

FOCUSED ON-SITE GROUNDWATER INVESTIGATION TECHNICAL MEMORANDUM

Former Springvilla Dry Cleaner
1459 Mohawk Boulevard
Springfield, Oregon 97401

Oregon DEQ ECSI No. 3222

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1 INTRODUCTION

At the request of McKay Investment Company, PNG Environmental, Inc. (PNG) prepared this Technical Memorandum summarizing the results of focused on-site groundwater investigation for the Springvilla Dry Cleaner located at 1459 Mohawk Boulevard in Springfield, Oregon (Figures 1 and 2). The investigation activities were completed in accordance with PNG's Focused On-Site Groundwater Investigation Work Plan (PNG 2020b) approved by the Oregon Department of Environmental Quality (DEQ). The focused groundwater investigation was completed in response to an Oregon DEQ request to conduct additional on-site characterization of residual dry cleaning contamination in vicinity of the Springvilla Dry Cleaner (DEQ 2020, Appendix A). The purpose of this work, as requested by DEQ, was to evaluate groundwater quality in upper intermediate-zone depths beneath the former Waremart building to identify if residual contaminant sources exist and to support future modeling for completion of the Remedial Investigation and Risk Assessment (RI/RA) for the site (Figure 3). The focused groundwater investigation activities are being completed under the DEQ RI/FS order with McKay Investment Company LLC (McKay) (DEQ 2011).

2 BACKGROUND

2.1 ON-SITE IRAM SUMMARY

Interim remedial action measure (IRAM) activities were initiated in 2003 and involved installation of a horizontal vapor collection and venting system beneath the floor of the former Springvilla Dry Cleaner. The vapor collection system was installed to mitigate vapor intrusion into the Springvilla and potentially the Waremart Building. A secondary purpose of this system was for possible injection of amendments to facilitate contaminant degradation (HartCrowser 2003).

In mid-2004, portions of the former Springvilla Dry Cleaner and a common wall with the adjacent Waremart Building were demolished to facilitate additional IRAM activities. In October 2004, approximately 150 cubic yards (cyd) of soil was removed from beneath the former Springvilla facility and disposed to an off-site landfill. These activities also included soil removal in proximity to a separated drain line (HartCrowser 2005). Subsequently, horizontal infiltration piping was installed in the excavation and, upon restoration, sodium permanganate with a bromide tracer was injected into the subsurface. An additional sodium permanganate with bromide tracer injection was conducted in October 2005.

In September 2007, groundwater recirculation was initiated at the site consisting of three down gradient intermediate-zone extraction wells and five up-gradient shallow-zone injection wells (Figures 4 and 5). The primary objective of the groundwater recirculation system was to reduce on-site volatile organic compound (VOC) concentrations in groundwater and reduce off-site migration of contaminant impacts to potential private and municipal water supplies (HartCrowser 2008). The recirculation system involved injection of CarBstrate™ brand dextrose/nutrient amendment and re-injection in the source area and areas of known residual contamination in an effort to promote reductive dechlorination. Slug injections of ethyl lactate were introduced into MW-11i, MW-14i, DEQ-1d, and DEQ-2i. DEQ-2i also received slug injections of CarBstrate at various times.

In January 2009, LactOil™ was introduced as an amendment into the intermediate groundwater, through recirculation, to further promote reductive dechlorination. This recirculation was then followed, in August 2009, by a combination of recirculation of Newman Zone™ emulsified oil into the intermediate groundwater and direct push injection of Newman Zone into the shallow groundwater beneath the former Waremart structure.

IRAM amendments applied to the site are summarized below (HartCrowser 2008 and 2010):

- October 2004 - October 2005: Injection of 1,100 gallons of 4 percent sodium permanganate and 2,000 gallons of 2 percent sodium permanganate.
- September 2007 – January 2009: Recirculation of:
 - 13,700 lbs CarBstrate.
 - 25,150 lbs ethyl lactate.
 - 4,950 lbs LactOil.
- May 2009 – May 2010: Recirculation of 10,500 lbs Newman Zone emulsified oil.
- August 2009: Direct injection of 6,300 lbs Newman Zone emulsified oil.

2.2 2019 AND 2020 ON-SITE INVESTIGATION

In 2019 and 2020, PNG completed on-site investigations required by DEQ as part of focused RI activities to determine if there were areas of residual dry cleaning contamination in soil, shallow groundwater, or soil vapor on-site that could present current or future unacceptable risk. Specifically, DEQ requested investigation of soil, shallow groundwater, and soil vapor on-site and in proximity to the former dry cleaner where future development, consistent with the existing commercial use, may occur. These data were collected to support: 1) completion of the on-site characterization of nature and extent of contamination, 2) assessment of current and future potential for vapor intrusion, 3) updating the conceptual site model (CSM), 4) completion of the human health risk assessment, 5) the feasibility study, and 6) selection of a final remedy.

The results of the on-site investigation are discussed in detail in PNG's On-Site Investigation report (PNG 2020a), but for clarity are briefly summarized in the following sections.

2.2.1 Soil Gas

- A network of thirteen sub-slab soil gas vapor pins (i.e., SG-1 through SG-13) were installed and sampled during two separate events. Eight soil gas vapor pins were installed within the footprint of the Waremart structure, three were installed in proximity to the former Springvilla Dry Cleaner and sewer line, and two were further down-gradient and beyond the footprint of the former Waremart building.
- Tetrachloroethene (PCE) was detected in all sub-slab soil gas vapor pin locations during both May 2019 (high groundwater) and August 2019 (low groundwater) events; trichloroethene (TCE) was generally not detected.
- The pattern of PCE detections in soil gas is indicative of relatively low-level residual contamination identified in soil and groundwater in the source area. Higher concentrations of PCE were detected in soil gas at five of the thirteen vapor pins located at the former Springvilla Dry Cleaner and in a west-southwesterly direction away from the former dry cleaner consistent with shallow groundwater flow.
- The May and August 2019 soil gas sampling events did not detect concentrations of target contaminants above DEQ's occupational vapor intrusion into buildings Risk Based Concentrations (RBCs). While the prior use of the Waremart structure has been for commercial purposes, at least one re-development plan involved use by sensitive populations (i.e., health club with day care). Such a potential future use could require risk-based screening levels similar to DEQ's residential or urban residential RBCs. Urban residential and residential RBCs for vapor intrusion were exceeded at a few locations approximate to the former Springvilla.

2.2.2 Soil and Groundwater Investigation

- Soil and groundwater investigations were completed with fifteen push probe borings (i.e., PNG-1 through PNG-15) installed to depths of up to 15 feet below ground surface (bgs). Investigations were completed in proximity to the former Springvilla and in down-gradient areas established by groundwater monitoring (Figures 7 and 8).

- Eleven borings (i.e., PNG-1 through PNG-11) were used for soil characterization while nine borings (i.e., PNG-1, PNG-3, PNG-9, PNG-10, PNG-11, PNG-12, PNG-13, PNG-14, and PNG-15) served an additional purpose for collection of groundwater samples. Two existing injection wells (i.e., IN-1s and IN-3s), located in close proximity to the former Springville, were also used to supplement the groundwater characterization. These locations were used to evaluate groundwater quality: 1) in proximity to the sanitary sewer service line (i.e., PNG-1 and IN-3s), 2) within the footprint and in close down-gradient proximity of the former dry cleaner (i.e., PNG-3, PNG-9, PNG-10, PNG-12, and IN-1s), 3) in proximity to the adjacent commercial structure to the north (i.e., PNG-11), and 4) a broader area beneath the former Waremart (i.e., PNG-9, PNG-10, PNG-12, PNG-13, PNG-14, and PNG-15).
- Soils encountered were consistent with those previously observed during Phase 1, 2, and 3 RI and are generally described as unconsolidated alluvial deposits. The alluvial deposits are further divided consisting of an upper fine-grained clayey silt/silty clay (Silt Unit) to depths of approximately 11 feet bgs underlain by coarse-grained gravels (Gravel Unit) that include interbedded layers of sand, silt, and clay. The regional hydrogeologic cross section by (Golder 1995) indicates the Gravel Unit (i.e., older alluvium) extends to over 400 feet in proximity to the Q Street Well.
- Soil investigation results further characterized the current nature and extent of target compounds in soil in the on-site source area. While both PCE and TCE were detected at various concentrations in thirteen of seventeen soil samples from eleven push probe locations, all were well below occupational RBCs with one exception. The highest PCE concentration of 54 milligrams per kilogram (mg/kg) was detected at PNG-6 (depth of 10 feet bgs) located in the eastern wall of the former excavation pit and immediately adjacent to a building load-bearing post. While the 54 mg/kg of PCE in soil at PNG-6 exceeds the occupational screening RBC for vapor intrusion to buildings of 36 mg/kg, empirical evidence from soil vapor pins suggest this pathway may not represent an unacceptable risk (i.e., sub-slab soil gas concentrations in the vicinity of PNG-6 do not exceed the occupational RBC for vapor intrusion) (PNG 2020a).
- Groundwater investigation results indicated the on-site dissolved VOC plume had been extensively remediated and was at relatively low or not detect concentrations as compared to pre-remedial concentrations in the source area. Of source area groundwater samples, including temporary well point borings, five shallow locations (i.e., IN-1s, PNG-3W, PNG-9W, PNG-10W, and PNG-12W) comprise a shallow-zone residual plume. The residual impact area is centered on the former excavation pit including the adjacent area of elevated residual soil, with elevated concentrations located in near down-gradient areas. Concentrations of all target contaminants, where detected, are below Occupational and Residential vapor intrusion RBCs. While PCE and/or TCE at IN-1s, PNG-3W, PNG-9W, PNG-10W, and PNG-12W exceed an occupational ingestion and inhalation RBC, groundwater is not currently used for drinking purposes at the site.
- During the October 2020 event at MW-25 cmt (located on the west and downgradient property line) PCE was detected at concentrations of 63 and 131 micrograms per liter (ug/L) at depths of 42 and 59 feet bgs (Figure 6) (PNG 2020b). Source-area groundwater investigation indicated the highest remaining concentrations of shallow-groundwater target compounds were in proximity to

the former IRAM excavation under the Springvilla (Figure 6). However, it was not known if this remaining contamination is limited to the shallow-zone in close proximity to the Springvilla or if it may be contributing to contamination detected at MW-25 cmt. Consequently, DEQ requested the relationship between the shallow source area groundwater contamination to that detected in the upper intermediate-zone at MW-25 cmt be quantified to support future modeling efforts.

2.3 REGULATORY FRAMEWORK

Oregon's environmental cleanup rules (Oregon Administrative Rules [OAR] 340-122) establish the standards and procedures to be used to assure protection of the present and future public health, safety and welfare, and the environment in the event of a release or threat of a release of a hazardous substance. In the event of a release of a hazardous substance, remedial actions shall be implemented to achieve:

- Acceptable risk levels defined in OAR 340-122-0115, as demonstrated by a residual risk assessment; or
- Numeric cleanup standards developed as part of an approved generic remedy identified or developed by the Department under OAR 340-122-0047, if applicable; or
- For areas where hazardous substances occur naturally (e.g., metals, etc.), the background level of the hazardous substances, if higher than those levels specified above.

Acceptable risk levels may be evaluated through conducting a site-specific risk assessment that calculates exposure point concentrations (EPCs) for specific exposure-pathway receptor-scenarios, or responsible parties (RPs) may use generic for hazardous substances under DEQ's Risk-Based Decision Making (RBDM) guideline to streamline the risk assessment process. In terms of the latter, DEQ has compiled default risk-based screening reference levels for common exposure-pathway receptor-scenarios that could be utilized in lieu of site-specific risk calculations (OAR 340-122-0115). In particular, the pre-calculated risk-based concentration (RBC) represents the concentration of a contaminant of interest (COI) in the impacted medium (e.g., soil, groundwater, or air) that potentially represents an unacceptable risk level.

2.3.1 DEQ Risk Based-Concentrations

DEQ first developed RBDM guidance in 2003 for comparing COI concentrations to default RBCs for applicable human health exposure scenarios. These RBCs eventually replaced Environmental Protection Agency (EPA) Preliminary Remediation Goals (PRGs) as screening DEQ-applicable criteria in human health risk assessments. Published RBC tables are updated periodically by DEQ; with the most recent update relevant to Springvilla was published in 2018 (DEQ 2018).

In the 2009 revision to its RBC tables, DEQ included newly-developed soil gas and indoor air RBCs for residential, urban residential, and occupational settings. DEQ also published final guidance for vapor intrusion assessments (DEQ 2010), and issued air and soil vapor RBC values which have also been revised over time. In September 2017, DEQ updated their guidance as Risk-Based Decision Making for the Remediation of Contaminated Sites to reflect a broader spectrum of contaminated sites (DEQ 2017). The last DEQ RBC table revision was in May 2018 (DEQ 2018).

The published RBCs represent a conservative default concentration of a chemical in an impacted medium (e.g., soil, groundwater, or air). When chemical concentrations on a

site exceed the RBC, unacceptable human health impacts are possible. For carcinogens, the regulatory standard is represented by an excess cancer risk of one in one million (1×10^{-6}); for non-carcinogens, this is represented by a Hazard Index of 1. RBC exceedances typically trigger further investigation and potentially a human health risk assessment. Therefore, RBCs can be applied at sites as generic, conservative cleanup standards and are routinely used by DEQ to determine if a site requires additional action. Site specific parameters used in the equations to develop the RBCs are often adjusted to match actual conditions in developing site-specific cleanup levels. As such, DEQ reserves the right to disallow the use of generic RBCs at sites that may not fit generic RBC default conditions, such as at sites with widespread contamination.

There are several exposure pathways by which a receptor may be exposed to a chemical, including incidental ingestion, inhalation, and dermal contact with the affected medium. The current and reasonably anticipated future use of properties in the Locality of Facility (LOF) are the primary criterion for determining whether a certain exposure pathway is likely to be of concern.

Considering the current occupational use of the Springvilla and Mohawk shopping center property and residential use in downgradient plume areas, the potential receptors and pathways that are considered preliminarily applicable are:

- Direct contact with soil by an occupational worker or construction worker could be a complete pathway of exposure where PCE was released in soil on the Springvilla property. However, this pathway is only complete for the occupational worker if the contaminants are within three feet of the surface. This pathway was evaluated as part of the 2020 on-site investigation and concentrations of target compounds were below applicable RBCs.
- Direct contact with groundwater by an excavation worker is a complete pathway in areas where the PCE plume exists at a depth within 10 to 15 feet of the surface. Groundwater monitoring has established depth to groundwater ranged seasonally from 4 to 15 feet bgs depending on location. This pathway was evaluated as part of the 2020 on-site investigation and concentrations of target compounds were below applicable RBCs.
- Volatilization of chemicals from subsurface soil or groundwater via soil gas to indoor and outdoor air is a complete pathway for the Springvilla property as occupational workers could potentially be exposed in indoor and outdoor air. In off-site neighborhoods to the west where the plume exists, vapor intrusion to a resident or occupational worker would be of concern if the near surface water (i.e., water table) was contaminated at concentrations above the applicable RBC (i.e., PCE and TCE at 3,700 ug/L and 200 ug/L for residential building and 48,000 ug/L and 3,700 ug/L for occupational building). It is important to note that a layer of near-surface (water table) clean groundwater in off-site areas provides protection against vapor intrusion from groundwater anticipated at depth in the aquifer.

As noted in Section 2.2.2, this pathway was evaluated for the on-site area as part of the 2020 on-site investigation. The highest concentrations of target compounds in shallow groundwater samples were detected at IN-1s, PNG-3W, PNG-9W, PNG-10W and PNG-12W (Figure 9). These five locations comprise the on-site shallow plume centered on the former excavation pit and adjacent area of identified residual soil impact with concentrations of PCE ranging from 3.5 to 223 ug/L. Concentrations of all target contaminants in the shallow-groundwater area are below occupational vapor intrusion RBCs.

The 2020 on-site soil investigation results further characterized the current nature and extent of target compounds in soil in the on-site source area. While both PCE and TCE were detected over a range of concentrations in on-site soil, only one location exceeded occupational RBCs for vapor intrusion into buildings. While this pathway is complete, empirical evidence from soil vapor pins suggested it may not represent an unacceptable risk (i.e., sub-slab soil gas concentrations in the vicinity of PNG-6 do not exceed the occupational RBC for vapor intrusion). This pathway will be further evaluated in the future risk assessment.

- Evaluation for domestic uses of groundwater in the LOF are ongoing. Of the 100 domestic wells identified in the LOF, one domestic well and one municipal supply well have been identified as known drinking water sources. The applicable RBC for PCE and TCE in residential drinking water are 12 ug/L and 0.49 ug/L respectively. Other groundwater use receptor scenarios beyond that established for generic RBC ingestion (such as irrigation contact) will require evaluation in the future.
- Soil leaching to groundwater was previously a complete on-site pathway as PCE on the Springvilla property migrated through the surficial silts/sands into the gravel aquifer. The one PCE concentration of 54 mg/kg detected in the east wall of the former IRAM excavation pit exceeds the leaching to groundwater RBC. This pathway will be further evaluated in the future risk assessment.
- Surface water has not been identified in the LOF; therefore, the plume discharge to surface water pathway is incomplete.

Potentially applicable RBCs are included on report tables for soil, groundwater, soil gas, and ambient air where appropriate. It is important to note that since groundwater impacts have been identified in the off-site down-gradient area and in proximity to a municipal water-supply well, U.S. Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs) are applicable to down-gradient groundwater. As such, these levels are included as screening levels on the on-site Springvilla source-area groundwater data tables; the MCL for both PCE and TCE is 5 ug/L.

3 INVESTIGATION RESULTS

3.1 OBJECTIVES

The objectives of the focused on-site groundwater investigation included the following:

- Characterize the extent and distribution of VOCs in close proximity to the Springvilla related to post-remedial actions conducted on-site between IN-3s and MW-22s/MW-21i (Figures 4 and 5).
- Evaluate the relationship between the shallow source area groundwater contamination in proximity to the Springvilla to that detected in upper-intermediate-zone groundwater near the down-gradient property boundary at MW-25 cmt.
- Obtain information to update the on-site conceptual site model (CSM).
- Obtain information to support future modeling in support of the remedial investigation (RI), risk assessment (RA), feasibility study (FS), and final remedy selection.

3.2 SUMMARY OF ACTIVITIES

Focused on-site groundwater characterization was completed in one field event utilizing borings with depth-discrete temporary well point installations. Temporary well points (TWP) allowed for an efficient characterization of groundwater, as opposed to installation of co-located groups (clusters) of monitoring wells.

All procedures and methods to facilitate soil boring installation and sampling followed PNG Standard Operating Procedures (SOPs), PNG's site-specific sampling and analysis plan (SAP) (PNG 2017), and the DEQ approved Focused On-Site Groundwater work plan (PNG 2020b).

On-Site Investigation activities are briefly summarized below.

3.2.1 Boring Locations and Rationale

PNG installed four borings (PNG-16, PNG-17, PNG-18, and PNG-19) that included depth-discrete temporary well point groundwater samples (Figure 9). Three of the borings were completed inside the former Waremart structure (PNG-16, PNG-17, and PNG-18), while one was completed outside (PNG-19). The locations of these borings were chosen based on the location of the historic shallow-zone groundwater plume, in consideration of a combination of shallow-zone and intermediate-zone groundwater flow direction (Figures 7, 8, and 9), and the IRAM recirculation well depths and locations (Figures 4, 5, and 9). Individual borings were installed up to a depth of 52.5 feet bgs.

3.2.2 Boring Installation Methodology

Borings were installed utilizing sonic boring technology necessary to penetrate the target depth within coarse gravel and cobble materials. A mini-sonic drilling rig equipped with 5-inch outside diameter (OD) steel casing was used to facilitate access inside the warehouse structure. Undisturbed and continuous soil cores were collected to provide detail regarding subsurface geology for both temporary well point well screen placement and conceptual site model (CSM) refinement. Subsurface soil contamination was not identified based on field screening indicators during any of the drilling activities. Consequently, similar to prior down-gradient investigations, collection of soil samples for analytical testing was not necessary.

Field boring logs are included in Appendix B.

3.2.3 Temporary Well Point Sampling

Four depth-discrete groundwater samples were collected from each temporary well point, except for PNG-19 where only three were necessary due to near-proximity MW-3s. Groundwater sample depths were selected in consideration of the depth of the shallow-zone groundwater plume (characterized at a depth of 10-15 feet bgs), locations of IRAM injection and extraction wells and their associated screen depths. Specifically, shallow-zone recirculation wells ranged in depths from 8 to 29 feet bgs, while intermediate-zone wells ranged in depths from 44 to 70 feet bgs (Figures 4 and 5). Consequently, depth-discrete groundwater samples were collected at 30-32, 40-42, and 50-52 foot depth intervals from each TWP located between the unscreened depth-interval between shallow and intermediate zone recirculation wells. At DEQ's request, an additional shallow-zone depth-discrete sample from 20-22.5 feet bgs was collected from PNG-16, PNG-17, and PNG-18, and from MW-3s near PNG-19 to further refine the extent of shallow-zone groundwater contamination on-site.

Per the approved work plan, groundwater samples were collected from each depth-interval utilizing an ISOFLOW packer sonic water sampling device. The focused on-site groundwater sampling investigation is summarized in Table 1. Groundwater sampling logs are included in Appendix B.

3.2.4 Boring Abandonment

Borings were abandoned in accordance to Oregon Water Resources Department (OWRD) rules and capped with concrete or asphalt concrete to match surrounding land surface.

3.2.5 Monitoring Well Sampling

As part of the temporary well point investigation, groundwater quality samples were collected from select on-site monitoring wells to supplement the investigation. Specifically, groundwater samples were collected from MW-22s and MW-21i at 300 feet and MW-25 cmt at 600 feet down-gradient from the Springvilla (Figure 9). A sample was also collected from MW-3s at a depth of 20 feet bgs in close proximity to PNG-19.

3.2.6 Laboratory Analysis

All temporary well point and monitoring well groundwater samples were analyzed for VOCs by U. S. Environmental Protection Agency (EPA) Method 8260D. All groundwater analysis was completed on a normal turnaround basis.

The temporary well point and monitoring well groundwater sampling results are summarized on Table 2 and illustrated on Figures 10, 11, 12, and 13. The laboratory reports and chain-of-custody documentation for groundwater samples are included in Appendix C.

3.2.7 Investigative Derived Waste Disposal

Nine 55-gallon drums of IDW soil cuttings and two 275-gallon totes of equipment decontamination rinsate and monitoring well and temporary well point purge water were generated. The soil and water waste was left on-site in a location designated by the current property owner pending disposal.

The soil waste was managed consistent with prior actions involving a contained in determination, regulatory acceptance of determination, and disposal under permit to a regional landfill as a Resource Conservation and Recovery Act (RCRA) subtitle D waste.

The water waste was disposed under a pre-existing blanket permit with the City of Springfield to the publicly operated treatment works.

IDW characterization and disposal documentation is included in Appendix D.

3.3 RESULTS

3.3.1 Soil Conditions

Soils encountered in PNG-16 through PNG-19 were similar to those previously encountered by PNG during Phase 1, 2, and 3 RI activities and are generally described as unconsolidated alluvial deposits. A fine-grained clayey silt/silty clay unit (Silt Unit) is generally observed to depths of approximately 11 feet bgs at the site. Underlying the Silt Unit are coarse-grained gravels (Gravel Unit) that include interbedded layers of sand, silt, and clay.

The upper approximate 40 feet of the Gravel Unit is relatively free of silt and appears to be relatively homogeneous. The Gravel Unit is interpreted by multiple site investigators to transition to a more heterogeneous and silty lower zone beginning at depths between 40 to 60 feet. It is notable that of the four depth discrete temporary well point groundwater samples at the 40-42.5 foot interval yielded the least water from each boring location.

The on-site Gravel Unit extends to a minimum depth 120 feet based on RI borings, and more regionally to at least 312 feet based on the Q Street well log. The regional hydrogeologic cross section by (Golder 1995) indicates the Gravel Unit (i.e., older alluvium) extends to over 400 feet in proximity to the Q Street Well.

3.3.2 Groundwater Conditions

Local Groundwater Flow

Groundwater monitoring to-date has characterized a generally westerly groundwater flow in the on-site source area with flow components to the southwest and northwest as the plume migrates off-site (PNG 2021). The most-recent shallow and intermediate zone groundwater contour maps for on-site wells local to the Springville are illustrated on Figures 7 and 8. Further to the west and down-gradient, off-site flow is to the northwest consistent with regional flow.

Vertical gradients at nested wells across the site are consistently downward.

Local Groundwater Quality

On site source area investigation in 2020 and focused temporary well point groundwater investigation in 2021 supplemented with select on-site monitoring wells has characterized the on-site shallow-zone contaminant plume. The lateral extent of the on-site shallow-zone plume is characterized by temporary well points PNG-1, -3, -9, -10, -11, -12, -13, -14, -15, -16, -17, -18, and -19, and monitoring wells MW-2s, MW-3s, MW-29s, MW-25 cmt, and IN-3s (Figure 10).

Prior to on-site IRAMs (i.e., 2006), the highest concentrations of target compounds detected on-site were at DEQ-4s located immediately down-gradient from the former dry cleaner (Figure 10). At that time PCE and TCE were detected in DEQ-4s at concentrations of 7,800 and 43 ug/L respectively. In 2021, the highest shallow-zone

source area target compounds were detected at PNG-16 with PCE and TCE at concentrations of 502 and 31 ug/L (Figure 10).

The shallow-zone plume is located in the approximate upper 10 feet of the shallow aquifer and is generally centered at PNG-10 and PNG-16 (Figure 10) while nearby temporary well points PNG-3, -9, and -12 refine a focused area with the highest overall shallow-zone concentrations on-site (Figure 10a). The location of the shallow-zone contaminant plume is not surprising since it is both immediately down gradient and close to the historic source of operations of the former Springvilla dry cleaner. The overall reduction in shallow-zone groundwater contamination likely reflects the effectiveness of IRAM actions including soil removal and ERD treatment.

The lateral extent of the on-site shallow-zone plume is well characterized by the 2020 and 2021 investigations. While the primary shallow-zone contaminant area is characterized by temporary well points PNG-3, -9, -10, -12, and -16 closely located to the Springvilla source, contamination decreases significantly down-gradient of PNG-12. The down-gradient extent is characterized by PNG-11, -13, -14, -15, -17, -18, and monitoring wells MW-2s, -3s, -22s, -29s, -25 cmt, and IN-3s to an area that is generally beneath the footprint of the former Waremart structure (Figure 10). This finding is consistent with off-site groundwater quality monitoring where shallow-zone groundwater is below detection limits (excepting at MW-28 cmt and MW-50s).

Deeper depth discrete samples from PNG-17, PNG-18, and PNG-19 (i.e., at depths of 30-32.5, 40-42.5, and 50-52.5 feet bgs) supplemented by on-site site monitoring wells generally characterize the intermediate-zone groundwater on-site and refine the distribution of VOCs in a zone critical to the CSM (Figure 11). While the highest on-site shallow-zone concentrations of VOCs were detected at PNG-16 in close proximity to the former Springvilla, the highest on-site concentrations down-gradient from there were detected in the upper intermediate zone at a depth of 40-42.5 feet bgs in PNG-17, PNG-18, and PNG-19. In this zone, PCE ranged between 53 to 1,860 ug/l (Figures 11 and 12).

PCE at a concentration of 1,860 ug/L is the highest detected in the intermediate-zone on the Springvilla site since July 2001 (i.e., MW-21i at 2,000 ug/L). Similar to shallow-zone groundwater contaminant findings, the relatively lower concentrations detected in the broader on-site intermediate-zone area likely reflect the effectiveness of prior IRAMs.

The on-site data indicate a pattern of contaminant migration into the intermediate zone within a short distance of migration from the Springvilla source area (Figures 12 and 13). The data indicate shallow-zone contamination in close proximity to the Springvilla source migrates quickly into the upper-intermediate zone at a 40-50 foot depth interval and then further down-gradient and off-site. This pattern of the highest contaminant concentrations in the intermediate-zone depth interval is consistent with off-site findings where the primary contaminant plume is located within a broader intermediate-zone depth range between 40 to 60 feet bgs throughout the locality of facility (PNG 2021).

Target VOCs were not detected in shallow on-site groundwater exceeding conservative residential RBCs for vapor intrusion. Current data indicate contamination has migrated from the onsite shallow aquifer zone to the down-gradient intermediate aquifer zone. All offsite shallow zone groundwater concentrations are below both DEQ residential and occupational vapor intrusion RBCs. The clean overlying shallow groundwater provides protection from vapor intrusion to commercial or residential properties down gradient of the site.

Offsite plume concentrations are greatest in the mid-depth portions of the aquifer while it has been established that deeper groundwater is non-detect. Progressively siltier soil

starting in the intermediate zone is apparently preventing vertical migration of contamination to deeper zones. This deeper zone represents the upper-most zone used for potable water withdrawal by the Q Street Well and has been not-detect within the LOF. The lack of detectable contamination in deep-zone groundwater suggests this municipal drinking water source is protected.

The highest on-site concentrations are centered at PNG-17 within the upper-intermediate zone depth interval of 40-42.5 feet bgs (Figures 10 and 13). Concentrations of PCE at 1,860 and TCE at 37 ug/l are not unexpected since this location is immediately down-gradient from the Springvilla source (Figures 10 and 11).

Laterally and cross-gradient from PNG-17, the intermediate-zone plume appears to be defined to the north considering the west to northwesterly flow gradient in combination with the lack of detectable concentrations at monitoring well MW-10s and nearly not-detect concentrations at MW-11i (Figures 3 and 13).

As indicated on Figure 13, the lateral extent of the plume south of PNG-17 is not fully defined with PNG-19. Historically, the highest intermediate-zone concentrations south of the Springvilla were detected at monitoring well MW-17i (1,200 ug/l PCE and 11 ug/l TCE Figures 3 and 5). Similar concentrations were detected further south across Centennial Boulevard at DEQ-2i. Following on-site IRAMs and elimination of pumping at the McKenzie-Willamette well field, contaminant concentrations in the upper intermediate-zone have decreased significantly in the southern site area (i.e., areas of MW-17i and DEQ-2i). While PCE at a concentration of 53 ug/L was detected at PNG-19, well pair MW-16s/17i does not show detectable levels of target compounds (Figure 13). Similarly, there has been a reduction in contaminant concentrations to near not-detectable levels at DEQ-2i, located further to the south across Centennial Boulevard (Figure 3). This trend suggests the detection at PNG-19 is a remnant, and the southerly component of the Springvilla plume will continue to degrade.

This investigation suggests that while there has been significant reduction in groundwater contamination from IRAMs, residual contamination persists at greater concentrations in the on-site source area than characterized by existing monitoring wells. This remnant plume is found in the upper intermediate zone that is not currently monitored with the screened intervals of the well network.

The investigation appears to have addressed the primary investigation objectives:

- The extent and magnitude of VOCs remaining in the onsite area has been characterized in the upper intermediate zone.
- The relationship and flow path of the plume from the onsite shallow zone to offsite intermediate zone has been characterized.
- The onsite Conceptual Site Model related to sources and pathways has been updated, and
- A source term for use in modeling the offsite plume migration has been identified.

4 CONCLUSIONS

The focused groundwater investigation was completed in response to an Oregon DEQ request to conduct additional on-site characterization of residual dry cleaning contamination in vicinity of the Springvilla Dry Cleaner (DEQ 2020). The primary objectives of the focused on-site groundwater investigation were to: 1) characterize the distribution of VOCs in close proximity to the Springvilla, 2) determine the relationship between shallow source area groundwater contamination to that detected in the intermediate-zone, 3) gather sufficient information to update the on-site CSM, and 4) gather data to support a model source term. The focused on-site groundwater characterization was successful in addressing these objectives. Conclusions from the focused groundwater investigation are as follows:

- Four borings that included depth-discrete temporary well point groundwater samples were installed. Three of the borings were completed inside the Waremart structure while one was completed outside.
- The locations of these borings were chosen based on the location of the shallow-zone groundwater plume, in consideration of a combination of shallow-zone and intermediate-zone groundwater flow direction, and the IRAM recirculation well depths and locations. Individual borings were installed up to a depth of 52.5 feet bgs.
- Soils encountered in the four temporary well point borings were similar to those previously observed during Phase 1, 2, and 3 RI and are generally described as unconsolidated alluvial deposits consisting of an upper fine-grained clayey silt/silty clay to depths of approximately 11 feet bgs underlain by coarse-grained gravels that include interbedded layers of sand, silt, and clay.
- Depth-discrete groundwater samples were collected at 30-32, 40-42, and 50-52 foot depth intervals from each temporary well point boring. An additional shallow-zone depth-discrete sample at a shallower 20-22.5 foot interval was collected from PNG-16, PNG-17, and PNG-18, and from MW-3s near PNG-19. The temporary well point depth intervals ranged roughly between the shallow and intermediate-zone recirculation system depth intervals.
- Local on-site shallow-zone groundwater flow is typically southwest to west with a westerly local intermediate-zone groundwater flow. Remedial investigations completed between IN-3s and MW-22s/MW-21i have established an off-site west to northwesterly shallow and intermediate-zone groundwater flow.
- The highest shallow-zone source area target contaminant concentration was detected at PNG-16 that was bracketed by lower concentrations in temporary well points installed in both 2020 and 2021. The current shallow-zone plume has been delineated and is centered on the former excavation pit and adjacent area of previously identified residual soil impact. The 2020 and 2021 on-site investigations indicate the shallow-zone contaminant plume located on the Mohawk Shopping Center property is primarily located under the former Waremart building.
- Deeper depth discrete sampling from PNG-17, PNG-18, and PNG-19 at depth intervals between 30 and 52.5 feet bgs further refine the distribution of VOCs in intermediate zone groundwater that is critical to the site CSM. While the highest concentration of VOCs in close proximity to the former Springvilla were detected in shallow-zone groundwater at PNG-16, the highest concentrations detected in

near down gradient on-site areas at PNG-17, PNG-18, and PNG-19 were detected in the upper intermediate zone (i.e., 40-42.5 foot depth interval).

- The on-site data indicate a pattern of contaminant migration into the intermediate zone within a short distance from the Springvilla source area. The pattern of the highest contaminant concentrations in the intermediate-zone depth interval are consistent with off-site findings where the primary contaminant plume is located within a broader intermediate-zone depth between 40 to 60 feet bgs throughout the locality of facility.
- The overall reduction in shallow-zone and extent of intermediate-zone contamination likely reflects the effectiveness of past IRAMs.
- Target VOCs were not detected in shallow on-site groundwater exceeding conservative residential RBCs for vapor intrusion. Current data indicate contamination has migrated from the onsite shallow aquifer zone to the down-gradient intermediate aquifer zone. All offsite shallow zone groundwater concentrations are below both DEQ residential and occupational vapor intrusion RBCs. The clean overlying shallow groundwater provides protection from vapor intrusion to commercial or residential properties down gradient of the site.
- Offsite plume concentrations are greatest in the mid-depth portions of the aquifer while it has been established that deeper groundwater is non-detect. This deeper zone represents the upper-most zone used for potable water withdrawal by the Q Street Well and has been not-detect within the LOF. The lack of detectable contamination in deep-zone groundwater appears to provide protection of drinking water from municipal water sources.
- The highest on-site VOC concentrations within the upper-intermediate zone on site were detected at PNG-17, as expected immediately down-gradient from the Springvilla source.
- Laterally and cross-gradient to the north of PNG-17, the intermediate-zone plume appears to be defined considering the west to northwesterly flow gradient in combination with the lack of detectable contamination at monitoring wells to the north.
- Following on-site IRAM and elimination of pumping at the McKenzie-Willamette well field, contaminant concentrations in the upper intermediate-zone have decreased significantly in the southern portion of the on-site and immediate off-site area. This trend suggests the southerly component of the Springvilla plume will continue to degrade.

The focused on-site groundwater investigation suggests that while there has been significant reduction in groundwater contamination from IRAM actions, residual contamination persists at greater concentrations in the on-site source area than previously characterized. However, the investigation appears to have addressed the primary investigation objectives, and in particular has derived a modeling source term for migration of on-site upper intermediate zone groundwater to off-site areas.

5 REFERENCES

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TABLES

Table 1
Focused On-Site Groundwater Investigation Summary
Former Springvillla Dry Cleaner
Springfield, Oregon

Location Number	Approximate Surface Elevation (feet msl)	Total Boring Depth		Screen Interval	Drilling Method	Soil Recovery Method	Groundwater Analysis	Comments
		(feet bgs)	(feet msl)	(feet bgs)				
Temporary Well Point Borings					Sonic	Continuous Core	VOCs each zone	Temporary well point via Isoflow packer / TWP sampler (see PNG 2020)
PNG-16	460	22.5	438	20.0 - 22.5				
	460	32.5	428	30.0 - 32.5				
	460	42.5	418	40.0 - 42.5				
460	52.5	408	50.0 - 52.5					
PNG-17	460	22.5	438	20.0 - 22.5	Sonic	Continuous Core	VOCs each zone	Temporary well point via Isoflow packer / TWP sampler (see PNG 2020)
	460	32.5	428	30.0 - 32.5				
	460	42.5	418	40.0 - 42.5				
	460	52.5	408	50.0 - 52.5				
PNG-18	460	22.5	438	20.0 - 22.5	Sonic	Continuous Core	VOCs each zone	Temporary well point via Isoflow packer / TWP sampler (see PNG 2020)
	460	32.5	428	30.0 - 32.5				
	460	42.5	418	40.0 - 42.5				
	460	52.5	408	50.0 - 52.5				
PNG-19	460	32.5	428	20.0 - 32.5	Sonic	Continuous Core	VOCs each zone	Temporary well point via Isoflow packer / TWP sampler (see PNG 2020)
	460	42.5	418	38.0 - 40.5				
	460	52.5	408	50.0 - 52.5				

Table 1
Focused On-Site Groundwater Investigation Summary
Former Springvillla Dry Cleaner
Springfield, Oregon

Location Number	Approximate Surface Elevation (feet msl)	Total Boring Depth		Screen Interval	Drilling Method	Soil Recovery Method	Groundwater Analysis	Comments
		(feet bgs)	(feet msl)	(feet bgs)				
Monitoring Wells								
MW-3s	466.53			10.0 - 25.0			VOCs	Low flow: 20 feet btoc
MW-22s	466.53			15.0 - 25.0			VOCs	Low flow: 23 feet btoc
MW-21i	466.54			50.0 - 70.0			VOCs	Low flow: 52 and 62 feet btoc
MW-25	463.64							
c1				14.2 - 14.7			VOCs	
c2				29.2 - 29.7			VOCs	
c3				42.28 - 42.78			VOCs	
c4				59.29 - 59.79			VOCs	
c5				71.74 - 72.24			VOCs	
c6				82.24 - 82.74			VOCs	
c7				107 - 107.5			VOCs	
Duplicate							VOCs	
Trip Blank							VOCs	
Field Equipment Blank							VOCs	

Notes:

bgs = Below ground surface

btoc = below top of casing

EPA = U.S. Environmental Protection Agency

msl = Mean sea level

TWP = Temporary well point

VOCs = Volatile organic compounds by EPA Method 8260D

Table 2
Temporary Well Point and Monitoring Well Groundwater Analytical Results (ug/L)
Former Springville Dry Cleaner
Springfield, Oregon

Location	Interval (feet btc)	Sample Date	PCE	TCE	cis- 1,2-DCE	Vinyl Chloride	Total CVOCs
February 2020 Focused On-Site Investigation							
Temporary Well Points							
PNG-1W		02/26/2020	1 UJ	1 UJ	1.4 J	1 UJ	1.4
PNG-3W		02/26/2020	52	2.4	1.0	1 U	56
PNG-9W		02/27/2020	46	36	65	30	185
PNG-10W		02/27/2020	223	461	404	135	1,250
PNG-11W		02/26/2020	1.4	0.5 U	0.5 U	0.5 U	1.4
PNG-12W		02/27/2020	67	1 U	1 U	1 U	67
PNG-13W		02/27/2020	0.5 U	0.5 U	0.5 U	0.5 U	0
PNG-14W		02/27/2020	5.8	1 U	3.5	1 U	9.3
PNG-15W		02/27/2020	0.78	0.5 U	1.1	0.5 U	1.8
Monitoring Wells							
IN-1s		02/26/2020	3.5	12	18	4.0	37
IN-3s		02/26/2020	0.5 U	0.73	0.5 U	0.5 U	0.73
January 2021 Focused On-Site Groundwater Investigation							
Temporary Well Points							
PNG-16	20.0 - 22.5	01/14/2021	502	31	37	5.0	577
	30.0 - 32.5	01/14/2021	75	30	57	1.9	167
	40.0 - 42.5	01/14/2021	122	14	20	2.8	159
	50.0 - 52.5	01/15/2021	3.9	4.5	3.9	1.3	14
PNG-17	20.0 - 22.5	01/13/2021	7.9	0.80	1.2	0.5 U	10
	30.0 - 32.5	01/13/2021	355	31	28	3.2	417
	40.0 - 42.5	01/13/2021	1,860	37	41	11	1,950
	50.0 - 52.5	01/14/2021	103	14	35	12	165
PNG-18	20.0 - 22.5	01/12/2021	19	27	15	4.5	66
	30.0 - 32.5	01/12/2021	55	54	78	12	202
	40.0 - 42.5	01/13/2021	156	29	26	2.2	213
	50.0 - 52.5	01/13/2021	28	35	37	14	117
(PNG-99W) dup	50.0 - 52.5	01/13/2021	28	36	39	16	121
PNG-19	30.0 - 32.5	01/11/2021	0.5 U	0.57	8.9	16	26
	38.0 - 40.5	01/12/2021	53	28	29	8.4	119
	50.0 - 52.5	01/12/2021	7.2	1.1	4.2	6.6	19
Monitoring Wells							
MW-3s*	20	01/11/2021	0.5 U	0.5 U	0.5 U	0.61	0.61
MW-22s*	23	01/11/2021	27	1.0	1.5	0.5 U	29
MW-21i*	52	01/11/2021	0.5 U	16	42	34	94
	62	01/11/2021	0.5 U	13	40	33	89
MW-25	c1 14 - 15	01/11/2021	0.5 U	0.5 U	0.5 U	0.5 U	0
	c2 29 - 30	01/11/2021	61	45	23	1.3	130
	c3 42 - 43	01/11/2021	103	59	24	1.5	189
	c4 59 - 60	01/11/2021	99	30	62	20	214
	c5 72 - 72	01/11/2021	0.5 U	0.5 U	8.6	2.0	11
	c6 82 - 83	01/11/2021	77	6.9	4.4	0.84	89
	c7 107 - 108	01/11/2021	0.5 U	0.5 U	0.5 U	0.5 U	0
DEQ Screening-Level Criteria for Groundwater^a							
Ingestion and Inhalation							
Residential			12	0.49	36	0.027	NA
Urban Residential			49	2.0	140	0.066	NA
Occupational			48	3.3	260	0.49	NA
Volatilization to Outdoor Air							
Residential			64,000	3,300	>S	350	NA
Urban Residential			150,000	6,900	>S	430	NA
Occupational			>S	20,000	>S	5,900	NA
Vapor Intrusion into Buildings							
Residential			3,700	200	>S	17	NA
Urban Residential			8,700	430	>S	21	NA
Occupational			48,000	3,700	>S	880	NA
GW in an Excavation							
Construction/Excavation			5,600	430	18,000	960	NA
EPA Maximum Contaminant Levels^b							
Drinking Water			5	5	70	2	NA

Table 2
Temporary Well Point and Monitoring Well Groundwater Analytical Results (ug/L)
Former Springvillla Dry Cleaner
Springfield, Oregon

Notes:

^a Oregon Department of Environmental Quality (DEQ) Generic Risk-Based Concentrations (revised May 2018)

^b Environmental Protection Agency (EPA) National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCL) EPA 816-F-09-004, (EPA 2009)

>S = the RBC exceeds the solubility limit of this compound.

* = low flow sample collected at depth noted within well screen interval

CVOCs = Combined total of detected chlorinated VOCs (PCE, TCE, DCE, and Vinyl Chloride)

DCE = Dichloroethene

J = Estimated value. See corresponding data validation report for additional information.

NA = Not Applicable

PCE = Tetrachloroethene

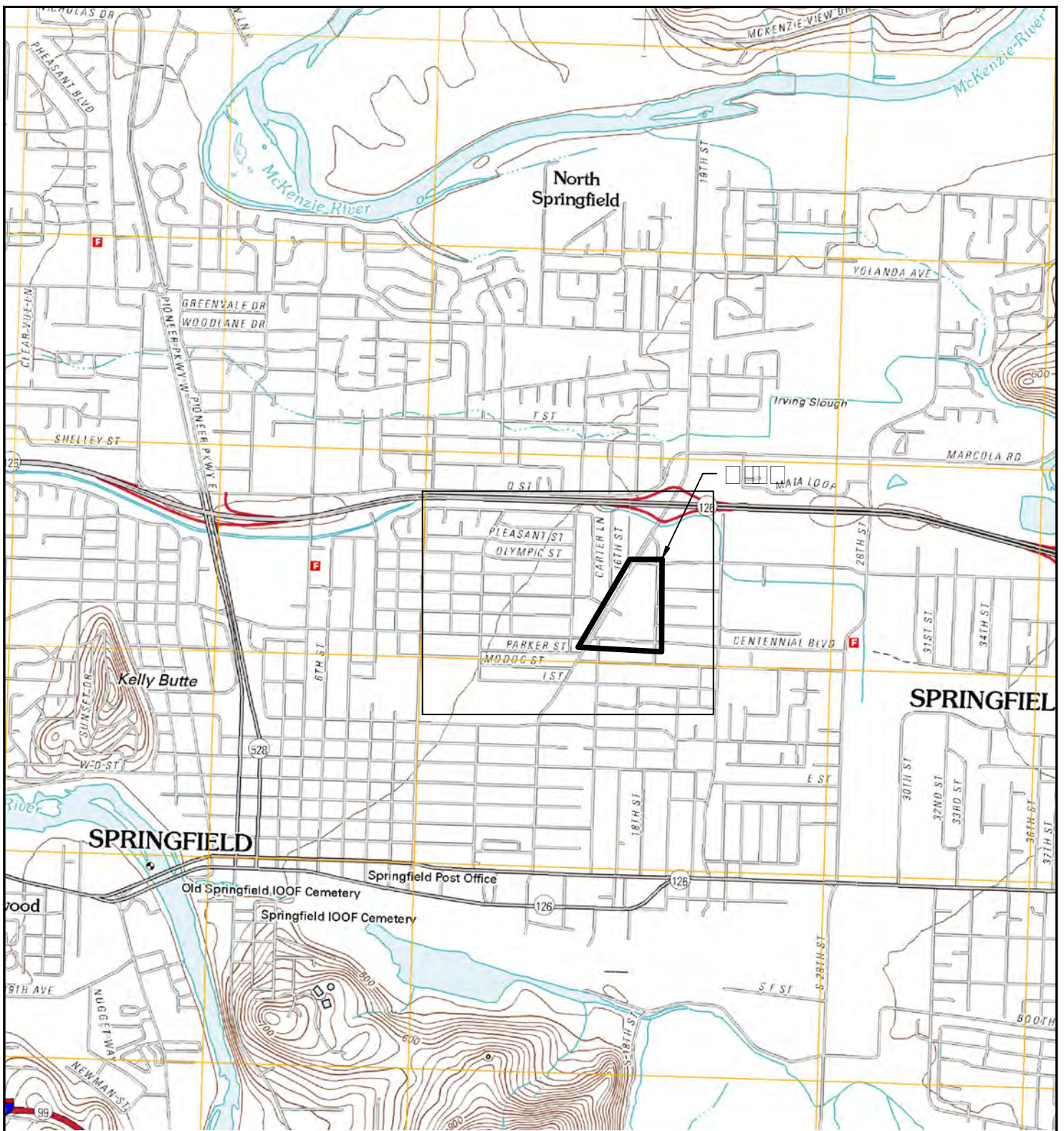
TCE = Trichloroethene

U = Not detected at the reporting limit shown.

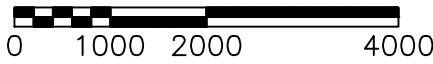
ug/l = micrograms per liter

Volatile Organic Compounds (VOCs) analyzed by EPA Method 8260B/C

FIGURES



APPROXIMATE SCALE IN FEET



NOTE: USGS, SPRINGFIELD QUADRANGLE
OREGON-LANE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

PNG ENVIRONMENTAL, INC. 6665 SW Hampton St., Ste. 101 Tigard, OR 97223 TEL (503) 620-2387 FAX (503) 620-2977	DATE: 7-8-14 FILE NAME: 1176-01 DRAWN BY: JJT APPROVED BY: SV	FORMER SPRINGVILLA DRY CLEANER 1459 MOHAWK BLVD SPRINGFIELD, OR.	SITE LOCATION MAP	Project No. 1176-01 Figure No. 1
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C:\Users\Josh\Desktop\Autocad Files\PNG-Autocad\1176-01 Springfield\2020\Aug 2020\1176-01_BM-082520.dwg 2.17.2014

LEGEND

- Monitoring Well
- Municipal Water-Supply Well

NOTE:
BASE MAPS:
• Lane County Assessment and Taxation
• Statewide Land Survey



PNG ENVIRONMENTAL, INC.

6665 SW Hampton St., Ste. 101 Tigard, OR 97223

TEL (503) 620-2387
FAX (503) 620-2977

DATE: 8-31-20
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: SV

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

SITE FEATURES
REGIONAL

Project No.
1176-01
Figure No.
2

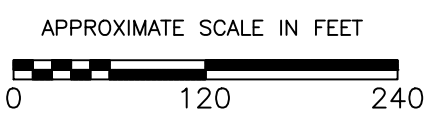
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LEGEND

- MW-1  Monitoring Well
-  Former Monitoring Well

NOTE:
BASE MAPS:
• Springfield Utility Board
• Statewide Land Survey



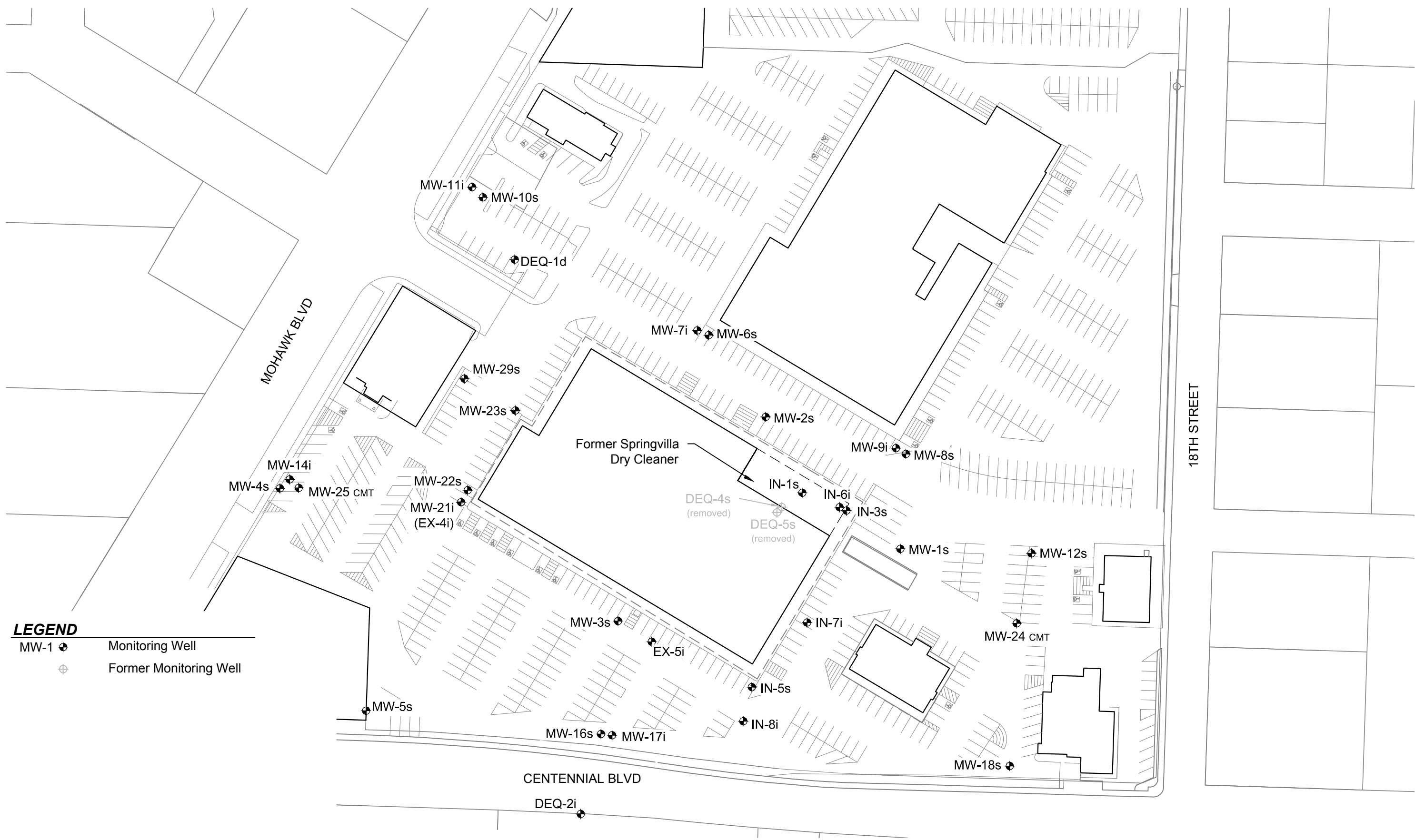
PNG ENVIRONMENTAL, INC.
6665 SW Hampton St., Ste. 101 Tigard, OR 97223
TEL (503) 620-2387
FAX (503) 620-2977

DATE: 2-13-17
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: SV

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

SITE FEATURES
LOCAL

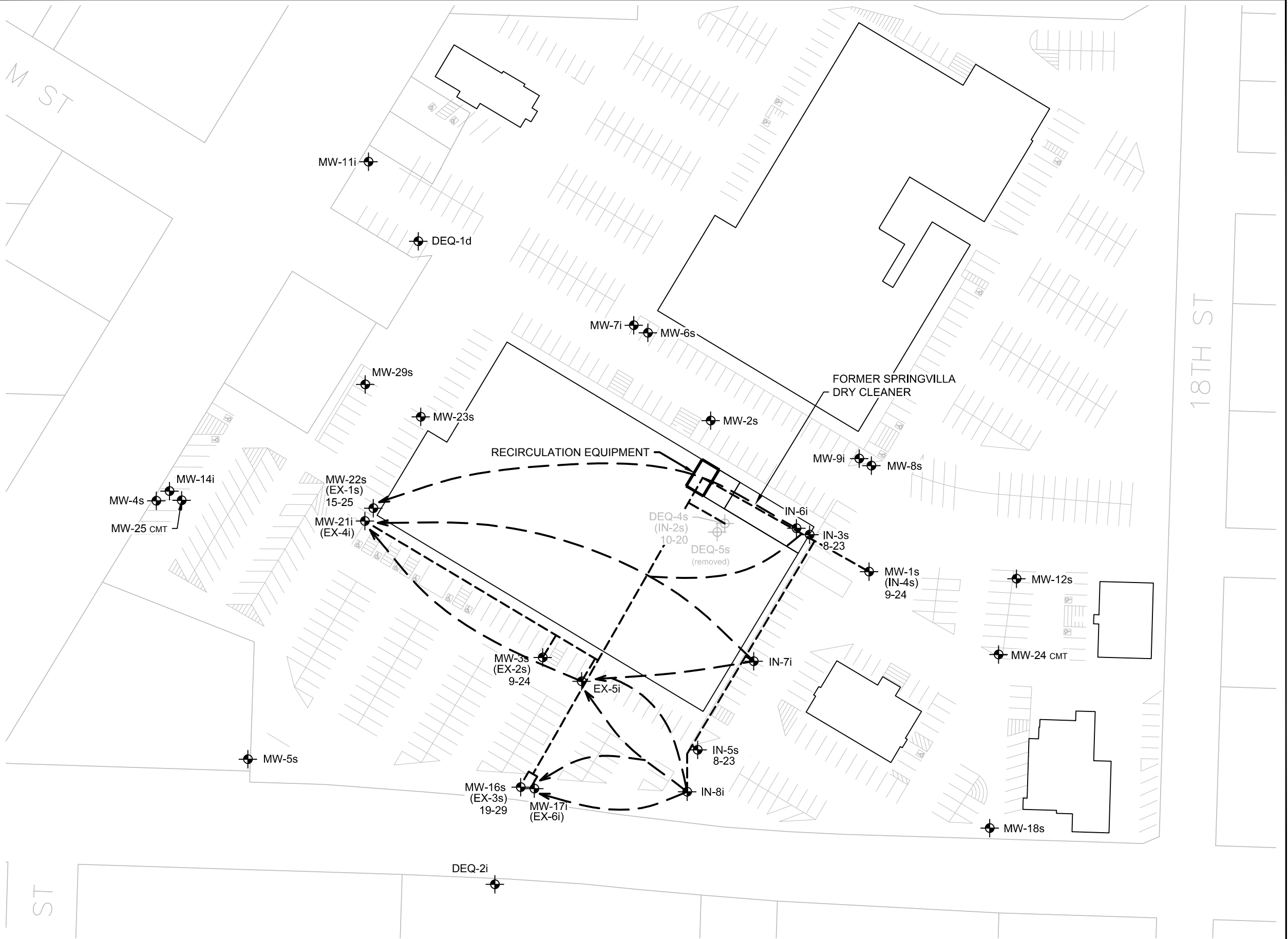
Project No.
1176-01
Figure No.
3



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APPROXIMATE SCALE IN FEET

0 80 160



LEGEND

-  Monitoring Well
-  Former Monitoring Well
-  Recirculation Piping
-  Conceptual Intermediate Zone Flow-Line
- IN = HartCrowser Injection Well (2007)
- EX = HartCrowser Extraction Well
- MW = Bergeson-Boese, Maul Foster, or HartCrowser Monitoring Well (1999-2010)
- CMT = PNG Monitoring Well (2011)
- 15-25 = Well Screen Zone

NOTE:

- BASE MAPS:
- Lane County Assessment and Taxation
 - Statewide Land Survey
 - Bergeson-Boese
 - Oregon DEQ
 - HartCrowser (2007 & 2011)
 - Features shown are approximate and for illustrative purposes only.

PNG ENVIRONMENTAL, INC.

6665 SW Hampton St., Ste. 101
Tigard, OR 97223

TEL (503) 620-2387
FAX (503) 620-2977

DATE: 8-26-20
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: GT

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

2007 RECIRCULATION SYSTEM
SHALLOW WELLS

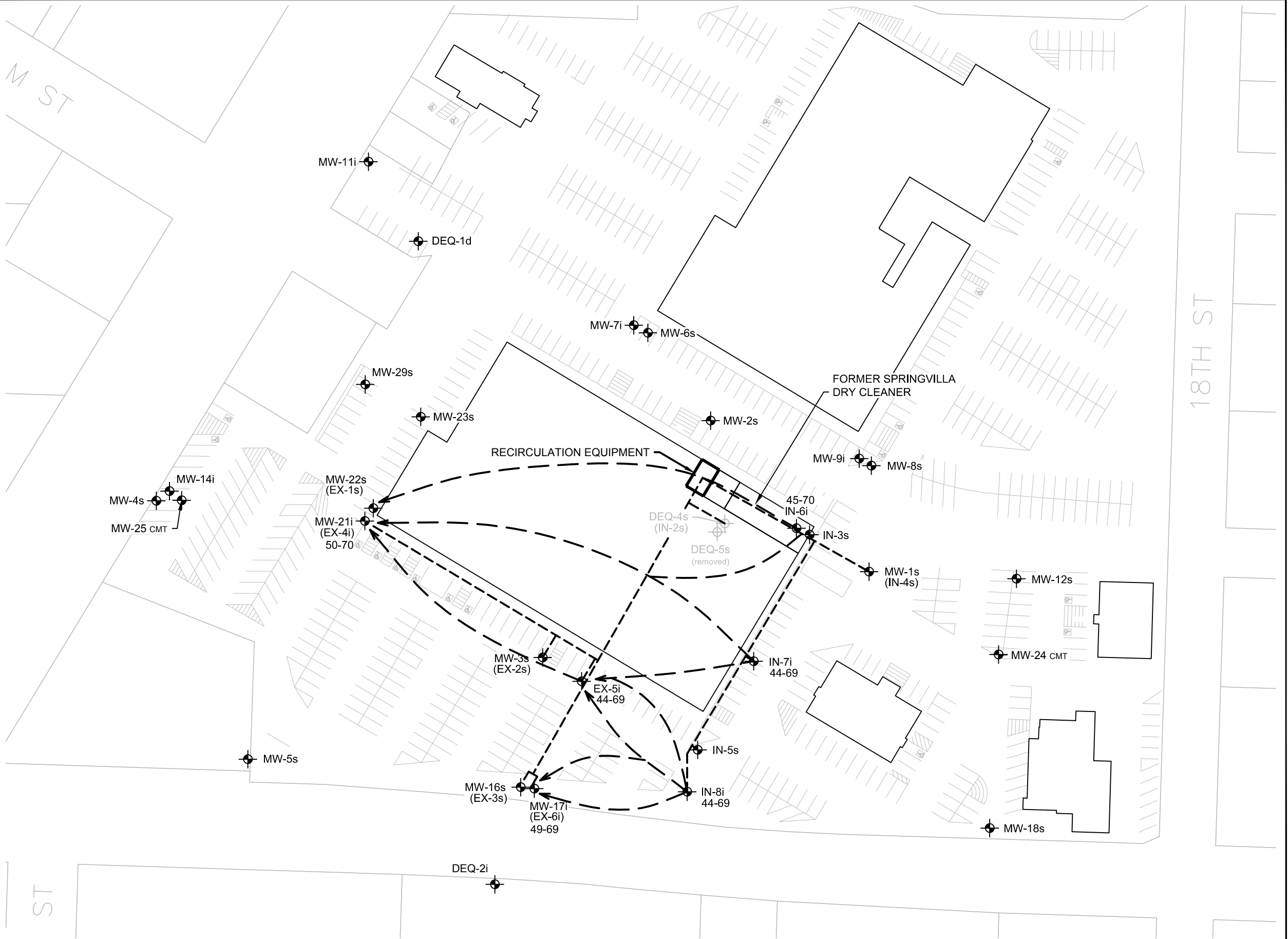
Project No.
1176-01

Figure No.
4

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APPROXIMATE SCALE IN FEET

0 80 160



LEGEND

-  Monitoring Well
-  Former Monitoring Well
-  Recirculation Piping
-  Conceptual Intermediate Zone Flow-Line
- IN = HartCrowser Injection Well (2007)
- EX = HartCrowser Extraction Well
- MW = Bergeson-Boese, Maul Foster, or HartCrowser Monitoring Well (1999-2010)
- CMT = PNG Monitoring Well (2011)
- 44-69 = Well Screen Zone

NOTE:

- BASE MAPS:
- Lane County Assessment and Taxation
 - Statewide Land Survey
 - Bergeson-Boese
 - Oregon DEQ
 - HartCrowser (2007 & 2011)
 - Features shown are approximate and for illustrative purposes only.

PNG ENVIRONMENTAL, INC.

6665 SW Hampton St., Ste. 101 Tigard, OR 97223

TEL (503) 620-2387
FAX (503) 620-2977

DATE: 8-26-20
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: GT

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

2007 RECIRCULATION SYSTEM
INTERMEDIATE WELLS

Project No.
1176-01

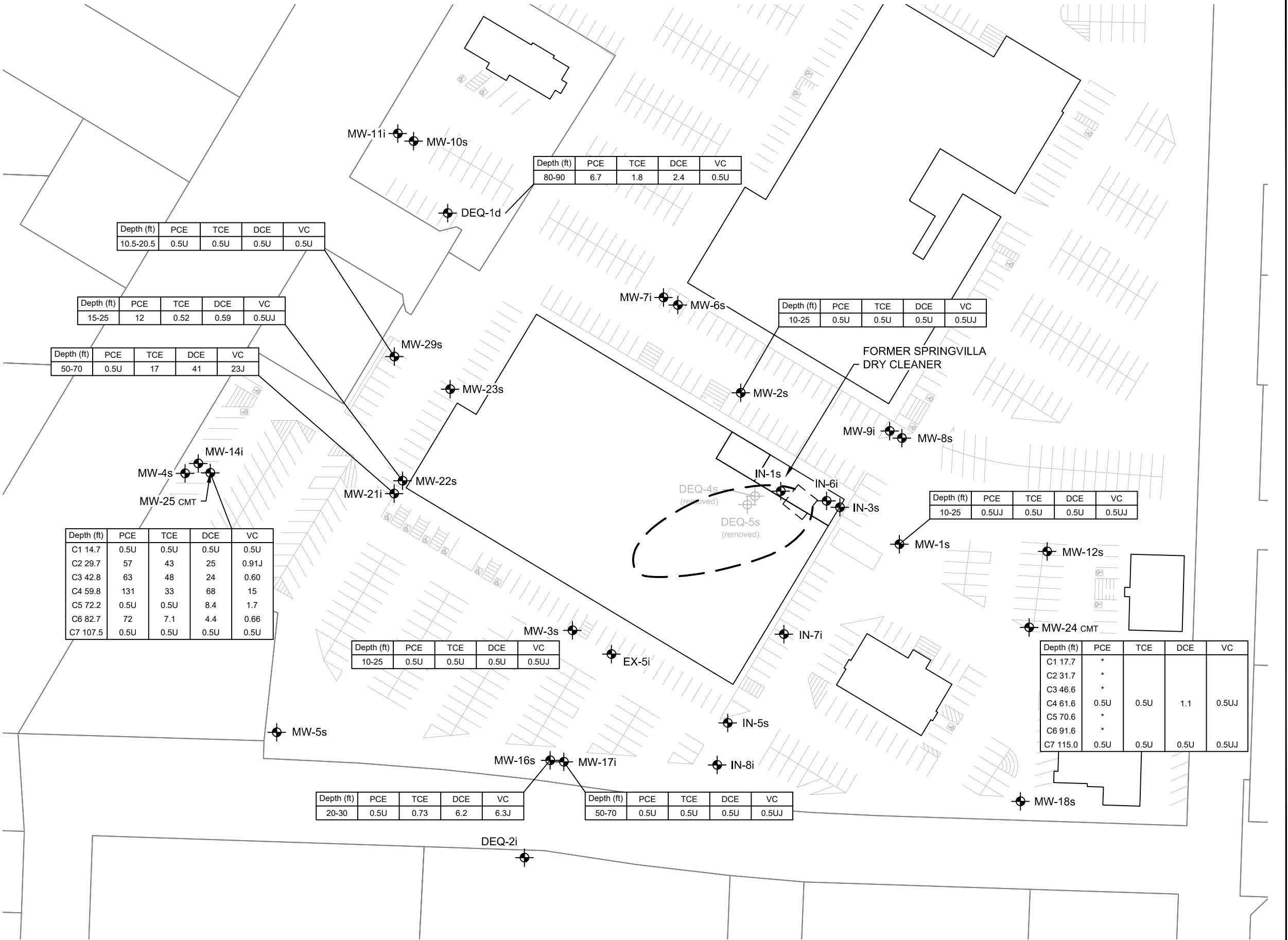
Figure No.
5

LEGEND

- Monitoring Well
- Former Monitoring Well
- IN = HartCrowser Injection Well (2007)
- MW = Bergeson-Boese, Maul Foster, or HartCrowser Monitoring Well (1999-2010)
- CMT = PNG Monitoring Well (2011)
- PCE= Tetrachloroethene
- TCE= Trichloroethene
- DCE= cis-1,2-Dichloroethene
- VC= Vinyl Chloride
- 140= Concentration (ug/L)
- U= Not Detected Above Laboratory Reporting Limit Indicated
- c1 14.7= CMT™ Channel Number and Depth in Feet.
- *= Not Sampled During this Monitoring Event
- HartCrowser Soil Removal Area (08/2004)
- Approximate Area of Residual Shallow Groundwater Impact

NOTE:

- BASE MAPS:
- Lane County Assessment and Taxation
 - Statewide Land Survey
 - Bergeson-Boese & HartCrowser
 - Oregon DEQ
 - Features shown are approximate and for illustrative purposes only.



PNG ENVIRONMENTAL, INC.

6665 SW Hampton St., Ste. 101 Tigard, OR 97223

TEL (503) 620-2387 FAX (503) 620-2977

DATE: 3-15-21
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: GT

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

VOCs IN GROUNDWATER - LOCAL
OCTOBER 2020

Project No.
1176-01

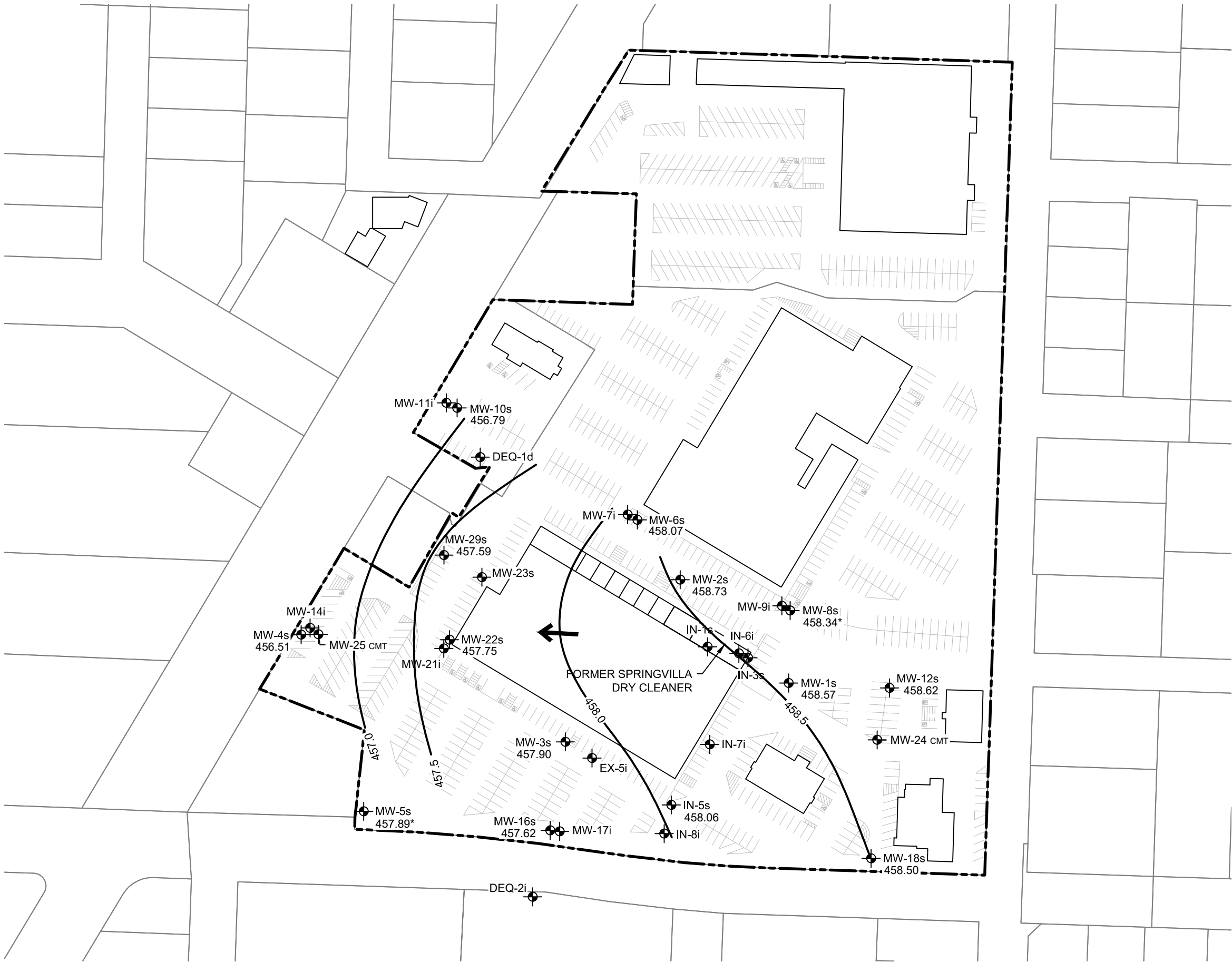
Figure No.
6

LEGEND

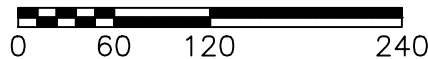
- Monitoring Well (PNG)
- Municipal Water-Supply Well
- 461.24 Groundwater Elevation (Feet MSL)
- Groundwater Contour
- Approximate Groundwater Flow Direction
- * = Not Used for Contouring
- Well Screen Depths Between 8 and 26 feet BGS.

NOTE:

- BASE MAPS:
- Lane County Assessment and Taxation
 - Statewide Land Survey



APPROXIMATE SCALE IN FEET



PNG ENVIRONMENTAL, INC.

6665 SW Hampton St., Ste. 101
Tigard, OR 97223

TEL (503) 620-2387
FAX (503) 620-2977

DATE: 11-18-20
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: SV

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

GROUNDWATER ELEVATION CONTOURS
SHALLOW ZONE AQUIFER
OCTOBER 2020

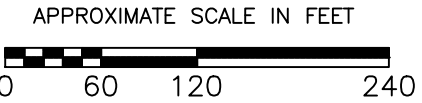
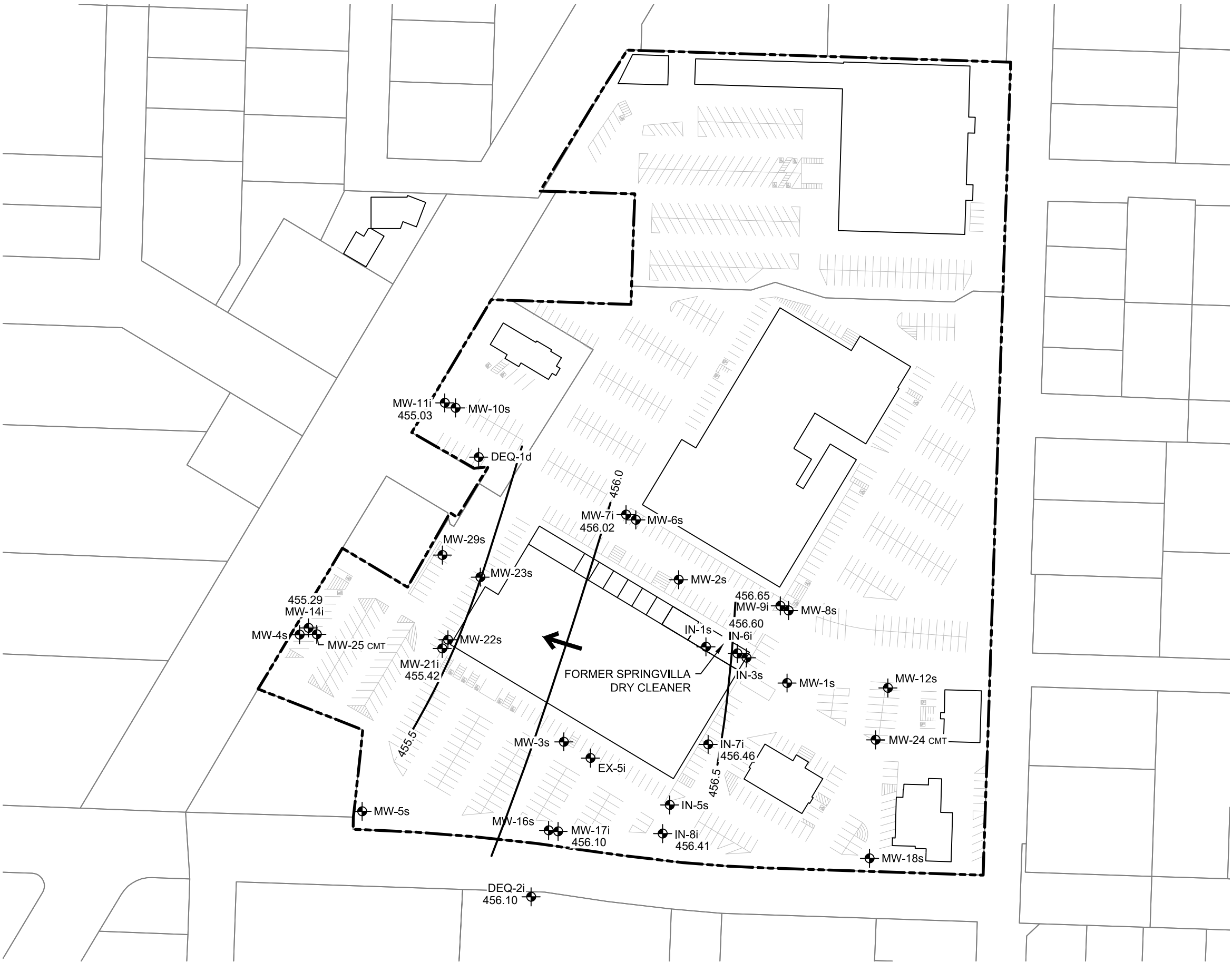
Project No.
1176-01

Figure No.
7

LEGEND

- Monitoring Well (PNG)
- Municipal Water-Supply Well
- 456.74 Groundwater Elevation (Feet MSL)
- Groundwater Contour
- Approximate Groundwater Flow Direction
- Well Screen Depths Between 40 and 60 feet BGS.

NOTE:
BASE MAPS:
• Lane County Assessment and Taxation
• Statewide Land Survey



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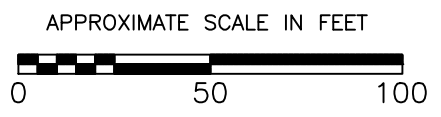
DATE: 11-23-20
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: SV

FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

GROUNDWATER ELEVATION CONTOURS
INTERMEDIATE ZONE AQUIFER
OCTOBER 2020

Project No.
1176-01
Figure No.
8

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Note: MW-10s and MW-11i are approximately 60 feet to north of DEQ-1d

MOHAWK BLVD

Depth (ft)	PCE	TCE
14.7	0.5U	0.5U
29.7	61	45
42.8	103	59
59.8	99	30
72.2	0.5U	0.5U
82.7	77	6.9
107.5	0.5U	0.5U

MW-29s		
DEPTH(FT)	PCE	TCE
10.5-20.5	0.52	0.5U

PNG-17		
DEPTH(FT)	PCE	TCE
22.5	7.9	0.8
32.5	355	31
42.5	1,860	37
52.5	103	14

MW-2s		
DEPTH(FT)	PCE	TCE
10-25	0.5U	0.5U

PNG-11		
DEPTH(FT)	PCE	TCE
10-15	1.4	0.5U

LEGEND

- MW-1 Monitoring Well
- Former Monitoring Well
- PNG Boring (2020)
- PNG Temporary Well Point Boring Groundwater Sample Location (2020)
- Temporary Well Point Boring (2021)
- HartCrowser Soil Removal Area (08/2004)
- Approximate Area of Detected Shallow Groundwater Impact (Less than 25' Depth)
- PCE= Tetrachloroethene (ug/L)
- TCE= Trichloroethene (ug/L)
- U= Not Detected Above Laboratory Reporting Limit Indicated
- J= Estimated Value



Reference Levels (ug/L)		
RBC Ingestion & Inhalation	PCE	TCE
Occupational	48	3.3
RBC Vapor Intrusion		
Occupational	48,000	3,700

NOTE:
BASE MAPS:
• Lane County Assessment and Taxation
• Statewide Land Survey
• Bergeson-Boese & HartCrowser
• Oregon DEQ
• Features shown are approximate and for illustrative purposes only.

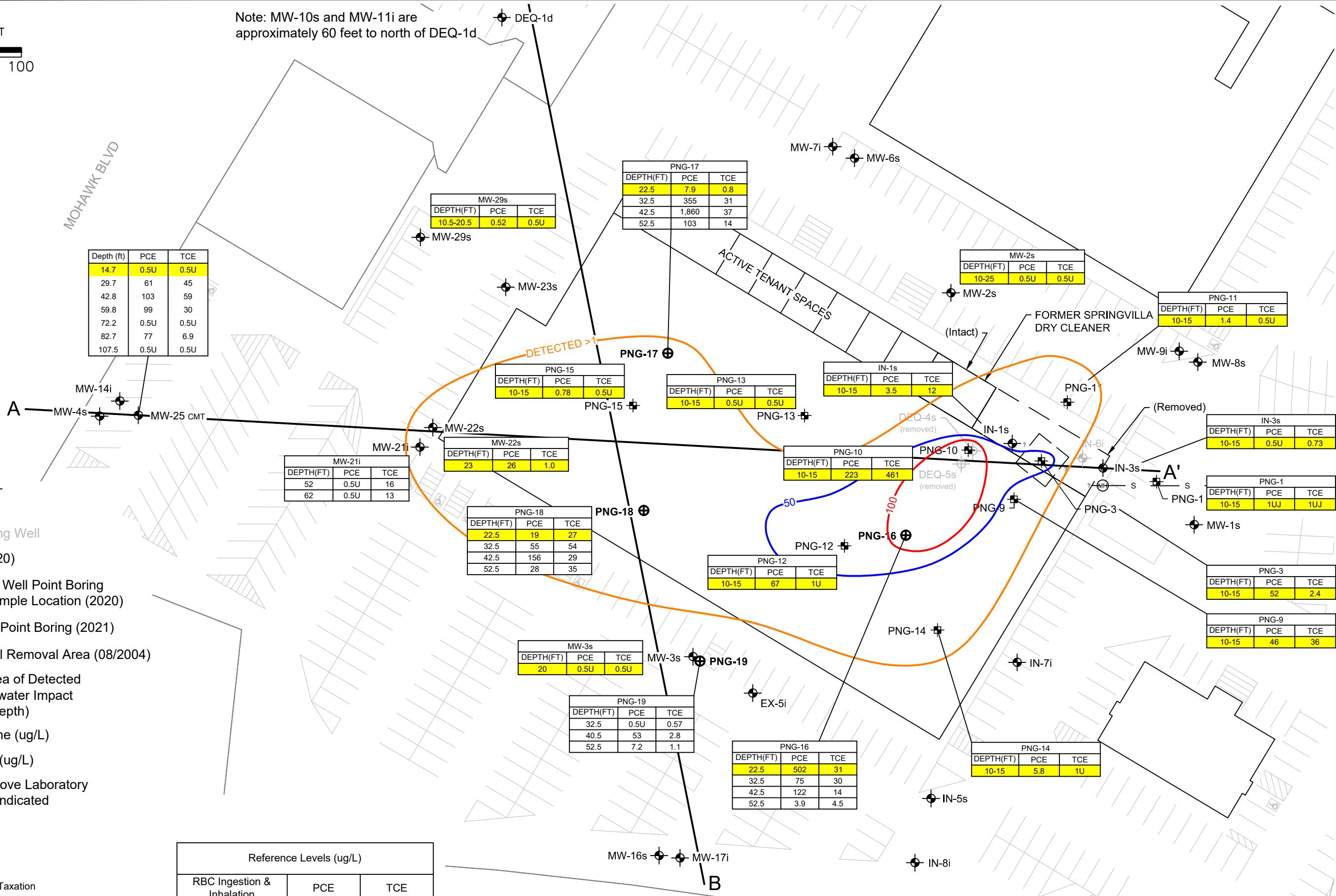
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DATE: 3-30-21
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: SV

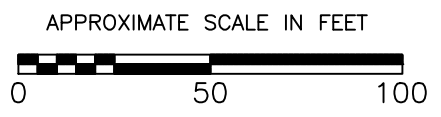
FORMER SPRINGVILLA DRY CLEANER
1459 MOHAWK BLVD
SPRINGFIELD, OR

TEMPORARY WELL POINT AND
SHALLOW ZONE GROUNDWATER
RESULTS (LESS THAN 25' DEPTH)

Project No.
1176-01
Figure No.
10



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Note: MW-10s and MW-11i are approximately 60 feet to north of DEQ-1d

MOHAWK BLVD

Depth (ft)	PCE	TCE
14.7	0.5U	0.5U
29.7	61	45
42.8	103	59
59.8	99	30
72.2	0.5U	0.5U
82.7	77	6.9
107.5	0.5U	0.5U

MW-29s		
DEPTH(FT)	PCE	TCE
10.5-20.5	0.52	0.5U

PNG-17		
DEPTH(FT)	PCE	TCE
22.5	7.9	0.8
32.5	355	31
42.5	1,860	37
52.5	103	14

MW-2s		
DEPTH(FT)	PCE	TCE
10-25	0.5U	0.5U

PNG-11		
DEPTH(FT)	PCE	TCE
10-15	1.4	0.5U

LEGEND

- MW-1 Monitoring Well
- Former Monitoring Well
- PNG Boring (2020)
- PNG Temporary Well Point Boring Groundwater Sample Location (2020)
- Temporary Well Point Boring (2021)
- HartCrowser Soil Removal Area (08/2004)
- Approximate Area of Upper Intermediate Zone Groundwater Impact (30-42.5' Depth)
- PCE= Tetrachloroethene (ug/L)
- TCE= Trichloroethene (ug/L)
- U= Not Detected Above Laboratory Reporting Limit Indicated
- J= Estimated Value

Reference Levels (ug/L)		
RBC Ingestion & Inhalation	PCE	TCE
Occupational	48	3.3
RBC Vapor Intrusion		
Occupational	48,000	3,700

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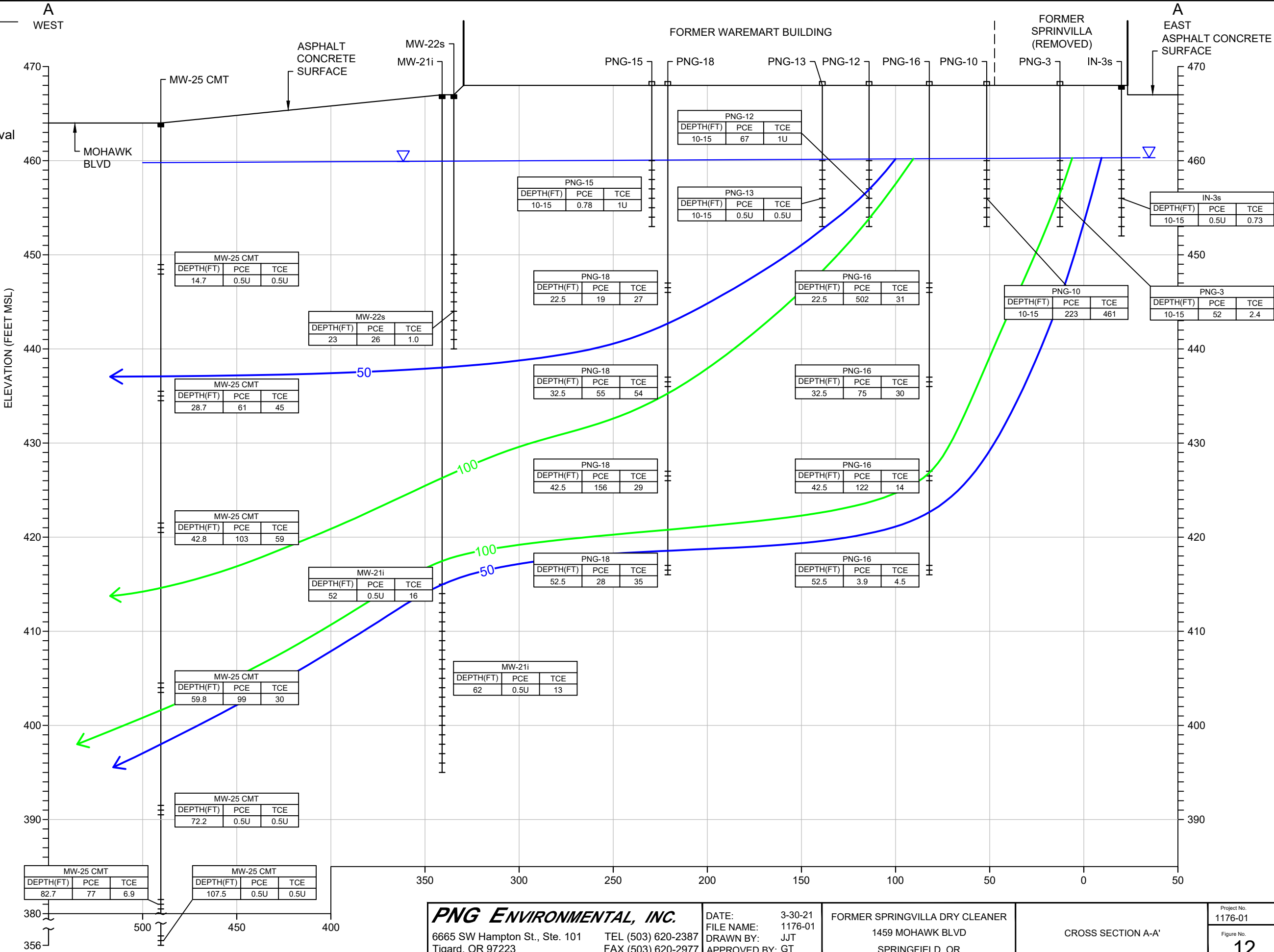
TEL (503) 620-2387 FAX (503) 620-2977

DATE: 3-30-21 FILE NAME: 1176-01 DRAWN BY: JJT APPROVED BY: SV	FORMER SPRINGVILLA DRY CLEANER 1459 MOHAWK BLVD SPRINGFIELD, OR	TEMPORARY WELL POINT AND UPPER INTERMEDIATE GROUNDWATER RESULTS (30-42.5' DEPTH)	Project No. 1176-01 Figure No. 11
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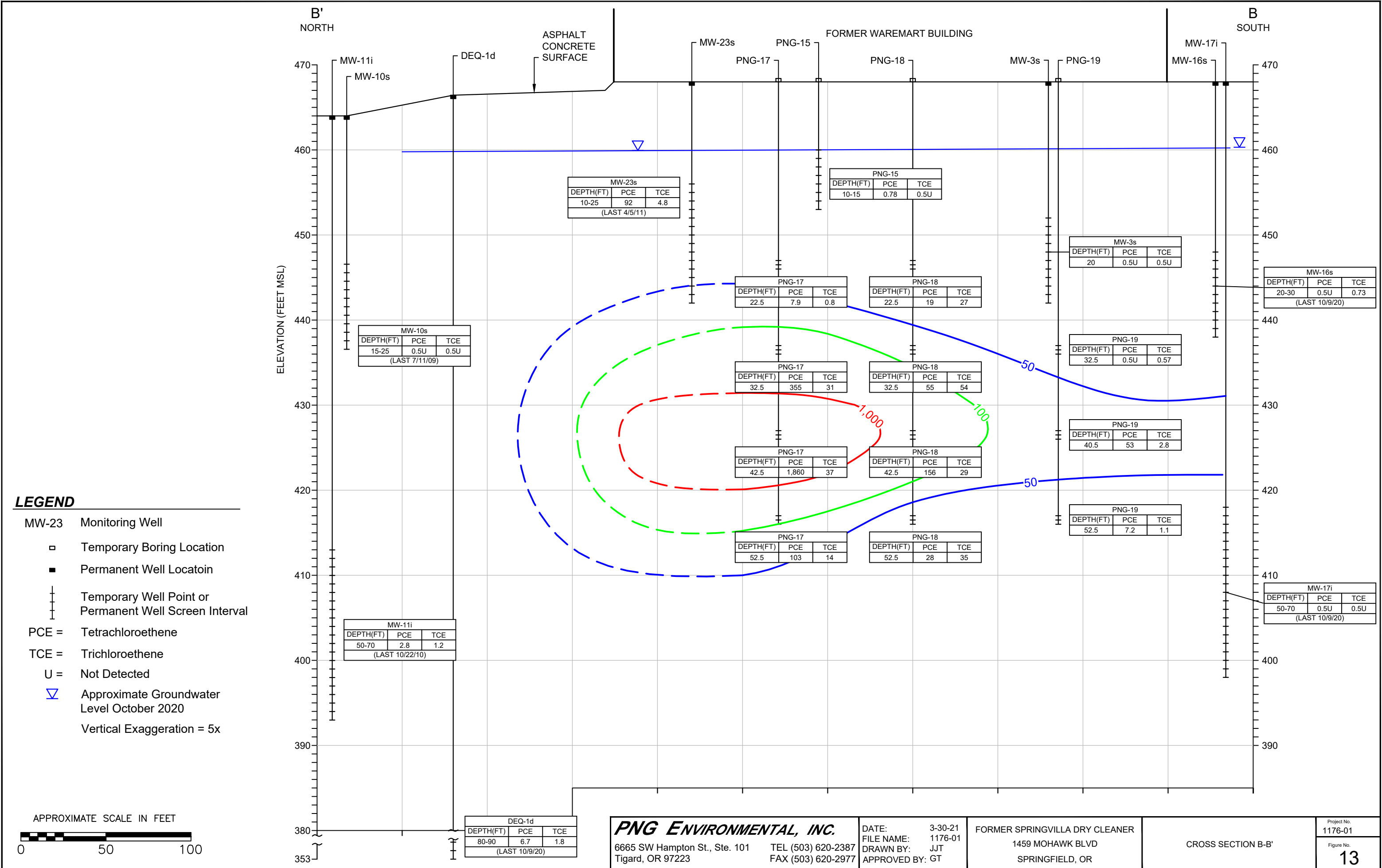
LEGEND

- MW-22 Monitoring Well
- Temporary Boring Location
 - Permanent Well Locatoin
 - Temporary Well Point or Permanent Well Screen Interval
- PCE = Tetrachloroethene
- TCE = Trichloroethene
- U = Not Detected
- Approximate Groundwater Level October 2020
- Vertical Exaggeration = 5x

Note:
Refer to October 2020
Semi-Annual Report for
Off-site Plume Conditions



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DATE: 3-30-21
FILE NAME: 1176-01
DRAWN BY: JJT
APPROVED BY: GT

1459 MOHAWK BLVD
SPRINGFIELD, OR

CROSS SECTION B-B'

Project No.
1176-01

Figure No.
13

APPENDIX A
OREGON DEQ LETTER

State of Oregon
Department of Environmental Quality

Memorandum

To: Guy Tanz, PNG Environmental **Date:** 8/4/20

From: Don Hanson, DEQ

Subject: **Review of Documents**

- Q Street Municipal Well Aquifer Test Report, 3/16/2020
- On-Site Investigation Technical Memo, 5/22/20
- Interim Pumping Assessment Technical Memorandum, May 28, 2020

Project: Springvilla Dry Cleaners

cc: Project file, ECSI 3222

Ec: Alyssa Leidel, DEQ Eugene

Dear Mr. Tanz,

DEQ has reviewed the above documents and has provided comments on the individual reports below. Many of the comments are related and have to do with the better understanding distribution of the groundwater contaminant plume and its spread now and in the future. As our comments note, additional delineation in several areas will be needed to support this understanding. Once you have had a chance to review our comments, please respond and propose steps to fill in these data gaps, monitor the contamination, and predict where the contamination will likely migrate, all of which will be necessary to define the locality of the facility and the conceptual site model.

COMMENTS ON: Q STREET MUNICIPAL WELL AQUIFER TEST REPORT DATED 3/16/2020

1. Introduction: The report states that *the pumping assessment was completed to determine if the Q Street water-supply well has hydraulic influence on the Springvilla groundwater contaminant plume*. What is your conclusion regarding the hydraulic influence of the Q Street well?
2. Introduction: The report states that *the aquifer test was conducted to provide hydraulic data necessary to evaluate plume fate and transport and support selection and performance of groundwater modeling*. The report does not suggest what type of groundwater modeling is needed to accomplish this. DEQ previously requested an analysis of different modeling approaches (i.e., 2D vs. 3D). We discussed the topic of modeling some in our video conference call on 4/24/20. We request that you provide an analysis of various modeling options and a proposal based on the needs of the project and the benefits of the various models, and any data gaps that may need to be filled to help facilitate a successful modeling outcome.
3. The proposed modeling approach needs to address the following:
 - a. Properly define the upper and lower aquifers with support of geology and hydrogeology;

- b. Address and provide reasoning concerning the broad extent of the plume;
 - c. Identify any data gaps that need filling to provide adequate model input for a successful outcome.
4. From P 11, 3.4.2, Semi-log plots-
“A semi-log plot of the pumping-phase drawdown data for the Q Street well is presented on Figure 17. It took about 10 minutes after the pump was turned on for water levels to stabilize and consistent drawdown to begin. The slope of the drawdown curve is relatively shallow at first and increases gradually during the first day of the test. The slope becomes much steeper after that time and plots as a relatively straight line during the last six days of the test. This shape is the opposite of what would be expected if there was significant leakage into the aquifer from overlying zones, which would cause the drawdown curve to flatten late in the test.”
 - We wonder if a step-drawdown test would have been able to provide more information to characterize the aquifer. This would not need to be nearly as long of a test. Why was a step drawdown test not done?
5. From P 11, 3.4.2, Semi-log plots-
“For the analysis discussed below, data collected after the first day of the test are defined as late-time pumping-phase data. These are considered to be more representative of the aquifer as a whole, and all of the aquifer properties estimated below are based on the late-time data.”
Please explain why you consider late time more representative of the aquifer.
6. (Comment received from SUB)The data indicate that the lower aquifer is semi-confined (leaky). In order to analyze the test data, the conceptual model of the aquifer system was modified so that the lower aquifer would include the full screened interval of the Q Street well. In this simplified conceptual model, only the shallow and intermediate zones are included in the non-confined aquifer. The aquifer test data appear to fit this conceptual model relatively well.
7. (Comment from Rainbow) Sections 2.2.2 and 4.3.1 indicate that he modified the conceptual model to simplify it, placing the entire screened interval of the Q Street Well in the lower aquifer. It seems like this might amplify the downward migration which could be beneficial if it gives us a worst case scenario for Q Street Well impacts. On the other hand, if the model shows less horizontal migration in the upper aquifer by taking out Q Street Well's pumping impact, this might be a negative.

COMMENTS ON: ON-SITE INVESTIGATION TECHNICAL MEMORANDUM, May 22, 2020

1. Section 2.2 – Regulatory Framework. The report correctly explains two methods for risk assessment. It is important to remember that in streamline the risk assessment process using RBCs, cumulative risk from various chemicals and exposure pathways still need to be considered, as is done in a baseline risk assessment. RBCs are also often used in baseline risk assessments as part of the COC screening process.

2. This report does a good job documenting the current shallow groundwater and soil conditions at the former shopping center site. While not a primary objective of this assessment, in light of the off-site groundwater plume nature and extent discussions that are ongoing, including modeling, it appears that a data gap exists regarding the current deeper (intermediate/deep zone) groundwater contaminant conditions beneath the former Waremart building. We feel that additional vertical characterization of groundwater will be needed in this location to support future modeling.

COMMENTS ON: INTERIM PUMPING ASSESSMENT TECHNICAL MEMORANDUM,
5/28/2020

1. How does PNG propose to quantify the relationship between the intermediate and deep aquifers?
2. The increasing VOC concentrations in the intermediate zone aquifer in most areas of the plume are concerning and will require further delineation to track and better understand the continued plume spread to the west, south/southwest, and north.

**APPENDIX B
FIELD LOGS
(ATTACHED CD)**

APPENDIX C
LABORATORY RESULTS AND CHAIN-OF-CUSTODY
DOCUMENTATION
(ATTACHED CD)

APPENDIX D
INVESTIGATIVE DERIVED WASTE DISPOSAL
DOCUMENTATION
(ATTACHED CD)