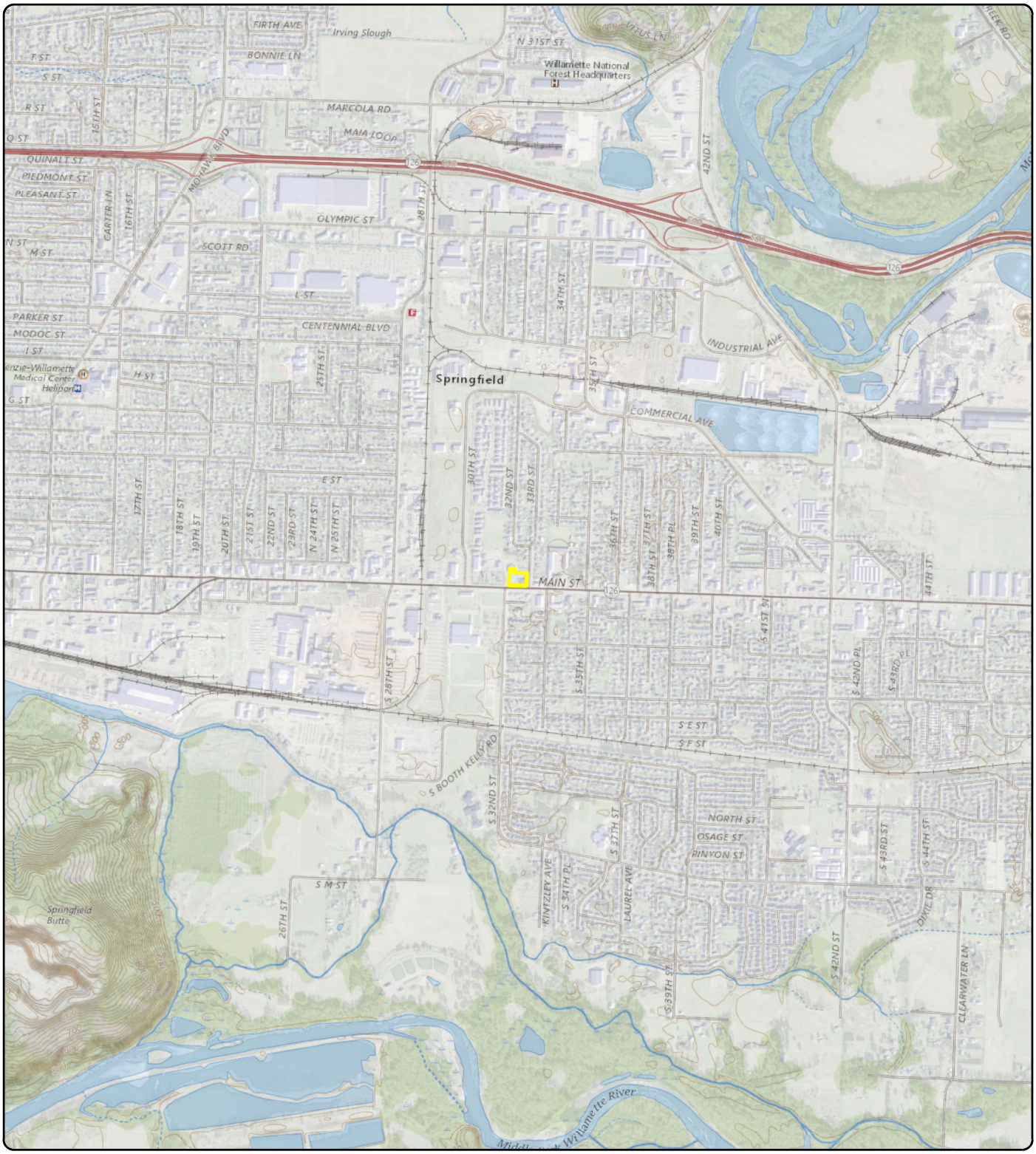
Limitations

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Figures

MAUL
FOSTER
ALONGI



Notes:
U.S. Geological Survey 7.5-minute topographic quadrangle: Springfield.
Township 17 south, range 3 west, section 36.

Data Source:
Property boundary obtained from Lane County.

Legend

Property Boundary

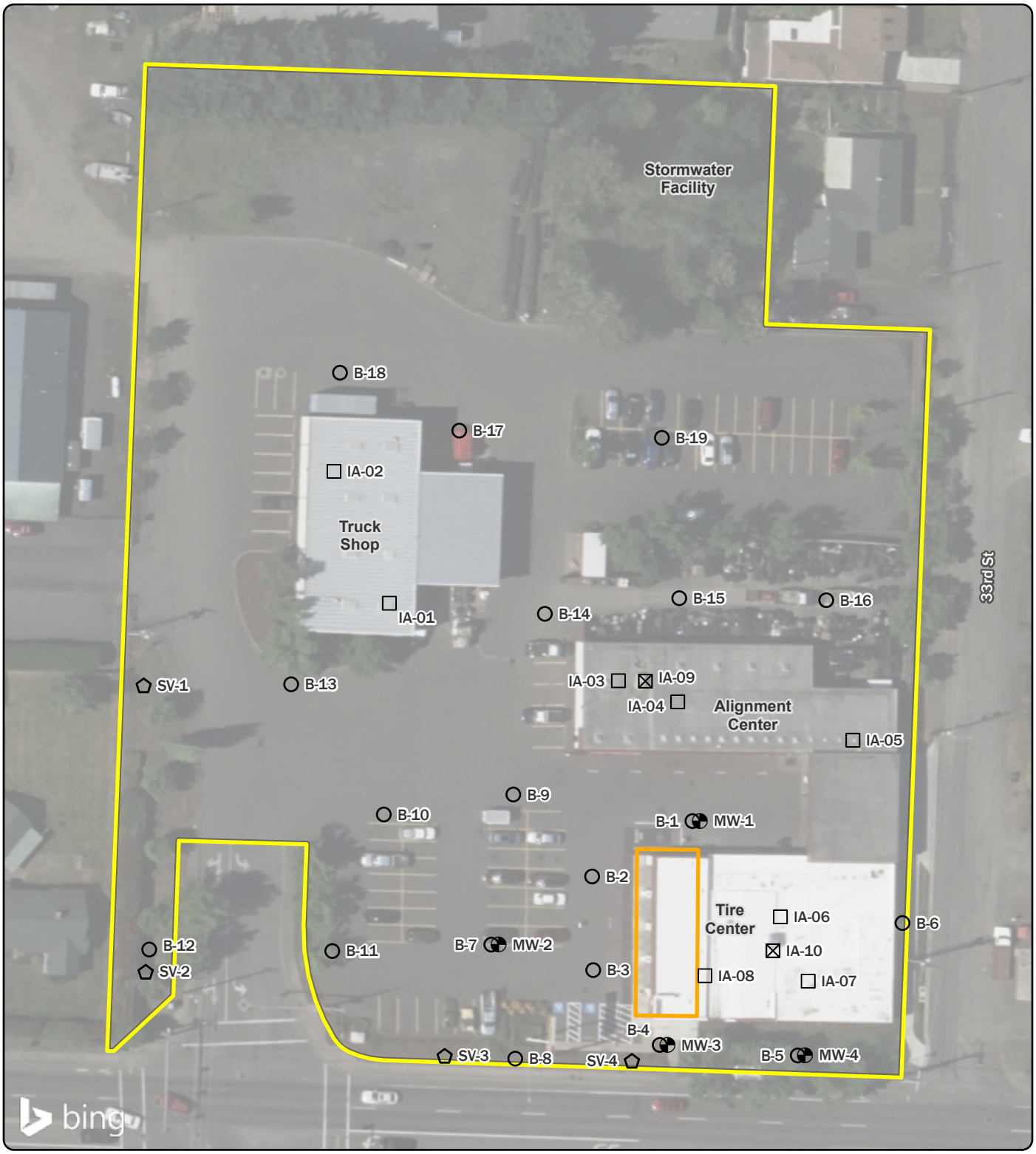
Figure 1-1
Site Vicinity

Les Schwab Tire Center
Springfield, Oregon

0 1,000 2,000
Feet

MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

Path: X:\0_MFA_Projects\M0553\10\001\Fig1_Site_Vicinity.mxd
Print Date: 7/29/2022
Reviewed By: jpace
Produced By: sturner
Project: M0553.10.001



Legend

- Boring
- Monitoring Well
- Indoor Air Sample
- Rooftop Air Sample
- Soil Vapor Boring
- Excavation Footprint
- Property Boundary

Figure 2-1
Soil, Groundwater, Soil Vapor, and Indoor Air Sample Locations

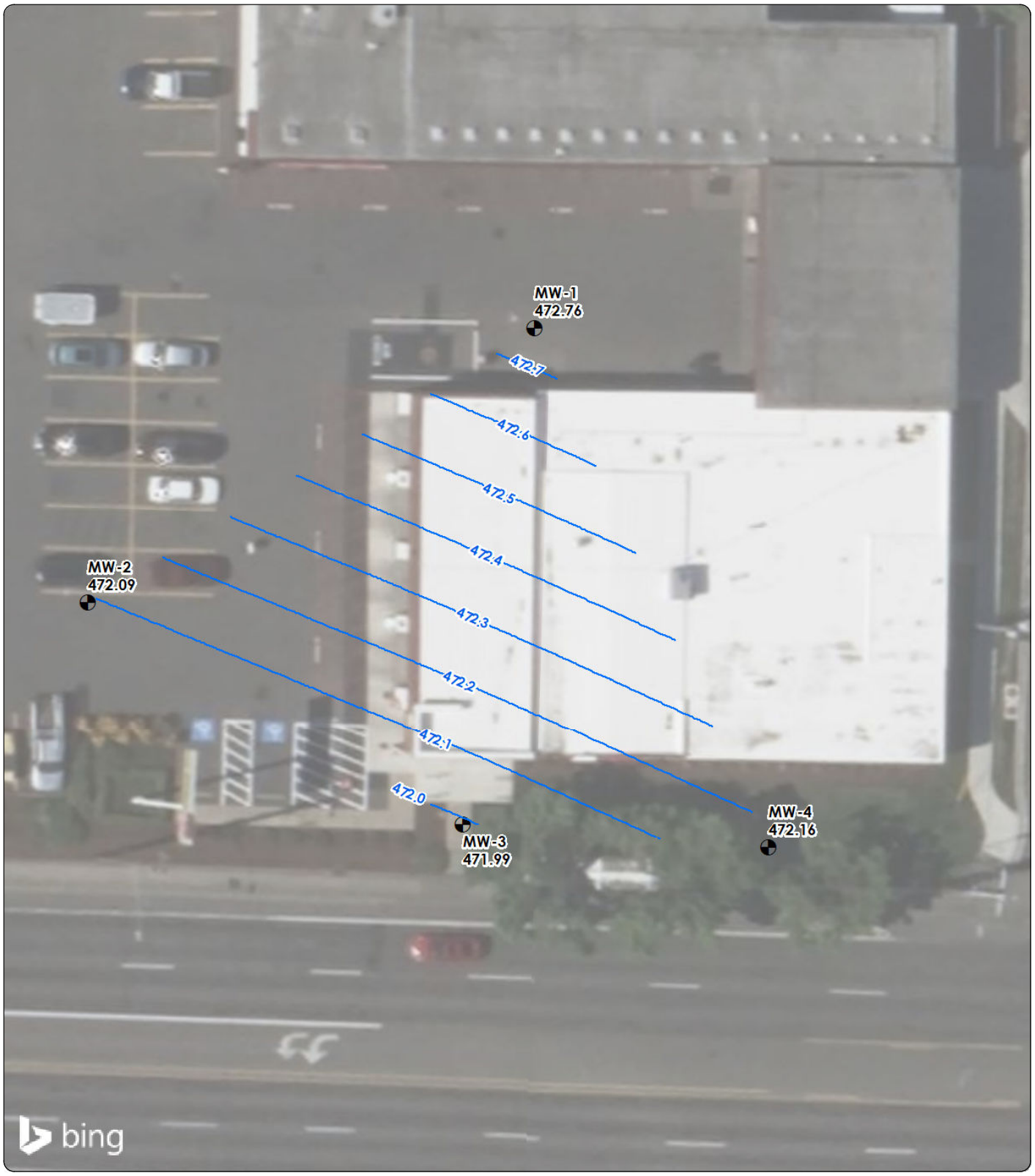
Les Schwab
Springfield, Oregon

0 50
Feet

Data Source
Aerial photograph obtained from Microsoft Bing.

MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

Path: X:\O_MFA_Projects\M0553\10\002\Pro\M0553_10_002_004.aprx\Fig 2-1 Soil Groundwater, Soil Vapor, and Indoor Air Sample Locations
Print Date: 11/15/2024
Reviewed By: dweatherby
Produced By: sturner
Project: M0553.10.002



Notes
Groundwater elevations measured on March 9, 2023.
NAVD 88 = North American Vertical Datum of 1988.

Data Source
Aerial photograph obtained from Microsoft Bing.

Legend

- Monitoring Well
- Groundwater Elevation (feet NAVD 88)

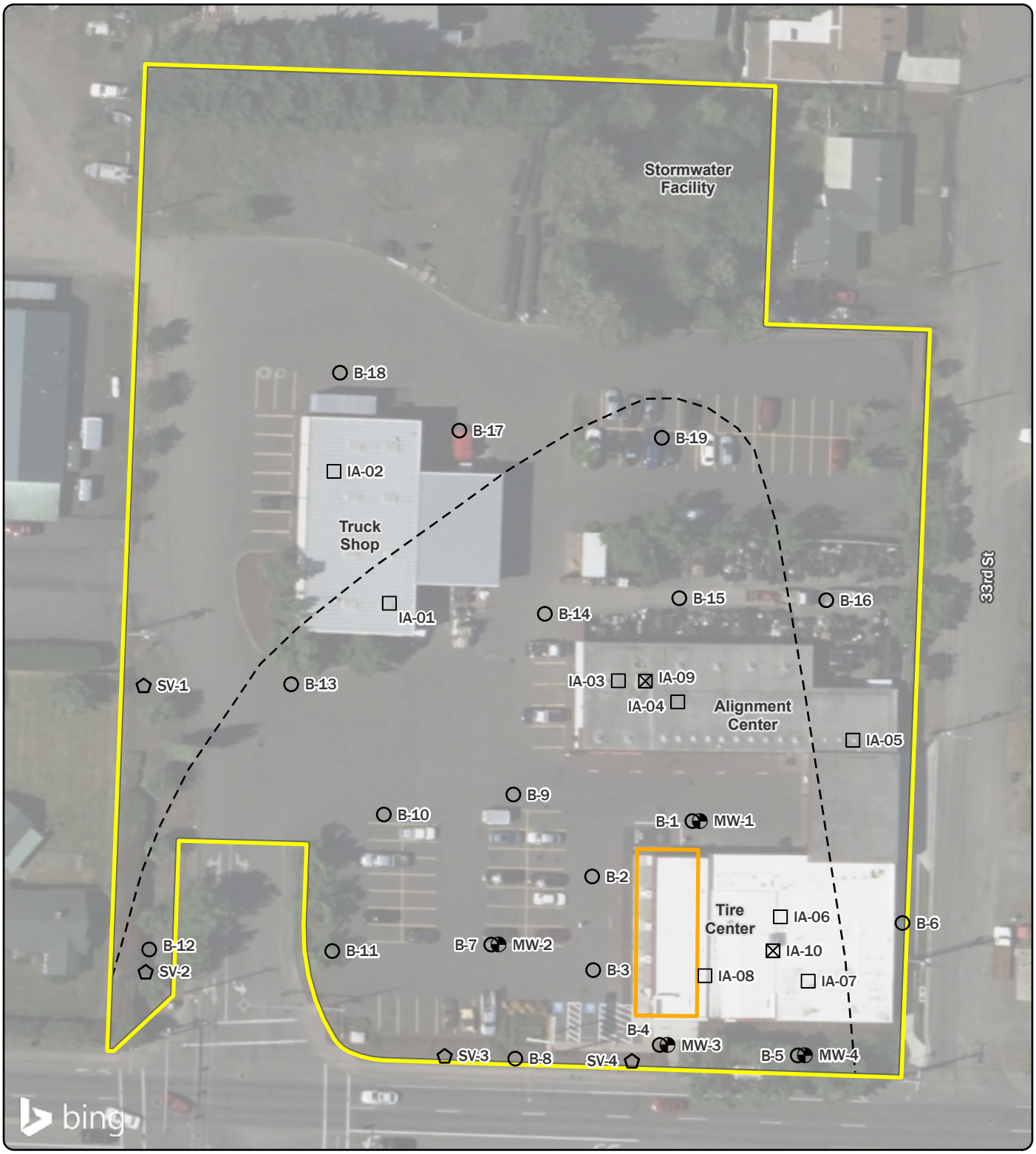
Figure 2-2
Groundwater Elevation Contours—March 2023

Les Schwab Tire Center
Springfield, Oregon

0 10 20
Feet

MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

Path: X:\0_MFA_Projects\M0553\10\002\Fig 2-2 Groundwater Elevation Contour.mxd
Print Date: 11/15/2024
Reviewed By: dweatherby
Produced By: sturner
Project: M0553.10.002



Legend

- Boring
- Monitoring Well
- Indoor Air Sample
- Rooftop Air Sample
- Soil Vapor Boring
- Approximate Extent of Visual Indicators of Contamination in Soil
- Excavation Footprint
- Property Boundary

Data Source
Aerial photograph obtained from Microsoft Bing.

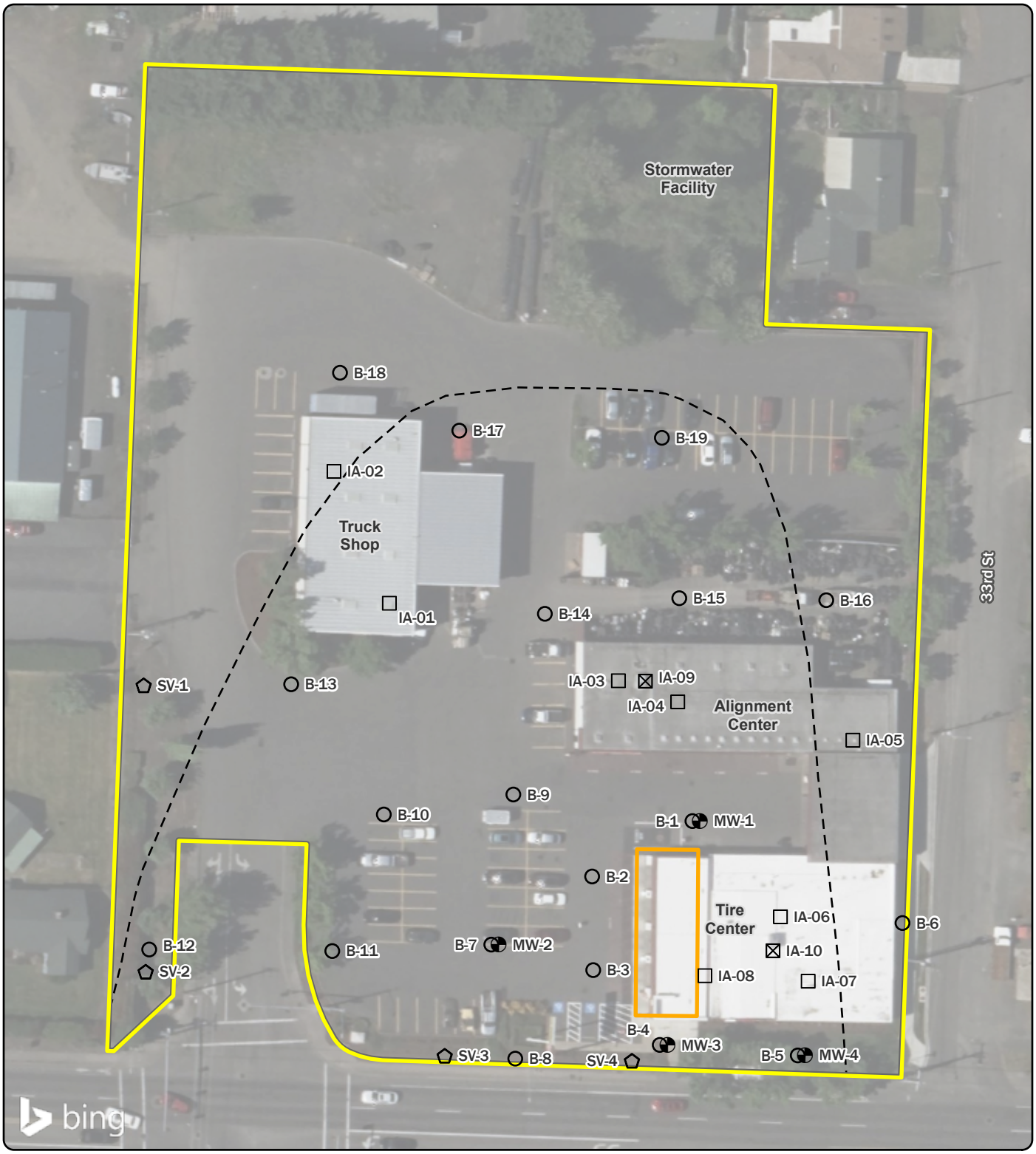
MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

Figure 4-1
Approximate Extent of Visual Indicators of Contamination in Soil

Les Schwab
Springfield, Oregon

0 50
Feet

Path: X:\O_MFA_Projects\M0553\10\002\Pro\M0553_10_002_004.aprx\Fig 4-1 Approximate Extent of Visual Indicators of Contamination in Soil
Print Date: 11/20/2024
Reviewed By: dweatherby
Produced By: sturner
Project: M0553.10.002



Legend

- Boring
- Monitoring Well
- Indoor Air Sample
- Rooftop Air Sample
- Soil Vapor Boring
- Approximate Extent of Vapor Intrusion Risk-Based Concentration Exceedances in Groundwater
- Excavation Footprint
- Property Boundary

Figure 4-2
Approximate Extent of Vapor Intrusion Risk-Based Concentration Exceedances in Groundwater

Les Schwab
Springfield, Oregon

0 50
Feet

Data Source
Aerial photograph obtained from Microsoft Bing.

MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

Tables

MAUL
FOSTER
ALONGI

Table 1
Summary of Soil Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, Soil, Ingestion, Dermal Contact, and Inhalation[1]			RBC, Soil, Leaching to Groundwater[1]			B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Sample Name:							B1-SS-11.0	B2-SS-8.0	B3-SS-8.0	B4-SS-8.5	B5-SS-8.5	B6-SS-9.0	B7-SS-8.0	B-8-S-9.0	B-9-S-11.5	B-10-S-14.0
Collection Date:	Occupational	Construction Worker	Excavation Worker	Residential	Urban Residential	Occupational	10/25/2022	10/25/2022	10/25/2022	10/25/2022	10/25/2022	10/25/2022	10/25/2022	06/22/2023	06/22/2023	06/22/2023
Collection Depth (ft bgs):							11.0	8.0	8.0	8.5	8.5	9.0	8.0	9.0	11.5	14.0
TPH (mg/kg)																
Gasoline-range hydrocarbons	20,000	9,700	NV	31	31	130	17.5	655	1,120	407	433	6.61 U	577	355	955	3,180
Diesel-range hydrocarbons	14,000	4,600	NV	9,500	9,500	NV	32.9	93.2 J+	363 J+	709 J+	83.4 J+	24.3 U	64.7 J	81.6 J	227	274 J
Oil-range hydrocarbons	14,000[a]	4,600[a]	NV	9,500[a]	9,500[a]	NV	318	48.8 U	55 U	55.9 U	57.0 U	48.5 U	51.6 U	52.7 U	289	56.1
VOCs (mg/kg)																
Benzene	37	380	11,000	0.023	0.1	0.1	--	--	--	0.173 U	0.0702 U	--	0.158 U	0.0314 U	0.0884 U	0.417 U
Ethylbenzene	150	1,700	49,000	0.22	0.94	0.9	--	--	--	0.434 U	0.175 U	--	0.395 U	0.0785 U	0.221 U	1.04 U
Naphthalene	23	580	16,000	0.077	0.37	0.34	--	--	--	1.73 U	0.702 U	--	1.58 U	0.314 U	0.884 U	4.17 U
Toluene	88,000	28,000	770,000	84	340	490	--	--	--	0.867 U	0.351 U	--	0.790 U	0.157 U	0.442 U	2.08 U
Xylenes, total[b]	25,000	20,000	560,000	23	87	100	--	--	--	1.30 U	0.526 U	--	1.18 U	0.235 U	0.663 U	3.12 U

Table 1
Summary of Soil Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, Soil, Ingestion, Dermal Contact, and Inhalation[1]			RBC, Soil, Leaching to Groundwater[1]			B11	B12	B13	B14	B15	B16	B17	B18	B19
Sample Name:							B-11-S-13.0	B-12-S-10.5	B-13-S-10.0	B-14-S-8.0	B15-S-7.5	B16-S-8.0	B17-S-7.5	B18-S-8.0	B19-S-7.5
Collection Date:	Occupational	Construction Worker	Excavation Worker	Residential	Urban Residential	Occupational	06/22/2023	06/22/2023	06/22/2023	06/22/2023	12/06/2023	12/06/2023	12/06/2023	12/06/2023	12/06/2023
Collection Depth (ft bgs):							13.0	10.5	10.0	8.0	7.5	8.0	7.5	8.0	7.5
TPH (mg/kg)															
Gasoline-range hydrocarbons	20,000	9,700	NV	31	31	130	202	4.90 U	295	1,500 J	197	6.47 U	6.91 U	7.27 U	7.53 U
Diesel-range hydrocarbons	14,000	4,600	NV	9,500	9,500	NV	28.1 U	272	25.5 U	2,150 J	20,300	24.1 U	22.6 U	23.7 U	2,420
Oil-range hydrocarbons	14,000[a]	4,600[a]	NV	9,500[a]	9,500[a]	NV	56.3 U	44.9 U	51.0 U	42.7 U	1,900 U	48.2 U	45.3 U	47.5 U	50.0 U
VOCs (mg/kg)															
Benzene	37	380	11,000	0.023	0.1	0.1	0.0342 U	0.0098 U	0.0317 U	0.0486 UJ	0.0132 U	0.0129 U	0.0138 U	0.0145 U	0.0151 U
Ethylbenzene	150	1,700	49,000	0.22	0.94	0.9	0.0854 U	0.0245 U	0.0792 U	0.670 J	0.0329 U	0.0324 U	0.0345 U	0.0363 U	0.0377 U
Naphthalene	23	580	16,000	0.077	0.37	0.34	0.342 U	0.0980 U	0.317 U	1.70 UJ	0.132 U	0.129 U	0.138 U	0.145 U	0.151 U
Toluene	88,000	28,000	770,000	84	340	490	0.171 U	0.0490 U	0.158 U	0.243 UJ	0.0659 U	0.0647 U	0.0691 U	0.0727 U	0.0753 U
Xylenes, total[b]	25,000	20,000	560,000	23	87	100	0.256 U	0.0735 U	0.238 U	0.364 UJ	0.0988 U	0.0971 U	0.104 U	0.109 U	0.113 U

Table 1
Summary of Soil Analytical Results
Les Schwab, Springfield, Oregon

Notes

Shading indicates values that exceed screening criteria (color key below); non-detects (U or UJ) were not compared with screening criteria.

When multiple criteria are exceeded, results are shaded based on the highest value.

RBC, Soil, Ingestion, Dermal Contact, and Inhalation, Occupational

RBC, Soil, Ingestion, Dermal Contact, and Inhalation, Construction Worker

RBC, Soil, Leaching to Groundwater, Residential

RBC, Soil, Leaching to Groundwater, Urban Residential

RBC, Soil, Leaching to Groundwater, Occupational

-- = not analyzed.

DEQ = Oregon Department of Environmental Quality.

ft bgs = feet below ground surface.

J = result is estimated.

J+ = result is estimated, but the result may be biased high.

mg/kg = milligrams per kilogram.

NV = no value.

RBC = risk-based concentration.

TPH = total petroleum hydrocarbons.

U = result non-detect at the method reporting limit.

UJ = result is non-detect with an estimated reporting limit.

VOC = volatile organic compound.

[a]Screening level is for generic diesel/heating oil, as residual-range hydrocarbon values are not available.

[b]Total xylenes are reported by the laboratory.

Reference

[1]DEQ. 2023. Table: *Risk-Based Concentrations for Individual Chemicals.* Oregon Department of Environmental Quality, Environmental Cleanup Program. June.

Table 2
Summary of Groundwater Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, GW, Ingestion & Inhalation from Tapwater[1]			RBC, GW, Volatilization to Outdoor Air[1]	RBC, GW in Excavation[1]	RBC, GW, Volatilization to Indoor Air, Chronic[2]		B1	MW-1	B4	MW-3	B5	MW-4	B6	B7	MW-2	
Sample Name:								B1-GW-15.0	MW-1-GW-10.0	B4-GW-10.5	MW-3-GW-9.0	B5-GW-10.8	MW-4-GW-10.0	B6-GW-13.75	B7-GW-12.0	MW-2-GW-10.0	MW-2-GW-10.0
Collection Date:	Residential	Urban Residential	Occupational	Occupational	Construction and Excavation Worker	Residential	Commercial	10/25/2022	03/01/2023	10/25/2022	03/27/2023	10/25/2022	03/27/2023	10/25/2022	10/25/2022	03/01/2023	03/27/2023
Collection Depth (ft bgs):								15	10	10.5	9.0	10.8	10	13.75	12	10	10
TPH (ug/L)																	
Gasoline-range hydrocarbons	110	110	450	NV	14,000	120	520	344	4,590	3,120	5,940	266	1,830	100 U	2,090	22,200	20,100
Diesel-range hydrocarbons	100	100	430	NV	NV	400	1,700	204 U	735 J+	408 J+	--	202 U	343 J+	204 U	213 U	878 J+	821 J+
Oil-range hydrocarbons	100[a]	100[a]	430[a]	NV	NV	400[a]	1,700[a]	408 U	594	400 U	--	404 U	390 U	408 U	439	449 U	377 U
VOCs (ug/L)																	
Benzene	0.46	2	2.1	14,000	1,800	2.8	12	--	0.330	9.28 J	5.30	0.200 U	0.600	--	0.690	233	273
Ethylbenzene	1.5	6.7	6.4	43,000	4,500	7.1	31	--	12.6	132	166	0.500 U	1.90	--	37.2	543	484
Naphthalene	0.17	0.78	0.72	16,000	500	11	50	--	16.5	29.9	132	2.00 U	2.00 U	--	20.7	236	201 J
Toluene	1,100	4,400	6,300	NV	220,000	36,000	150,000	--	1.00 U	3.14	5.00 U	1.00 U	1.00 U	--	9.06	689	957
Xylenes, total[b]	190	710	830	NV	23,000	780	3,300	--	5.23	60.8	164	1.50 U	1.50 U	--	148	1,930	2,130

Table 2
Summary of Groundwater Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, GW, Ingestion & Inhalation from Tapwater[1]			RBC, GW, Volatilization to Outdoor Air[1]	RBC, GW in Excavation[1]	RBC, GW, Volatilization to Indoor Air, Chronic[2]		B8	B12	B13	B14	B15	B16	B17	B18	B19
Sample Name:								B-8-GW-12.5	B-12-GW-17.5	B-13-GW-17.5	B-14-GW-17.5	B15-GW-14.0	B16-GW-12.0	B17-GW-13.0	B18-GW-14.5	B19-GW-14.5
Collection Date:	Residential	Urban Residential	Occupational	Occupational	Construction and Excavation Worker	Residential	Commercial	06/22/2023	06/22/2023	06/22/2023	06/22/2023	12/06/2023	12/06/2023	12/06/2023	12/06/2023	12/06/2023
Collection Depth (ft bgs):								12.5	17.5	17.5	17.5	14.0	12.0	13.0	14.5	14.5
TPH (ug/L)																
Gasoline-range hydrocarbons	110	110	450	NV	14,000	120	520	5,950	2,920	4,360	1,960	615	100 U	100 U	100 U	100 U
Diesel-range hydrocarbons	100	100	430	NV	NV	400	1,700	817 J	394 J	588 J	648 J	7,380 J	225 UJ	251 J	208 UJ	242 J
Oil-range hydrocarbons	100[a]	100[a]	430[a]	NV	NV	400[a]	1,700[a]	408 U	426 U	404 U	377 U	460 UJ	449 UJ	444 UJ	417 UJ	460 UJ
VOCs (ug/L)																
Benzene	0.46	2	2.1	14,000	1,800	2.8	12	2.60	32.8	194	10.0	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
Ethylbenzene	1.5	6.7	6.4	43,000	4,500	7.1	31	14.9	0.520	76.7	24.3	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
Naphthalene	0.17	0.78	0.72	16,000	500	11	50	20.0 U	2.00 U	13.8	31.8	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Toluene	1,100	4,400	6,300	NV	220,000	36,000	150,000	10.0 U	2.02	8.38	4.27	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Xylenes, total[b]	190	710	830	NV	23,000	780	3,300	35.3	15.5	65.5	87.5	1.50 U	1.50 U	1.50 U	1.50 U	1.50 U

Table 2
Summary of Groundwater Analytical Results
Les Schwab, Springfield, Oregon

Notes

Shading indicates results that exceed screening criteria (color key below); non-detect results (U or UJ) were not compared with screening criteria.

When multiple criteria are exceeded, results are shaded based on the highest value. When multiple criteria of the same value are exceeded, results are shaded based on the residential pathway.

RBC, GW, Ingestion & Inhalation from Tapwater, Residential

RBC, GW, Ingestion & Inhalation from Tapwater, Urban Residential

RBC, GW, Ingestion & Inhalation from Tapwater, Occupational

RBC, GW in Excavation, Construction & Excavation Worker

RBC, GW, Volatilization to Indoor Air, Chronic, Residential

RBC, GW, Volatilization to Indoor Air, Chronic, Commercial

-- = not analyzed.

DEQ = Oregon Department of Environmental Quality.

ft bgs = feet below ground surface.

GW = groundwater.

J = result is estimated.

J+ = result is estimated, but the result may be biased high.

NV = no value.

RBC = risk-based concentration.

TPH = total petroleum hydrocarbons.

U = result is non-detect at the method reporting limit.

ug/L = micrograms per liter.

UJ = result is non-detect with an estimated reporting limit.

VOC = volatile organic compound.

[a]Value is for generic diesel/heating oil, since generic residual-range hydrocarbons values are not available.

[b]Total xylenes are reported by the laboratory.

References

[1]DEQ. 2023. Table: *Risk-Based Concentrations for Individual Chemicals.* Oregon Department of Environmental Quality, Environmental Cleanup Program. June.

[2]DEQ. 2023. Table 1: *Chronic and Acute Vapor Intrusion Risk-Based Concentrations.* Oregon Department of Environmental Quality, Environmental Cleanup Program. June.

Table 3
Summary of Indoor Air Analytical Results
Les Schwab, Springfield, Oregon

Location:	Vapor Intrusion RBC, Air, Commercial[1]		IA-01	IA-02	IA-03	IA-04	IA-05	IA-06	IA-07	IA-08	IA-09	IA-10
Sample Name:			IA-01-091423	IA-02-091423	IA-03-091423	IA-04-091423	IA-05-091423	IA-06-091423	IA-07-091423	IA-08-091423	IA-09-091423	IA-10-091423
Collection Date:	Chronic	Acute	09/14/2023	09/14/2023	09/14/2023	09/14/2023	09/14/2023	09/14/2023	09/14/2023	09/14/2023	09/14/2023	09/14/2023
TPH (ug/m^3)												
Gasoline-range hydrocarbons	1,200	NV	570	260	140	330	98	1,300	350	160	58 U	58 U
VOCs (ug/m^3)												
Benzene	1.6	87	1.2	0.89	0.52	1.3	0.76	1.0	1.4	1.3	0.46	0.51
Ethylbenzene	4.9	66,000	1.8	0.82	0.28	1.2	0.39	0.56	0.97	0.70	0.16	0.20
m,p-Xylene	NV	NV	16	11	1.3	5.4	5.6	2.2	4.0	2.8	0.57	0.73
Naphthalene	0.36	600	3.5	2.8	0.30 J	0.60	0.88	0.20 J	0.32 J	0.23 J	0.098 U	0.096 U
o-Xylene	440	NV	1.4	0.85	0.36	1.5	0.53	0.75	1.3	0.97	0.21	0.27
Toluene	22,000	23,000	13	5.9	1.7	8.4	2.6	3.0	6.6	4.2	1.0	1.1
Xylenes, total[a]	440	26,000	17 T	12 T	1.7 T	6.9 T	6.1 T	3.0 T	5.3 T	3.8 T	0.78 T	1.0 T

Notes

Shading indicates results that exceed screening criteria (color key below); non-detect results (U) were not compared with screening criteria.

Vapor Intrusion RBC, Air, Commercial, Chronic

J = result is estimated.

NV = no value.

RBC = risk-based concentration.

T = result is calculated.

TPH = total petroleum hydrocarbons.

U = result is non-detect at the method detection limit or method reporting limit.

ug/m^3 = micrograms per cubic meter.

VOC = volatile organic compound.

[a]Total xylenes are calculated as the sum of m,p-xylene and o-xylene.

Reference

[1]DEQ. 2023. Table 1: *Chronic and Acute Vapor Intrusion Risk-Based Concentrations.* Oregon Department of Environmental Quality, Environmental Cleanup Program. June.

Table 4
Summary of Soil Vapor Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, Soil Vapor, Volatilization to Indoor Air, Residential[1]		SV1	SV2	SV3	SV4
Sample Name:			SV1	SV2	SV3	SV4
Collection Date:	Chronic	Acute	12/07/2023	12/07/2023	12/07/2023	12/07/2023
TPH (ug/m^3)						
Gasoline-range hydrocarbons	10,000	NV	1,700 U	1,600 U	300,000	7,800
VOCs (ug/m^3)						
1,1,1-Trichloroethane	170,000	370,000	2.8 U	2.7 U	87 U	4.4 U
1,1,2,2-Tetrachloroethane	1.6	NV	0.71 U	0.69 U	22 U	1.1 U
1,1,2-Trichloroethane	5.9	NV	0.28 U	0.27 U	8.7 U	0.44 U
1,1-Dichloroethane	59	NV	2.1 U	2 U	65 U	3.2 U
1,1-Dichloroethene	7,000	6,700	2.1 U	2 U	63 U	3.2 U
1,2,4-Trichlorobenzene	70	NV	3.9 U	3.7 U	120 U	5.9 U
1,2,4-Trimethylbenzene	2,100	NV	26 U	25 U	790 U	39 U
1,2-Dibromoethane	0.16	NV	0.4 U	0.38 U	12 U	0.61 U
1,2-Dichlorobenzene	7,000	NV	3.1 U	3 U	96 U	4.8 U
1,2-Dichloroethane	3.6	NV	0.21 U	0.2 U	6.5 U	0.32 U
1,2-Dichloropropane	25	7,700	1.2 U	1.2 U	37 U	1.8 U
1,3,5-Trimethylbenzene	2100	NV	26 U	25 U	790 U	39 U
1,3-Butadiene	3.1	22,000	2.4	2.9	62	73
1,3-Dichlorobenzene	NV	NV	3.1 U	3 U	96 U	4.8 U
1,4-Dichlorobenzene	8.5	400,000	1.2 U	1.1 U	37 U	1.8 U
1,4-Dioxane	19	240,000	1.9 U	1.8 U	58 U	2.9 U
2,2,4-Trimethylpentane	NV	NV	24 U	23 U	750 U	37 U
2-Butanone	170,000	170,000	31 U	29 U	940 U	47 U
2-Chlorotoluene	NV	NV	27 U	26 U	830 U	41 U
2-Hexanone	1,000	NV	21 U	20 U	660 U	33 U
2-Propanol	7,000	110,000	45 U	43 U	1,400 U	69 U
4-Ethyltoluene	NV	NV	26 U	25 U	790 U	39 U
4-Methyl-2-pentanone	100,000	NV	43 U	41 U	1,300 U	66 U
Acetone	NV	2,100,000	25 U	24 U	760 U	38 U
Acrolein	0.7	230	0.6 UJ	1 J	18 UJ	0.92 UJ
Allyl chloride	16	NV	16 U	16 U	500 U	25 U
Benzene	12	970	1.7	1.6 U	51 U	7.6
Benzyl chloride	1.9	8,000	0.27 U	0.26 U	8.3 U	0.41 U

Table 4
Summary of Soil Vapor Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, Soil Vapor, Volatilization to Indoor Air, Residential[1]		SV1	SV2	SV3	SV4
Sample Name:			SV1	SV2	SV3	SV4
Collection Date:	Chronic	Acute	12/07/2023	12/07/2023	12/07/2023	12/07/2023
Bromodichloromethane	2.5	NV	0.35 U	0.34 U	11 U	0.54 U
Bromoform	85	NV	11 U	10 U	330 U	17 U
Bromomethane	170	130,000	20 U	19 U	620 U	31 U
VOCs cont. (ug/m^3)						
Carbon disulfide	24,000	210,000	32 U	31 U	1,000 U	50 U
Carbon tetrachloride	16	63,000	1.6 U	1.6 U	50 U	2.5 U
Chlorobenzene	1,700	NV	2.4 U	2.3 U	74 U	3.7 U
Chloroethane	140,000	1,300,000	14 U	13 U	420 U	21 U
Chloroform	4.1	16,000	0.25 U	11	7.8 U	0.66
Chloromethane	3,100	33,000	19 U	19 U	590 U	30 U
cis-1,2-Dichloroethene	1,400	NV	2.1 U	2 U	63 U	3.2 U
cis-1,3-Dichloropropene	NV	NV	4.7 U	4.5 U	150 U	7.3 U
Cyclohexane	210,000	NV	36 U	34 U	1,100 U	55 U
Dibromochloromethane	NV	NV	0.44 U	0.43 U	14 U	0.68 U
Dichlorodifluoromethane (Freon 12)	3,500	NV	5.1 U	4.9 U	160 U	7.9 U
Ethanol	NV	NV	39 U	38 U	1,200 U	60 U
Ethyl acetate	2,400	NV	37 U	36 U	1,200 U	58 U
Ethylbenzene	37	730,000	2.3 U	2.2 U	74	6.8
Freon 113	170,000	NV	8 U	7.7 U	250 U	12 U
Freon 114	NV	NV	11 U	10 U	340 U	17 U
Heptane	14,000	NV	21 U	20 U	3,200	91
Hexachlorobutadiene	4.3	NV	1.1 U	1.1 U	34 U	1.7 U
Isopropylbenzene	14,000	NV	51 U	49 U	1600 U	79 U
m,p-Xylene	NV	NV	6.5	4.3 U	140 U	25
Methyl methacrylate	24,000	NV	21 U	20 U	660 U	33 U
Methyl tert-butyl ether	360	270,000	37 U	36 U	1,200 U	58 U
Methylene chloride	3,400	70,000	180 U	170 U	5,600 U	280 U
Naphthalene	2.8	6,700	1.4 U	1.3 U	81	2.1 U
n-Butane	NV	NV	25 U	24 U	760 U	210
n-Hexane	24,000	NV	18 U	18 U	2,300	140
n-Nonane	700	NV	27 U	26 U	840 U	42 U

Table 4
Summary of Soil Vapor Analytical Results
Les Schwab, Springfield, Oregon

Location:	RBC, Soil Vapor, Volatilization to Indoor Air, Residential[1]		SV1	SV2	SV3	SV4
Sample Name:			SV1	SV2	SV3	SV4
Collection Date:	Chronic	Acute	12/07/2023	12/07/2023	12/07/2023	12/07/2023
n-Pentane	35,000	NV	31 U	30 U	940 U	150
n-Propylbenzene	35,000	NV	26 U	25 U	790 U	39 U
o-Xylene	3,500	NV	2.3 U	2.2 U	69 U	7.6
Propylene	100,000	NV	21	22	300	470 J
Styrene	35,000	700,000	4.4 U	4.3 U	140 U	6.8 U
tert-Butyl alcohol	170,000	NV	63 U	61 U	1,900 U	97 U
VOCs cont. (ug/m^3)						
Tetrachloroethene	360	1,400	130	34 U	1,100 U	370
Tetrahydrofuran	70,000	NV	3.1 U	2.9 U	94 U	4.7 U
Toluene	170,000	250,000	39 U	38 U	1200 U	60 U
trans-1,2-Dichloroethene	1,400	26,000	2.1 U	2 U	63 U	3.2 U
trans-1,3-Dichloropropene	NV	NV	2.4 U	2.3 U	73 U	3.6 U
Trichloroethene	16	70	0.56 U	0.54 U	17 U	0.86 U
Trichlorofluoromethane (Freon 11)	NV	NV	12 U	11 U	360 U	18 U
Vinyl acetate	7,000	6,700	37 U	35 U	1,100 U	56 U
Vinyl bromide	6.2	NV	2.3 U	2.2 U	70 U	3.5 U
Vinyl chloride	5.6	43,000	1.3 U	1.3 U	41 U	2 U
Xylenes, total[a]	3,500	290,000	7.5 T	4.3 UT	140 UT	33 T

Table 4
Summary of Soil Vapor Analytical Results
Les Schwab, Springfield, Oregon

Notes

Shading (color key below) indicates values that exceed screening criteria; non-detects (U, UJ) were not compared with screening criteria.

RBC, Soil Vapor, Volatilization to Indoor Air, Residential, Chronic

J = result is estimated.

NV = no value.

RBC = risk-based concentration.

T = result is calculated.

TPH = total petroleum hydrocarbons.

U = result is non-detect at the method reporting limit.

ug/m^3 = micrograms per cubic meter.

UJ = result is non-detect with an estimated method reporting limit.

VOC = volatile organic compound.

[a]Total xylenes is the sum of m,p-xylene and o-xylene. When results are non-detect, half the reporting limit is used. When both results are non-detect, the highest reporting limit is shown.

Reference

[1]DEQ. 2023. Table 1: *Chronic and Acute Vapor Intrusion Risk-Based Concentrations.* Oregon Department of Environmental Quality. June.

Appendix A

Boring and Monitoring Well Completion Logs

MAUL FOSTER ALONGI

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Well Number	Sheet
M0553.10.002	**MW-1**	**1 of 1**

Project Name	**Les Schwab Tire Center**	TOC Elevation (feet)	
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**478.6**
Start/End Date	**2/28/2023 to 2/28/2023**	Northing	**876921.5**
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	**4269274.0**
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**11.0-feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**3.25-inch**

Depth (feet, BGS)	Well Details	Water Levels	Sample Data: Percent Recovery	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							@ 0.0 to 0.5 feet: Asphalt; black.
							0.5 to 1.0 feet: NO RECOVERY.
2							1.0 to 1.6 feet: SILTY SAND WITH GRAVEL (SM); reddish brown; 20% fines; 40% sand, fine to coarse, subangular to subrounded; 40% gravel, fine to coarse, subangular to subrounded; medium dense; moist.
3		▽	90		0.7		1.6 to 8.2 feet: SANDY SILT (ML); brown; 60% fines, low plasticity; 40% sand, fine; stiff; trace gravel, fine to coarse, subangular to subrounded; moist.
					0.5		
4		▼					
5		▼			0.4		
6					6.3		@ 6.5 to 8.2 feet: Becomes gray; petroleum hydrocarbon-like odor.
7							
8			100		280.9		
9							8.2 to 11.0 feet: SILTY SAND WITH GRAVEL (SM); gray; 20% fines; 40% sand, fine to coarse, subangular to subrounded; 40% gravel, fine to coarse, subangular to subrounded; very dense; slight petroleum hydrocarbon-like odor; wet.
					252.2		
10				MW-1-GW-10.0			
			100		14.3		
11							@ 11.0 feet: Refusal.

Total Depth = 11.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. btoc = below top of casing. 4. ID = identification. 5. PID = photoionization detector. 6. ppm = parts per million.

Borehole Completion Details
0 to 11.0 feet bgs: 3.25-inch borehole.
0 to 2.0 feet bgs: Concrete.
2.0 to 5.0 feet bgs: Bentonite chips hydrated with potable water.
5.0 to 11.0 feet bgs: 12x20 Colorado silica sand filter pack.

Monitoring Well Completion Details
Oregon Water Resources Department Well No. L149365
Traffic grade, flush-mounted monitoring well monument.
0 to 6.0 feet bgs: 2-inch-diameter, schedule 40, PVC blank riser pipe.
6.0 to 11.0 feet bgs: 2-inch-diameter, schedule 40, 0.010-inch machine slot PVC well screen (Colorado silica sand) with 2-inch-diameter PVC end cap.

▽ Water level at approximately 2.2 feet bgs following drilling on 2/28/2023. ▼ Depth to water was 3.83 feet btoc at 10:30 on 03/01/2023 prior to sampling. ▼ Depth to water was 5.3 feet bgs at 9:12 on 03/27/2023.

MFA BOREHOLE W/WELL W:\GINT\GINTWPROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 4/21/23

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Well Number	Sheet
M0553.10.002	**MW-2**	**1 of 1**

Project Name	**Les Schwab Tire Center**	TOC Elevation (feet)	
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**478.2**
Start/End Date	**2/28/2023 to 2/28/2023**	Northing	**876863.4**
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	**4269179.4**
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**11.0-feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**3.25-inch**

Depth (feet, BGS)	Well Details	Water Levels	Sample Data: Percent Recovery	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							@ 0.0 to 0.5 feet: Asphalt; black.
2							0.5 to 2.4 feet: SILTY GRAVEL WITH SAND (GM); brownish gray; 20% fines; 25% sand, fine to coarse, angular to subrounded; 65% gravel, fine to coarse, angular to subrounded; dense to very dense; petroleum hydrocarbon-like odor; moist.
3			100				2.4 to 9.5 feet: SILTY SAND (SM); brown; 40% fines, low plasticity; 60% sand, fine to medium, subangular to subrounded; dense to very dense; trace gravel, medium to coarse, subrounded; petroleum hydrocarbon-like odor; moist.
4					9.2		
5					295.5		
6		▼			406.4		
7					921.5		
8			100		565.5		
9		▼			391.9		@ 9.0 feet: Becomes wet.
10		▽		MW-2-GW-10.0			9.5 to 11.0 feet: WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM); gray; 15% fines; 25% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to coarse, subrounded; very dense; gray staining; wet.
11			100				@ 11.0 feet: Refusal.

Total Depth = 11.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. btoc = below top of casing. 4. ID = identification. 5. PID = photoionization detector. 6. ppm = parts per million.

Borehole Completion Details
0 to 11.0 feet bgs: 3.25-inch borehole.
0 to 2.0 feet bgs: Concrete.
2.0 to 5.0 feet bgs: Bentonite chips hydrated with potable water.
5.0 to 11.0 feet bgs: 12x20 Colorado silica sand filter pack.

Monitoring Well Completion Details
Oregon Water Resources Department Well No. L149364
Traffic grade, flush-mounted monitoring well monument.
0 to 6.0 feet bgs: 2-inch-diameter, schedule 40, PVC blank riser pipe.
6.0 to 11.0 feet bgs: 2-inch-diameter, schedule 40, 0.010-inch machine slot PVC well screen (Colorado silica sand) with 2-inch-diameter PVC end cap.

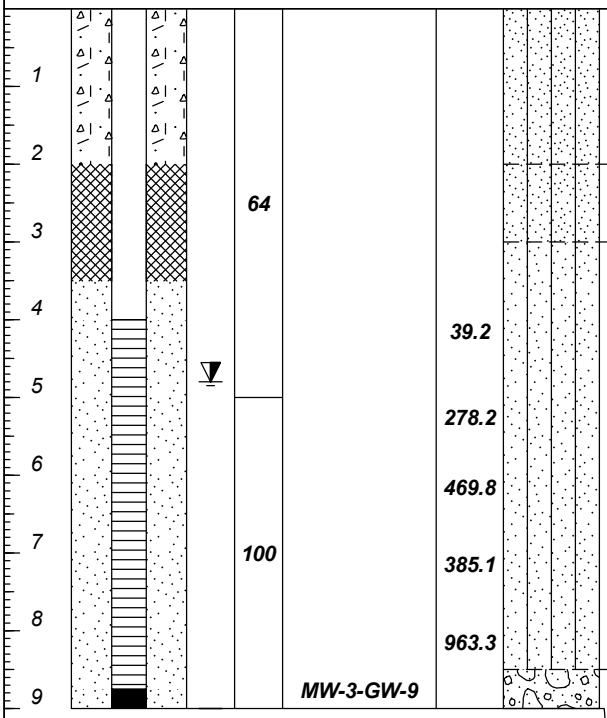
▽ Water level at approximately 10.2 feet bgs following drilling on 2/28/2023. ▼ Depth to water was 8.60 feet btoc at 10:30 on 03/01/2023 prior to sampling. ▼ Depth to water was 5.9 feet bgs at 9:20 on 03/27/2023 prior to re-sampling.

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Well Number	Sheet
M0553.10.002	**MW-3**	**1 of 1**

Project Name	**Les Schwab Tire Center**	TOC Elevation (feet)	
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**477.9**
Start/End Date	**2/28/2023 to 2/28/2023**	Northing	**876816.2**
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	**4269258.7**
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**9.0-feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**3.25-inch**



Soil Description

0 to 2.0 feet: SILTY SAND (SM); gray; 25% fines; 75 sand, fine to coarse, subangular to subrounded; medium dense; moist; abundant rootlets.

2.0 to 3.0 feet: SILTY SAND WITH GRAVEL (SM); gray; 25% fines; 50% sand, fine to coarse, subangular to subrounded; 25% gravel, fine to coarse, subrounded; medium dense to dense; petroleum hydrocarbon-like odor; moist.

3.0 to 8.5 feet: SANDY SILT (ML); gray; 50% fines, low plasticity; 50% sand, fine to coarse, subangular to subrounded; soft; petroleum hydrocarbon-like odor; moist.

@ 8.0 feet: Becomes firm.

8.5 to 9.0 feet: POORLY GRADED GRAVEL WITH SAND (GP); gray; 30% sand, medium to coarse, subangular to subrounded; 70% gravel, medium to coarse, subrounded; very dense; dry.

@ 9.0 feet: Refusal.

Total Depth = 9.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. btoc = below top of casing. 4. ID = identification. 5. PID = photoionization detector. 6. ppm = parts per million.

Borehole Completion Details

0 to 9.0 feet bgs: 3.25-inch borehole.
0 to 2.0 feet bgs: Concrete.
2.0 to 3.5 feet bgs: Bentonite chips hydrated with potable water.
3.5 to 9.0 feet bgs: 12x20 Colorado silica sand filter pack.

Monitoring Well Completion Details

Oregon Water Resources Department Well No. L149366
Traffic grade, flush-mounted monitoring well monument.
0 to 4.0 feet bgs: 2-inch-diameter, schedule 40, PVC blank riser pipe.
4.0 to 9.0 feet bgs: 2-inch-diameter, schedule 40, 0.010-inch machine slot PVC well screen (Colorado silica sand) with 2-inch-diameter PVC end cap.

Well was dry at time of drilling on 2/28/2023. Well was dry at 8:45 on 03/01/2023. ▼ Depth to water was 4.8 feet bgs at 9:30 on 03/27/2023 prior to re-sampling.

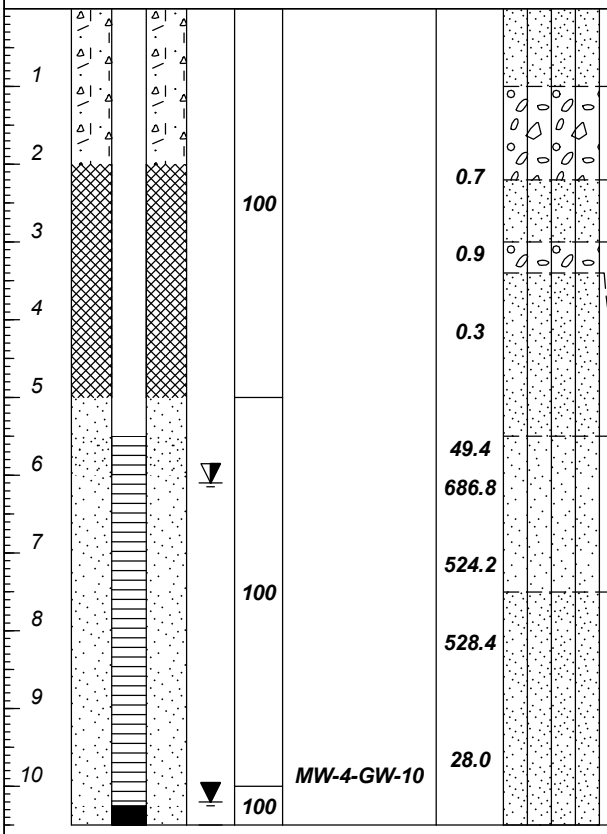
MFA BOREHOLE W/WELL W:\GINT\GINTWPROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 4/21/23

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Well Number	Sheet
M0553.10.002	**MW-4**	**1 of 1**

Project Name	**Les Schwab Tire Center**	TOC Elevation (feet)	
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**478.5**
Start/End Date	**2/28/2023 to 2/28/2023**	Northing	**876811.4**
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	**4269258.7**
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**10.5-feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**3.25-inch**



Soil Description
0.0 to 1.0 feet: SILTY SAND (SM); brownish red; 20% fines, low plasticity; 80% sand, fine to coarse, subangular to subrounded; loose; moist.
1.0 to 2.2 feet: SILTY GRAVEL WITH SAND (GM); brown; 25% fines, low plasticity; 35% sand, fine to coarse, subangular to subrounded; 40% gravel, fine to coarse, angular to subrounded; dense; moist.
2.2 to 3.0 feet: SILTY SAND (SM); brown; 40% fines, low plasticity; 60% sand, fine to medium; dense; moist.
3.0 to 3.4 feet: SILTY GRAVEL WITH SAND (GM); brown; 30% fines, low plasticity; 30% sand, fine to coarse, subangular to subrounded; 40% gravel, fine to coarse; very dense; moist.
3.4 to 5.5 feet: SILTY SAND (SM); brown; 30% fines, low plasticity; 70% sand, fine to medium, subangular to subrounded; medium dense; moist.
5.5 to 7.5 feet: SANDY SILT (ML); gray; 60% fines, low plasticity; 40% sand, fine to medium; soft; petroleum hydrocarbon-like staining; strong petroleum hydrocarbon-like odor; wet.
7.5 to 10.5 feet: SILTY SAND (SM); reddish brown; 30% fines, low plasticity; 70% sand, fine to medium, subangular to subrounded; medium dense; moist.
@ 10.5 feet: Refusal.

Total Depth = 10.5 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. btoc = below top of casing. 4. ID = identification. 5. PID = photoionization detector. 6. ppm = parts per million.

Borehole Completion Details
0 to 10.5 feet bgs: 3.25-inch borehole.
0 to 2.0 feet bgs: Concrete.
2.0 to 5.0 feet bgs: Bentonite chips hydrated with potable water.
5.0 to 10.5 feet bgs: 12x20 Colorado silica sand filter pack.

Monitoring Well Completion Details
Oregon Water Resources Department Well No. L149367
Traffic grade, flush-mounted monitoring well monument.
0 to 5.5 feet bgs: 2-inch-diameter, schedule 40, PVC blank riser pipe.
5.5 to 10.5 feet bgs: 2-inch-diameter, schedule 40, 0.010-inch machine slot PVC well screen (Colorado silica sand) with 2-inch-diameter PVC end cap.

Well was dry at time of drilling on 2/28/2023. ▼ Depth to water was 10.2 feet btoc at 10:30 on 03/01/2023 prior to sampling. ▼ Depth to water was 6.1 feet bgs at 9:36 on 03/27/2023 prior to re-sampling.

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B1**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**20.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							@ 0.0 to 0.5 feet: ASPHALT; black.
2					0.0		0.5 to 1.1 feet: SILTY SANDY GRAVEL (GM); brownish gray; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist.
3		100					1.1 to 1.4 feet: SANDY GRAVEL (GW); light gray; 5% fines; 20% sand, fine to coarse, subangular to subrounded; 75% gravel, fine to coarse, angular to subrounded; medium dense to dense; dry.
4							1.4 to 6.0 feet: SANDY SILT (ML); reddish brown; 60% fines, low plasticity; 40% sand, fine; soft; black staining from 1.4 to 1.8 feet; slight petroleum hydrocarbon-like odor at 1.4 feet.; moist.
5					0.0		
6					0.0		6.0 to 7.7 feet: SILTY SAND (SM); reddish brown; 40% fines, low plasticity; 60% sand, fine; loose; moist.
7							
8		100					7.7 to 12.0 feet: SILTY SAND (SM); gray; 20% fines, low plasticity; 80% sand, fine; loose; moist.
9					0.0		
10							
11	▼			B1-SS-11.0	0.0		
12							@ 12.0 to 12.4 feet: Layer of gravel, angular to subangular, loose.
13		100			0.0		@ 12.4 to 14.0 feet: Same as above from 7.7 to 12.0 feet.
14	▽						
15				B1-GW-15.0			14.0 to 20.0 feet: SANDY GRAVELLY SILT (ML); light greenish gray; 60% fines, nonplastic; 20% sand, fine; 20% gravel, fine to medium, subangular to subrounded; soft; wet (saturated).
16							
17							
18		100					
19							
20							

Total Depth = 20.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 20.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
10.0 to 20.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 14.0 feet bgs as observed in the core sample. ▼ Water measured at 11.5 feet bgs prior to sampling.

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B2**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Screen Int.	Sample ID	PID (ppm)	Lithologic Column	Soil Description
1							@ 0.0 to 0.5 feet: ASPHALT; blackish brown.
2							0.5 to 2.0 feet: SILTY SANDY GRAVEL (GM); gray; 20% fines; 20% sand, fine to coarse; 60% gravel, fine to coarse, subangular to subrounded; medium dense to dense; dry; (CONCRETE AND ROAD BASE).
3		**100**					2.0 to 5.0 feet: SANDY SILT (ML); gray; 50% fines, low plasticity; 50% sand, fine; firm; petroleum hydrocarbon-like odor; dry.
4					**16**		
5							
6					**118**		5.0 to 8.0 feet: SILTY SAND (SM); gray; 40% fines, low plasticity; 60% sand, fine to medium, subangular; loose to medium dense; moist.
7							
8		**100**					
9				**B2-SS-8.0**	**477**		8.0 to 9.5 feet: SANDY SILT (ML); gray; 60% fines, low plasticity; 40% sand, fine; soft; moist.
10							9.5 to 13.0 feet: SILTY SAND (SM); gray; 40% fines, low plasticity; 60% sand, fine to medium, subangular to subrounded; loose; petroleum hydrocarbon-like odor; moist to wet.
11					**81**		
12							
13	▽	**100**					13.0 to 15.0 feet: SILTY GRAVELLY SAND (SM); gray; 20% fines; 60% sand, fine to medium, subangular to angular; 20% gravel, fine to medium, subangular to angular; loose; wet.
14							
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ *Soil becomes wet at 13.0 feet bgs as observed in the core sample.*

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B3**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1–5		0					0.0 to 5.0 feet: NO RECOVERY.
5–7							5.0 to 7.0 feet: SILTY SAND (SM); gray; 20% fines; 80% sand, fine; loose; petroleum hydrocarbon-like odor; moist.
7–8	▽	100		B3-SS-8.0	81		7.0 to 7.2 feet: SILTY GRAVELLY SAND (SM); gray; 25% fines; 50% sand, angular to subangular, fine to coarse; 25% gravel, fine to medium, subangular to subrounded; dense; moist.
8–10					229		7.2 to 12.0 feet: SANDY SILT (ML); gray; 60% fines, low plasticity; 40% sand, fine; soft; petroleum hydrocarbon-like odor; moist.
10–12					98		
12–13		100					12.0 to 12.6 feet: SILTY SANDY GRAVEL (GM); brownish gray; 30% fines; 30% sand, fine to medium, subangular to subrounded; 40% gravel, fine to coarse, subangular to subrounded; medium dense; moist.
13–15					2		12.6 to 15.0 feet: SILTY SAND WITH GRAVEL (SM); gray; 40% fines, low plasticity; 45% sand, fine to coarse, subangular to subrounded; 15% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist.

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ *Soil becomes wet at 8.0 feet bgs as observed in the core sample.*

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Boring Number	Sheet
M0553.10.002	**B4**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**20.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Rootlets; loose.
2							0.2 to 1.2 feet: SILTY GRAVELLY SAND (SM); brownish gray; 30% fines, low plasticity; 40% sand, fine to coarse, subangular to subrounded; 30% gravel, fine, subrounded; medium dense; dry.
3		**70**			**0**		1.2 to 3.5 feet: SILTY SAND (SM); grayish brown; 20% fines; 80% sand, fine; dense; organic material (grass rootlets); dry.
4							3.5 to 5.0 feet: NO RECOVERY.
5					**0**		
6							@ 5.0 to 6.0 feet: Same as above from 1.2 to 3.5 feet.
7					**63**		6.0 to 11.4 feet: SILTY SAND (SM); gray; 20% fines; 80% sand, fine; loose; petroleum hydrocarbon-like odor; moist.
8		**100**					
9				**B4-SS-8.5**	**>999**		
10							
11	▼			**B4-GW-10.5**			
12					**22**		11.4 to 12.6 feet: SILTY SANDY GRAVEL (GM); light gray; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, subangular; medium dense; dry.
13	▽	**76**					12.6 to 13.8 feet: SILTY GRAVELLY SAND (SM); dark reddish brown; 30% fines, low plasticity; 40% sand, fine to medium, subangular to subrounded; 30% gravel, fine to medium, subangular to subrounded; medium dense to dense; wet.
14							13.8 to 15.0 feet: NO RECOVERY.
15							15.0 to 20.0 feet: GRAVELLY SAND WITH SILT (SP-SM); gray; 10% fines; 60% sand, fine to medium; 30% gravel, fine to coarse, subangular to subrounded; loose; wet (saturated).
16							
17							
18		**100**					
19							
20							

Total Depth = 20.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 20.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
10.0 to 20.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 12.6 feet bgs as observed in the core sample. ▼ Water measured at 10.5 feet bgs prior to sampling.

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Boring Number	Sheet
M0553.10.002	**B5**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**20.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							@ 0.0 to 0.1 feet: Roots; loose.
2							0.1 to 1.0 feet: SILTY SAND (SM); brown; 20% fines; 80% sand, fine; loose; organics (rootlets) throughout; moist.
3		100			11		1.0 to 1.8 feet: SILTY SANDY GRAVEL (GM); light gray; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, angular to subangular; medium dense; dry.
4							1.8 to 6.0 feet: SILT WITH SAND (ML); brown; 80% fines; 20% sand; firm; moist.
5					41		
6							
7					124		6.0 to 13.5 feet: SILTY SAND (SM); brown; 40% fines, low plasticity; 60% sand, fine; loose; moist.
8		100					
9				B5-SS-8.5	13		
10							
11	▼			B5-GW-10.8			
12							
13	▽	100					
14							13.5 to 20.0 feet: GRAVELLY SAND WITH SILT (SW-SM); dark gray and reddish brown; 15% fines; 60% sand, fine to coarse, subangular to subrounded; 25% gravel, fine to medium, subangular to subrounded; loose; wet (saturated).
15							
16							
17							
18		100					
19							
20							

Total Depth = 20.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 20.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
10.0 to 20.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 13.5 feet bgs as observed in the core sample. ▼ Water measured at 10.8 feet bgs prior to sampling.

MFA BOREHOLE W/RECON SCREEN W:\GINT\GINTW\PROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 11/12/24

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B6**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.5 feet: SANDY SILTY GRAVEL (GM); dark gray; 25% fines; 30% sand, fine to coarse, subangular to subrounded; 45% gravel, fine to medium, subangular; loose to medium dense; moist.
2							0.5 to 5.0 feet: SILT WITH SAND (ML); brownish gray; 70% fines, low plasticity; 30% sand, fine; firm; moist.
3		**100**			**0**		@ 1.7 feet: Color changes gradually to reddish brown.
4					**0**		
5							
6					**0**		5.0 to 7.0 feet: SILTY SAND (SM); gray; 20% fines; 80% sand, fine; loose; moist.
7							
8		**54**			**0**		7.0 to 7.7 feet: SANDY SILTY GRAVEL (GM); gray and reddish brown; 20% fines; 30% sand, fine to coarse, subangular to subrounded; 50% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist.
9				**B6-SS-9.0**			7.7 to 10.0 feet: NO RECOVERY.
10							
11	▽						@ 10.0 to 11.0 feet: Same as above from 7.0 to 7.7 feet.
12	▼						11.0 to 15.0 feet: GRAVELLY SAND WITH SILT (SW-SM); grayish brown; 10% fines; 70% sand, fine to coarse, subangular to subrounded; 20% gravel, fine to medium, subangular to subrounded; loose; wet (saturated).
13		**100**					
14				**B6-GW-13.75**			
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ *Soil becomes wet at 11.0 feet bgs as observed in the core sample.* ▼ *Water measured at 11.5 feet bgs prior to sampling.*

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B7**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**10/25/2022 to 10/25/2022**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							@ 0.0 to 0.2 feet: ASPHALT; black.
							0.2 to 1.5 feet: GRAVELLY SAND WITH SILT (SP-SM); brownish gray; 10% fines; 55% sand; 35% gravel; medium dense to dense.
2							
3		68			34		1.5 to 3.4 feet: SANDY SILT (ML); brownish gray; 60% fines, low plasticity; 40% sand, fine; stiff; moist.
4							3.4 to 5.0 feet: NO RECOVERY.
5	▽				44		
6					352		@ 5.0 to 8.5 feet: Same as above from 1.5 to 3.4 feet; soft and saturated from 5.0 to 6.0 feet.
7							
8		70		B7-SS-8.0	742		
9	▼						8.5 to 10.0 feet: NO RECOVERY.
10							
11					214		10.0 to 15.0 feet: SAND WITH SILT AND GRAVEL (SW-SM); 15% fines; 70% sand, fine to coarse, subangular to subrounded; 15% gravel, fine to medium, subangular to subrounded; loose; wet (saturated).
12							
13		100		B7-GW-12.0			
14							
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 5.0 feet bgs as observed in the core sample. ▼ Water measured at 8.5 feet bgs prior to sampling.

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B8**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1					5.1		0.0 to 0.9 feet: Bark and soil from landscaping.
2							0.9 to 1.3 feet: WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM); gray; 10% fines; 40% sand; 50% gravel, fine to coarse; medium dense; dry to moist; (FILL).
3		26					1.3 to 5.0 feet: NO RECOVERY.
4							
5							
6					11.7		5.0 to 9.0 feet: SILT (ML); gray; 90% fines, low plasticity; 10% sand; trace gravel, coarse, subangular; stiff; increasing petroleum hydrocarbon-like odor with depth.
7					16.7		
8	▼	80			95.6		
9				B-8-S-9.0			9.0 to 10.0 feet: NO RECOVERY.
10							
11	▽						10.0 to 10.8 feet: SILT (ML); gray; 90% fines; 10% sand; trace gravel, coarse, subangular; stiff; increasing petroleum hydrocarbon-like odor with depth.
12							10.8 to 13.0 feet: POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM); gray; 15% fines; 40% sand; 45% gravel, fine to medium, subangular to subrounded; loose; slight petroleum hydrocarbon-like odor; wet (saturated).
13		100		B-8-GW-12.5	156.2		
14							13.0 to 13.1 feet: POORLY GRADED GRAVEL (GP); 5% sand; 95% gravel; dense; faint petroleum hydrocarbon-like odor; wet.
15							13.1 to 15.0 feet: WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM); gray; 15% fines; 40% sand; 45% gravel, fine to coarse, subangular to subrounded; medium dense; slight hydrocarbon-like odor; moist.

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 10.8 feet bgs as observed in core sample. ▼ Water measured at 8.5 feet bgs prior to sampling.

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B9**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Lithologic Column	Soil Description
1						0.0 to 0.2 feet: Asphalt.
2						0.2 to 1.7 feet: GRAVELLY SILTY SAND (SM); gray; 20% fines; 50% sand; 30% gravel, fine to medium, subangular to subrounded; loose; dry; (FILL).
3		**50**				1.7 to 2.5 feet: SILT (ML); light gray; 90% fines, low plasticity; 10% sand; stiff; moist.
4						2.5 to 5.0 feet: NO RECOVERY.
5						
6						5.0 to 7.3 feet: SILT (ML); light gray; 90% fines, low plasticity; 10% sand; stiff; moist.
7						7.0 to 7.3 feet: Reddish brown flakes present.
8		**46**				7.3 to 10.0 feet: NO RECOVERY.
9						
10						10.0 to 10.8 feet: SILT (ML); light gray; 90% fines, low plasticity; 10% sand; stiff; moist.
11	▽					10.8 to 11.9 feet: SANDY SILTY GRAVEL (GM); light gray; 20% fines; 30% sand, fine; 50% gravel, medium to coarse, subrounded; loose; petroleum hydrocarbon-like odor; wet.
12				**B-9-S-11.5**		11.9 to 12.7 feet: GRAVELLY SILTY SAND (SM); brown to red; 20% fines; 40% sand; 40% gravel, fine to medium; medium dense; moist.
13		**54**				12.7 to 15.0 feet: NO RECOVERY.
14						
15						

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 10.8 feet bgs as observed in the core sample.

MFA BOREHOLE W/RECON SCREEN W:\GINT\GINTW\PROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 11/23/24

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B10**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Asphalt; black.
2							0.2 to 1.3 feet: SILTY SANDY GRAVEL (GM); brownish gray; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist.
3		**58**			**8.3**		1.3 to 2.9 feet: SILT (ML); gray; 90% fines, nonplastic; 10% sand; stiff; dry.
4							2.1 to 2.9 feet: Wood debris present; organic-like odor.
5							2.9 to 5.0 feet: NO RECOVERY.
6							5.0 to 10.3 feet: SILT (ML); gray; 90% fines, nonplastic; 10% sand; stiff; dry.
7					**7.8**		
8		**100**			**15.0**		
9							
10							
11				**B-10-S-14.0**	**6.0**		10.3 to 12.0 feet: SANDY GRAVEL WITH SILT (GW-GM); brown to gray; 15% fines; 35% sand; 50% gravel, fine to coarse, subangular to subrounded; medium dense; trace orange coloring; petroleum hydrocarbon-like odor; moist.
12	▽				**201.1**		
13		**62**					12.0 to 13.1 feet: SILTY SANDY GRAVEL (GM); brown to gray; 30% fines; 30% sand; 40% gravel, fine to coarse, subangular to angular; loose; no odor; wet.
14							13.1 to 15.0 feet: NO RECOVERY.
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 12.0 feet bgs as observed in the core sample.

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Boring Number	Sheet
M0553.10.002	**B11**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Asphalt; black.
2							0.2 to 1.4 feet: SILTY SANDY GRAVEL (GM); brownish gray; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist; (FILL).
3		**48**			**7.5**		1.4 to 2.4 feet: SILT (ML); gray; 90% fines; 10% sand; stiff; moist.
4							2.4 to 5.0 feet: NO RECOVERY.
5							
6					**8.8**		5.0 to 8.8 feet: SILT (ML); brown; 90% fines: 10% sand; soft; moist.
7	▼	**76**					
8					**12.3**		@ 7.5 feet: Becomes gray; stiff; petroleum hydrocarbon-like odor.
9					**190.4**		@ 8.0 feet: Becomes brown; soft; strong petroleum hydrocarbon-like odor.
10							8.8 to 10.0 feet: NO RECOVERY.
11					**64.8**		10.0 to 12.0 feet: SILT (ML); brown; 90% fines; 10% sand; soft; petroleum hydrocarbon-like odor; moist.
12	▽	**40**		**B-11-S-13.0**			@ 11.5 feet: Becomes wet.
13							12.0 to 15.0 feet: NO RECOVERY.
14							
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ *Soil becomes wet at 11.5 feet bgs as observed in the core sample.* ▼ *Water measured at 7.09 feet following drilling.*

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Boring Number	Sheet
M0553.10.002	**B12**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**20.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.4 feet: SILTY SAND (SM); dark brown; 40% fines; 60% sand; loose; (TOPSOIL).
2							0.4 to 1.8 feet: SILTY GRAVELLY SAND (SM); gray; 30% fines; 40% sand; 30% gravel, fine to coarse, subangular to subrounded; medium dense; dry; (FILL).
3		36			13.7		1.8 to 5.0 feet: NO RECOVERY.
4							
5							
6							5.0 to 6.8 feet: SILTY GRAVELLY SAND (SM); gray; 30% fines; 40% sand; 30% gravel, fine to coarse, subangular to subrounded; medium dense; faint petroleum hydrocarbon-like odor; dry; (FILL).
7					7.4		
8		60					6.8 to 8.0 feet: SANDY SILTY GRAVEL (GM); brownish gray; 25% fines; 35% sand; 40% gravel, fine to coarse, subangular to angular; medium dense; faint petroleum hydrocarbon-like odor; moist.
9	▼						8.0 to 10.0 feet: NO RECOVERY.
10					8.0		
11				B-12-S-10.5			10.0 to 11.0 feet: SANDY SILTY GRAVEL (GM); brownish gray; 25% fines; 35% sand; 40% gravel, fine to coarse, subangular to angular; medium dense; faint petroleum hydrocarbon-like odor; moist.
12					10.4		11.0 to 13.0 feet: SILTY SANDY GRAVEL (GM); gray; 30% fines; 30% sand; 40% gravel, fine to coarse, subangular; medium dense; faint petroleum hydrocarbon-like odor; moist.
13		60					
14							13.0 to 15.0 feet: NO RECOVERY.
15	▽				9.9		
16							15.0 to 20.0 feet: SANDY GRAVEL (GP); gray; 20% sand; 80% gravel, subrounded; medium dense; faint petroleum hydrocarbon-like odor; wet.
17							
18		100		B-12-GW-17.5			
19							
20							

Total Depth = 20.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 20.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
10.0 to 20.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 15.0 feet bgs as observed in the core sample. ▼ Water measured at 8.95 feet following drilling.

MFA BOREHOLE W/RECON SCREEN W:\GINT\GINTW\PROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 11/12/24

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B13**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**20.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Asphalt.
2					14.8		0.2 to 0.5 feet: SILTY SANDY GRAVEL (GM); brownish gray; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist; (FILL).
3		100			7.9		0.5 to 11.7 feet: SILT (ML); gray; 90% fines; 10% sand; trace gravel, fine, subrounded; stiff; dry to moist.
4					11.8		
5							
6					12.0		@ 5.7 feet: Becomes brown; loose.
7							
8		100					
9	▼						@ 8.2 feet: Becomes gray; soft; petroleum hydrocarbon-like odor; moist; brown staining at upper contact.
10				B-13-S-10.0	274.8		@ 10.0 feet: Becomes brown; loose; no petroleum hydrocarbon-like odor.
11							
12	▽				72.2		11.7 to 14.2 feet: SILTY GRAVELLY SAND (SM); brownish gray; 40% fines; 40% sand; 20% gravel, fine, angular to subrounded; wet.
13		84					
14							
15							14.2 to 15.0 feet: NO RECOVERY.
16							15.0 to 20.0 feet: SILTY GRAVELLY SAND (SM); brownish gray; 40% fines; 40% sand; 20% gravel, fine to medium, subangular to subrounded, wet.
17							
18		100		B-13-GW-17.5			
19							
20							

Total Depth = 20.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 20.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
10.0 to 20.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 11.7 feet bgs as observed in the core sample. ▼ Water measured at 8.95 feet following drilling.

Geologic Borehole Log

MAUL FOSTER ALONGI

Project Number	Boring Number	Sheet
M0553.10.002	**B14**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**6/22/2023 to 6/22/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**20.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Asphalt; black.
2							0.2 to 2.0 feet: SILTY SANDY GRAVEL (GM); brown; 20% fines; 20% sand, fine to coarse, subangular to subrounded; 60% gravel, fine to medium, subangular to subrounded; medium dense to dense; moist; (FILL).
3		**40**					2.0 to 5.0 feet: NO RECOVERY.
4							
5							
6					**14.7**		5.0 to 7.0 feet: SILT WITH SAND AND GRAVEL (ML); gray to brown; 80% fines; 10% sand; 10% gravel, fine to medium; stiff.
7							
8		**100**					7.0 to 8.0 feet: GRAVELLY SILT (ML); dark gray to black; 60% fines; 10% sand; 30% gravel.
9	▼			**B-14-S-8.0**	**427.9**		8.0 to 11.8 feet: Same as above from 5.0 to 7.0 feet.
10							
11					**258.5**		
12							
13		**70**					11.8 to 13.5 feet: SANDY SILTY GRAVEL (GM); dark gray; 25% fines; 35% sand; 40% gravel, fine to coarse, subangular; dense; slight petroleum hydrocarbon-like odor; moist.
14					**20.4**		13.5 to 15.0 feet: NO RECOVERY.
15	▽						
16							15.0 to 20.0 feet: SILTY GRAVEL WITH SAND (GM); gray to brown; 25% fines; 30% sand; 45% gravel, fine to coarse; loose; wet.
17							
18		**100**		**B-14-GW-17.5**			
19							
20							

Total Depth = 20.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 20.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
10.0 to 20.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

▽ *Soil becomes wet at 15.0 feet bgs as observed in the core sample.* ▼ *Water measured at 9.29 feet following drilling.*

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B15**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**12/6/2023 to 12/6/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.8 feet: GRAVELLY SILTY SAND (SM); brownish gray; 20% fines; 40% sand, fine to coarse, subangular; 40% gravel, fine to medium, subangular to subrounded; medium dense; moist.
2					**0.5**		0.8 to 2.8 feet: SANDY SILT (ML); gray; 50% fines, low plasticity; 50% sand, fine to medium; stiff to very stiff; moist.
3		**80**					
4					**1.3**		2.8 to 4.0 feet: SANDY SILT (ML); orange and brown; 60% fines, low plasticity; 40% sand, fine; trace gravel; medium dense; moist.
5							@ 3.8 feet: Becomes gray. 4.0 to 5.0 feet: NO RECOVERY.
6					**50.4**		5.0 to 9.5 feet: SANDY SILT (ML); gray; 40% fines, low plasticity; 60% sand, fine; petroleum hydrocarbon-like odor; sheen; soft; moist.
7					**113.3**		
8	▽	**100**		**B15-S-7.5**			@ 7.5 feet: Becomes wet.
9							
10					**34.4**		9.5 to 15.0 feet: GRAVELLY SILTY SAND (SM); gray; 15% fines; 55% sand, fine to coarse; 30% gravel, fine to medium, subangular to subrounded; medium dense; wet.
11							
12							
13		**100**					
14				**B15-GW-14.0**			
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ *Soil becomes wet at 7.5 feet bgs as observed in the core sample.*

MFA BOREHOLE W/RECON SCREEN W:\GINT\GINTW\PROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 11/12/24

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B16**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**12/6/2023 to 12/6/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1					0.2		0.0 to 0.6 feet: WELL-GRADED GRAVEL WITH SAND (GW): grayish brown; 60% sand, fine to coarse, angular to subangular; 40% gravel, fine to medium, subangular to angular; medium dense; dry to moist.
2							0.6 to 9.0 feet: SANDY SILT (ML); 50% fines, low plasticity; 50% sand, fine to medium; stiff to very stiff; moist.
3		100			0.2		@ 2.4 feet: Becomes grayish brown; 60% fines, low plasticity; 40% sand, fine to medium; soft; moist.
4							
5					0.2		
6							
7							
8		100					
9	▽			B16-S-8.0	0.2		9.0 to 15.0 feet: GRAVELLY SILTY SAND (SM); grayish brown with multicolored gravel; 15% fines; 55% sand, medium to coarse, subangular; 30% gravel, medium to coarse, subrounded to angular; medium dense; wet.
10							
11							
12		100		B16-GW-12.0			
13							
14							
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 8.5 feet bgs as observed in the core sample.

MFA BOREHOLE W/RECON SCREEN W:\GINT\GINTW\PROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 11/12/24

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B17**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**12/6/2023 to 12/6/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1					0.3		0.0 to 0.2 feet: Asphalt.
2							0.2 to 2.4 feet: SANDY GRAVEL (SW); brown; 50% sand, fine to coarse; 50% gravel, fine to medium, subangular; medium dense; moist.
3		64					2.4 to 3.2 feet: SANDY SILT (ML); brown; 50% fines, low plasticity; 50% sand, fine to medium; trace gravel; stiff to very stiff; moist.
4					0.3		3.2 to 5.0 feet: NO RECOVERY.
5							
6					0.4		5.0 to 10. feet: SANDY SILT (ML); orange brown; 60% fines, low plasticity; 40% sand, fine to medium; soft; moist.
7							
8		100		B17-S-7.5	0.3		
9	▽						@ 9.0 feet: Becomes wet.
10							10.0 to 15.0 feet: SANDY GRAVEL WITH SILT (GW-GM); gray with multicolored gravel; 10% fines; 40% sand, medium to coarse, subrounded; 50% gravel, fine to coarse, subangular to subrounded; medium dense; wet.
11							
12							
13		100		B17-GW-13.0			
14							
15							

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 9.0 feet bgs as observed in the core sample.

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B18**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**12/6/2023 to 12/6/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Percent Recovery	Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Asphalt.
2					0.0		0.2 to 1.7 feet: SANDY GRAVEL WITH SILT (GW-GM); brownish gray; 10% fines; 40% sand, fine to medium; 50% gravel, fine to medium, subangular to angular; medium dense; moist.
3		100					1.7 to 3.2 feet: SANDY SILT (ML); orange brown; 50% fines, low plasticity; 50% sand, fine to medium; stiff to very stiff; moist.
4					0.0		3.2 to 5.0 feet: NO RECOVERY.
5							
6					0.0		5.0 to 8.0 feet: SANDY SILT (ML); brown; 60% fines, low plasticity; 40% sand, fine to medium; soft; moist.
7							
8	▽	100		B18-S-8.0	0.0		8.0 to 14.0 feet: SANDY GRAVEL (SW); gray with multicolored gravel; 50% sand, medium to coarse; 50% gravel, fine to medium, angular to subrounded; medium dense; trace fines; wet.
9							
10							
11							
12		100					
13							@ 13.0 feet to 13.3 feet: Layer of 100% sand, medium to coarse.
14							14.0 to 15.0 feet: SAND (SP); gray; 100% sand, fine to medium; loose; wet.
15				B18-GW-14.5			

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 8.0 feet bgs as observed in the core sample.

MAUL FOSTER ALONGI

Geologic Borehole Log

Project Number	Boring Number	Sheet
M0553.10.002	**B19**	**1 of 1**

Project Name	**Les Schwab Tire Center**		
Project Location	**3294 Main Street, Springfield, Oregon**	Surface Elevation (feet)	**~480**
Start/End Date	**12/6/2023 to 12/6/2023**	Northing	
Driller/Equipment	**Holt Services, Inc./GeoProbe 7822DT**	Easting	
Geologist/Engineer	**S. Maloney**	Total Depth of Borehole	**15.0 feet**
Sample Method	**Core Barrel**	Outer Hole Diam	**2.25 inch**

Depth (feet, bgs)	Water Levels	Sample Data: Percent Recovery	Sample Data: Screen Int.	Sample Data: Sample ID	Sample Data: PID (ppm)	Lithologic Column	Soil Description
1							0.0 to 0.2 feet: Asphalt.
2					0.1		0.2 to 0.9 feet: POORLY GRADED SANDY GRAVEL (GP); gray; 20% sand, medium to coarse; 80% gravel, fine, subangular to subrounded; medium dense; moist.
3		60					@ 0.6 feet: Gravel becomes coarse.
4					0.4		0.9 to 3.0 feet: SILTY SAND (SM); brownish gray; 40% fines, low plasticity; 60% sand, fine to medium; stiff to very stiff; moist.
5							@ 2.0 feet: Color changes to brownish red.
6					3.8		3.0 to 5.0 feet: NO RECOVERY.
7					70.2		5.0 to 9.5 feet: SANDY SILT (ML); brown; 60% fines, low plasticity; 40% sand, fine; soft; moist.
8		100		B19-S-7.5	5.4		@ 6.0 feet: Color changes to gray; petroleum hydrocarbon-like odor and staining present.
9							@ 7.5 feet: Color changes back to brown; petroleum hydrocarbon-like odor decreases.
10	▽				5.4		9.5 to 15.0 feet: SILTY SAND WITH GRAVEL (SM); grayish brown with multicolored gravel; 10% fines; 60% sand, fine to coarse, subrounded; 30% gravel, fine to coarse, subangular to subrounded; medium dense; wet.
11							
12		100					
13							
14							
15				B19-GW-14.5			

Total Depth = 15.0 feet bgs

NOTES:

1. Depths are relative to feet below ground surface. 2. bgs = below ground surface. 3. ID = identification. 4. PID = photoionization detector. 5. ppm = parts per million.

Borehole Completion Details
0 to 15.0 feet bgs: 2.25-inch borehole.

Reconnaissance Well Completion Details
5.0 to 15.0 feet bgs: Temporary polyvinyl chloride slotted screen.

Borehole Abandonment Details
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

▽ Soil becomes wet at 9.5 feet bgs as observed in the core sample.

MFA BOREHOLE W/RECON SCREEN W:\GINT\GINTW\PROJECTS\0553.10.002\FIELD LOGS DIGITIZED.GPJ 11/12/24

Appendix B

GeoPotential Ground Penetrating Radar and Magnetometer Survey Report

MAUL FOSTER ALONGI

GeoPotential

ENVIRONMENTAL & EXPLORATION GEOPHYSICS

330 Creekside Terrace, Fairview, OR 97024 Phone: (503) 912-6441 Fax: (503) 912-6448
WEB http://www.geopotential.biz/ E-MAIL GeoPotential@geopotential.biz

SUMMARY REPORT

SUBSURFACE MAPPING SURVEY TO DETECT UNDERGROUND STORAGE TANKS

Les Schwab Tire Center
3294 Main Street
Springfield, Oregon

CLIENT

Maul Foster Alongi
103 E 13th Street
Vancouver, WA 98685

DATE OF SURVEY

August 3&4, 2023

GeoPotential Project Number: 1537

CONTENTS

FIGURES

APPENDICES

SUMMARY

A Subsurface Mapping Survey (SMS) was conducted over portions of an asphalt parking lot, soil covered lot, concrete sidewalks and landscaped areas for the Les Schwab Tire Center located at 3294 Main Street in Springfield, Oregon to search for possible Underground Storage Tanks (USTS) and UST backfilled pits (see Figures).

Magnetic Surveys, Ground Penetrating Radar (GPR) Surveys and hand held magnetic and electromagnetic scanners were used for the project.

Two backfilled excavations containing ferric material that may be related to USTS were detected in the area covered by the SMS.

INTRODUCTION

Ralph Soule & Tarek Zaher of GeoPotential conducted the Subsurface Mapping Survey. Sean Maloney was the representative for MFA. Fieldwork was conducted on August 3 & 4, 2023. The report was completed and e-mailed to MFA on August 7, 2023.

Subsurface mapping surveys are geophysical surveys utilizing geophysical methods and data to detect and locate natural and manmade subsurface features. Magnetic Surveys are used to detect and map the locations of buried **ferrous** (iron-bearing) objects (see Appendix A). Ground Penetrating Radar (GPR) Surveys are used to map both natural and manmade subsurface features such as USTs, utilities, backfilled pits, etc. (see Appendix B.). Pipe and cable locators are used to map the locations of buried utilities and piping.

Once subsurface ferrous objects are detected from a magnetic survey then hand held scanners and GPR surveys are used to map the locations, depths, sizes and shapes of the objects.

SURVEY OBJECTIVES

The objectives of this SMS survey were:

1. Search for USTS.
2. Search for backfilled UST Pits.

SURVEY SITE

The SMS Site consisted of asphalt covered parking areas, a soil covered lot, concrete sidewalks and landscaped areas. Three Les Schwab buildings occupied portions of the Site (see Figures). A tire Lot with a MFA reported diesel UST is located as shown on Figure 3. Historical information provided by MFA indicated former gas stations had occupied the Southeast corner of the Site. There were no surface indications of USTS.

SURVEY EQUIPMENT

The following geophysical instruments were used to conduct the survey:

- GEOMETRICS 858G Cesium Vapor Magnetometer (Magnetic Survey).
- Mala RAMAC Ground Penetrating Radar System with a 450 MHz antenna (GPR Survey).
- Schonstedt GA52 Magnetic Gradiometer.
- Aqua-Tronics A6 Pipe & Cable locator.
- Heath Sure Lock pipe & Cable locator.

This equipment and the procedures used to meet the survey objectives of this project have been proven effective in detecting metallic objects and mapping non-metallic features such as disturbed soil from backfilled pits.

Geophysical techniques are excellent at detecting changes in the subsurface caused by natural and manmade objects; however, they are poor at actually identifying subsurface features. Complementary methods may be used to assist in the interpretation; however, the only sure way of identifying a buried feature is by excavation.

Brief descriptions of the magnetic method and the radar method are included in the Appendices.

PROCEDURE

Magnetic Survey

The Magnetic Survey consisted of acquiring magnetic readings along traverses using a 5 foot spacing between traverses over the SMS Site. Buildings and the Tire Lot could not included in the SMS as they produce Magnetic interference. A rectangular grid was laid out over the area and magnetic data recorded along traverses. Magnetic data were downloaded to a computer, processed and contoured to produce the Magnetic Map shown in Figure 2. The Magnetic Map is plotted at a Contour Interval of 500 nT. This contour interval is sufficient to detect USTS.

In general buried ferriferous objects will produce stronger positive magnetic anomalies that are shown as red contours on the Magnetic Map. Surface ferric objects such as metal fences will in general produce low magnetic anomalies which are shown as blue contours on the Magnetic Maps. Two Magnetic Anomalies which may be caused by USTS are designated as M1 and M2 on Figures 2 & 3.

Ground Penetrating Radar Surveys

Over areas that contained suspect USTs GPR Profiles were acquired using a 450 MHz antenna. The data were processed and interpreted as discussed below. Where possible the GPR was also used to scan portions of the Tire Lot and the Southeast corner of the Site as shown on Figure 3 to search for USTS and UST Pits.

Pipe and Cable Survey

Hand held magnetic and electromagnetic scanners were used to help identify USTs and map utilities.

RESULTS

Results are shown on Figures 2 & 3. Results were marked on the Site with white marking paint.

No USTS were detected by the SMS.

M1 is interpreted to be caused by a 20X18 foot reinforced concrete slab. This slab may be the former location of a fuel island. No piping going to or from this slab was detected by the SMS indicating this was unlikely to be a fuel island.

M2 is interpreted to be caused by ferric debris in a 6 foot diameter backfilled excavation about 6 feet deep. This may be the former location of a small UST.

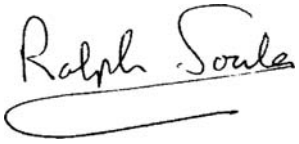
All other Magnetic Anomalies detected on the Site are interpreted to be caused by surface features or subsurface utilities.

The GPR Survey of a portion of the Tire Lot where the reported UST was located produced no indications of a UST or UST Pit in the area covered by the GPR Survey.

LIMITATIONS

Limitations of magnetometer and GPR surveys can be seen in the Appendices.

Geophysical surveys consist of interpreting geophysical responses from subsurface features. Since a variety of subsurface features can produce identical geophysical responses, it is necessary to confirm the geophysical interpretation with intrusive investigations such as excavating or drilling. In addition, many subsurface features may produce no geophysical response.

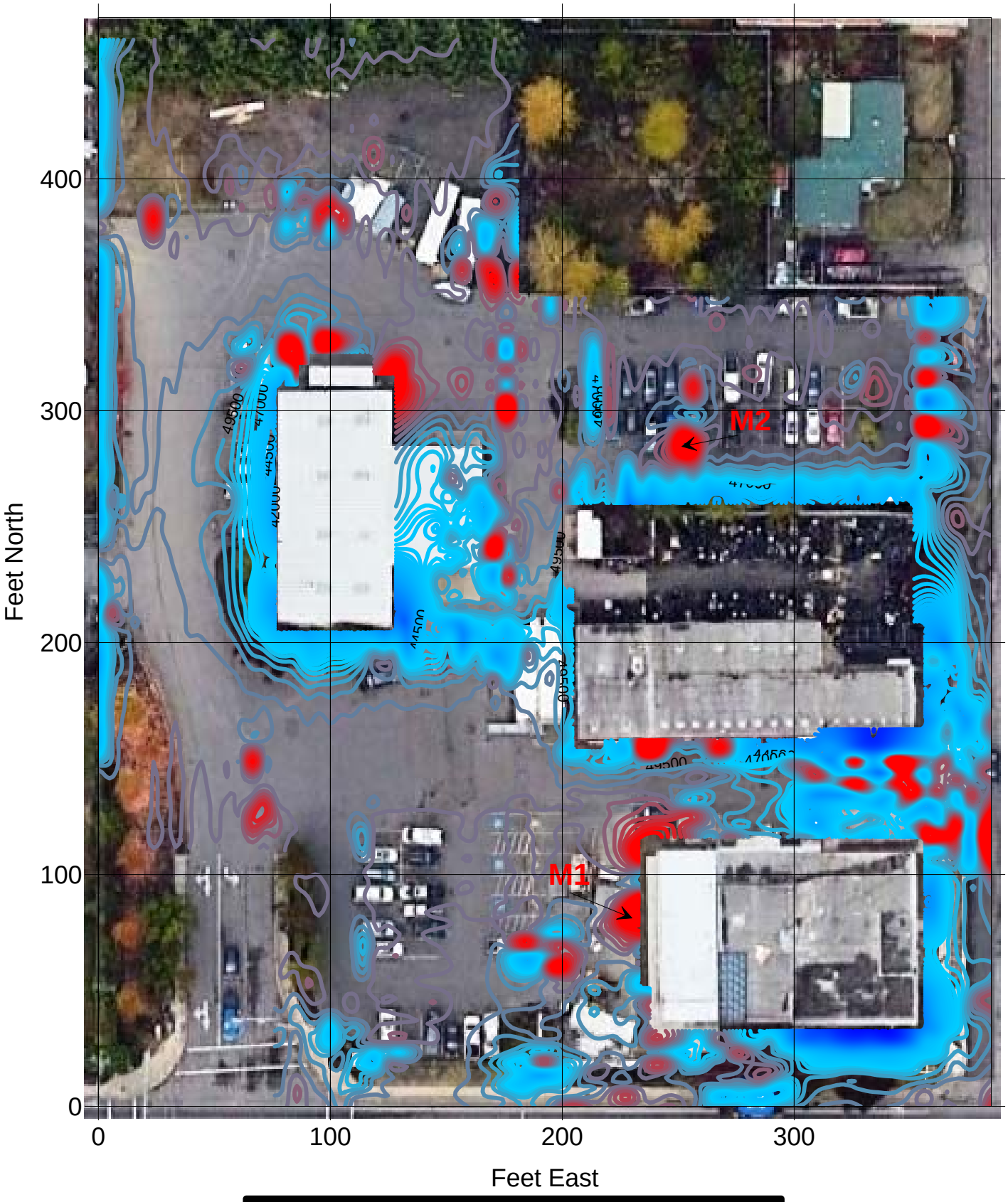


Ralph Soule **August 7, 2023**
GeoPotential

Subsurface Mapping Survey Boundary

Reported UST Location

GeoPotential — ENVIRONMENTAL & EXPLORATION GEOPHYSICS 330 Creekside Terrace, Fairview, OR 97024 Phone: (503) 912-6441 Fax: (503) 912-6448 WEB http://www.geopotential.biz/ E-MAIL GeoPotential@geopotential.biz	
DATE: 8/3,4/2023	***SUBSURFACE MAPPING SURVEY*** PROJECT No. 1537
LOCATION: Les Schwab Tire Center 3294 Main Street Springfield, Oregon	**Figure 1: Location Map**
CLIENT: MFA	



GeoPotential

ENVIRONMENTAL & EXPLORATION GEOPHYSICS

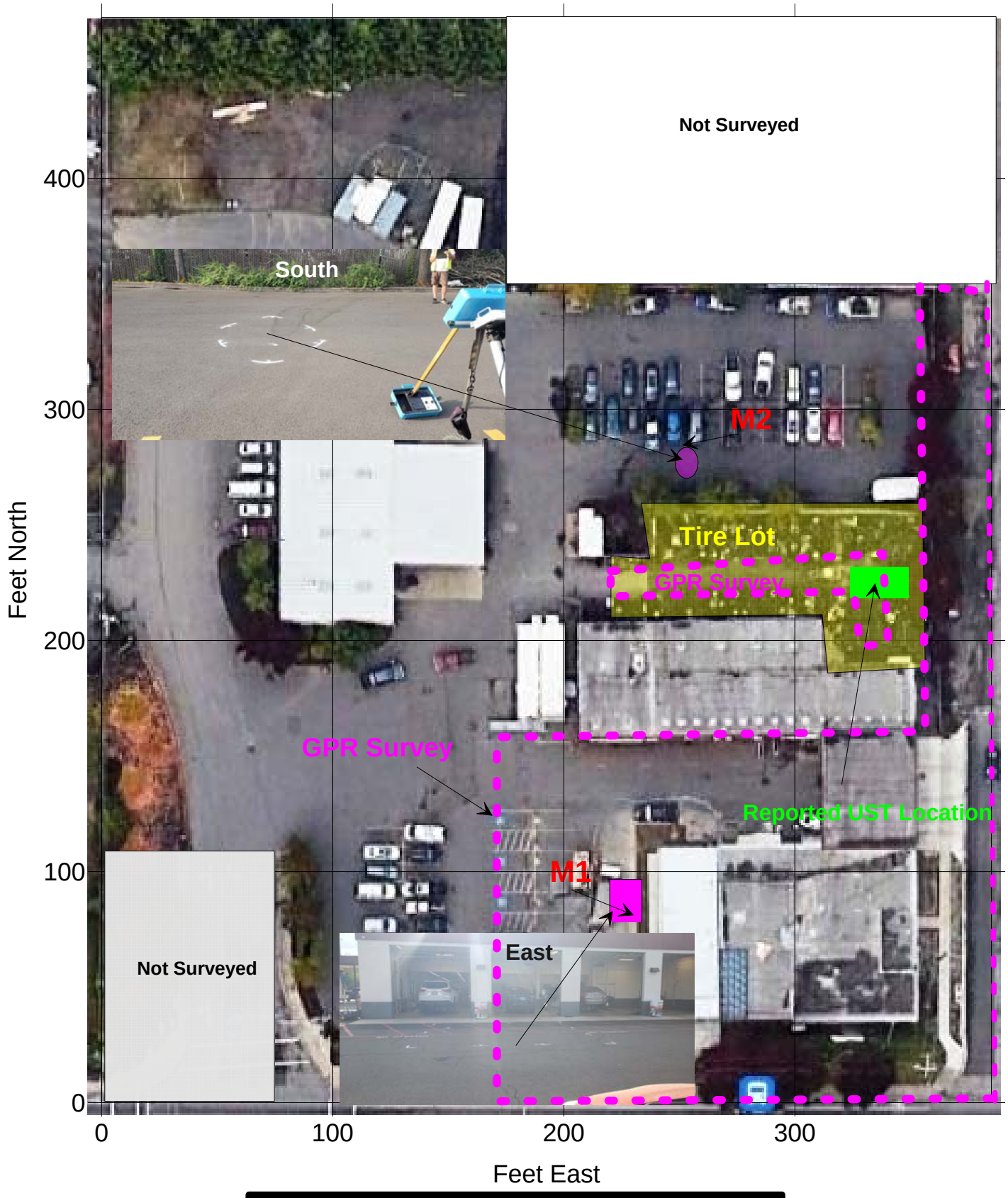
330 Creekside Terrace, Fairview, OR 97024 Phone: (503) 912-6441 Fax: (503) 912-6448
WEB http://www.geopotential.biz/ E-MAIL GeoPotential@geopotential.biz

DATE: 8/3,4/2023 **SUBSURFACE MAPPING SURVEY** PROJECT No. 1537

LOCATION:
Les Schwab Tire Center
3294 Main Street
Springfield, Oregon

CLIENT: MFA

Figure 2: Magnetic Map
(Contour Interval = 500 nT)



GeoPotential

ENVIRONMENTAL & EXPLORATION GEOPHYSICS

330 Creekside Terrace, Fairview, OR 97024 Phone: (503) 912-6441 Fax: (503) 912-6448
WEB http://www.geopotential.biz/ E-MAIL GeoPotential@geopotential.biz

DATE: 8/3,4/2023

SUBSURFACE MAPPING SURVEY

PROJECT No. 1537

LOCATION:
Les Schwab Tire Center
3294 Main Street
Springfield, Oregon

Figure 3: Interpretation Map

CLIENT: MFA

GeoPotential
ENVIRONMENTAL & EXPLORATION GEOPHYSICS
330 Creekside Terrace, Fairview, OR 97024 Phone: (503) 912-6441 Fax: (503) 912-6448
WEB http://www.geopotential.biz/ E-MAIL GeoPotential@geopotential.biz

APPENDIX A
MAGNETOMETER SURVEYS

The earth's magnetic field, measured in "nano Teslas" (nT), behaves like a bar magnet (a dipolar field), with the strongest magnetic field located at the poles, and the weakest field located near the equator. In the continental United States, the average field intensity varies widely, however, the average value is about 50,000 nT. Also, like the magnetic field around the bar magnet, the earth's magnetic field is inclined. This inclination in the continental United States varies between 60 and 75 degrees, generally depending upon the latitude of the measuring location. The earth's magnetic field varies constantly and, during sunspot activity, quite dramatically. A magnetometer is an electronic device that measures the intensity of the earth's magnetic field.

Naturally occurring geologic features and buried ferrous metal objects such as underground storage tanks, drums, ordnance, pipes and debris filled trenches produce both horizontal and vertical disturbances to the earth's local magnetic field. The objects causing these "anomalies" can be detected quickly and reliably using portable magnetometers.

The intensity of an anomaly is a function of the size, depth of burial and magnetic susceptibility of the object. As a rule of thumb, single drums buried several feet below the surface produce anomalies of about 200 nT relative to the normal undisturbed background and can be detected at a horizontal distance of about 15 feet, while large caches of drums can produce anomalies of many thousands of nT and may be detectable 50 feet away.

Magnetometers generally measure total intensity of the local magnetic field. A magnetic gradiometer is a variant of the magnetometer that measures both the horizontal and the vertical magnetic field at each survey point. It consists of two identical sensors located vertically on a staff and having a fixed separation. The intensity of the magnetic field caused by a buried metal object varies inversely with the distance between the object and the sensor. The relative intensities measured simultaneously at each sensor are used to determine the relative depth of burial of an object.

Relative depth estimates of buried metal objects can be made using a single sensor. In general, for a given object, the deeper the object is buried, the lower the amplitude and the wider the anomaly. Shallowly buried objects produce higher amplitude anomalies with closely spaced contour lines.

Magnetic surveys can only detect **ferrous metal** objects and cannot be used to identify the buried object. Estimates of the total mass of a buried object are difficult due to the physical properties of the object and other factors. Interference caused by observed surface metal objects limits the accuracy of the survey. The anomalies produced by fences, power lines, cars and buildings can easily mask the anomaly caused by an underground target.

Magnetic surveys are cost effective. Using the standard "step and wait" magnetometer, data from approximately 1000 points can be obtained in one field day corresponding to between 1 acre and about 5 acres depending on site conditions and survey goals. More modern cesium magnetometers collect up to 10 readings per second continuously, thus the operator can proceed without stopping. Many modern magnetometers use an audible signal to call attention to anomalous data as it is obtained. At some sites metallic objects can be detected and marked in the field at the time of the survey.

The use of a second, automatically recording "base station" magnetometer is highly recommended due to temporal variations in the earth's magnetic field. These changes must be removed from the field data before an accurate interpretation can be made, particularly when searching for small-buried objects.

Magnetic data are most commonly presented in two contour maps. The TOTAL MAGNETIC FIELD CONTOUR MAP shows the horizontal variation of the total intensity of the magnetic field and, therefore, the areal extent of anomalies. The GRADIOMETER CONTOUR MAPS show the horizontal variation of the vertical gradient of the magnetic field and indicate the relative depth of burial of the objects causing those anomalies. Color versions of these maps may be produced showing only the magnetic highs and lows.

GeoPotential
ENVIRONMENTAL & EXPLORATION GEOPHYSICS
330 Creekside Terrace, Fairview, OR 97024 Phone: (503) 912-6441 Fax: (503) 912-6448
WEB http://www.geopotential.biz/ E-MAIL GeoPotential@geopotential.biz

APPENDIX B
GROUND PENETRATING RADAR SURVEYS

Ground Penetrating Radar (GPR) can be a valuable tool to accurately locate both metallic and non-metallic UST's and utilities, buried drums and hazardous material at some sites. It may detect objects below reinforced concrete floors and slabs. GPR may delineate trenches and excavations and, under some conditions, it may be used to locate contaminant plumes. It has been used as an archaeological tool to look for buried artifacts. It may accurately profile fresh water lake bottoms either from a boat or from a frozen lake surface. GPR may be used to locate voids below roads and runways. GPR has numerous engineering applications. It can be used in non-destructive testing of engineering material, for example, locating rebar in concrete structures and determining the thickness of concrete and other structural material.

GPR uses short impulses of high frequency radio waves directed into the ground to acquire information about the subsurface. The energy radiated into the ground is reflected back to the antenna by features having different electrical properties to that of the surrounding material. The greater the contrast, the stronger the reflection. Typical reflectors include water table, bedrock, bedding, fractures, voids, contaminant plumes and man-made objects such as UST's and metal and plastic utilities. Materials having little electrical contrast like clay and concrete pipes may not produce strong reflections and may not be seen. Data are digitally recorded or downloaded to a laptop computer for filtering and processing.

The frequency of the radar signal used for a survey is a trade off. Low frequencies (250 MHz – 50 MHz) give better penetration but low resolution so that pipes and utilities may not be seen. Pipes and utilities may be seen using higher frequencies (500 MHz) but the depth of penetration may be limited to only a few feet especially in the wet, clayey soils found in many areas of the NW USA. The GPR frequency is dependent upon the antenna. Once an antenna is selected, nothing the operator can do can increase the depth of penetration.

Radar data is ambiguous. Many buried objects produce echoes that may be similar to the echo expected from the target object. Boulders and debris produce reflections that are similar to pipes and tanks. Subtle changes in the electrical properties along a traverse caused by changes in soil type, mineralogy, grain size, and moisture content all produce “noise” that can make interpretation difficult. Interpreting radargrams is an art as much as a science.

Under some conditions, although a UST itself may not be clearly visible in a GPR record, the excavation or trench in which the UST is buried is evident. Usually GPR data is used to compliment data from other “tools”. For example, a trench-like reflection but no clear UST reflection, combined with a “tank” shaped magnetic anomaly suggests the presence of a UST. Although the UST itself could not be seen using GPR, the radar showed a trench-like reflection. The magnetic data showed a large ferrous object. We would report a possible UST at that location.

GPR is often used in conjunction with magnetometer surveys. Magnetometer Surveys are very fast and large areas can be covered cost effectively. Magnetic anomalies are marked in the field, and then may be further investigated using radar.

GPR, like other geophysical tools, is excellent at detecting changes across a site, but it is poor at actually identifying the cause of the change. **The only definite way to identify buried objects is through excavation.**

ADVANTAGES - General

- When GPR data is properly interpreted subsurface objects can usually be confidently identified. This often requires the GPR data be combined with other geophysical data, surface features and historical information.
- GPR provides continuous records along traverses which, depending on the goal of the survey, may be interpreted in the field.
- At flat, open sites, for reconnaissance purposes, the antenna can be towed behind a vehicle at several mph.
- Many GPR antennas are shielded and are unaffected by surface and overhead objects and power lines.
- GPR can be used in conjunction with magnetic or EM surveys to accurately locate buried objects.

ADVANTAGES – Site specific

- With a low frequency antenna, in clean, dry, sandy soil, reflections from targets as deep as 100 feet are possible. Geologic features such as bedrock and cross bedding may be seen at some sites.
- The resolution of data is very high particularly for high frequency antennas.
- Shallow, man-made objects generally can be detected.
- Fiberglass UST's and plastic pipes can be detected using GPR.

LIMITATIONS - General

- To acquire the highest quality data, proper coupling between the antenna and the ground surface is necessary. Poor data may be obtained at sites covered with debris, an uneven surface, tall grass and brush. Objects located at curbs are difficult to see.
- Acquiring GPR data is slow. The antenna must be over the target. The signal from the antenna is cone-shaped. Reflections from objects to the side of the antenna may be seen, but their actual location relative to the antenna is not obvious.
- Penetration of the GPR signal is "site specific" and its depth of penetration at a particular site cannot be predicted ahead of time. Near surface conductive material, such as salty or contaminated ground water and wet, clay-rich soil, may attenuate the radar signal, limiting the effective depth of the survey to several feet. Reinforced concrete also can attenuate the signal. Rebar may produce reflections that look like pipes.

- GPR may not be cost-effective for some projects. For a detailed survey mapping underground storage tanks and utilities, it may be necessary to collect data in orthogonal directions at 5-foot line spacing.

LIMITATIONS – Interpretation

- Interpretation can be difficult. Radar data are ambiguous. Subsurface objects can be detected but, in general, they cannot be identified. USTs and utilities have a characteristic reflection, however, large rocks and boulders have a similar reflection.

- The reflection visible in a GPR record is very complex and may be caused by small changes in the electrical properties of the soil. The target in mind may not produce the reflection. Due to "noise", the target may be missed. USTs and deep utilities may be missed if they are under debris and/or other pipes.

- Other methods may be necessary to aid in the interpretation of the data (use a magnetometer to detect a large metallic mass, then GPR to determine if the object is tank-like, or a utility locator to determine if there are feed lines and fill pipes leading to the object).

- Adequate contrast between the ground and the target is required to obtain reflections. UST's may be missed if they are badly corroded. Utilities made of "earth" materials like clay and concrete may not be detected since their electrical properties are similar to the surrounding soil.

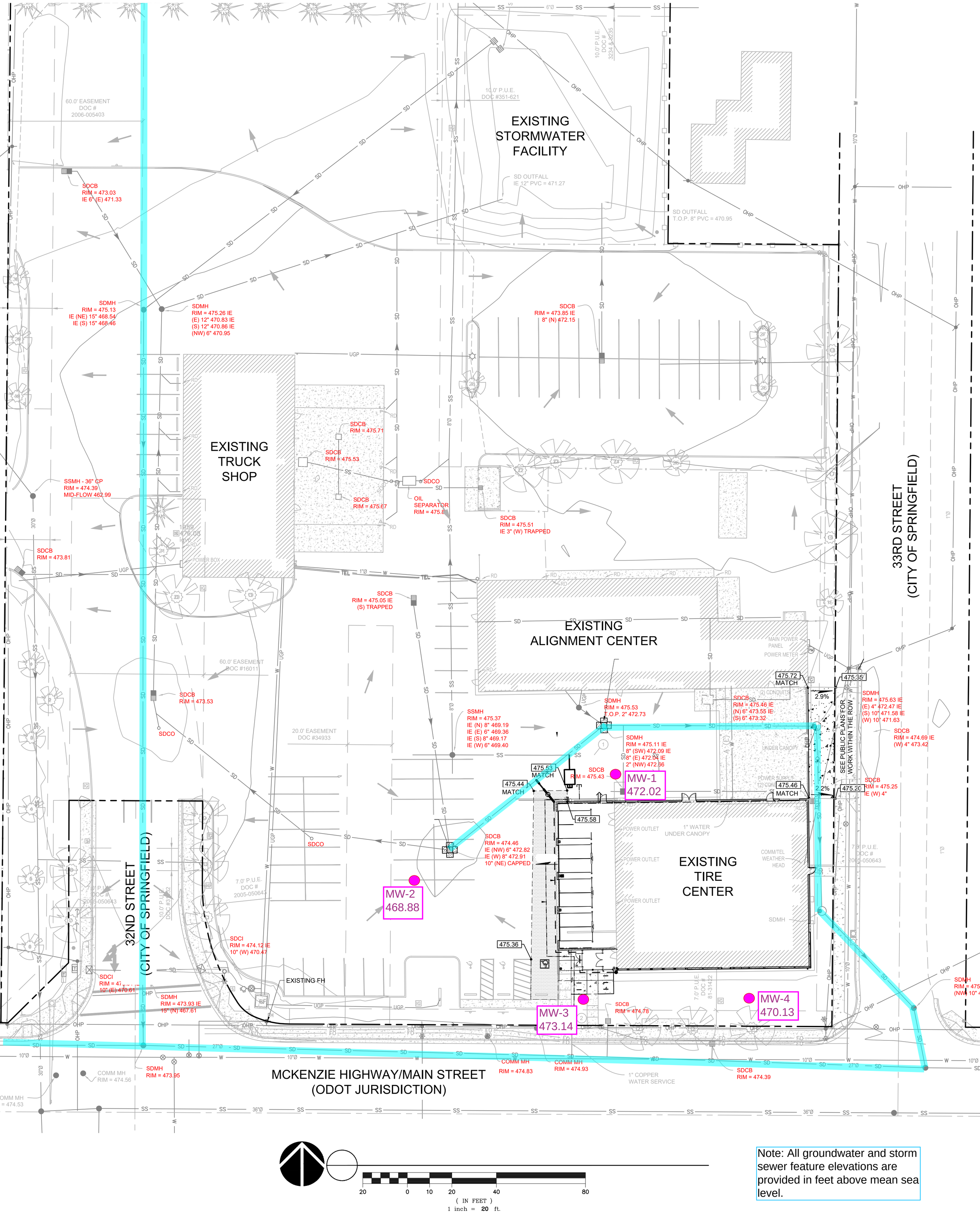
- To determine the depth to an object without "ground truth", assumptions must be made regarding soil properties. Even with ground truth at several locations on the same site, changes in material across a site (therefore changes in signal velocity) can cause errors in depth measurements at other locations.

Appendix C

Groundwater Intrusion Observation Locations

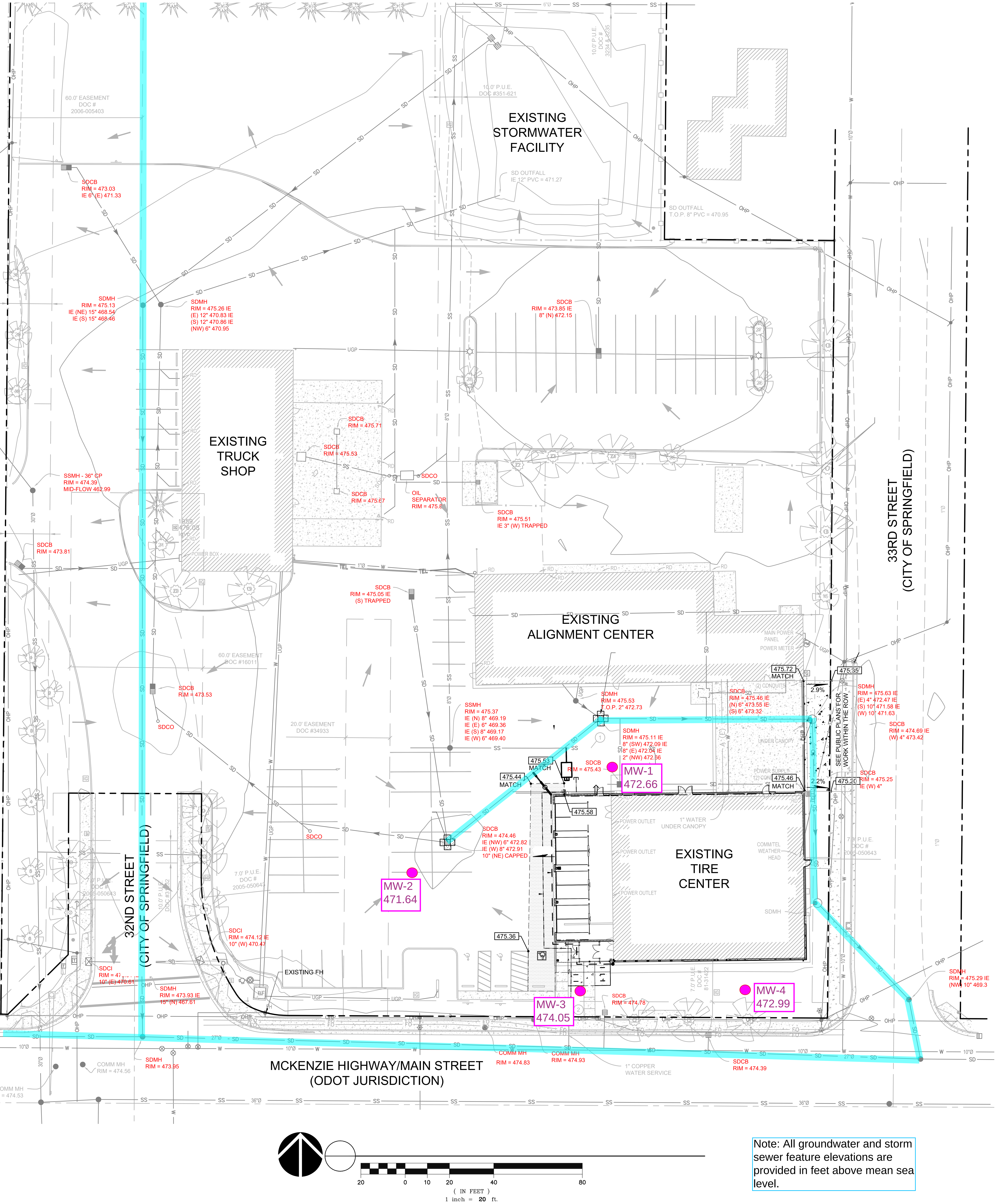
MAUL FOSTER ALONGI

Appendix C: August 2023 Groundwater Intrusion Assessment Observation Locations



Note: All groundwater and storm sewer feature elevations are provided in feet above mean sea level.

Appendix C: March 2024 Groundwater Intrusion Assessment Observation Locations



Note: All groundwater and storm sewer feature elevations are provided in feet above mean sea level.