STAFF REPORT

Meeting Date:	January 7, 2026
Author:	Sharon Darroux, Engineering Manager
Department:	Public Works
Division:	Engineering
Subject:	St. Helens Reservoir Siting Study
Type of Item:	Adopt Reservoir Siting Study
CC:	City Administrator John Walsh
	Public Works Director Mouhamad Zaher

Introduction:
The reservoir project is the City's plan to build a new 5.0-million-gallon water reservoir that will help keep St. Helens' water system safe, reliable, and ready for the future. Our community has been operating with aging infrastructure and the loss of a major reservoir, which puts pressure on daily water use, fire protection, and emergency readiness. This project adds much-needed storage, strengthens our ability to respond during dry seasons or emergencies, and ensures that clean, dependable water will continue to be available for residents, businesses, and future growth. It is an investment in the health, safety, and long-term resilience of St. Helens.

Background:
On May 7, City Council approved a contract with Keller Associates to conduct a Reservoir Siting Study to evaluate potential locations for a new water storage reservoir. The study assessed candidate sites based on system hydraulics; subsurface, geotechnical, and soil conditions; environmental impacts and regulatory requirements; site constraints and constructability; adjacent land uses and aesthetics; and estimated construction costs.

The key objectives of the study were to:

- identify optimal site locations for a new reservoir;
- ensure compliance with federal, state, and local drinking water regulations;
- evaluate and minimize potential environmental and community impacts;
- optimize hydraulic performance by improving system pressure, reducing pumping costs, and ensuring reliable water delivery;
- enhance system redundancy and emergency response capacity, including consideration of seismic risks, flood hazards, and redundancy in water supply routes; and
- identify a site that is cost-effective to develop, operate, and maintain, considering land acquisition, grading, utility access, and long-term operations and maintenance costs.

On December 17, Keller Associates presented the draft Reservoir Siting Study to City Council, including a recommended site located at Pittsburg Road and Meadowview Drive. City Council feedback and input were subsequently incorporated into the final report.

The study evaluated four potential sites based on hydraulic performance; geotechnical and seismic considerations; permitting and environmental factors; land use and planning processes; cost and constructability; and stakeholder engagement results. Site No. 2, located at the eastern corner of Pittsburg Road and Meadowview Drive, was determined to have the most favorable geologic conditions, strong compatibility with existing water system hydraulics, relatively short pipeline connections compared to the other sites, and the lowest overall anticipated capital cost. Based on these factors, Site No. 2 is the recommended location for the new reservoir.

Requested Action:
City Council is requested to adopt the St. Helens Reservoir Siting Study Report and to authorize City staff to proceed with negotiations to acquire the property identified as Site No. 2 in the Reservoir Siting Study Report, as the recommended reservoir site located at Pittsburg Road and Meadowview Drive.

Attachments:

- Final Reservoir Siting Study

DECEMBER 2025
PROJECT NO. 225054
CITY PROJECT NO. W-484

CITY OF ST. HELENS

Technical Report

Reservoir Siting Study

PREPARED BY

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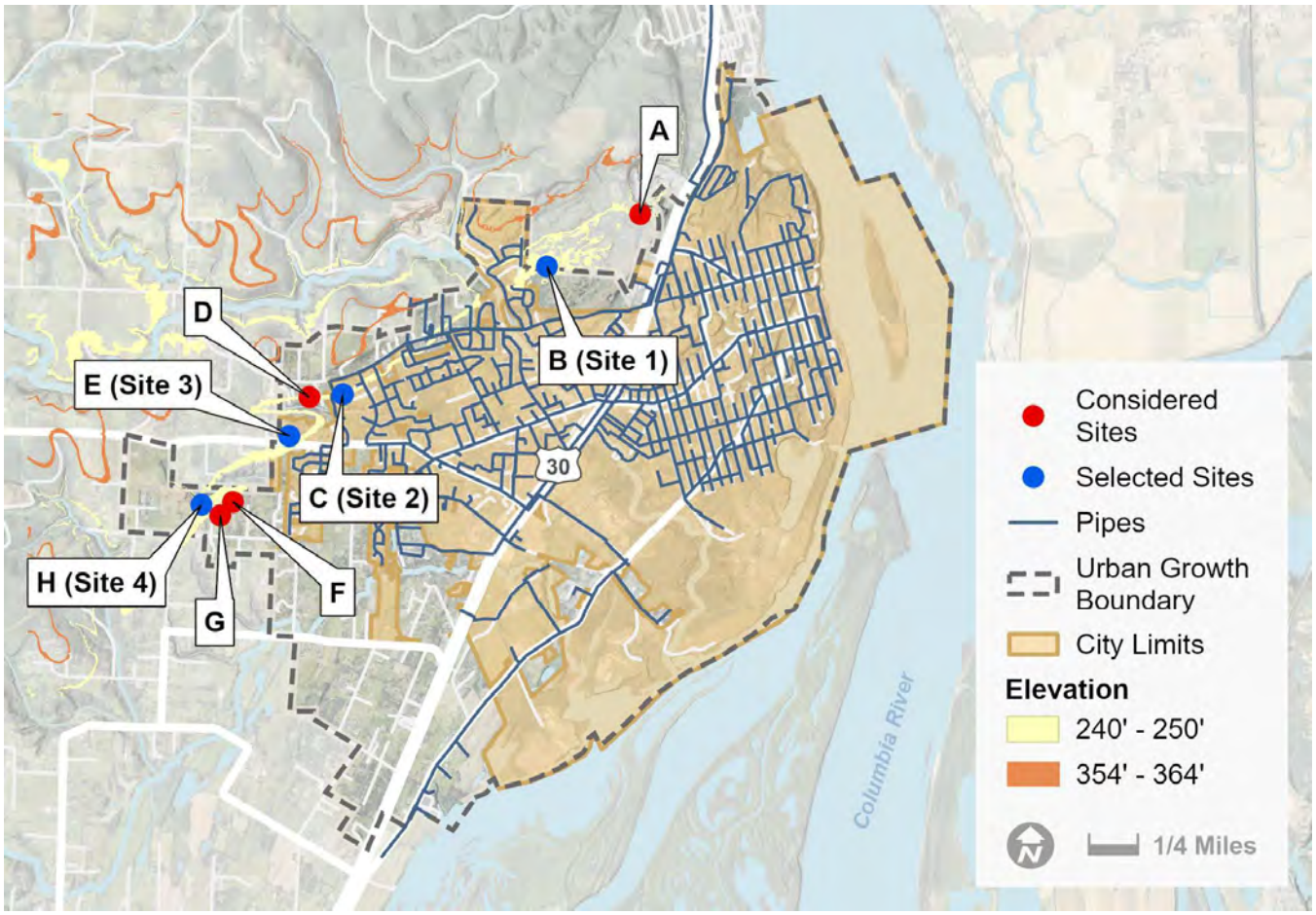
EXECUTIVE SUMMARY

The City of St. Helens currently faces potable water storage deficits that are expected to increase with growth while working to maintain aging infrastructure. The City contracted with Keller Associates (Keller) for the development of a reservoir siting study to evaluate potential sites for the proposed 5.0 MG reservoir. The improvements have been spurred by the City's desire to meet the storage requirements while improving redundancy and providing capacity for future growth.

Site Identification and Determination of Priority Sites

A review of potential sites that aligned with the hydraulic requirements of the existing water system identified eleven sites. Several of these sites were removed from consideration due to future cost, operations, and maintenance implications associated with a site in the high pressure zone or known site deficiencies. Of the original eleven sites that were originally identified, eight were evaluated with a preliminary desktop study. These eight sites are depicted in **Figure ES-1**.

FIGURE ES-1: PRELIMINARY SITE IDENTIFICATION



The preliminary desktop study considered seismic and geologic hazards, liquefaction potential, surrounding land uses, constructability, proximity to the main pressure zone, proximity to an overflow and drain connection, and hydraulic operations. The list of eight sites considered was narrowed down based on the desktop study to a list of four sites, shown in blue in **Figure ES-1**, that warranted further investigation in the study.

Evaluation of Priority Sites

The four priority sites were evaluated more thoroughly, considering hydraulics, geotechnical and seismic considerations, permitting and environmental factors, land use and planning processes, cost and constructability, and stakeholder engagement results.

Hydraulic Evaluation

The hydraulic evaluation determined that there is a transmission bottleneck in Site 1 where a 12-inch line in Sunset Boulevard would significantly impact the empty and fill rates of the reservoir. If Site 1 is selected, it is recommended that the 12-inch line be upsized to 24-inches to minimize headloss. Additionally, if Site 1 is selected, a redundant connection to the Main PZ is recommended. All four sites would require an altitude valve to maximize the usable volume of both reservoirs.

Geologic Investigation

Field investigations of Sites 2, 3, and 4 were conducted with one geotechnical boring at or near each site. The sample from Site 2 showed a layer of colluvium overlaying basalt at approximately 14.5 ft below ground surface. Site 3 had a thin layer of fill material overlaying Missoula Flood deposits. The soils of Site 4 showed a layer of colluvium overlaying Missoula Flood deposits with sandy river mudstone starting at 37.5 feet below ground surface. The most unsuitable subsurface conditions were encountered at Site 4, which is likely to require deep foundations. Site 3 is more suitable than Site 4, but less suitable than Site 2, with the potential for structural mat foundations or limitations to tank height. Of the three sites evaluated, Site 2 shows the most suitable subsurface conditions for the reservoir and has no atypical structural conditions expected.

Environmental and Permitting Review

An environmental and permitting review for each of the four sites was conducted, including an evaluation of aquatic resources, vegetation and habitat, special-status species, archaeological, historical, and cultural resources, visual impacts, hazardous materials, and the associated permits for each site. The environmental review found no fatal flaws for any of the four sites. Sites 2 and 4 have wetlands and areas that will need to be delineated and should be considered as part of the design process. A habitat assessment will be required for any selected site. No historical, cultural, or archaeological resources were identified at any of the sites.

Land Use and Planning Review

Keller coordinated with the planning authority from both the City and County to confirm the planning requirements and procedures associated with each site. Site 1 and Site 4 are both located outside City limits with a PF-80 zoning classification. Both sites would require a Site Design Review and Site 4 would also require a Conditional Use Permit. Sites 2 and 3 are both located within the city limits with an R7 classification. Both sites require a Conditional Use Permit.

Property Owner and Stakeholder Engagement

As part of the study, property owners associated with all four sites were contacted and the project was discussed with them. The Site 1 property owner indicated a disinterest in selling all or part of the property and rejected a right-of-entry agreement to complete field investigations on the site. The property owners at Sites 2 and 3 indicated an openness to selling all or part of their property to the City for a potential reservoir site. Site 4 is located on the County Fairgrounds property and is therefore managed by both the Columbia County Fair Board and the County. The County has not indicated whether or not it would be open to selling part of the fairground property.

Various parties engaged with stakeholders, including property owners, City and County staff, tribal organizations, City Council members, and others, as part of the study to involve the interested parties in the process. Two stakeholder engagement presentations were held in addition to a public meeting. Feedback from all parties shaped the decision-making process.

Recommended Site Determination

An evaluation of the sites was presented to the City staff and included consideration for many factors, including cost and constructability, stakeholder feedback, environmental and permitting considerations, hydraulics, property owner interest in selling, land use and planning, and geologic conditions. Ultimately, Site 2 is the preferred site for the future 5.0 MG reservoir. A map of Site 2 is presented in **Figure ES-2** and a preliminary site concept rendering is shown as **Figure ES-3**.

FIGURE ES-2: SITE 2 LOCATION

FIGURE ES-3: PRELIMINARY SITE CONCEPT RENDERING

1 - BACKGROUND

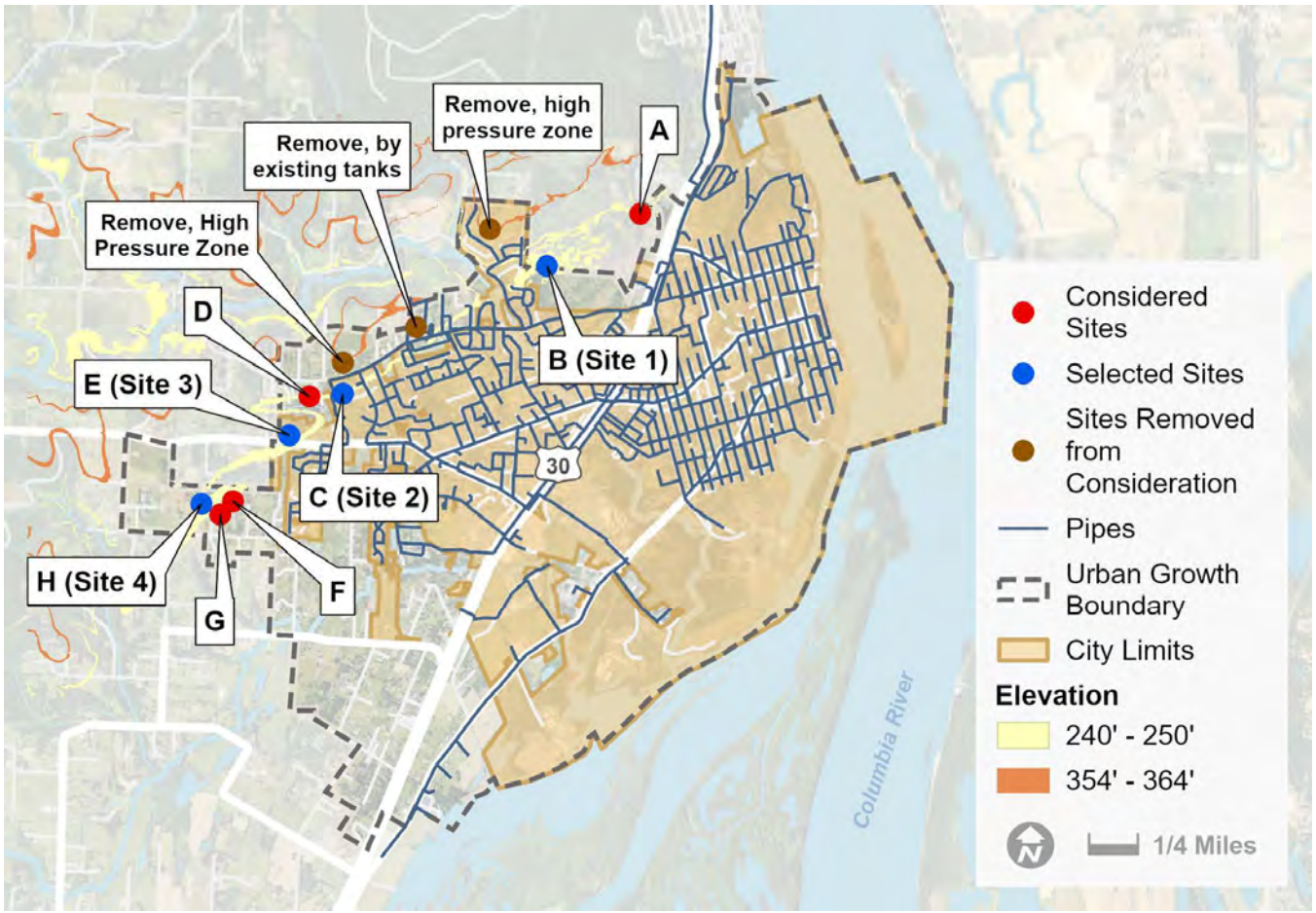
The City of St. Helens (the City) Water Master Plan (WMP) from 2022 identified issues with aging infrastructure and an existing water storage deficiency that is expected to increase during the 20-year planning period. Preliminary design of a new tank to replace an existing 2.0 MG tank at the same site as the 2.5 MGD tank was started previously, but the project was abandoned due to design and constructability constraints associated with the site. For this reason, the City has commissioned a siting study for a 5.0 MG reservoir. The City contracted with Keller Associates (Keller) to identify and evaluate potential sites. This report summarizes the evaluation and reports on the findings.

2 - PRELIMINARY SITE IDENTIFICATION AND EVALUATION

2.1. INITIAL SITE IDENTIFICATION

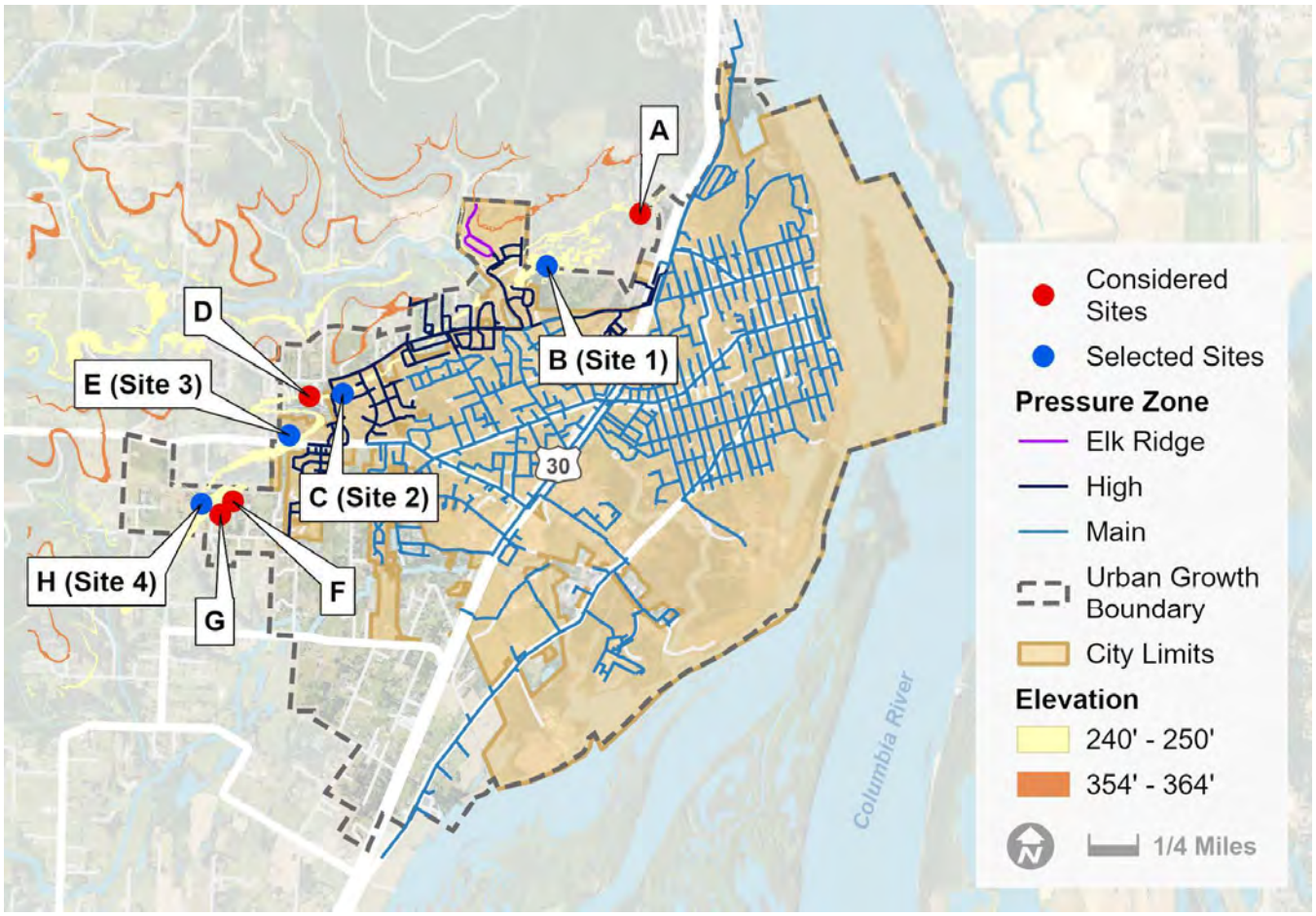
The City's water distribution system is broken down into three pressure zones – the high pressure zone (High PZ), main pressure zone (Main PZ), and the Elk Ridge pressure zone (Elk Ridge PZ). The hydraulics of the system require that the tank be sited within a 10' elevation range in either the Main PZ (240'-250') or High PZ (354'-364'). An initial group of eleven potential sites with undeveloped land were identified with consideration for the potential elevations where the tank could be sited. These sites are presented in **Figure 1**.

FIGURE 1: PRELIMINARY SITE IDENTIFICATION



Preliminary evaluation of the sites identified issues that would greatly impact the future reservoir design, construction, and operation. For example, the installation of the reservoir within the High PZ would require costly equipment and operations would be more complex compared to a reservoir sited within the Main PZ. The City decided that sites identified within the High PZ were to be excluded from consideration for these reasons. Similarly, the existing reservoir site includes known geotechnical hazards which would increase capital cost and negatively affect constructability. The existing reservoir site was also excluded from further evaluation. A total of three sites were removed from consideration as the sites were either within the High PZ or are located within a site with known challenges. With the exclusion of these sites, eight sites remained for additional consideration and were named Sites A-H. A map of each site, tank location, water connection pathway, and overflow/drain connection pathway are available as **Appendix A**. A map of all eight sites is presented as **Figure 2**.

FIGURE 2: PRELIMINARY SITE IDENTIFICATION



2.2. SITE EVALUATION CRITERIA

The remaining eight sites were evaluated using a desktop review of site topography, publicly available geological resources, existing land use, proximity to the Main PZ, and site access. This section describes the information that was collected and the purpose of each in further narrowing down the sites. A summary of the findings from the preliminary site evaluation are available in **Appendix B**.

2.2.1. Desktop Geological Evaluation

Geotechnical favorability greatly impacts the cost and constructability of a reservoir site. An ideal site will have a low risk of liquefaction and a low landslide risk. A desktop analysis of the geologic substrate,

liquefaction risk, and landslide risk was conducted using data available by the Oregon Department of Geology and Mineral Industries (DOGAMI) and the Oregon Geologic Data Compilation. Sites A and B are in an area with shallow basalt rock with a low risk of liquefaction. Sites C-H are in an area that could be expected to be composed primarily of Missoula flood deposits, which have a moderate risk of liquefaction. Landslide risk for Sites C-H ranged from low to moderate, with mapping showing Sites C and D having the highest risk of the sites evaluated.

2.2.2. Land Use

Existing zoning, land availability, and neighboring land use will influence the cost of property acquisition and the associated timeline to achieve approval. Sites were evaluated using publicly available zoning and tax lot information. In general, sites that are either zoned for residential use or adjacent to existing homes may be more likely to face neighborhood opposition. Sites C-G are zoned for medium density residential, are on mostly undeveloped areas, and are generally located adjacent to existing housing. Sites A and B are located in areas with larger areas of forests and shrubbery, but Site A is located adjacent to an active quarry. Neither Site A nor B are in areas that would be expected to have significant neighborhood opposition due to the nearby quarry. Site H is located within a County-owned park, which could improve the likelihood that the property owner would be a willing seller.

2.2.3. Constructability and Access

Reservoirs are constructed with a flat bottom at a set elevation, so significantly sloping sites are likely to require greater site development costs. Favorable sites have low slopes across the potential tank site and topography and nearby roadways that are conducive to improved site access. Sites B, E, F, and G have average slopes at 4% or below, while others range from 5.5% (Site C) to the highest at 10% (Site D). While the reservoir location for most sites is less than 150 feet from an existing road, Sites B and D would require a longer driveway that would have to be built through private property, therefore increasing costs due to the access improvements and the associated land acquisition or easements.

2.2.4. Proximity to Main PZ

As previously discussed, the reservoir must be connected to the Main PZ. Sites located adjacent to the High PZ require the pipeline line to connect to a location in the Main PZ, increasing the length of associated water pipeline. Sites on the far extents of the City such as Sites B, F, G, and H would require the greatest pipeline lengths for connecting to the Main PZ (between 4,690 and 6,220 linear feet). Sites such as Sites A, C, and E that are more centrally located require less pipeline (under 2,370 linear feet). Long pipeline lengths greatly impact the overall capital cost of the improvements while simultaneously increasing the quantity of assets for which the City is responsible for maintaining and increasing the area disturbed during construction.

2.2.5. Proximity to Overflow and Drain Connection Point

Water reservoirs must be designed with an overflow to release water in the event the tank is overfilled and a drain line for fully emptying the reservoir, both of which are connected together in a line hereinafter referred to as the overflow/drain line. After dechlorination, reservoir overflow/drain lines are often piped to a location above the ordinary high water level in a stream or to a stormwater system when a stream or other receiving water body is not available. Similar to the connection to the Main PZ, the overflow/drain can impact overall costs while increasing the area disturbed during construction. Sites C, D, F, G, and H are near existing streams (between 120 and 670 linear feet) that were assumed to be able to receive the overflow and/or drain volumes. Sites A, B, and E are significantly farther from receiving water bodies and would therefore be expected to discharge to the City's stormwater conveyance system. The stormwater system would need to be evaluated for each site to concretely determine whether the stormwater system could handle these additional flows during a storm. If the existing capacity at the connection point is insufficient, the project may also require improvements to the stormwater system.

2.2.6. Hydraulic Operations

In St. Helens, the Water Filtration Facility (WFF) turns on and off based on the water levels in the existing 2.5 MG reservoir. Currently, the 2.5 MG reservoir is the only active reservoir in the Main PZ and will therefore stop filling once the reservoir reaches its maximum operational level. When multiple reservoirs are located within the same pressure zone, reservoirs fill at different rates depending on their location within the water system. These flow rates can be regulated using an altitude valve. For example, if the new reservoir is constructed closer to the WFF than the existing 2.5 MG Reservoir, the hydraulic conditions would cause the new reservoir to fill faster, and an altitude valve will be required to prevent overflowing while the existing reservoir continues filling to the maximum operating level. The inverse conditions would exist if the new reservoir were further from the WFF and an altitude valve would likely be required to be installed at the existing 2.5 MG Reservoir. Altitude valves are commonly used to control reservoir levels by sensing the water level in the reservoir and opening and closing accordingly to fill the reservoir. All sites (A-H) are expected to require an altitude valve at one or both reservoir sites.

2.3. SELECTED SITES FOR FURTHER INVESTIGATION

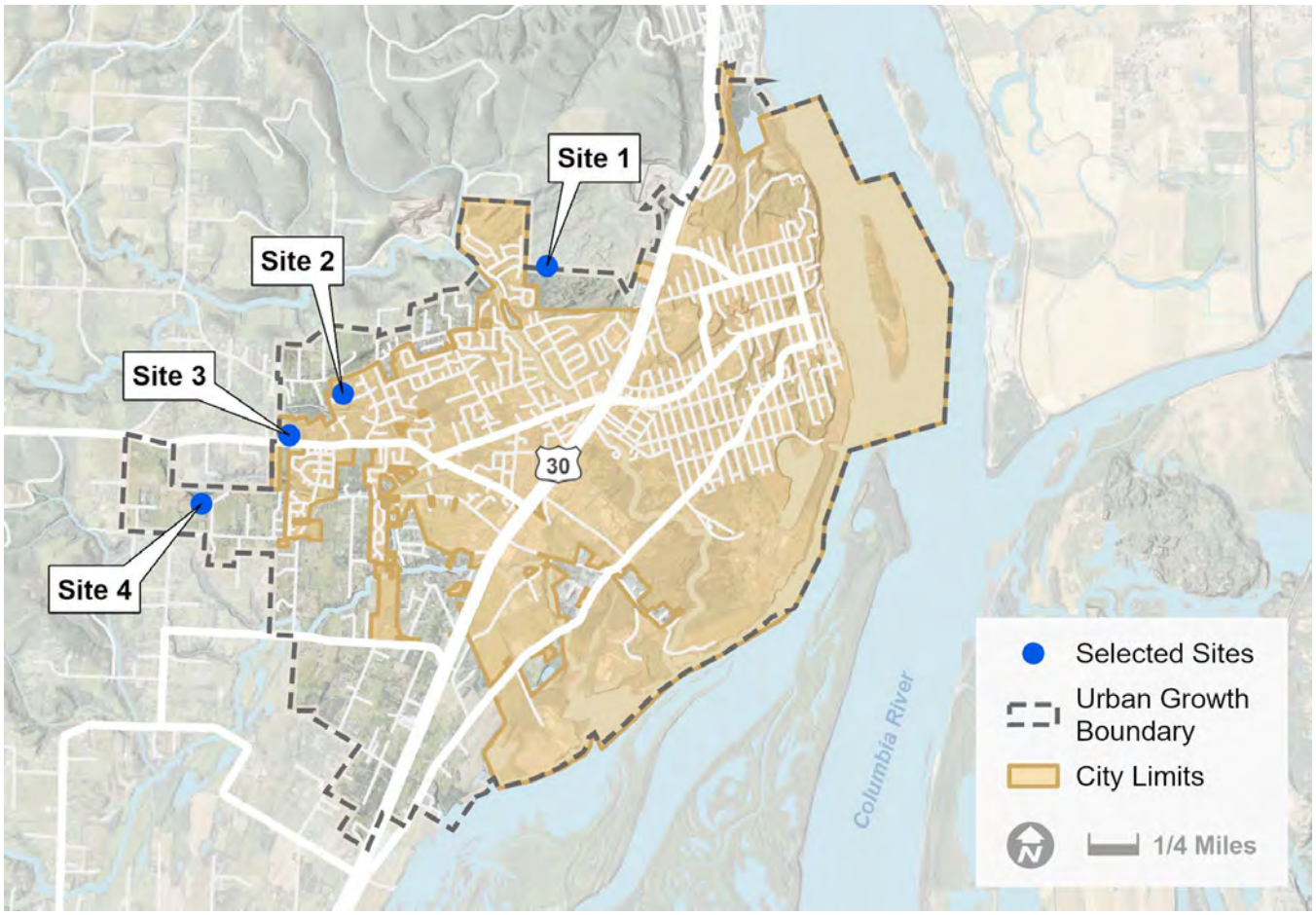
Out of the eight original sites, the four sites selected for further consideration were Site B, C, E, and H. Site A was dismissed due to its proximity to an active quarry, where frequent blasting raised seismic concerns. Site D was also removed from consideration because it had significant cross-slopes (a 10% slope across the proposed reservoir location) and would require a relatively long connection to the water system. Sites F, G, and H are close to one another, with similar geologic conditions expected, similar site conditions, and significant pipe corridors required to connect to the Main PZ. Of the three, Site H was selected as a priority site over the others because it is flat and has the smallest length from the site to the stream for an overflow/drain line. For simplicity, the selected sites were renamed numerically and are presented in **Table 1**.

TABLE 1: INITIAL SELECTED SITE SUMMARY

Initial Site Reviewed	Site Selection and Renaming
Site A	Not selected
Site B	Site 1
Site C	Site 2
Site D	Not selected
Site E	Site 3
Site F	Not selected
Site G	Not selected
Site H	Site 4

A map of the selected sites is presented as **Figure 3**.

FIGURE 3: SITES 1-4 MAP



2.3.1. Site 1 (Site B)

Site 1 is located on the northern edge of the City limits, west of Highway 30 and north of Pittsburg Road. A drone photo of the site is shown in **Figure 4** and the general location of the future reservoir is shown in **Figure 5**.

Site 1 (Site B) was identified as a recommended site because the geologic conditions are expected to have an underlayment of basalt, which reduces the risk of landslide and liquefaction. The existing site is owned by Weyerhaeuser, which also leases the eastern portion of the adjacent property for quarry work.

FIGURE 4: SITE 1 DRONE PHOTO

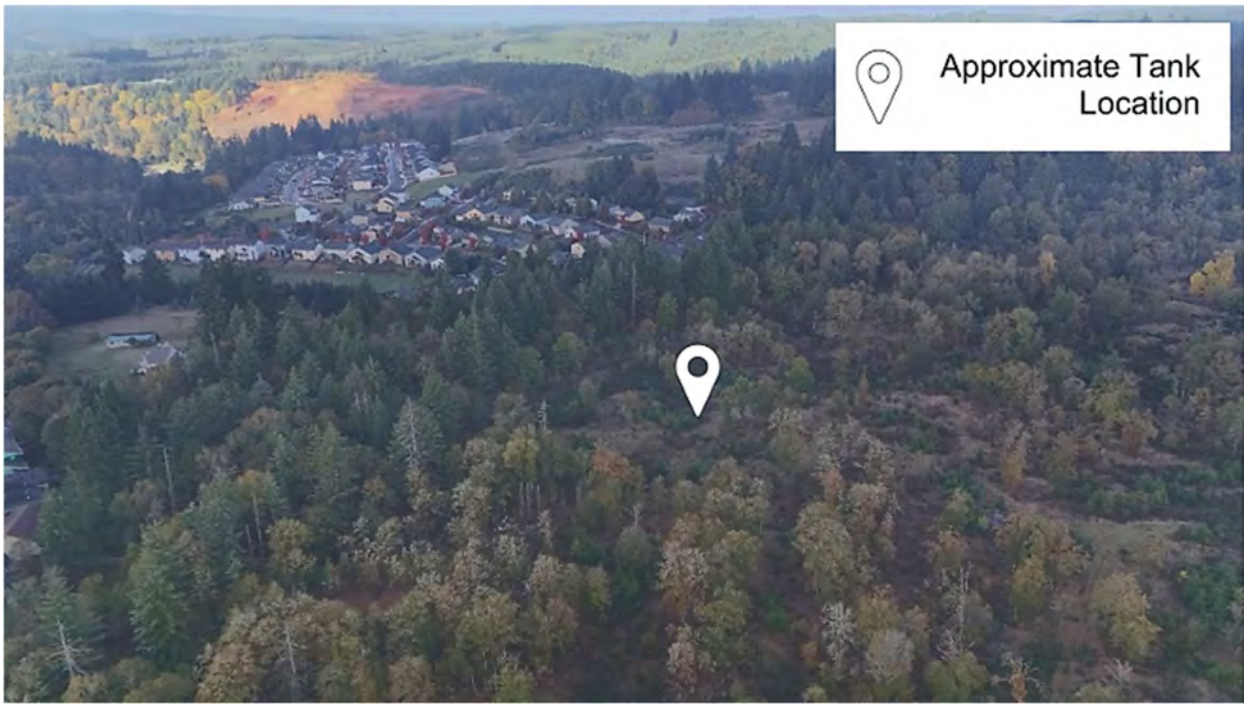
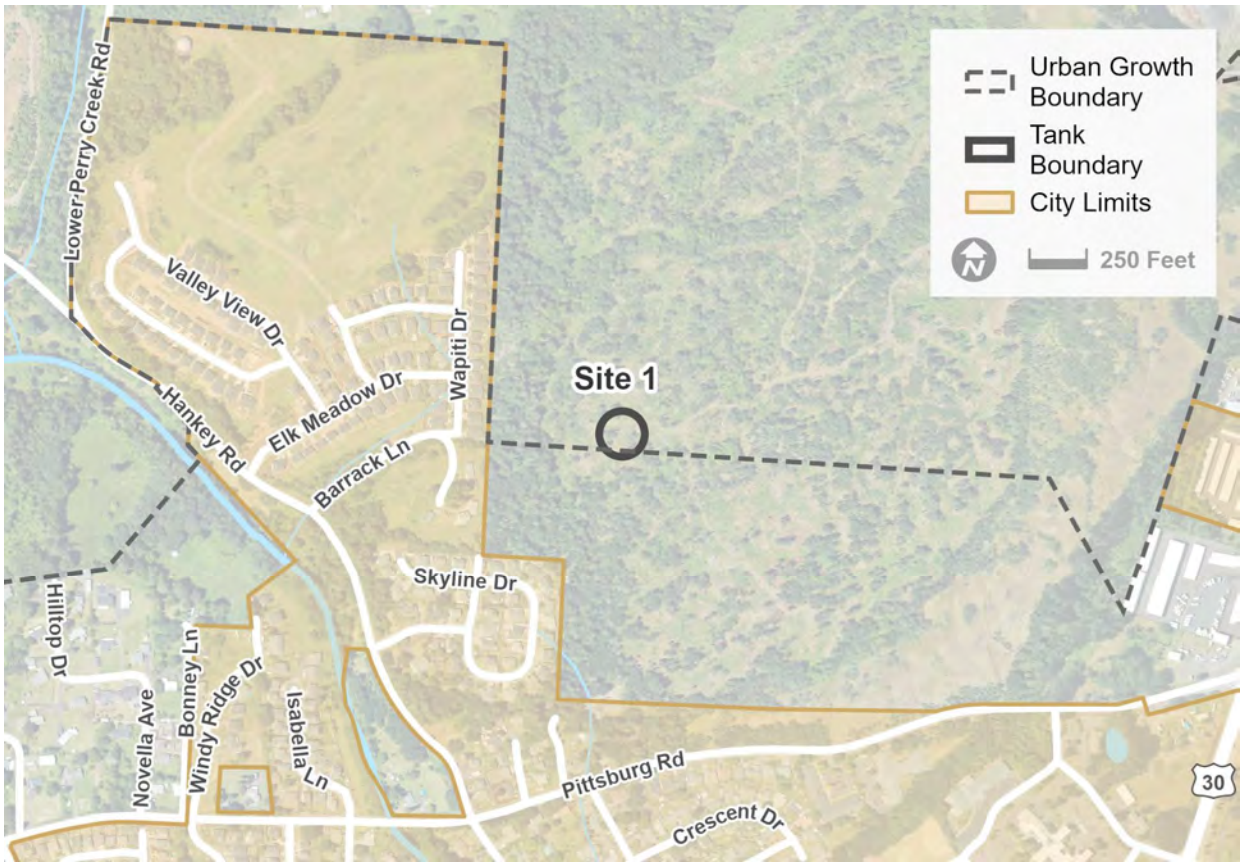


FIGURE 5: SITE 1 LOCATION



2.3.2. Site 2 (Site C)

Site 2 (Site C) fronts Pittsburg Road to the north and Meadowview Drive to the west. It is located between several residential neighborhoods. A drone photo of Site 2 is shown in **Figure 6** and a map of the location of Site 2 is shown in **Figure 7**.

Site 2 (Site C) was selected as a recommended site because the associated water connection and overflow/drain piping lengths are short relative to the other sites. Additionally, the site has low slopes and minimal site preparation is expected. The reservoir could be accessed from Pittsburg Road or Meadowview Drive.

FIGURE 6: SITE 2 DRONE PHOTO

FIGURE 7: SITE 2 LOCATION

2.3.3. Site 3 (Site E)

Site 3 (Site E) fronts Sykes Road to the south and is located on the far western extent of the City. A drone photo of Site 3 is shown in **Figure 8** and a map of the general site location is shown in **Figure 9**.

The reservoir at Site 3 is anticipated to be located within the heavily wooded area, about 100' north of Pittsburg Road. Site 3 has low slopes in this area and is expected to require a short pipeline for the connection to the Main PZ.

FIGURE 8: SITE 3 DRONE PHOTO

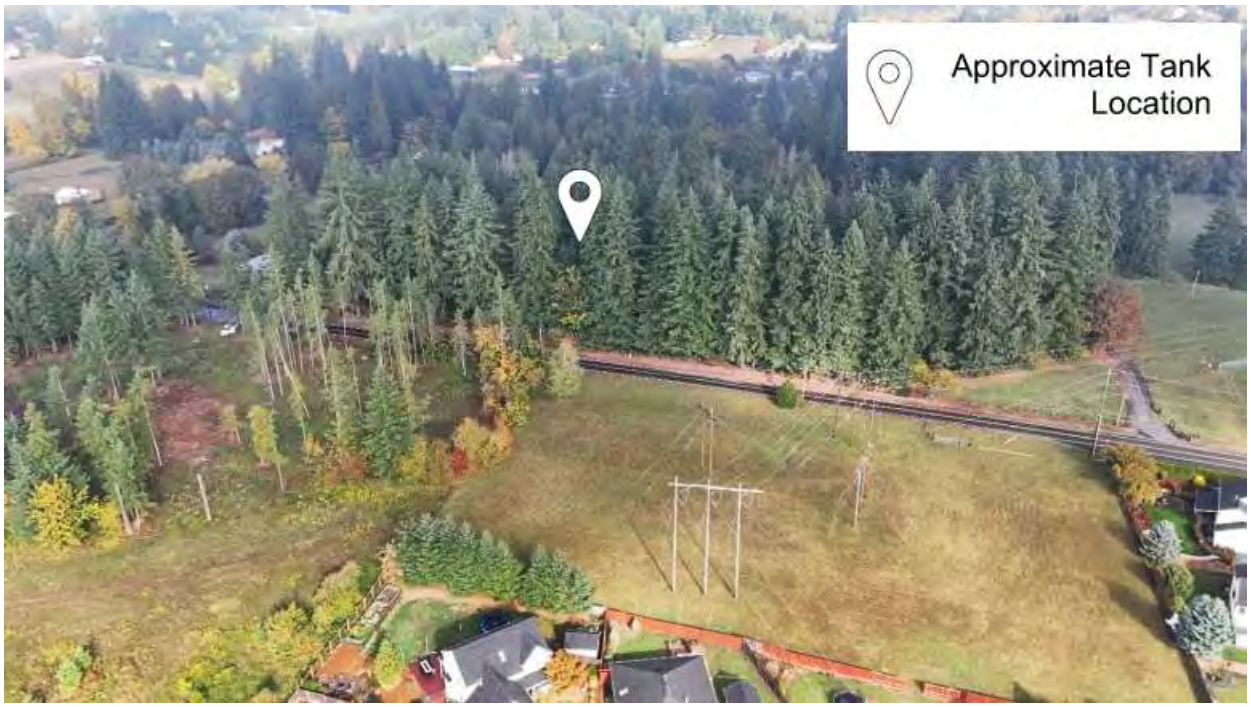


FIGURE 9: SITE 3 LOCATION

2.3.4. Site 4 (Site H)

Site 4 (Site H) is located west of the City limit, north of Bachelor Flat Road and south of Sykes Road. The reservoir is anticipated to be sited just north of the baseball field in the County park. A drone photo of the site is presented in **Figure 10** and a map of the general site location is shown in **Figure 11**.

Site 4 was selected for further evaluation because the site is flat, the overflow/drain pathway is anticipated to be short, and the site access is anticipated to be allowed through the County's property.

FIGURE 10: SITE 4 DRONE PHOTO

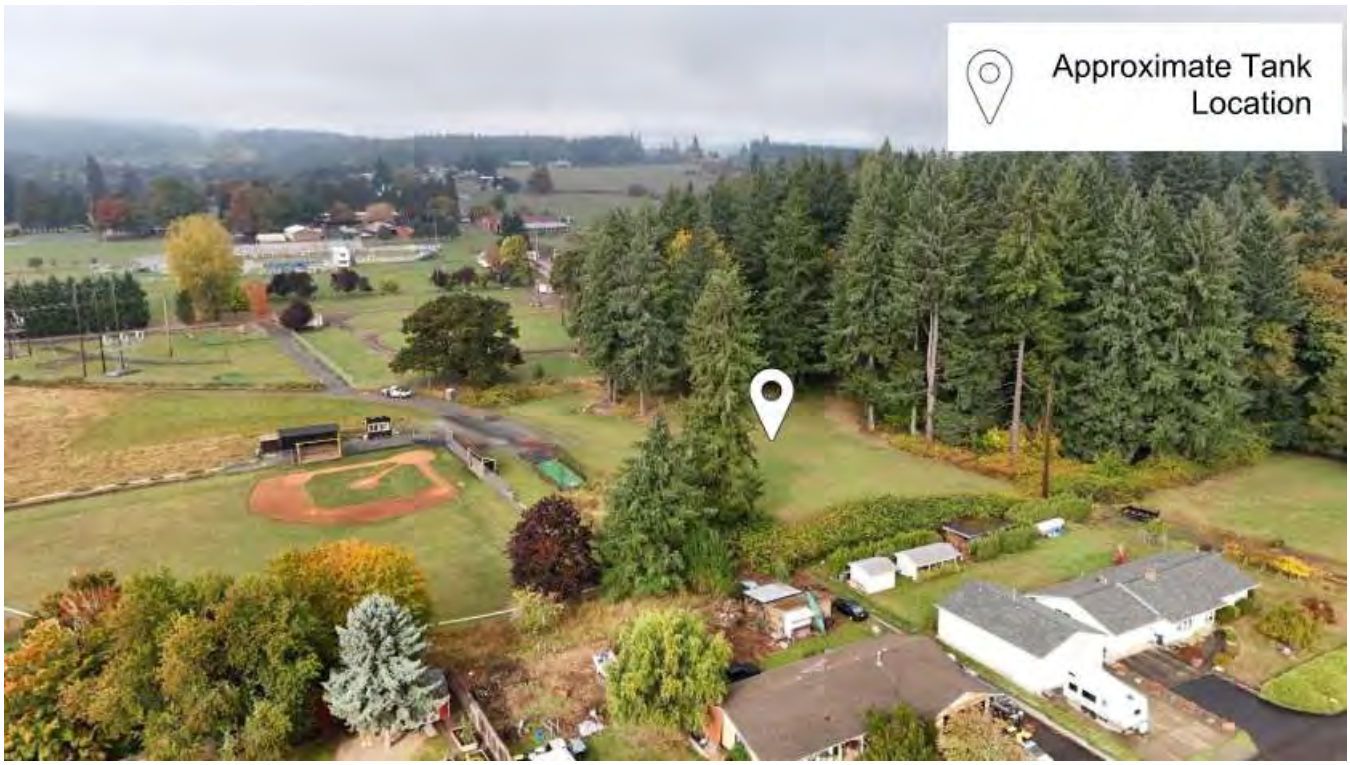


FIGURE 11: SITE 4 LOCATION

3 - HYDRAULIC ANALYSIS

A hydraulic analysis was completed for the four selected reservoir sites using Innovyze Infowater Pro. The City's existing hydraulic model was used to identify transmission bottlenecks, control valve requirements, impacts to system pressure and available fire flow, and considerations for the overflow and drain connections.

Sufficient transmission piping for filling and emptying the new reservoir must be included in a reservoir design to maintain the existing hydraulic grade line (HGL) across the zone, maximize the benefit of the new reservoir, and maintain pipe velocities below recommended maximums. The model was used to evaluate the existing distribution system under average day demand (ADD), max day demand (MDD), and peak hour demand (PHD) to identify transmission bottlenecks which may develop for the potential reservoir sites.

Extended period simulations were used to show how the two reservoirs in the Main PZ will fill and where altitude valves will be required.

Impacts to distribution system pressure and available fire flow were considered for each of the proposed reservoir sites. However, these impacts are not a primary factor in comparing the different sites. Pressure and available fire flow deficiencies can be corrected through other distribution improvements such as looping pipes and upsizing small diameter pipes. The addition of a reservoir may also result in localized improvements to these factors.

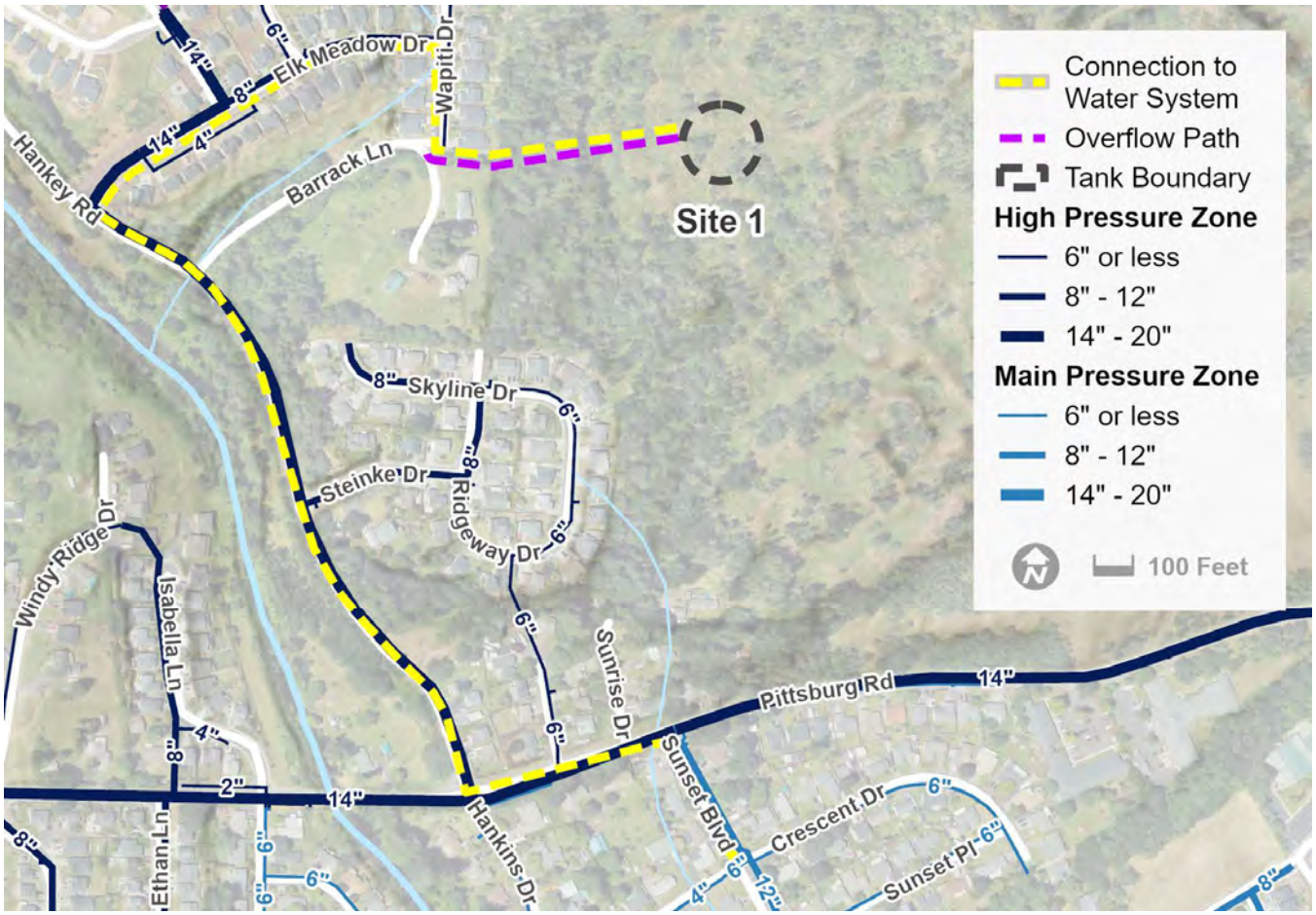
Water reservoirs require an overflow line to safely convey excess water if system controls malfunction. A drain for fully emptying the reservoir is also required for operational flexibility and is typically connected to the overflow line. The model was used to document maximum expected overflow rates at each of the sites. Overflow/drain lines would discharge to a nearby stream for Sites 2 and 4 under the assumption that the streams could handle the detained flows when the overflow/drain is flowing. In the cases of Sites 1 and 3, there are no proximate streams and both sites will require connections to the City stormwater collection system. The available capacity for the overflow/drain volumes was evaluated for the associated connections to the stormwater system.

There are many scenarios that could lead to overflow at one or both of the reservoirs. This study considers the "worst-case" scenario which would be if the WFF failed to turn off while it was pumping at its maximum anticipated production rate of 4,000 gpm. This would likely occur during the middle of the night while also occurring during an average winter (low) demand (approximately 0.8 MGD). It was assumed both reservoirs would be able to overflow; therefore, the flow will be split between the existing and proposed reservoirs. The City indicated that at least one person is on call at all times and would receive notifications if the WFF failed to turn off, if flows are too high, or if discharge pressures are too high. A response time of 15 minutes was assumed for the City to turn off the pumps at the WFF, based on discussions with city operators.

3.1. SITE 1 HYDRAULIC ANALYSIS

The location of Site 1 and the preliminary pipe alignment are illustrated in **Figure 12**. The following sections discuss the transmission, operation, pressure and fire flow, and overflow considerations specific to this site.

FIGURE 12: SITE 1 CONNECTION TO EXISTING WATER SYSTEM AND OVERFLOW SYSTEM

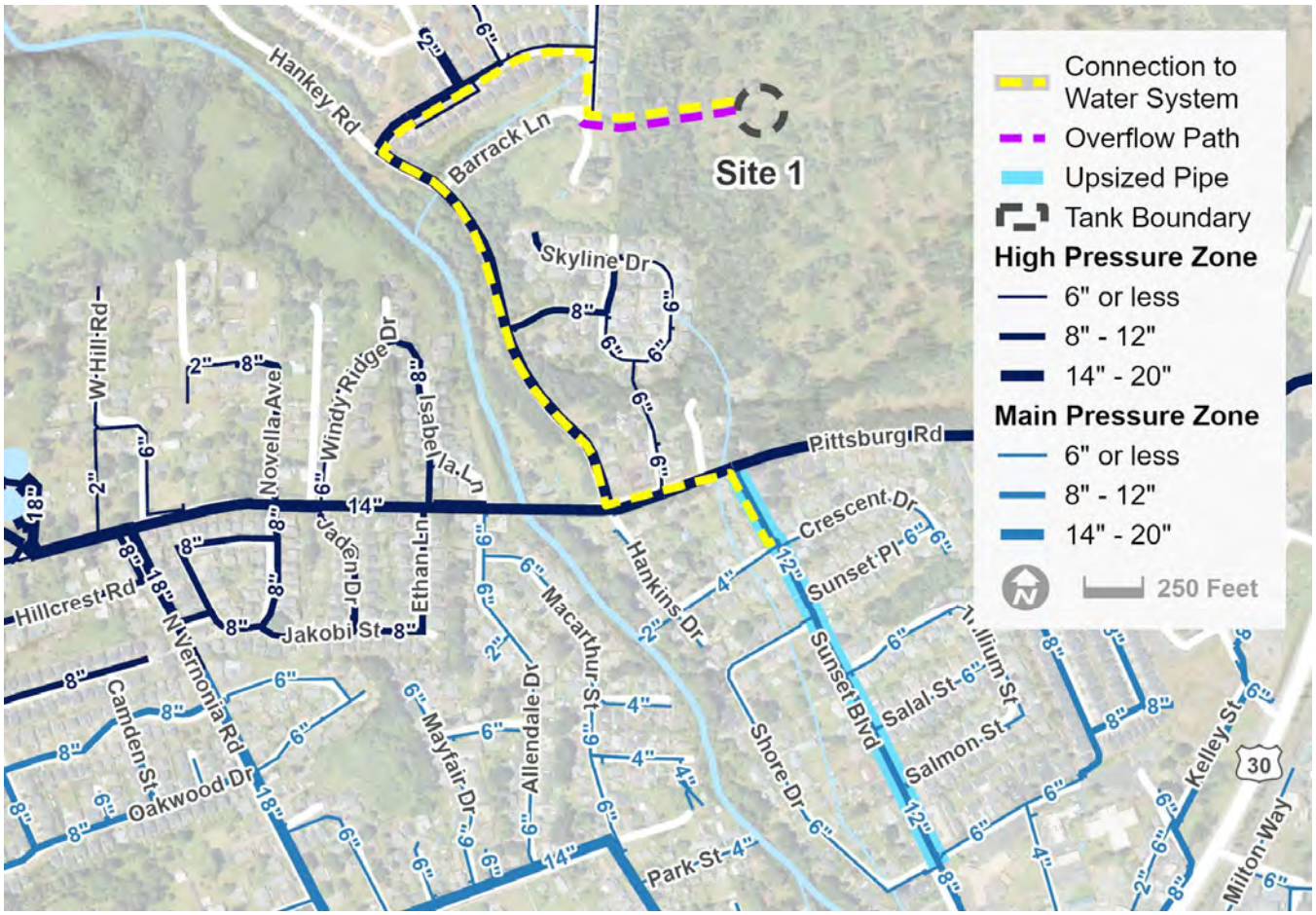


3.1.1. Transmission Analysis

Though Site 1 is located near the existing water system distribution piping, the nearby pipes are a part of the High PZ. For this reason, approximately 5,000 feet of new transmission line would be required to connect to the Main PZ piping as illustrated in **Figure 12**. The new pipeline would be constructed parallel to the existing Elk Ridge Reservoir fill/discharge line in Elk Meadows Drive and Hankey Road. Modeling indicates that a 24-inch diameter pipeline would be recommended to reduce headloss as it fills and empties. The larger diameter would improve the pipeline's ability to empty to meet PHD and fire flow demands.

To fill or empty from Site 1, water would flow north from an existing 14-inch pipe along Columbia Road through a single 12-inch pipe along Sunset Boulevard. The City's most recent GIS mapping shows a 380-foot section 8-inch pipe along Sunset Boulevard south of Shore Drive. North of Columbia Boulevard, the tank fill/discharge line does not have any other connections with other portions of the Main PZ. This means, if a break occurs in the 12-inch pipe along Sunset Boulevard or in the new transmission line in Hankey Road/Elk Meadows Drive, the reservoir would either have reduced transmission capacity or would not be able to be utilized at all. **Figure 13** depicts the transmission limitations associated with Site 1. To improve the resiliency of the system, a connection to the High PZ pipe could be made so there is a redundant source of supply to fill the tank. A pressure reducing valve (PRV) would be required to lower the HGL back to the Main PZ HGL.

FIGURE 13: SITE 1 TRANSMISSION LIMITATIONS



During PHD, with both reservoirs set to the same hydraulic grade, the existing reservoir would empty at rate of more than two times that of the potential new reservoir at Site 1. This indicates the existing 12-inch/8-inch pipe along Sunset Boulevard is a transmission bottleneck that limits the influence of the new reservoir. It is recommended that the 12-inch pipe along Sunset Boulevard would be upsized to 24-inches, to ensure that both reservoirs empty at approximately the same rate.

3.1.2. Operation and Controls

The MDD extended period simulation shows that the existing 2.5 MG reservoir has a higher turnover rate than the new Site 1 reservoir. This is a result of the smaller transmission pipes leading to the Site 1 reservoir, meaning that the headloss for transmission would be greater and the empty and fill rates would be longer. The existing reservoir has approximately 2-3 feet of operating depth while the new Site 1 reservoir has less than 1 foot. This could lead to water stagnation in the new reservoir with an increased water age and potential for low chlorine residuals. Furthermore, if the WFF controls remain based on the existing 2.5 MG reservoir, the new Site 1 reservoir would not reach its full level before the WFF turns off. To address this, an altitude valve would be required on the existing 2.5 MG reservoir and the WFF 'off' setting would be recommended to be controlled using the level in the new reservoir. The 2.5 MG reservoir would drain much faster than the new reservoir, so the WFF 'on' setpoint would be recommended to be controlled by the level in the 2.5 MG reservoir rather than the new reservoir.

3.1.3. Pressure and Fire Flow Conditions

Portions of the local system pressures and available fire flow would be influenced by the new Site 1 Reservoir, namely along Sunset Boulevard, north of Columbia Road. Existing PHD pressures are between 40-60 psi and there were no existing identified in the WMP. The available fire flow along Sunset Boulevard meets the required fire demand except for a few dead-end lines. The new Site 1 Reservoir will increase the available fire flow within this area, but as mentioned, there are no existing deficiencies.

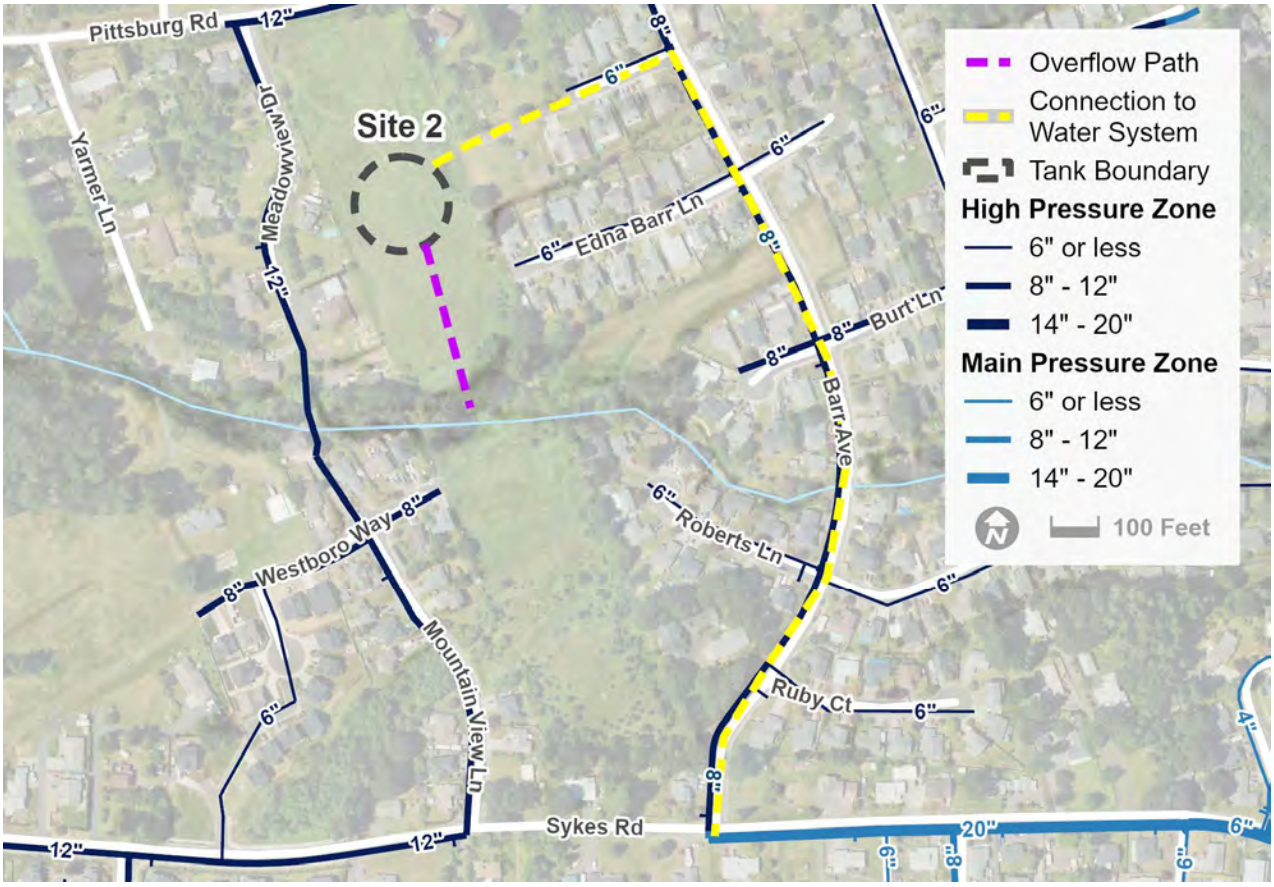
3.1.4. Overflow Analysis

The maximum overflow rate for the new Site 1 without increasing the pipe size along Sunset Boulevard is expected to be 1,000 gpm which would correspond to a volume of 15,000 gallons of overflow volume at the maximum period before for city operator response (15 minutes). If the transmission piping is upsized along Sunset Boulevard, the max overflow rate would be increased to approximately 2,200 gpm and a volume of 33,000 gallons. Approximately 900-1,000 feet of overflow piping will need to be constructed to connect to the existing stormwater system. The proposed overflow/drain pipeline would connect to an existing 24-inch stormwater pipe near Wapiti Drive and Elk Meadows Drive This storm system discharges into Milton Creek approximately 1,000 ft downstream of the connection point. This stormwater system does not have existing capacity constraints for the flows anticipated under an overflow event.

3.2. SITE 2 HYDRAULIC ANALYSIS

The location of Site 2 and the preliminary pipe alignment are illustrated in **Figure 14**. The following sections discuss the transmission, operation, pressure and fire flow, and overflow considerations specific to this site.

FIGURE 14: SITE 2 CONNECTION TO EXISTING WATER SYSTEM AND OVERFLOW SYSTEM



3.2.1. Transmission Analysis

Similar to Site 1, Site 2 is also located close to the existing water system distribution piping on Pittsburg Road. However, the nearby lines are a part of the High PZ. Approximately 2,400 feet of new transmission line would be required to connect to the existing Main PZ piping as illustrated in **Figure 14**. The new pipeline would be constructed parallel to an existing 8-inch waterline along Barr Avenue. A 24-inch diameter pipeline is recommended to reduce headloss while the reservoir fills and empties. The larger diameter will improve its ability to be emptied to meet PHD and fire flow demands.

The transmission network to Site 2 is well looped and there are multiple paths through the system to fill the reservoir. The only single transmission pathway would be the new 24-inch line along Barr Avenue to the new reservoir. While the transmission piping would be more resilient than Site 1, a connection from the High Zone from Barr Avenue could be considered as an alternative fill point for resiliency if there was a line break in the new 24-inch pipe.

During PHD, with both reservoirs set to the same hydraulic grade, the existing reservoir would empty at a slightly higher flow rate than the new reservoir, indicating good transmission from the new tank site to the system. There is an existing 20-inch pipe along Sykes Road and Columbia Boulevard that has multiple looped interconnections. No transmission bottlenecks were identified to or from Site 2.

3.2.2. Operation and Controls

The MDD extended period simulation shows that the existing 2.5 MG reservoir and the new reservoir would operate well together and have similar turnover. The existing 2.5 MG reservoir would fill slightly faster than the new reservoir because it is located closer to the WFF. An altitude valve should be installed on the existing 2.5 MG reservoir so it can stop filling while the new reservoir finishes filling. The 2.5 MG reservoir would also empty slightly faster; however before the pumps from the WFF are given the indication to turn on, the two tank levels are less than 1 foot different. This minimal difference in the emptying rate demonstrates that the reservoirs work well together. The WFF ‘on’ setting controls could continue to be operated based on the 2.5 MG reservoir, but the ‘off’ setting should be controlled on the levels in the new reservoir to fully fill the new reservoir during each cycle.

3.2.3. Pressure and Fire Flow Conditions

The local system pressures and available fire flow would see minimal changes from construction of the new reservoir at Site 2. Existing PHD pressures are between 40-60 psi and no existing deficiencies were identified in the WMP. The available fire flow along Sykes Road meets the required fire demand except for a few dead-end and small diameter lines.

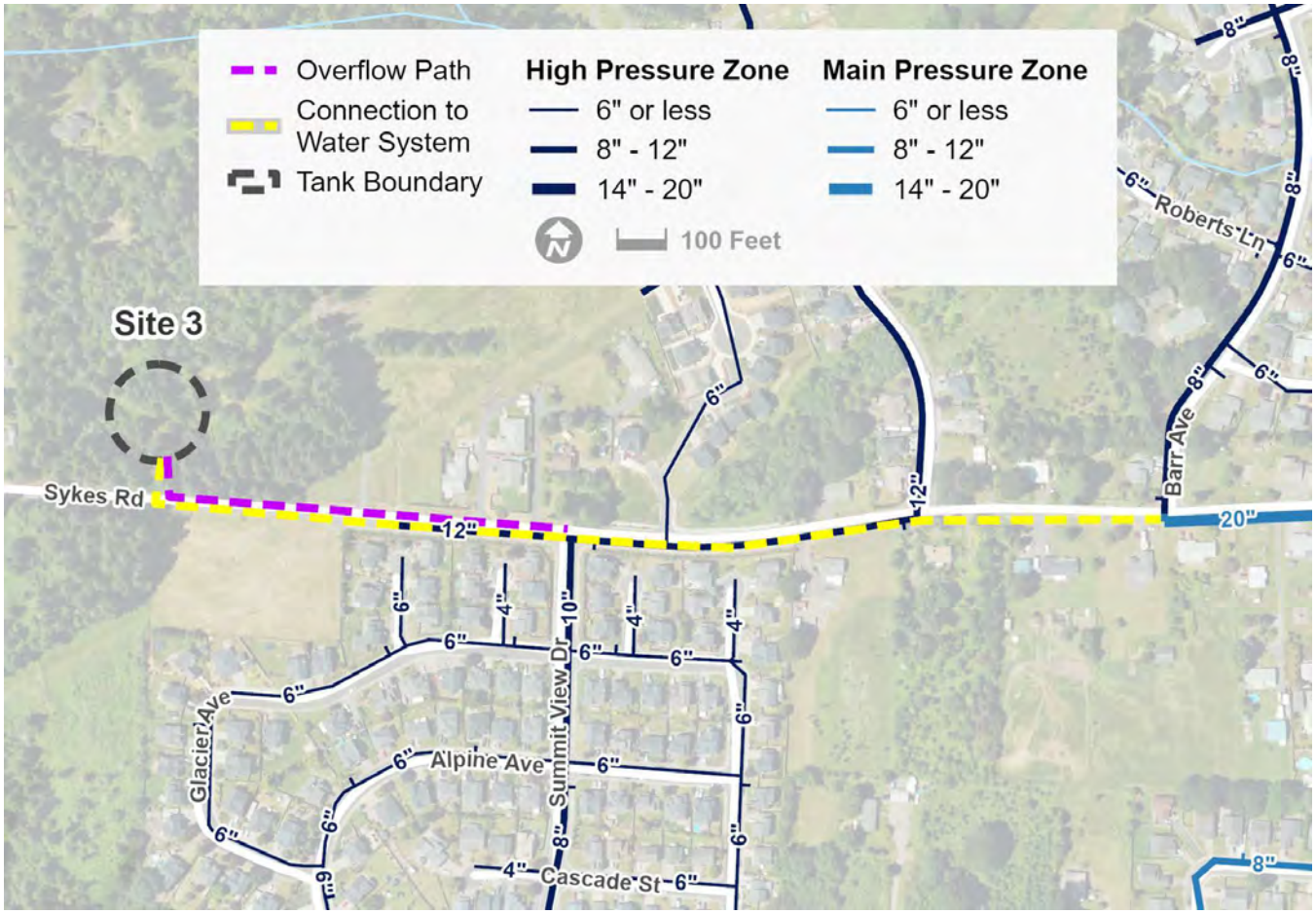
3.2.4. Overflow Analysis

The maximum anticipated overflow rate for Site 2 is 1,900 gpm which would result in an overflow volume of 28,500 gallons. The reservoir at Site 2 would be located less than 500 feet north of a branch of McNulty Creek. The overflow/drain line was assumed to be able to be routed directly into this water body and no connection to the existing stormwater system would be required.

3.3. SITE 3 HYDRAULIC ANALYSIS

The location of Site 3 and the preliminary pipe alignment are illustrated in **Figure 15**. The following sections discuss the transmission, operation, pressure and fire flow, and overflow considerations specific to this site.

FIGURE 15: SITE 3 CONNECTION TO EXISTING WATER SYSTEM AND OVERFLOW SYSTEM



3.3.1. Transmission Analysis

Site 3 is also located on the west side of the City limits along Sykes Road. Approximately 2,600 feet of new transmission line will be required to connect to the existing Main PZ piping as illustrated in **Figure 15**. The new pipe will be constructed in Sykes Road and connect to the existing 20-inch pipe at Sykes Road and Barr Ave. Similar to the other two sites, a 24-inch diameter pipeline is recommended to reduce headloss as it fills and empties. The larger diameter will improve its ability to be emptied to meet PHD and fire flow demands.

The transmission network description for Site 3 is the same as Site 2 because they connect to the Main PZ at the same location. As described in the Site 2 transmission analysis, the system is well looped and there are multiple paths through the system to fill the reservoir and the only single transmission pathway would be the new 24-inch line along Sykes Road to the new reservoir.

During PHD, with both reservoirs set to the same hydraulic grade, the new reservoir empties at a slightly higher flow rate than the existing reservoir indicating good transmission from the new tank site to the system.

There is an existing 20-inch pipe along Sykes Road and Columbia Boulevard and has multiple looped interconnections. No transmission bottlenecks were identified to or from Site 3.

3.3.2. Operation and Controls

The operation and controls for the Site 3 Reservoir are very similar to Site 2. The MDD extended period simulation shows that the existing 2.5 MG Reservoir and the new reservoir operate well with each other and have similar turnover. The existing 2.5 MG Reservoir fills slightly faster than the new reservoir because it is located closer to the WFF. An altitude valve should be installed on the existing 2.5 MG Reservoir so it can stop filling while the new reservoir finishes filling. The 2.5 MG Reservoir also empties slightly faster; however, before it triggers the WFF to turn on, the two tank levels have a difference of less than one foot. The WFF controls can continue to be turned on based on the 2.5 MG Reservoir, but to fully fill the new reservoir with each cycle, the 'off' setting should be based on the new reservoir levels.

3.3.3. Pressure and Fire Flow Conditions

The local system pressures and available fire flow would see minimal changes as a result of constructing the new reservoir at Site 3. Existing PHD pressures are between 40-60 psi and no existing deficiencies were identified in the WMP. The available fire flow along Sykes Road meets the required fire demand with the exception of a few dead-end and small diameter lines.

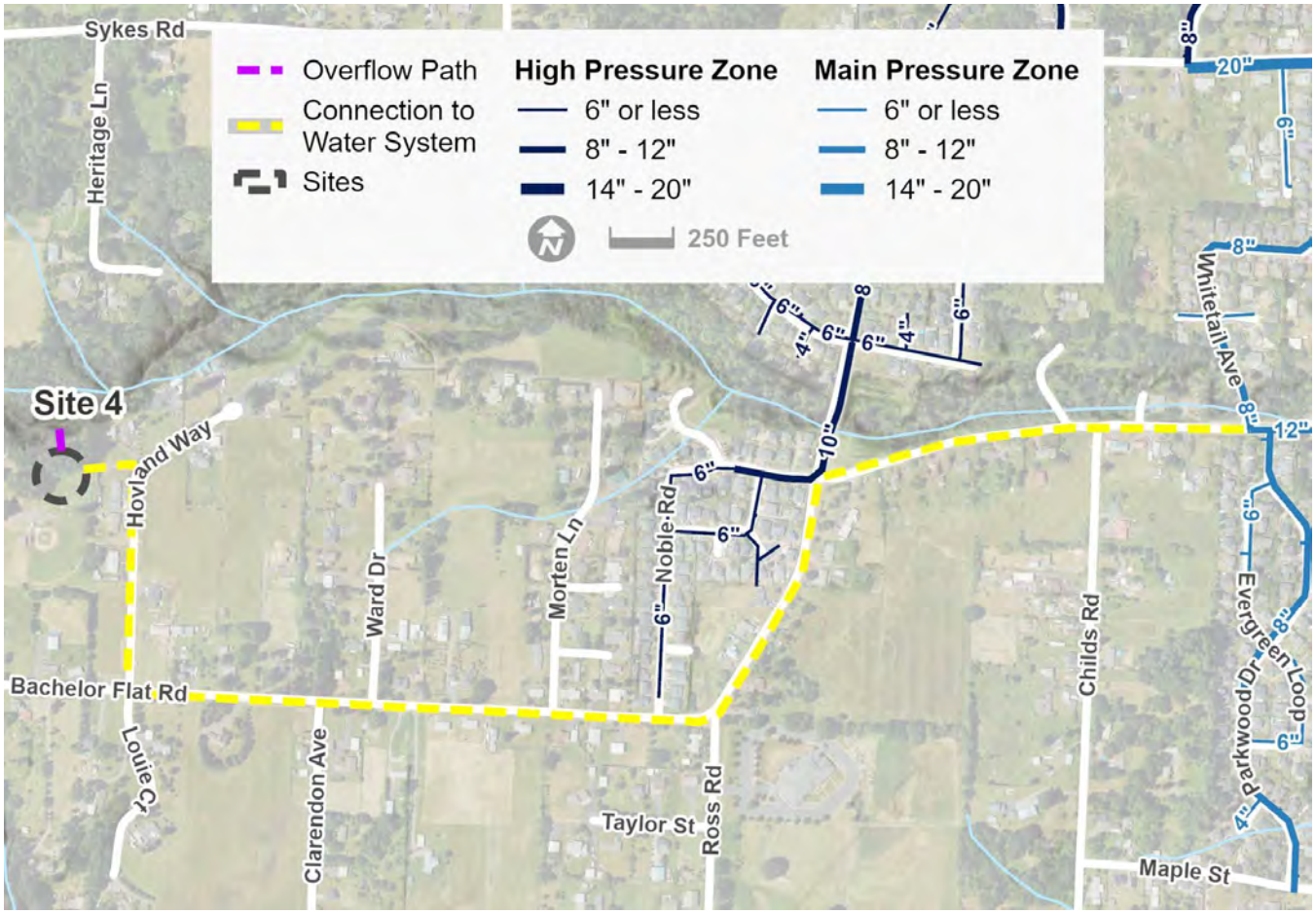
3.3.4. Overflow Analysis

The maximum anticipated overflow rate for Site 3 is 1,800 gpm which would result in an overflow volume of 27,000 gallons. Approximately 1,400 feet of overflow piping would need to be constructed to connect to the existing stormwater system. The proposed overflow would drain into an existing 12-inch pipe along Sykes Road at Summit View Drive. This system does not have existing capacity constraints for the flows anticipated during an overflow event. It should be noted that this manhole is very shallow (approximately 3 feet deep). There is a constant slope from the reservoir site to this point, however once the pipe is near the connection point, the cover depth on top of the pipe is likely between 2.5 and 3.0 feet. If additional cover is required, the first segment of the existing storm pipe could be reconstructed deeper and at a shallower slope.

3.4. SITE 4 HYDRAULIC ANALYSIS

The location of Site 4 and the preliminary pipe alignment are illustrated in **Figure 16**. The following sections discuss the transmission, operation, pressure and fire flow, and overflow considerations specific to this site.

FIGURE 16: SITE 4 CONNECTION TO EXISTING WATER SYSTEM AND OVERFLOW SYSTEM



3.4.1. Transmission Analysis

Site 4 is located outside of the City limits but within the Urban Growth Boundary (UGB). This site would have the longest new pipeline required to connect to the existing system with about 6,300 feet of new transmission pipe required. The new transmission pipe would be installed along Bachelor Flat Road and connect to the existing Main PZ at Whitetail Avenue as illustrated in **Figure 16**. Similar to the other three sites, a 24-inch diameter pipeline is recommended to reduce headloss while filling and emptying. The larger diameter would improve the reservoir's ability to be emptied to meet PHD and fire flow demands.

The connection to the existing Main PZ piping would be a 12-inch pipe that is well looped with the system. The 12-inch pipe splits at Columbia Boulevard and Gable Road, each with a 12-inch line. Apart from the new 6,300 feet of new pipe the system has multiple paths to fill the tank, and no improvements are recommended to improve redundancy.

During PHD, with both reservoirs set to the same hydraulic grade, the new reservoir would empty at a lower flow rate than the existing reservoir indicating the transmission is not as good as Site 2 and Site 3, but no specific bottleneck was identified.

3.4.2. Operation and Controls

The MDD extended period simulation shows that the existing 2.5 MG Reservoir has higher turnover than the potential Site 4 reservoir. This is primarily a result of the new reservoir being farther from the WFF and the transmission pipes are reduced to 12-inches west of Sykes Road. The water level in the new reservoir would be about 2 feet lower than the existing reservoir level when the 2.5 MG Reservoir reaches its full setpoint. The new reservoir would be about 1 foot higher than the existing reservoir at its low setpoint. This difference in turnover could lead to water stagnation in the new reservoir with an increased water age and potential for low chlorine residuals. To correct this, an altitude valve would be recommended to be installed on the 2.5 MG reservoir to stop the 2.5 MG reservoir from filling while the new reservoir continues to fill and the WFF off setpoint would be based on the new reservoir level. Because the 2.5 MG reservoir would also drain faster than the new reservoir, the WFF on setpoint should remain controlled by the 2.5 MG reservoir level. This would ensure that the water level in the 2.5 MG reservoir will not get too low.

3.4.3. Pressure and Fire Flow Conditions

The local system pressures and available fire flow would see minimal changes as a result of constructing the new reservoir at Site 4. Existing PHD pressures are between 40-60 psi and no existing deficiencies were identified in the WMP. The available fire flow along Gable Road meets the required fire demand apart from a few dead-end and small diameter lines.

3.4.4. Overflow Analysis

The maximum anticipated overflow rate for Site 4 is 1,500 gpm which would result in an overflow volume of 22,500 gallons. The Site 4 reservoir would be located just south of a branch of McNulty Creek. The overflow/drain line was assumed to be routed directly into this water body with no required connection to the existing stormwater system.

4 - GEOTECHNICAL AND SEISMIC CONSIDERATIONS

Shannon & Wilson completed site visits and subsurface explorations for Sites 2, 3, and 4, which included three borings ranging from 36.5 to 61.5 feet below ground surface (bgs). Soil samples were tested in the lab for moisture content, Atterberg limits, and particle size distribution.

Note that subsurface investigations could not be conducted at Site 1 because the property owner rejected the right of entry agreement, citing a disinterest in selling either of the two parcels in question. Data collected regarding the conditions of Site 1 was collected via a desktop analysis only.

A geotechnical engineering report with the findings from Sites 2 through 4 was submitted to Keller in December 2025. Key results from that report, along with the findings from the desktop analysis for Site 1, are summarized in this section. A full copy of the report is available in **Appendix C**.

4.1. GEOTECHNICAL AND SEISMIC SETTING

Site 1 is located on surface geology classified as part of the Sentinel Bluffs unit, consisting of basalt bedrock. Site 1 is near the area of a mapped landslide and the basalt may be overlain by 15-20 feet below ground surface (bgs) of a combination of silt, clay, and sand. Nearby well logs show a silt layer from 25-70 feet bgs overlaying basalt bedrock. The well logs did not indicate whether the basalt was weathered.

Sites 2 through 4 are primarily underlain by Pleistocene-aged Missoula Flood deposits. North of Site 2, mapping indicates the presence of Grande Ronde Basalt. Subsurface explorations at Site 2 confirmed the presence of the colluvial deposits underlain by basalt.

The project area lies within the northern edge of the Cascadia fore-arc, a region affected by both margin-normal subduction and margin-parallel compression. This interaction creates complex deformation and results in large and potentially damaging earthquakes (Magnitude of greater than 6.0). Seismic hazards in this area are associated with three key sources:

- The locked portion of the Cascadia Subduction Zone (CSZ), which can generate large megathrust earthquakes.
- The deep intraslab section of the CSZ, within the subducting Juan de Fuca Plate, which is responsible for Wadati-Benioff zone events.
- Shallow crustal faults in the overriding North American Plate.

All three seismic sources could influence ground motion hazards at the project site.

4.2. FIELD MEASURED SUBSURFACE CONDITIONS

4.2.1. Site 2

The boring of Site 2 was made up of largely 3 different units:

- Colluvium (0-14.5 ft bgs): Dense Clayey Gravel with Sand (GC), very dense Silty Gravel with Sand (GM), and medium dense/very stiff Sandy Silt to Sandy Silt with Gravel (ML);
- Predominantly Decomposed Grande Ronde Basalt (14.5-17.5 ft bgs): Predominantly decomposed to medium dense Silty Sand (SM); and
- Grande Ronde Basalt (17.5-36.5 ft bgs): Extremely weak to weak (R0–R2), slightly to highly weathered.

4.2.2. Site 3

Site 3 consisted mainly of two different units:

- Fill (0-7 ft bgs): Includes pavement and base aggregate section; very stiff Lean Clay with Sand (CL).
- Missoula Flood Deposits – Fine-Grained Facies (7-61.5 ft bgs): Stiff Silt with Sand (ML), and medium stiff to very stiff Lean Clay (CL).

4.2.3. Site 4

The boring of Site 4 was made up of largely 3 different units:

- Colluvium (0-12 ft bgs): Medium dense Silty Sand (SM), medium dense Silt with cobbles (ML), stiff Silt (ML), and medium stiff Elastic Silt (MH).
- Missoula Flood Deposits – Fine-Grained Facies (12-37.5 ft bgs): Very soft to medium stiff Lean Clay (CL) and medium stiff Fat Clay (CH).
- Sandy River Mudstone (37.5-61.5 ft bgs): Medium stiff to stiff Fat Clay (CH).

4.3. GROUNDWATER CONDITIONS

Groundwater levels were measured during drilling by lowering a water level indicator through the hollow-stem auger. The measured groundwater levels are tabulated in **Table 2**.

TABLE 2 . MEASURED GROUNDWATER CONDITIONS

Site	Borehole	Date	Water level in feet bgs
Site 2	B-1	9/24/2025	9.5
Site 3	B-2	9/25/2025	15.7
Site 4	B-3	10/21/2025	15

Groundwater levels are expected to vary depending on topography and precipitation.

4.4. GEOTECHNICAL CONSTRUCTION CONSIDERATIONS

The following provides an overview of the geological hazards and preliminary foundation design considerations for each site.

4.4.1. Site 2

Subsurface investigations at Site 2 indicate low risk for seismic and geologic hazards. The potential for liquefaction, lateral spreading, and landslides is minimal due to dense soils, low groundwater levels, and relatively flat terrain. The site is classified as Site Class C for seismic design per the 2022 Oregon Structural Specialty Code.

Soils consist of medium dense to very stiff colluvium overlying decomposed and intact Grande Ronde Basalt. These materials are expected to have low compressibility and support shallow foundation systems. An allowable bearing capacity of 3,000 psf is appropriate for design, assuming removal and replacement of any soft zones with compacted fill.

Excavation to depths greater than 5 feet is not anticipated. Standard earthwork equipment should be adequate, and specialized rock removal methods are not expected to be necessary. Groundwater levels are low and unlikely to impact construction, but internal sump pits can be used if needed.

4.4.2. Site 3

Site 3 presents low seismic and geologic risk. Liquefaction and lateral spreading potential are minimal due to deep groundwater and cohesive soils. The site has flat topography, and landslide or surface fault rupture hazards are also considered low. According to the 2022 Oregon Structural Specialty Code, the site is classified as Site Class E based on standard penetration testing data, but future classifications (ASCE 7-22) may place it in Site Class D or E based on shear wave velocity.

Soils encountered include medium-stiff to stiff Missoula Flood Deposits with occasional softer layers. These are expected to be moderately compressible below 10 feet. Conventional shallow foundations are considered feasible, though design may require limiting water tank height or using a structural mat foundation. An allowable bearing capacity of 2,000 psf is recommended, with over-excavation and replacement required in soft zones.

The site is densely vegetated with mature trees and a thick root zone that will need full removal. Grubbing may cause extensive soil disturbance, requiring replacement with imported granular structural fill. Native soils are unlikely to be reusable except during dry summer conditions. Standard earthwork equipment should be sufficient, but excavation should proceed in small sections to manage moisture and fill placement effectively.

4.4.3. Site 4

Subsurface conditions at Site 4 suggest moderate seismic risk, with some soils showing susceptibility to liquefaction and potential for limited lateral spreading and settlement. While no significant liquefaction is expected, localized landslide hazards were observed along the northern slope above the creek. Setback distances should be established in accordance with the Oregon Structural Specialty Code, and further landslide analysis is recommended. The site is classified as Site Class E (likely to fall within Class E, DE, or D under future ASCE 7-22 criteria).

Soils consist of medium-stiff colluvium overlying soft Missoula Flood Deposits and Sandy River Mudstone. A zone of very soft clay between 12- and 23-foot depth makes shallow foundations unsuitable. Deep foundations, such as auger cast piles embedded in a structural mat, are recommended to ensure stability and mitigate settlement. Driven piles may be feasible but should be evaluated due to potential vibration impacts on nearby residences.

Construction will require specialty contractors for deep foundations, and auger cast piles are preferred for lower noise and vibration but may be more expensive. Vegetation removal will be necessary, particularly in the northern portion of the site, which is densely wooded with a significant root zone. Grubbing will disturb soils, requiring removal and replacement with compacted imported fill.

5 - PERMITTING AND ENVIRONMENTAL COMPLIANCE

An analysis of potential environmental and permitting considerations for Sites 1-4 was completed by SWCA, Inc (December 2025). Their conclusions are summarized in this section and a full report is available in **Appendix D**. The review included Landownership, Land Use, Zoning, Aquatic Resources, Vegetation and Habitat, Special-Status Species, Archaeological Historical and Cultural Resources, Visual Impacts and Aesthetics, Hazardous Materials and Permit implications.

5.1. AQUATIC RESOURCES AND VEGETATION AND HABITAT IMPLICATIONS

Table 3 provides an overview of the aquatic features and information on the National Land Cover Database (NLCD) data, as well as the category according to the Oregon Department of Fish and Wildlife (ODFW) for each tank site. For the ODFW Category, the lower the number, higher the quality of the habitat. For a detailed view of the estimate of the acreage of ODFW habitat categories see **Appendix D**. A habitat assessment is required for all site locations.

TABLE 3 . AQUATIC FEATURES, VEGETATION, AND HABITAT

Tank Site	Aquatic Features	Vegetation & Habitat Summary
1	None within parcel. Two mapped streams crossed by connection line (existing culverts assumed).	Developed (40.4%) and mixed forest (34.9%). Tank site is herbaceous/wooded. Habitat: Habitat: Douglas-fir–Western Hemlock Forest (42.1%), low-quality habitat (Category 5-6)
2	Mapped Wetland features: • Riverine, Intermittent Streambed, Seasonally Flooded (0.06 acre)* • Palustrine emergent (0.55 acre) • Mapped Water features: • Perennial Stream/River (317 linear feet)	Developed (64.9%), tank site is herbaceous open space. Habitat: Developed-Upland mix (68.8%). Some emergent wetlands are present, likely Category 3-5 habitat.
3	No mapped wetlands or water features.	Developed open space (51.1%), tank site appears forested. Habitat: Douglas-fir–Western Hemlock Forest (47.8%), likely low-moderate quality (Category 4-5).
4	Mapped Wetland features: • Riverine, Intermittent Streambed, Seasonally Flooded (0.36 acre) • Mapped Water features: • Intermittent Stream/River (1,056 linear feet)	Pasture (40.7%) and developed open space (37.7%). Tank site is grassland/forest. Habitat: Agricultural Pasture (34.3%), likely low to moderate quality (Category 4-6).

For Site 2, the associated regulatory buffers (50 to 75 feet) cover approximately 22% (2.65 acres) of the 12-acre parcel. Although the tank footprint avoids direct intersection with these resources, it lies approximately 240 feet from the stream buffer and 630 feet from the wetland buffer. A wetland and waters delineation was completed in 2021 at Site 2 for the property owner by Wetland Solutions Northwest, LLC. The delineation did not identify any wetlands in the northern area of the site but showed a 75' riparian buffer from the stream. The 2021 wetland survey, wetland and buffer map, and wetland & waters delineation report are available as **Appendix E**. A map depicting the approximate boundaries of the delineated riparian buffer, wetlands, and wetland buffers is presented as **Figure 17**.

FIGURE 17: SITE 2 HISTORICAL WETLAND DELINEATION AREA OVERLAY

The proposed water line at Site 2 crosses the stream along an existing road assumed to contain a culvert, likely avoiding removal-fill impacts. However, the overflow path would discharge into the stream and may require a sensitive lands permit due to disturbance within the buffer, as well as a discharge permit from ODEQ.

Site 4 includes a 0.36-acre riverine wetland and a 1,056-foot intermittent stream, which may be part of the same drainage. These features occupy about 1.6% of the 22-acre site, with estimated protective buffers potentially extending up to 2 acres. The tank site avoids these features and lies approximately 100 feet away. While the overflow path is expected to discharge above the ordinary high water line, construction within the buffer may still require County permitting under Columbia County Zoning Ordinance Section 1170, as well as ODEQ approval for any discharges.

In both cases, the use of directional drilling is anticipated to reduce construction-related impacts within regulated buffers. However, formal delineations and agency coordination will be required to confirm jurisdictional boundaries and determine final permitting requirements.

5.2. SPECIAL-STATUS SPECIES

Special-status species include species protected or managed under the federal Endangered Species Act (ESA), Oregon Endangered Species Act, Migratory Bird and Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act (BGEPA). For overview only, the species that may occur on each site are listed below.

Site 1

- Columbian white-tailed deer

- Monarch butterfly
- Suckley's cuckoo bumble

Site 2

- Northwestern pond turtle
- Monarch butterfly
- Suckley's cuckoo bumble
- Nelson's checkermallow

Site 3

- No species listed as expected to occur.

Site 4

- Northwestern pond turtle
- Monarch butterfly
- Suckley's cuckoo bumble

All four tank sites fall within the same U.S. Fish and Wildlife Service (USFWS) IPaC resource area, which identifies 15 bird species of conservation concern (BCC) that may use the project area. These birds are not listed under the Endangered Species Act (ESA) but are considered at risk without conservation efforts.

All native migratory birds, including BCC species, are protected under the Migratory Bird Treaty Act (MBTA), which prohibits incidental take of birds, eggs, or active nests. While habitat removal or destruction of unoccupied nests is not restricted, construction activities that could disturb nesting birds are regulated.

Given the presence of suitable habitat and nearby wetlands, Sites 2 and 4 may attract nesting birds. To stay in compliance with the MBTA, surface disturbance and vegetation clearing should be avoided between February 1 and August 31. If construction must occur during this period, pre-construction nest surveys are recommended. Coordination with the Oregon Department of Fish and Wildlife (ODFW) is also advised to confirm nesting windows and any site-specific recommendations.

5.3. ARCHAEOLOGICAL, HISTORICAL, AND CULTURAL RESOURCES

SWCA anticipates that archaeological, historic, and cultural resources could require surveys, studies, and agency coordination as part of the overarching land use permitting process. The results of the background review indicate that none of the sites have been surveyed for cultural resources with only a regional desktop analysis having occurred across the four sites.

If there is a federal- or state-level regulatory nexus, formal consultation with interested Tribal entities and SHPO under Section 106 of the National Historic Preservation Act (NHPA) is required and would be the responsibility of the lead federal agency charged with issuing the federal permit.

5.4. VISUAL IMPACTS AND AESTHETICS AND HAZARDOS MATERIALS

Overall, Sites 2 and 4 are expected to result in greater visual impacts compared to Sites 1 and 3 as they appear less likely to be visible based on the presence of intervening vegetation and the distance between tanks and nearby residents.

Based on review of the Oregon State Fire Marshall's Hazardous Substance Incidents database, there are nine recorded incidents within a 0.5-mile buffer of the sites. Given that these incidents did not occur within the sites themselves, they are not expected to impact or be impacted by the project.

5.5. SUMMARY OF REQUIRED PERMITTING EFFORTS BY SITE

The following table provides an overview of the probability of permits being triggered depending on the site location.

TABLE 4 . PERMITS AND PERMIT APPLICABILITY

Permit	Permit Trigger	Site 1	Site 2	Site 3	Site 4
USACE Removal-Fill Permit	Discharges of dredged or fill material into WOTUS, including their adjacent wetlands.	-	Low	-	Moderate
USFWS EAS Section 7 consultation	Actions that have a federal nexus (e.g., federal funding or federal permit) and may affect federally listed species or their critical habitat.	Low	Low	Low	Low
USFWS BGEPA compliance	Projects that may result in the take of eagles, including their parts, nests, or eggs.	Low	-	-	-
USFWS MBTA compliance	Projects and activities that have the potential to result in take of migratory birds.	High	High	High	High
DSL Removal-Fill Permit	Removal of material from, or placement of fill in, waters of the state (50 cubic yards or greater), or any amount of removal/fill in state-designated Essential Salmonid Habitat.	-	Low	-	Moderate
ODEQ CWA Section 401 WQC	Discharge of fill material into or removal of substrate or sediment in WOTUS and waters of the state that also require a federal Removal-Fill Permit from the USACE.	-	Low	-	Moderate
ODEQ 1200-C Permit	Construction Stormwater General Discharge Permit	High	High	Low	High
ODEQ NPDES Permit	Discharges of pollutants into surface waters of the state.	-	Moderate	-	Moderate
ODA Listed Plant Permit or Consultation	Any land action on Oregon non-federal public lands which results in, or might result in, the taking of a threatened or endangered plant species.	-	Moderate	-	-
SHPO Section 106	Required if there are potential impacts to cultural and/or historical resources that are listed in or eligible for listing in the NRHP	-	Low	-	Moderate
Columbia County Zoning Review	Development of "reservoirs and water impoundments" in the PF-80 zoning designation.	High	-	-	-

Permit	Permit Trigger	Site 1	Site 2	Site 3	Site 4
Columbia County Determination of Similar Use (DSU)	Proposed uses in the CS-I zoning designation that are not explicitly permitted, but may qualify as "other uses found similar by the Planning Commission"	-	-	-	High
Columbia County Type 2 Site Design Review	All new development of community or governmental uses which is not explicitly exempted.	High	-	-	High
City of St. Helens CUP	Development of "major public facility" within the R7 zoning designation.	-	High	High	-
City of St. Helens Sensitive Land Permit	Development (excluding those which are exempted) within significant wetlands, riparian corridors, and protective buffers, as defined under SHMC 17.40.	-	Low	-	-
City of St. Helens Erosion Control and Sediment Prevention Permit	Sites disturbing 5,000 square feet or greater, or sites disturbing 1,000 square feet that are within 50 feet of a water body or wetland.	-	High	High	-

Note: Permits with a dash in place of a rating are not applicable for the specified site.

6 - LAND USE AND PLANNING

The parcels for Sites 1, 2, and 3 are currently privately owned. Only Site 4 is owned by the County. Sites 2 and 3 are located within the St. Helens City limits, whereas Sites 1 and 4 are located outside the City limits. Planning authorities from both the City and the County were engaged to confirm the land use, zoning, and planning considerations associated with each site.

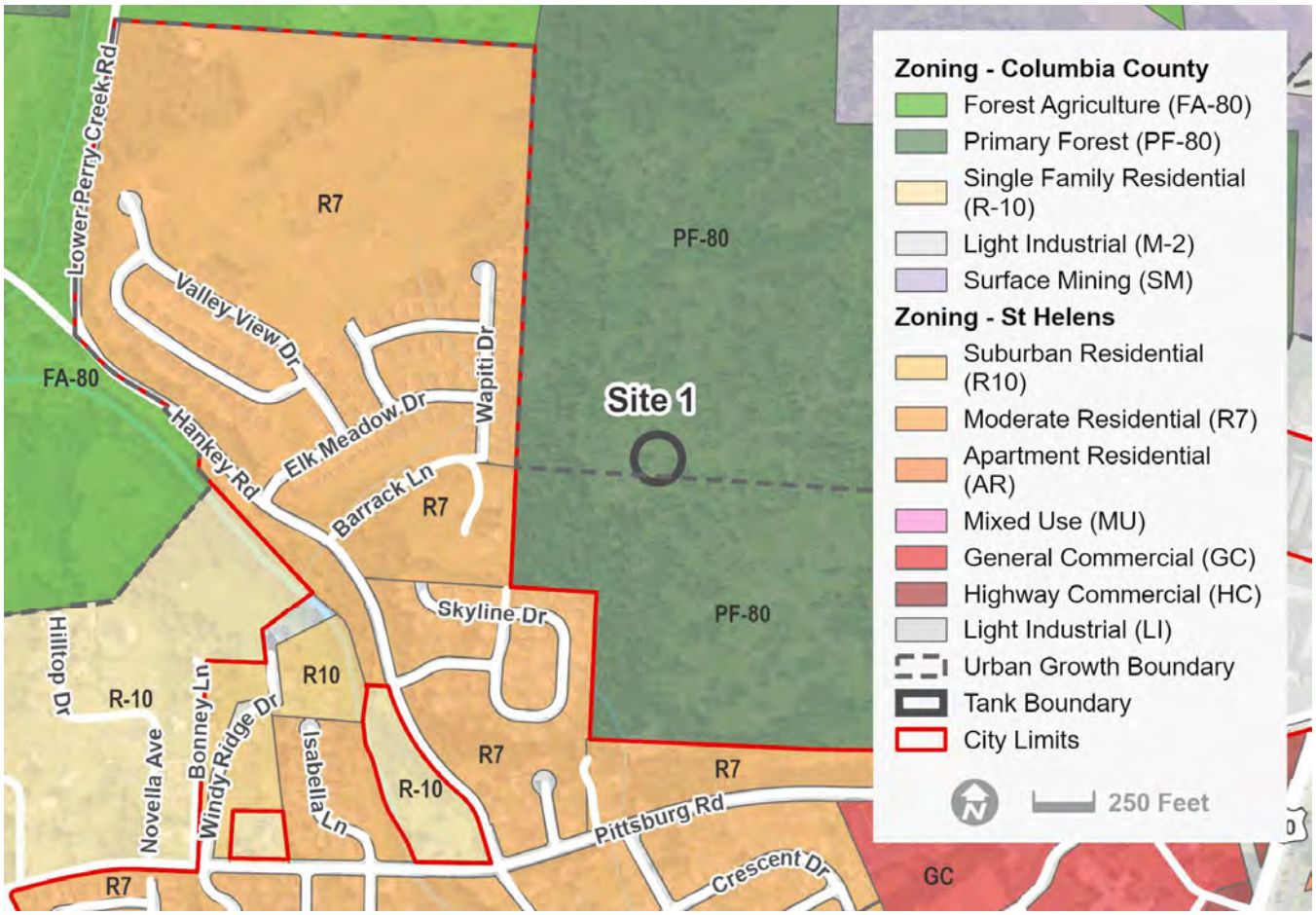
All proposed overflow/drain paths are planned to be within the same tax lots as their associated tank, whereas all the proposed water line connections would extend outside of the tax lot boundaries and would follow along existing public right-of-way lines.

6.1. SITE 1

Site 1 is located outside St. Helens City limits in Columbia County, partially within and partially outside of the UGB. The site is within the County's Primary

Forest (PF-80) zoning designation. The PF-80 zone is designed to conserve and manage forest lands for timber production and related uses, while also allowing other types of compatible uses such as recreational uses, locationally dependent uses, or dwellings under certain conditions. **Figure 18** depicts the land use associated with the proposed reservoir site and surrounding uses.

FIGURE 18: SITE 1 LAND USE MAP

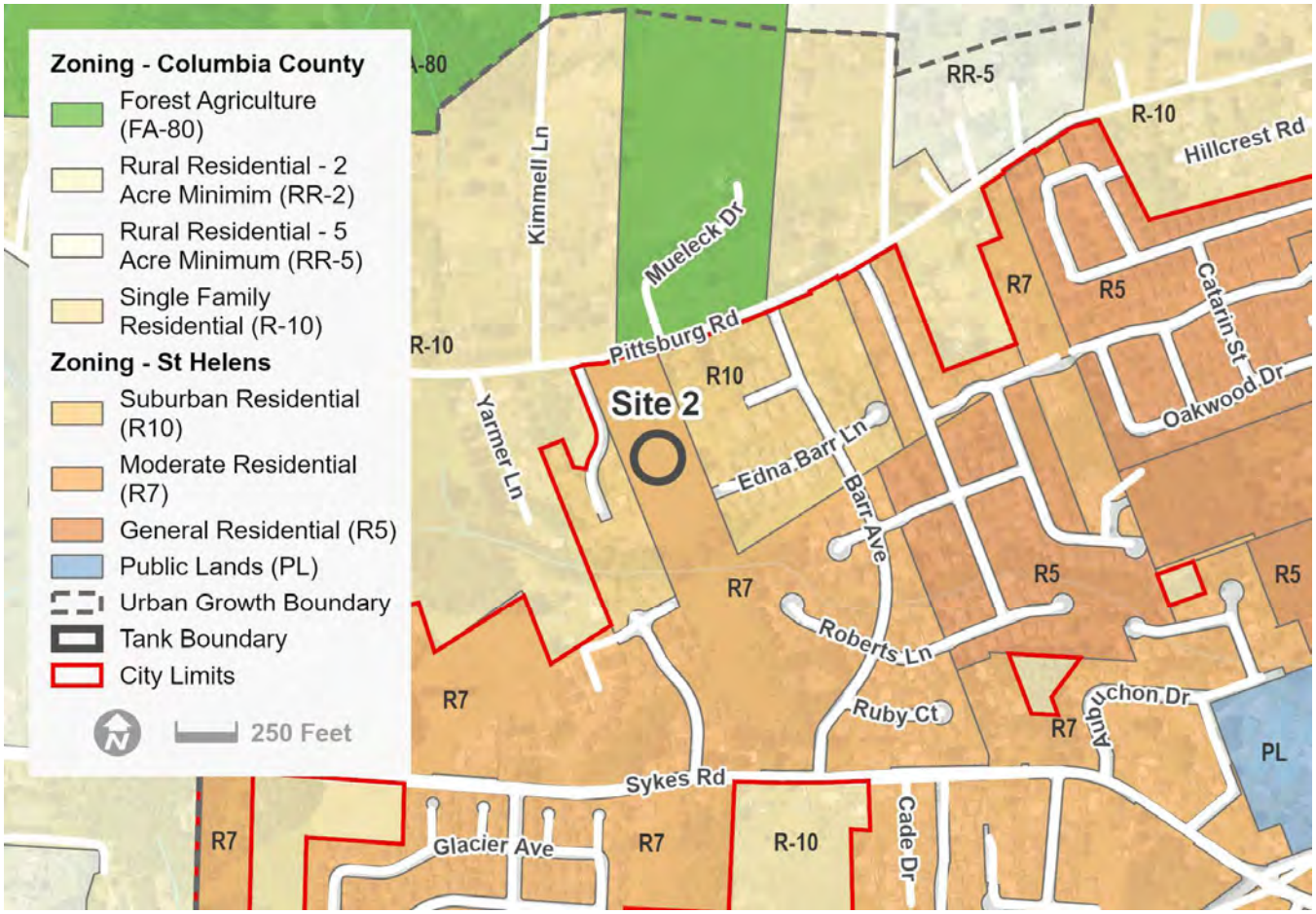


Under the PF-80 designation, the reservoir project would require approval of a Site Design Review application, which may be an administrative or quasi-judicial decision, depending on the size of the development. A pre-application conference will be required. There is also an existing Conditional Use Permit (CU 22-92) for Surface Mine operations on these two parcels.

6.2. SITE 2

Sites 2 is located within the St. Helens City limit and is within the City's Moderate Residential (R7) zoning designation. **Figure 19** shows Site 2 and the nearby zoning designations.

FIGURE 19: SITE 2 LAND USE MAP

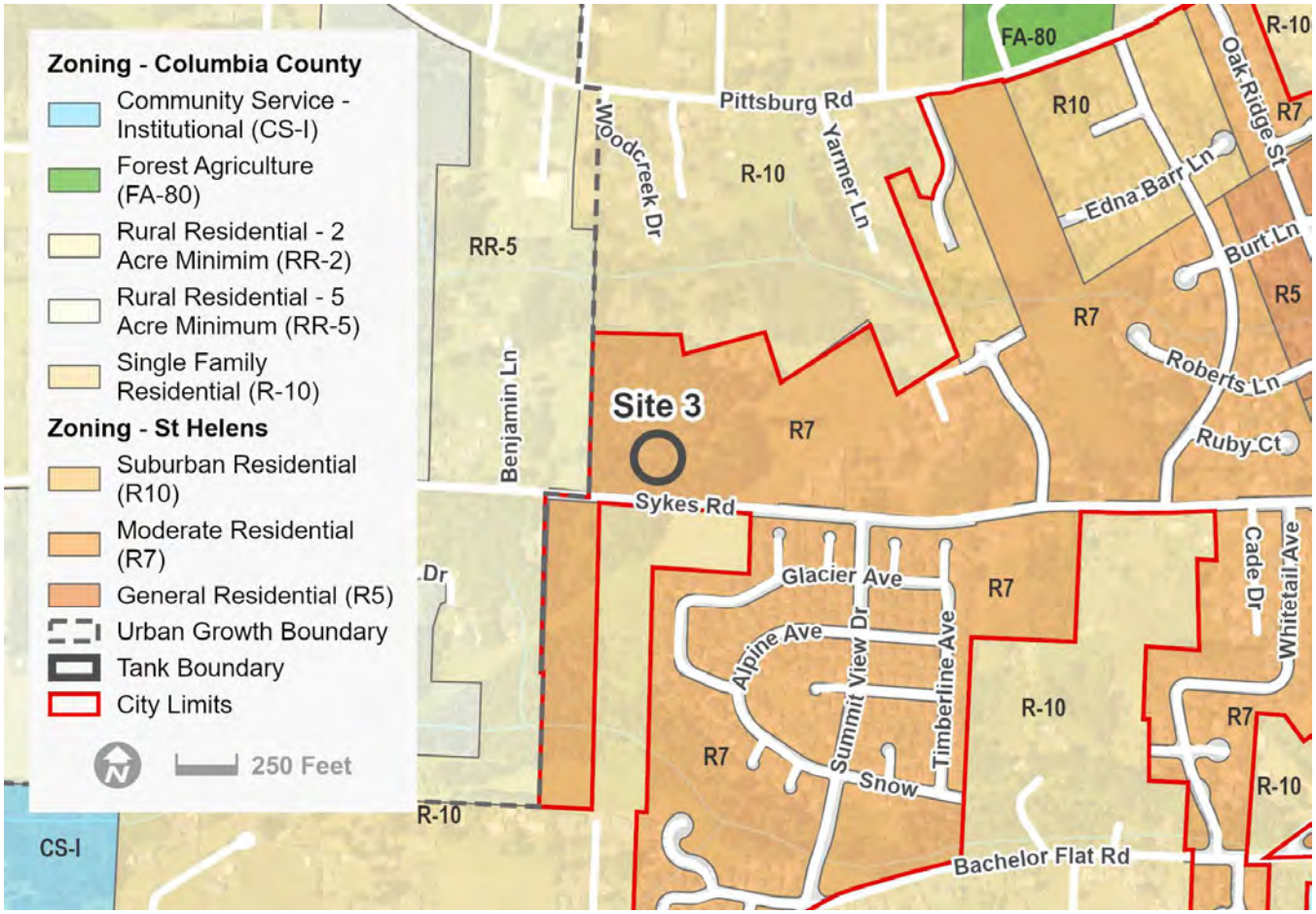


As listed in Section 17.32.060(3)(h) of the St. Helens Community Development Code (SHCDC) "major public facilities," which includes but is not limited to "water system reservoirs," are allowed as a conditional use in the R-7 zone. A Conditional Use Permit must be obtained for this property and frontage improvements may be required.

6.3. SITE 3

Site 3 is located within the St. Helens City limit, within the City's Moderate Residential (R7) zoning designation. A map of this site is included in **Figure 20**.

FIGURE 20: SITE 3 LAND USE MAP

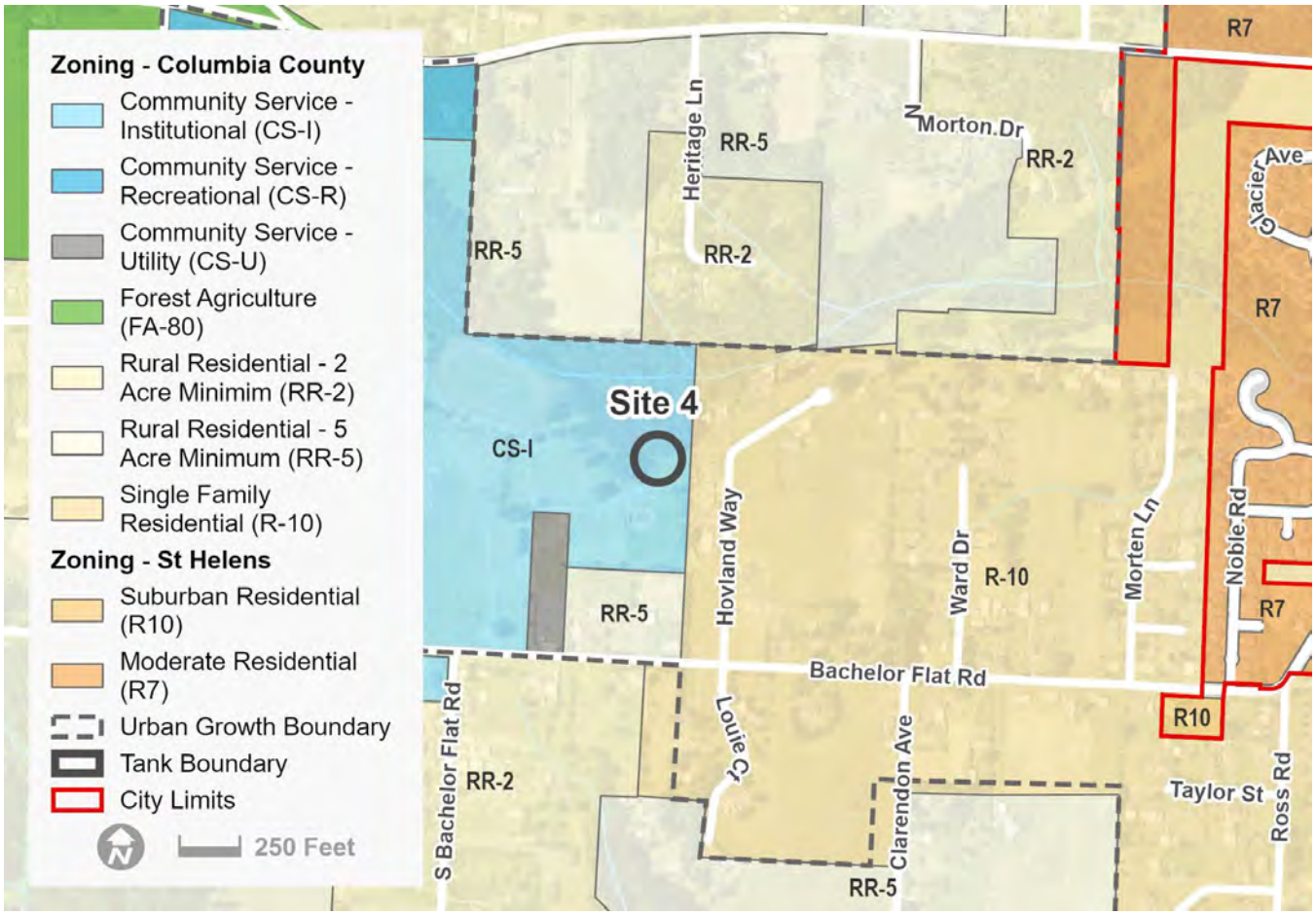


Similar to Site 2, a Conditional Use Permit must be obtained for this property as it falls within the R7 zone. As the City has indicated the intention to purchase only a portion of this property, a land partition would be required. Frontage improvements should be expected.

6.4. SITE 4

Site 4 is located outside St. Helens City limits in Columbia County. The site is within the County's Community Service – Institutional (CS-I) zoning designation. The CS-I zone is intended to provide a mechanism for the establishment of public and private facilities necessary to meet the demand for the various types of public assemblies and public and private institutional facilities. A map showing zoning designations in the area is presented in **Figure 21**.

FIGURE 21: SITE 4 LAND USE MAP



The parcel on which the reservoir would be sited does not explicitly permit reservoirs and water impoundments. However, the County Planning Commission may approve the project as a Permitted Use. This process would require a Determination of Similar Use (DSU) application in conjunction with a Site Design Review application. Additionally, a Pre-Application Conference would be required prior to the submission of the Site Design Review application. Both the DSU and Site Design Review application must be reviewed by the County Planning Commission.

6.5. OWNERSHIP AND ZONING OVERVIEW

An overview of parcel ownership and zoning for all four sites is presented in **Table 5**.

TABLE 5 . PROPERTY OWNERSHIP AND ZONING

Tank Site	Ownership	Owner	Tax Lot ID	Zoning
1	Private	Weyerhaeuser NR Company	5N1W3200 1600; 5N1W32DD 100	Columbia County PF-80
2	Private	Comstock Chieko Revocable Trust	4N1W 6AD 2600; 4N1W 6D0 604	City of St. Helens R7
3	Private	Thayer Paul L and Laura R	4N1W 6DB 1203	City of St. Helens R7
4	Public	Columbia County	4N1W 7BB 400	Columbia County CS-I

7 - PROPERTY OWNER COMMUNICATION

Commonstreet Consulting supported communication efforts with property owners by engaging them for involvement as stakeholders, coordinating Right of Entry (ROE) approvals, and discussing potential design concepts with them. This section includes a brief description of the outcomes from property owner communication.

7.1. SITE 1

The Site 1 parcels are owned by Weyerhaeuser, a prominent logging company. The company has an existing long-term lease with Knife River for the use of the adjacent property as a quarry and indicated that they were disinterested in pursuing any potential purchase of the property. Weyerhaeuser rejected the proposed ROE and no subsurface investigations could be conducted.

7.2. SITE 2

The Site 2 property owner expressed interest in selling the property but maintained that preference that the property be purchased in full (both parcels). The property owner granted a ROE agreement for the City to conduct the investigations related to the study.

7.3. SITE 3

Paul and Laura Thayer indicated that they were open to future discussions regarding the purchase of a portion of their property for the future reservoir site. A ROE was not required for this site as the borings were conducted in the public right-of-way.

7.4. SITE 4

Site 4 is located on the County Fairgrounds property and is therefore managed by both the Columbia County Fair Board and the County. The Columbia County Board of County Commissioners approved the ROE. The County has indicated it is open to selling part of the fairground property with certain provisions.

8 - STAKEHOLDER ENGAGEMENT

SWCA supported the development of a Stakeholder Engagement Plan (SEP) for the City's use during the project. The SEP identified stakeholder engagement goals, supported in the development of the stakeholder list, and recommended outreach methods in coordination with the City to achieve the engagement goals. A summary of the SEP is included in this section. The SEP prepared by SWCA is provided in **Appendix F**.

8.1. STAKEHOLDER ENGAGEMENT METHODS

SWCA coordinated with the City to identify several outreach methods to reach the identified stakeholders. These outreach methods are tabulated in **Table 6**.

TABLE 6 . PERMITS AND PERMIT APPLICABILITY

Outreach Method	Description	Responsible	Target Date
Mailing List	Contact information for potentially interested parties will be maintained in a mailing list. This list included individuals and organizations that may be affected by or have an interest in the project. It will serve as the primary distribution list for project-related communications and updates.	City, SWCA	3 weeks prior to public meeting
Public Mailing	Informational postcards were mailed to adjacent landowners for up to four potential reservoir sites. Postcards were sent prior to the public meeting and included information about the project and the public meeting, along with a link to the project website.	SWCA	2 weeks prior to public meeting
Public email blast	Informational emails were emailed to adjacent landowners for the four potential reservoir sites considered. Emails were sent prior to the public meeting and included information about the project and the public meeting, along with a link to the project website.	City	2 weeks prior to public meeting
Newspaper Advertisement	Public meeting details were advertised in the Columbia County Spotlight newspaper to broaden public awareness.	SWCA	Ad will run once: 1 week prior to public meeting
Public Meeting	One in-person public open house occurred in the evening. Meeting materials included sign-in sheets, information boards, and a project handout.	SWCA, Keller, City	November 13, 2025

Keller, SWCA, and the City conducted a public meeting on November 13, 2025. The event was held open-house style, with SWCA preparing boards summarizing the project progress and both Keller and City staff communicating with attendees. This presentation method allowed for one-on-one communication about the attendees' concerns while educating them on the project efforts. Approximately 20 people attended, many of whom requested to be added to the City email list for future reservoir-related communications. No written feedback was provided by attendees at the open house.

8.2. STAKEHOLDER FEEDBACK

Participants in the public meeting described concerns about rate increases associated with the project and communicated their concern that the reservoir may appear visually unappealing. One resident voiced concerns

regarding the impacts of an abandoned landfill site upstream of Site 4. This concern was evaluated by the project team and determined to be unlikely to affect project design or construction.

9 - COST AND CONSTRUCTABILITY

Keller completed a site visit with Walsh Group to evaluate the existing site conditions of Sites 1-4 and determine the relative ranking of construction costs between the four sites. Each site was evaluated on constructability with consideration for site layout, potential laydown areas, access for deliveries, available space for pre-stressed tank wrapping, equipment storage, and site preparation prior to significant construction activities. Capital cost was originally evaluated with consideration for known conditions and was refined later in the process with feedback from pre-stressed concrete tank manufacturers and City preferences.

9.1. SITE EVALUATION RESULTS

9.1.1. Site 1

As the ROE was rejected for Site 1, the site was evaluated from the nearby right-of-way and with additional support from aerial imagery and topographical data available from public data sources. Access to Site 1 would require a driveway connecting the property to the nearby roadways. Site 1 would be expected to require some site preparation in advance of most construction activities. Construction would be expected to have significant impacts to the flow of traffic in the adjacent residential areas. Connections to the Main PZ and to the stormwater system for the overflow/drain require approximately 5,400 linear feet of pipeline, which is the longest overflow/drain pipeline length of the four sites evaluated in depth. The existing pipeline on Sunset Boulevard would need to be upsized from the existing 12-inch to a future 24-inch pipeline. A more in-depth analysis of the constructability and cost associated with the site could not be completed without property access.

9.1.2. Site 2

Site 2 has gentle sloping topography to the nearby stream with nearby access available from Meadowview Drive. The land would require minimal preparation in advance of construction activities and space is available for laydown areas, tank wrapping, equipment storage, and large delivery access. Site access during construction is expected to impact the surrounding residential areas. No atypical structural limitations or requirements are expected because of the geologic conditions. Approximately 2,730 linear feet of pipeline would be required to connect to the Main PZ and to connect the overflow/drain pipeline to the stream. Site 2 is ideal for construction and is likely to have the least cost.

9.1.3. Site 3

Site 3 is heavily forested and is located off Sykes Road, a relatively high-traffic County road. Site preparation is expected to be significant and would include significant removal of trees on the reservoir site. The reservoir access drive location is expected to be relatively difficult to site and construct due to the proximity of the reservoir to Sykes Road. Tank wrapping is expected to be possible but difficult in this location due to other nearby trees, homes, and utility lines. Significant congestion would be anticipated in the early stages of construction. Once the site preparation is complete, the impact to traffic through Sykes Road would lessen. The subsurface conditions will likely require tank height and foundation considerations, increasing the expected cost of the reservoir and foundation preparation. To connect the overflow/drain line to the stormwater system and to connect to the Main PZ would require approximately 3,120 linear feet of pipeline.

9.1.4. Site 4

The construction associated with Site 4 is expected to prove difficult. Subsurface conditions are expected to prove difficult for heavy machinery in addition to having significant tank restrictions to account for the geologic

hazards. Nearby utilities, namely overhead power lines, are expected to be a challenge for tank wrapping. Access from the County Fairgrounds drive is expected to be sufficient. Construction would impact the County Fairgrounds but would not be anticipated to greatly affect the flow of traffic in the surrounding area. The connection to the Main PZ is the longest of the four sites and requires a pipeline that is approximately 6,220 linear feet. In total, approximately 6,340 linear feet of pipeline would be required to install the reservoir at this site.

9.2. RELATIVE RANKING

Keller and Walsh Group identified the following relative ranking of sites, where the top choice is expected to have the best construction conditions and lowest costs and the bottom choice is expected to have the least preferred construction conditions and highest costs.

- #1 – Site 2 (Best Choice)
- #2 – Site 3
- #3 – Site 1
- #4 – Site 4 (Least Preferred Choice)

Site 2 was identified as the best option as it has good site access, no atypical structural considerations or limitations, and the required site preparation is expected to be minimal. Additionally, the length of pipelines for the connection to the water system and overflow/drain line is the shortest combined length of the four priority sites.

10 - SITE EVALUATION SUMMARY

Sites were evaluated with consideration for various criteria including:

- Hydraulics and Operations – Valving, water transmission, available pressure and flows, and controls.
- Environmental Considerations – Permitting, special-status species, wetlands, and aquatic resources.
- Piping Connection Pathways – Water system and overflow/drain pathways and overall lengths.
- Geotechnical Favorability – Seismic and geological hazards, reservoir design implications, groundwater implications, and soil compatibility.
- Land Use and Permitting – Planning processes and timelines expected for approval and land use compatibility.
- Owner Willingness to Sell – Interest from property owner in selling area associated with site.
- Capital Cost – Expected relative capital cost.
- Public Support – Interest or disinterest in siting locations from public stakeholders.

Each site was evaluated according to each criterion on a scale from 1-5, where 1 is low or poor and 5 is high or good. The City identified the relative importance of each criterion by assigning a weight. A weighted average using the assigned weight and score was developed for each site as part of the decision matrix, shown in **Table 7**.

TABLE 7 . DECISION MATRIX

		Score			
Criteria	**Weight**	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Hydraulics and Operations	10%	1	4	4	**2**
Environmental Considerations	10%	4	3	3	**2**
Piping Connection Pathways	10%	2	5	3	**1**
Geotechnical Favorability	20%	2	5	3	**1**
Land Use and Planning	15%	3	4	4	**2**
Owner Willingness to Sell	5%	1	4	5	3
Capital Cost	25%	2	5	3	1
Public Support	5%	2	4	3	1
WEIGHTED AVERAGE	**100%**	**2.2**	**4.5**	**3.4**	**1.5**

Site 2 has highly favorable geologic conditions, would work well within the existing water system hydraulics, has relatively short piping pathways compared to the other sites, and is expected to have the lowest overall capital cost. For these reasons, it is recommended that the City proceed with design of the 5.0 MG reservoir at Site 2. The planning level cost for Site 2 can be referenced in **Appendix G**.

11 - RECOMMENDED SITE

A rendering of a site concept for Site 2 is depicted in **Figure 22**. This concept includes the following items:

- 5.0 MG Pre-Stressed Concrete Tank with a Flat Roof, Access Stair and Access Ports,
- Asphalt access drive and parking area,
- Gravel access surrounding the reservoir,
- Fenced and Gated Entrance for Security,
- Arborvitae Trees for Screening,
- and a Detention Pond for Overflow, Drain, and Stormwater Management.

FIGURE 22: PRELIMINARY SITE CONCEPT RENDERING

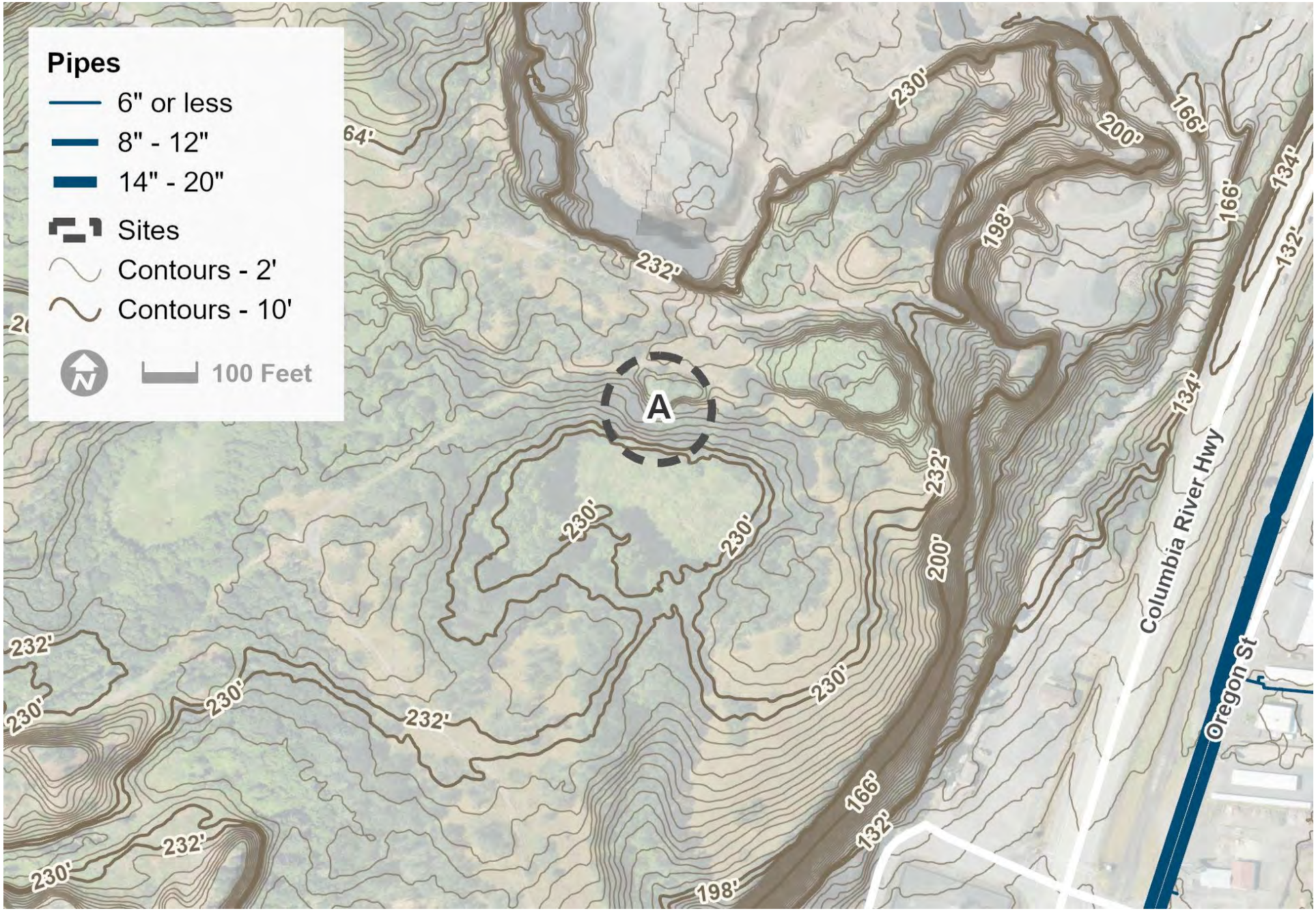
12 - NEXT STEPS

The next step in the process is property acquisition. This step may take time to progress to a point at which the City is comfortable to proceed with design. In the meantime, the City should continue working to secure funding for the design and construction of the 5.0 MG reservoir.

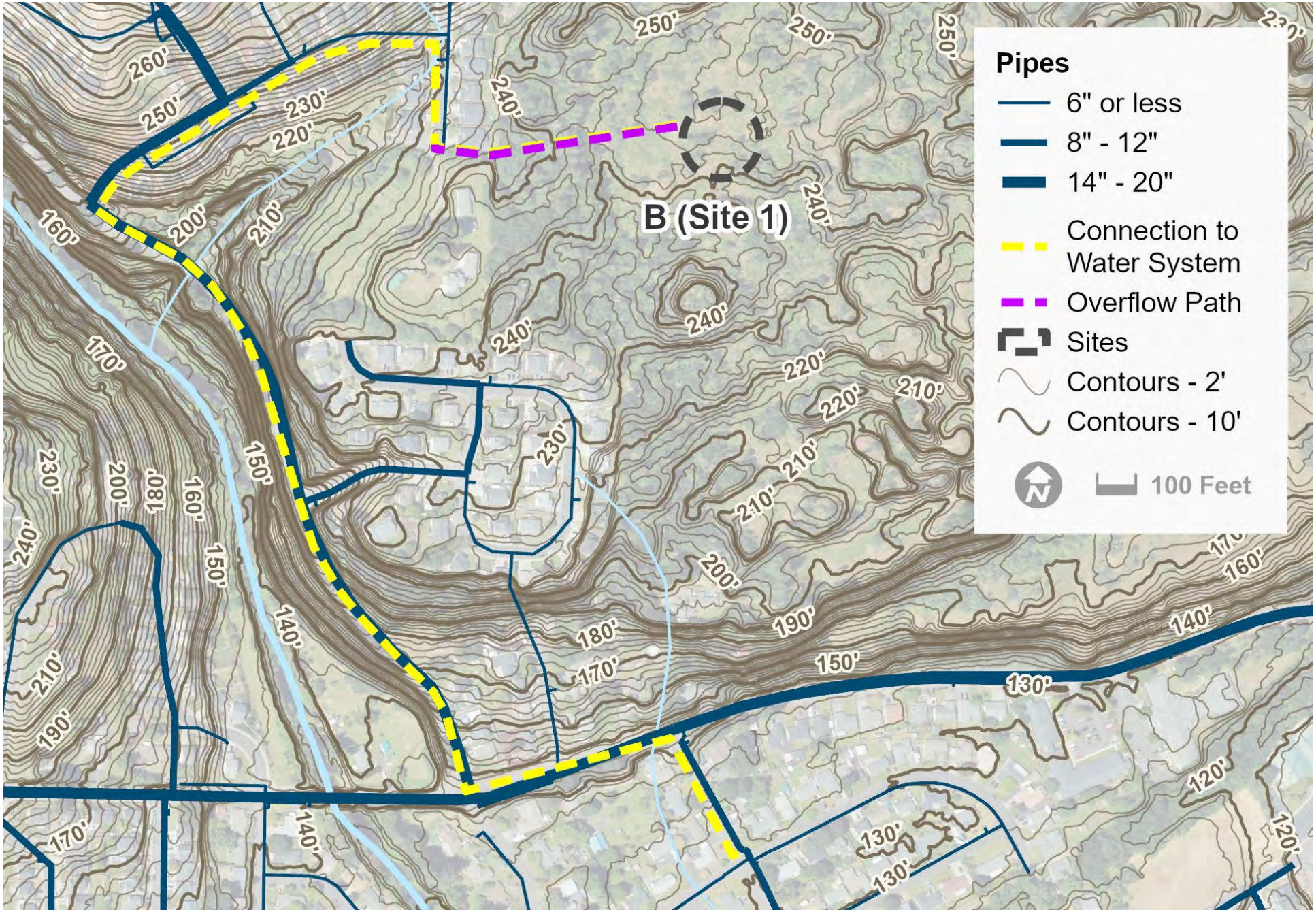
APPENDIX A

Maps of Preliminary Sites A-H

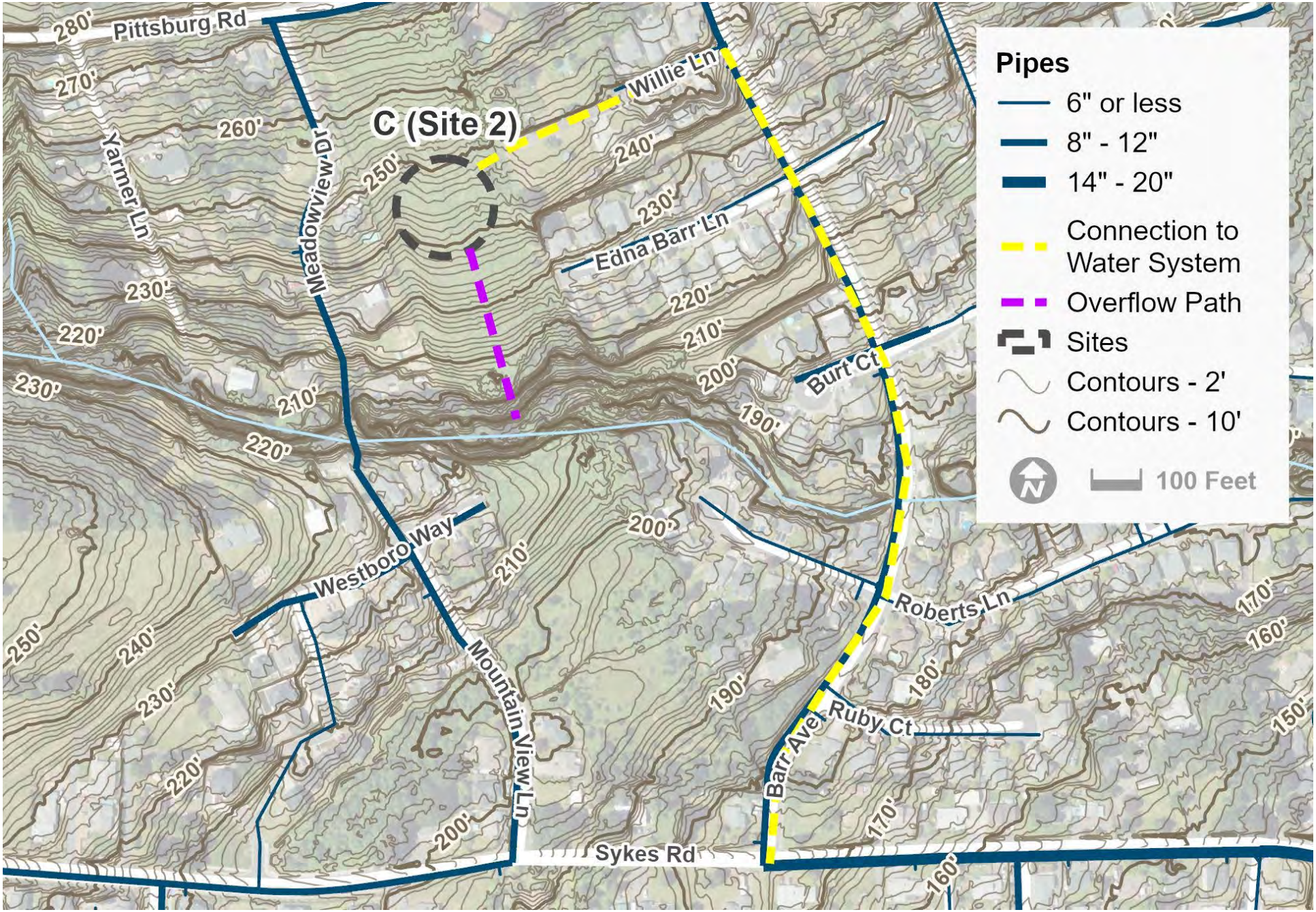
Site A Site Map



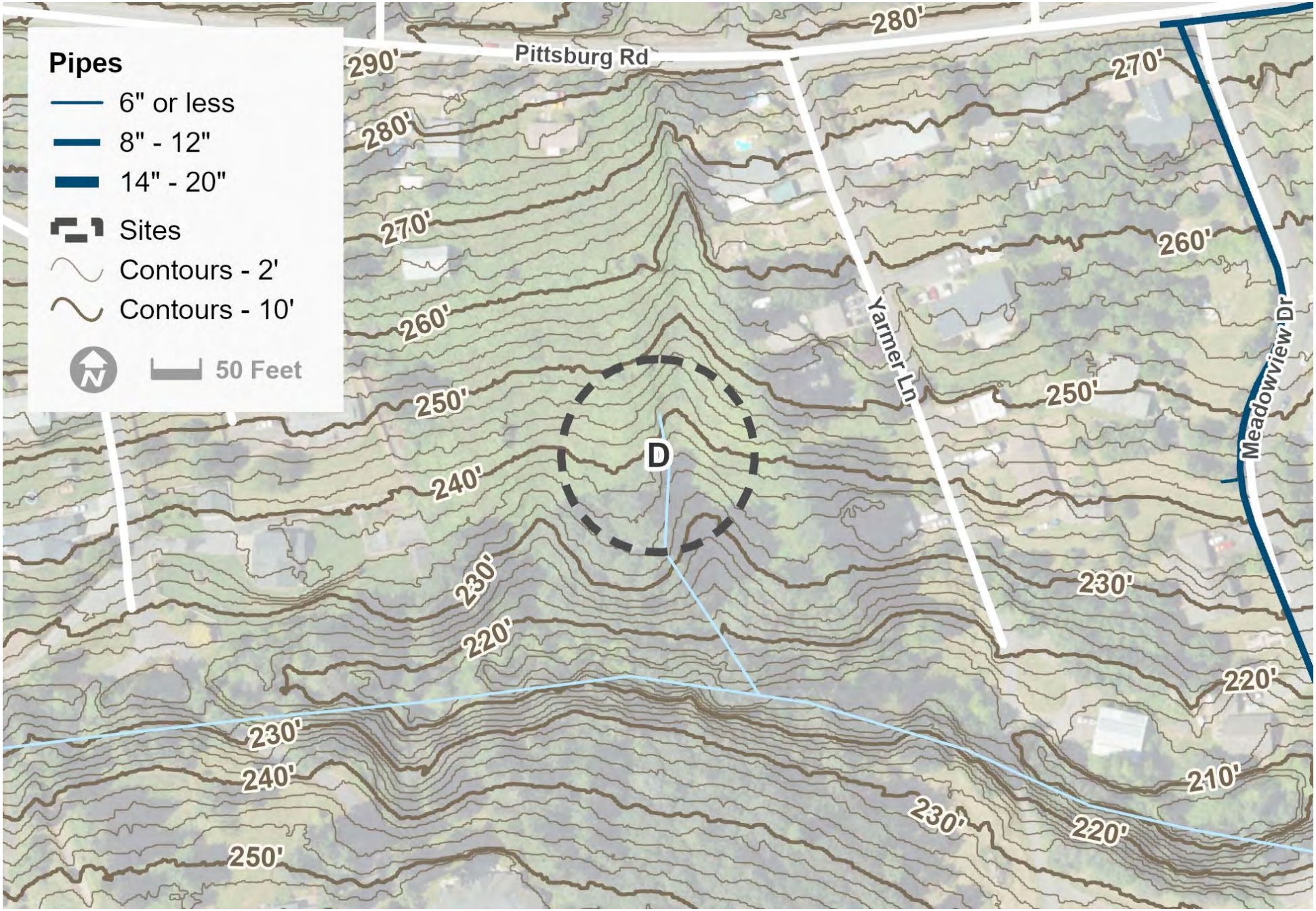
Site B (Site 1) Map



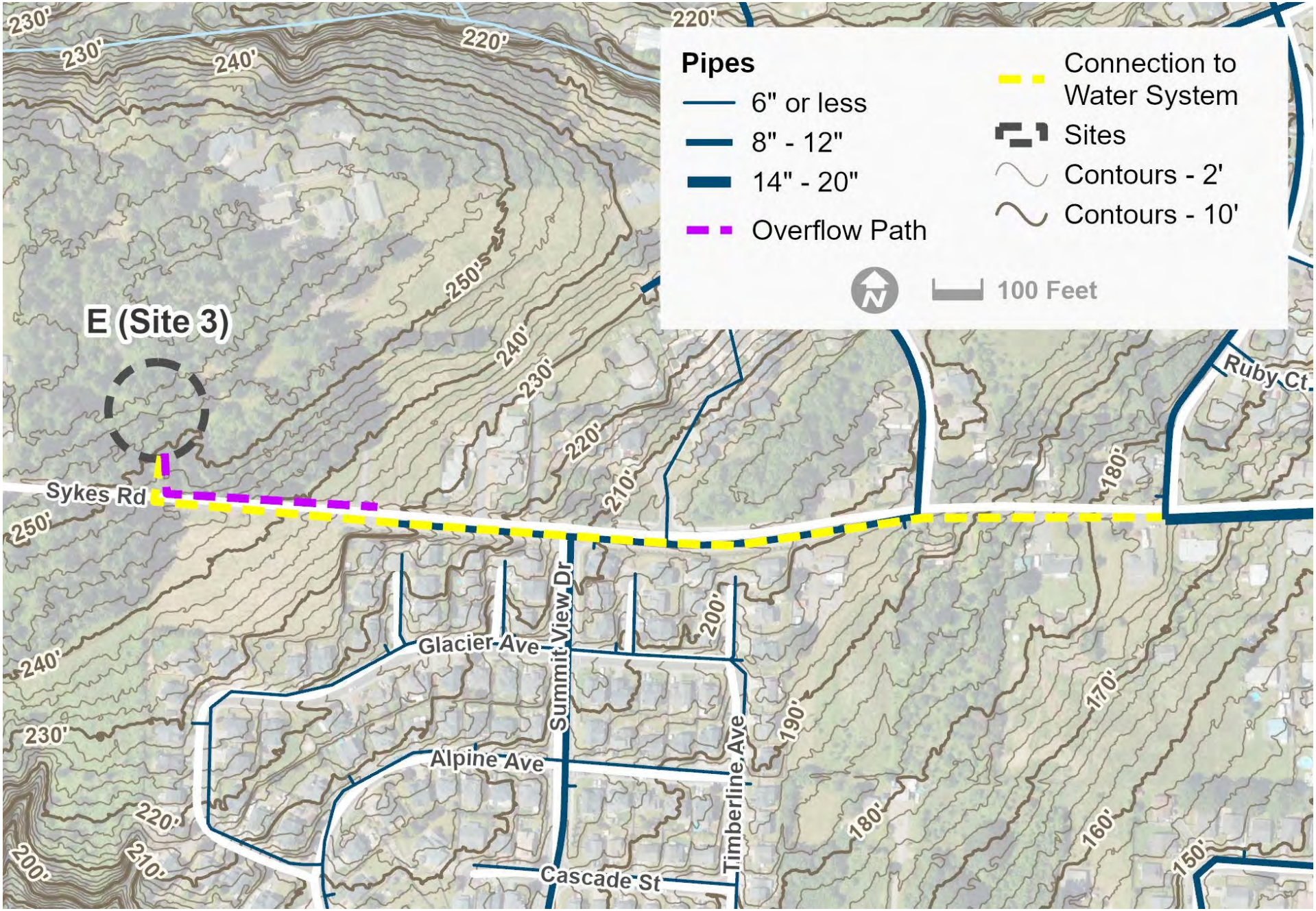
Site C (Site 2) Map



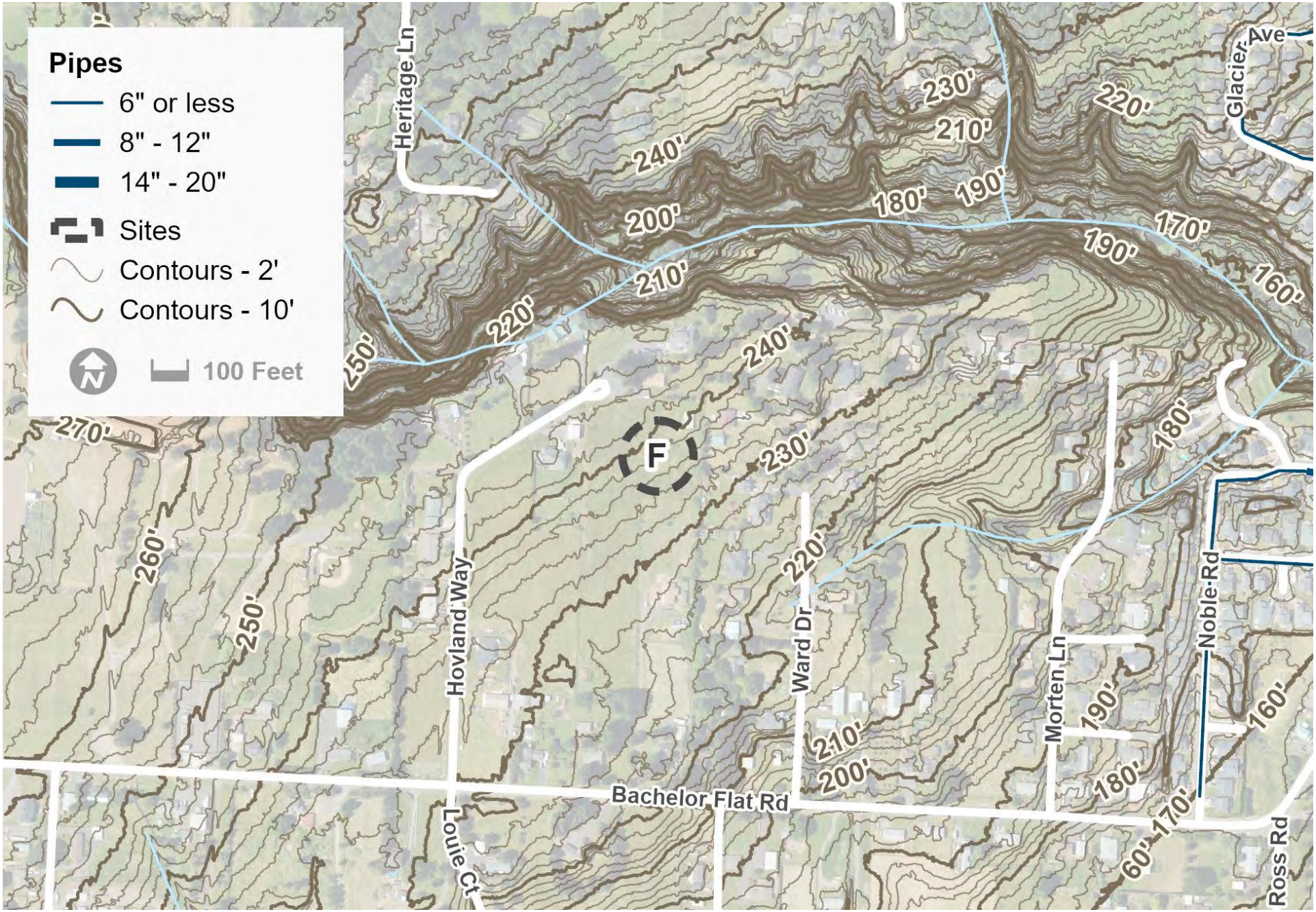
Site D Map


Pipes
6" or less
8" - 12"
14" - 20"
Sites
Contours - 2'
Contours - 10'
50 Feet
Pittsburg Rd
Yarmer Ln
Meadowview Dr
D
280'
290'
270'
260'
250'
240'
230'
220'
210'

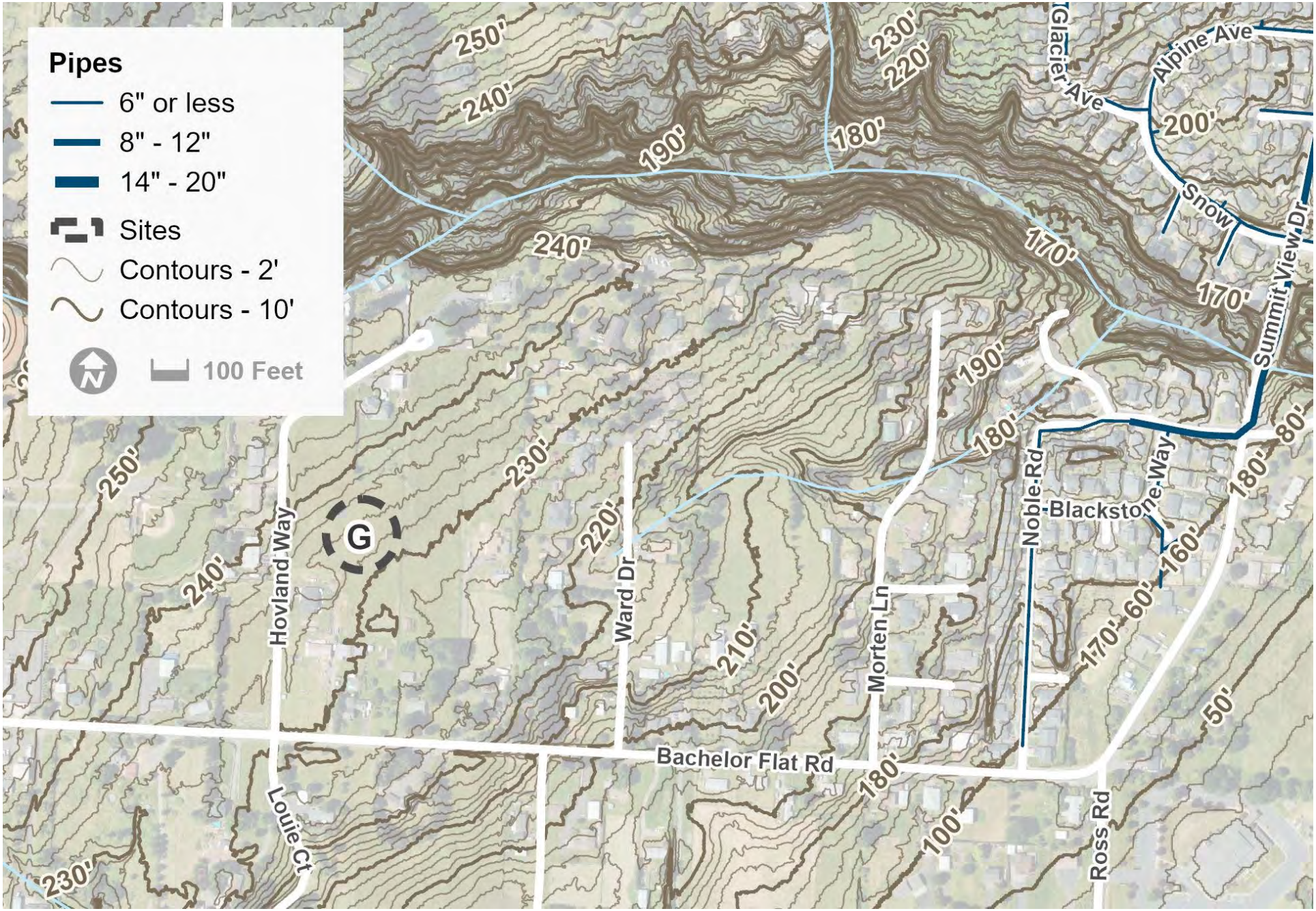
Site E (Site 3) Map



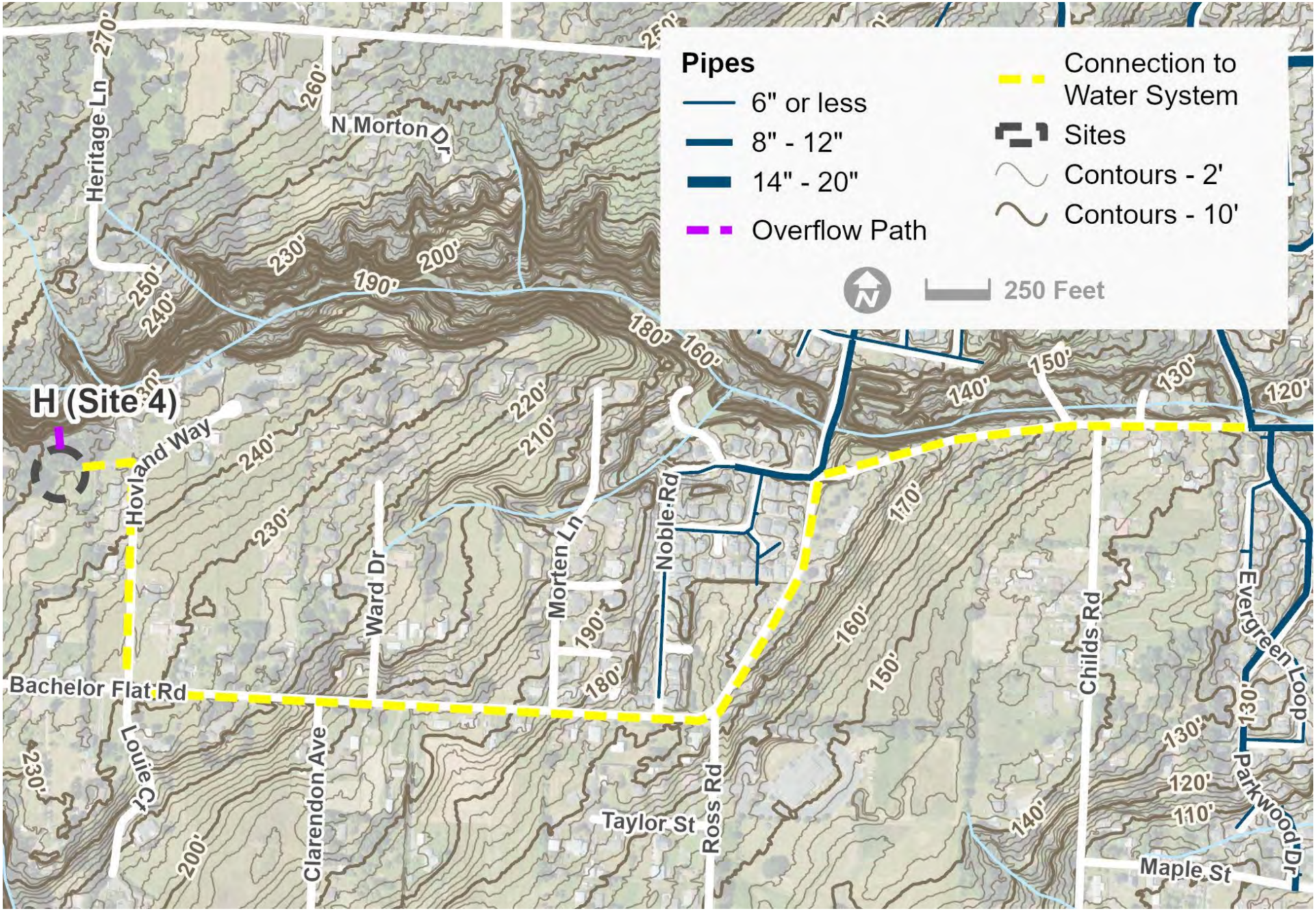
Site F Map


Pipes
6" or less
8" - 12"
14" - 20"
Sites
Contours - 2'
Contours - 10'
100 Feet
F
Heritage Ln
Glacier Ave
Hovland Way
Ward Dr
Morten Ln
Noble Rd
Bachelor Flat Rd
Louie Ct
Ross Rd
270'
260'
250'
240'
230'
220'
210'
200'
190'
180'
170'
160'
60'

Site G Map


Pipes
6" or less
8" - 12"
14" - 20"
Sites
Contours - 2'
Contours - 10'
100 Feet
G
Hovland Way
Louie Ct
Ward Dr
Morten Ln
Noble Rd
Blackstone Way
Ross Rd
Bachelor Flat Rd
Glacier Ave
Alpine Ave
Snow
Summit View Dr
250'
240'
230'
220'
210'
200'
190'
180'
170'
160'
100'
80'
60'
50'

Site H (Site 4) Map



APPENDIX B

Preliminary Site Evaluation Summary of Findings

Characteristic	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H
Substrate	Basalt Rock	Basalt Rock	Missoula Flood Deposits	Missoula Flood Deposits	Missoula Flood Deposits	Missoula Flood Deposits	Missoula Flood Deposits	Missoula Flood Deposits
Liquefaction Risk	None	None	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Landslide Risk	Moderate-low	Low	Moderate	Moderate	Moderate-low	Low	Low	Low
Land Availability	Industrial property owner. Positive past experience	Industrial Property Owner	Undeveloped Property. Spans two parcels. May have some neighborhood opposition	Undeveloped Property	Semi-rural property. May be particularly sensitive to public works proposals	Undeveloped Property	Undeveloped Property	County park, may be more readily available
Land Use / Zoning	Mineral and Aggregate; Prime Forest 80	Prime Forest 80	Medium Density Residential	Medium Density Residential	Medium Density Residential	Medium-Density Residential	Medium-Density Residential	UC Rural Industrial
Surrounding Land Use / Space constraints	No space constraints (forest)	No space constraints (forest)	Nearby housing	Nearby housing	No space constraints (forest)	Nearby housing, park	Nearby housing, park	Nearby housing, park
Proximity to Main PZ in Water System (linear feet)	1970 LF	4690 LF	2370 LF	3640 LF	2190 LF	6590 LF	5840 LF	6220 LF
Proximity for Overflow / Drain	1700+ LF to stormwater ditch[1]	650 LF to stormwater system[1]	360 LF to stream	180 LF to stream	930 LF to stormwater ditch[1]	420 LF to stream	670 LF to stream	120 LF to stream
Accessibility	Easy access from nearby Liberty Hill Dr. Would need very short driveway	Would need to build a road through private property (620 ft)	Nearby road; would need to construct a short driveway through private property	Nearby road; would need to construct a short driveway through private property	Easy access from Sykes Rd. Short driveway needed	Easy access from Hovland Way. Short driveway, through private property	Easy access from Hovland Way. Short driveway, through private property	Easy access from Hovland Way. Short driveway, through private property
Slopes	17 ft gradient across tank, 8.5% slope.	6 ft gradient across tank, 3% slope.	11 ft gradient across tank, 5.5% slope.	20 ft gradient across tank, 10% slope.	9 ft gradient across tank, 4.5% slope.	7 ft gradient, 3.5% slope.	8 ft gradient, 4% slope.	2 ft gradient, 1% slope.
Operational Hydraulics	Likely requires altitude valve on new tank	Likely requires altitude valve on new tank	May require altitude valve at existing tank	May require altitude valve at existing tank	May require altitude valve at existing tank	Likely requires altitude valve at existing tank	Likely requires altitude valve at existing tank	Likely requires altitude valve at existing tank

Note:
1. Subject to available stormwater system capacity.

APPENDIX C

Shannon & Wilson Geotechnical Engineering Report, December 2025

SUBMITTED TO:
Keller Associates, Inc.
245 Commercial Street SE,
Suite 210
Salem, OR 97301

BY:
Shannon & Wilson
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Lake Oswego, OR 97035

(503) 210-4750
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GEOTECHNICAL ENGINEERING REPORT

St. Helens Reservoir Siting Study

ST. HELENS, OREGON

SHANNON & WILSON

December 2025

Shannon & Wilson No: 115125

Submitted To: Keller Associates, Inc.
245 Commercial Street SE, Suite 210
Salem, OR 97301
Attn: Peter Olsen, PE

Subject: GEOTECHNICAL ENGINEERING REPORT, ST. HELENS RESERVOIR SITING STUDY, ST. HELENS, OREGON

Shannon & Wilson prepared this report and participated in this project as a subconsultant to Keller Associates, Inc. (Keller). Our scope of services was specified in our Subconsultant Agreement with Keller dated July 21, 2025. This report presents findings from our preliminary geotechnical evaluation and subsurface exploration, along with geotechnical considerations for site selection of a new above-ground water reservoir. It was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON

Jordan Melby, PE
Senior Engineer

JLM:RPP/mmb

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Appendices

1 INTRODUCTION

This report presents the findings from our subsurface field explorations, laboratory testing, and preliminary geotechnical design evaluations, along with geotechnical considerations developed for the St. Helens Reservoir Siting Study in St. Helens, Oregon. As a subconsultant to Keller, Shannon & Wilson is providing geotechnical services to support the reservoir site selection process.

2 PROJECT UNDERSTANDING

2.1 Project Description

The City of St. Helens is planning to construct a new 5.0-million-gallon (MG) above-ground concrete reservoir to enhance its water storage capacity. Four potential sites have been identified within the city and surrounding areas of Columbia County, as illustrated in Figure 1, Vicinity Map. These preliminary site locations were selected by Keller based on optimal elevation and location.

Initially, seven candidate sites were identified by Keller for consideration. However, based on hydraulic constraints and other assessments, Keller and the City narrowed the list to four viable sites. Of these, three were selected for subsurface exploration to assess geotechnical conditions. Subsurface exploration was not conducted at Site 1 as the property owner denied access to the property. The findings from the subsurface explorations will inform the main geotechnical considerations for each property, guiding the final reservoir siting decision.

2.2 Site Descriptions

Although four potential reservoir sites were identified by Keller and the City, Shannon & Wilson conducted site reconnaissance and subsurface explorations at only three of them (Sites 2 through 4). During these visits, we observed surface conditions within the proposed reservoir footprints and surrounding areas. Site-specific observations from each location are detailed in the following sections.

2.2.1 Site 2

As shown in Figure 1, Vicinity Map, Site 2 is located just south of Pittsburg Road, near its intersection with Meadowview Drive, in the northwest corner of the City. The property is currently undeveloped and covered with short, ankle-high grasses. It is bordered on all

sides by residential lots and features a gentle slope toward the southeast. At the southern edge of the site, the elevation drops approximately 20 to 25 feet into an old drainage channel. Photographs of Site 2 are provided in Exhibits 2-1 through 2-4.

Exhibit 2-1: Photo looking southeast across Site 2. The stake in the foreground is the location of boring B-1.

Exhibit 2-2: Photo of the southern extent of the property at Site 2. South of the blackberry bushes in the foreground, the property drops off to an old drainage channel.

Exhibit 2-3: Photo from Pittsburg Road looking south at Site 2.

Exhibit 2-4: Photo looking southeast across Site 2.

2.2.2 Site 3

Site 3 is situated just north of Sykes Road on the west side of the city. The property is privately owned, and at the time of site reconnaissance and subsurface investigation, right-of-entry had not yet been obtained. Consequently, all observations were conducted from within the Columbia County right-of-way and supplemented with aerial imagery and LiDAR analysis.

Site 3 is currently heavily forested with a gentle slope to the south, as determined from LiDAR analysis. The property is surrounded on all sides by residential lots. Shannon & Wilson performed boring B-2 within Columbia County ROW just south of the proposed location of the reservoir. Exhibits 2-5 through 2-7 provide photographs of the site taken from the existing right-of-way.

Exhibit 2-5: Photo looking north into private property at the proposed site of the reservoir.

Exhibit 2-6: Photo looking west along Sykes Road. The private property on the right side of the photo is where the proposed reservoir would be constructed.

Exhibit 2-7: Photo looking west along Sykes Road. The private property on the right side of the photo is where the proposed reservoir would be constructed.

2.2.3 Site 4

Site 4 is located at the Columbia County Fairgrounds, just north of Bachelor Flat Road. The proposed reservoir site is currently undeveloped; however, a community baseball field lies immediately to the south. The site is bordered by residential lots to the east, while the remaining surroundings consist of Fairgrounds property and wooded areas. The topography is generally flat, though gently rolling hills are present to the north and west. Notably, the North Fork of McNutty Creek runs just north of the site, incised approximately 30 feet below the elevation of the proposed reservoir. Exhibits 2-8 through 2-10 show the existing site conditions.

Exhibit 2-8: Photo looking east across Site 4.

Exhibit 2-9: Photo looking south across Site 4.

Exhibit 2-10: Photo looking west across Site 4.

2.3 Scope of Services

Our services were performed in accordance with the scope described in our Subconsultant Services Agreement with Keller dated July 21, 2025. These services included:

- Reviewing published geologic subsurface information, available well logs, and geotechnical explorations in the site vicinity;
- Conducting site reconnaissance to mark exploration locations, coordinate access to the boring locations, and arrange utility locating for the exploration sites;
- Performing a subsurface exploration program consisting of one boring at three (3) sites selected by Keller and the City. Each boring was performed to a depth between 36.5 and 61.5 feet below ground surface (bgs);
- Performing laboratory testing on select samples from the subsurface explorations, including moisture content, fines content determination, and Atterberg limits determinations;
- Performing an evaluation of geologic hazards at four sites based on our review of available information and results from the subsurface explorations;
- Developing preliminary soil profiles and parameters for engineering analysis;
- Providing preliminary foundation support options for the proposed reservoir at the three sites where explorations were performed, including anticipated bearing capacity and total and differential settlement; and
- Preparing this GER.

3 GEOLOGIC SETTING

3.1 Regional Geology

The City of St. Helens is at the northern end of the Portland Basin, a structural depression created by complex folding and faulting of the basement rocks. The most prevalent basement rock of the Portland Basin is a sequence of lava flows called the Columbia River Basalt Group (CRBG), which flowed into the area between about 17 million and 6 million years ago (Beeson and others, 1991). Due to the wet and mild climate of the Pacific Northwest, intense chemical weathering of the geologic units has taken place (Evarts, 2009). In some instances, the rocks of the CRBG have been completely weathered to soil, destroying all primary rock textures. This has resulted in the development of soil horizons as thick as 10 meters.

The Columbia and Willamette Rivers converge within the Portland Basin, and with their tributaries, have contributed to extensive sedimentary deposits which overlie the basement

rock formations. These deposits are known within the Portland Basin as Sandy River Mudstone (SRM) and Troutdale Formation. According to Beeson and others (1991), the SRM consists of claystone, siltstone, and sandstone beds deposited in the Miocene to Pliocene epochs (about 10 million to 3.5 million years ago), and the Troutdale Formation consists of well-consolidated, friable to moderately well-cemented conglomerate and sandstone, also deposited in the Miocene to Pliocene epochs (about 12.5 million to 1.6 million years ago).

Toward the end of the Pleistocene, a tremendous load of sediment was deposited at the Project Site by a series of catastrophic floods. During the late stages of the last great ice age, between about 18,000 and 15,000 years ago, a lobe of the continental ice sheet repeatedly crossed and dammed the Clark Fork River in western Montana, which then formed an immense glacial lake called Lake Missoula (Allen and others, 2009). Periodically, the ice dam was breached and flood waters from Lake Missoula flowed southwest across portions of eastern Washington and into the Columbia River drainage. Forty or more repetitive outburst floods have been documented (Allen and others, 2009). These repeated floods are collectively referred to as the Missoula Floods. During each short-lived episode, floodwaters washed across the Idaho panhandle, through the eastern Washington scablands, and through the Columbia River Gorge. When the floodwater emerged from the western end of the gorge, it deposited a tremendous load of sediment (O'Connor and others, 2001).

During and after the Missoula Floods, rivers, streams, and wind have moved and deposited surficial sediment throughout the region. In more recent times, humans have changed the landscape, grading cuts and fills for development.

3.2 Local Geology

The surficial geology at sites 2, 3, and 4 has been mapped by Wells (2020) and Evarts (2004) as predominantly Pleistocene Missoula Flood Deposits. However, just north of Site 2, both authors have mapped the area as Grande Ronde Basalt (a member of the CRBG). During our subsurface explorations at Site 2, colluvial deposits were encountered overlying Grande Ronde Basalt. At Site 3, only fine-grained sediments of Missoula Flood Deposits were encountered, and at Site 4, colluvial deposits were found overlying Missoula Flood Deposits and Sandy River Mudstone.

Shannon & Wilson did not perform any geotechnical explorations at the proposed Site 1, located north of Pittsburg Road. According to geologic mapping, the site is entirely underlain by Grande Ronde Basalt. However, a review of nearby well logs indicates that while basalt is present, it may be highly to completely weathered in some areas, potentially

resembling soil rather than competent rock. Given this variability, if Site 1 is to be considered for development, a comprehensive geotechnical evaluation is strongly recommended to accurately characterize subsurface conditions.

4 SEISMIC SETTING

The contemporary tectonics and seismicity of the region are the result of oblique, northeastward subduction at a rate of about 40 millimeters per year (mm/yr) of the Juan de Fuca oceanic plate beneath the North American continental plate (e.g., Wells and others, 1998; Wells and Simpson, 2001). This complex tectonic setting produces east-west compressive strain along the Cascadia Subduction Zone (CSZ), as well as northward translation and rotation of the mobile, crustal, Cascadia fore-arc blocks that span the leading edge of the North America plate (Wells and others, 1998; McCaffrey and others, 2007, 2013). Rotation of the Sierra-Nevada block and expansion of the Basin and Range drive the northward migration and clockwise rotation of the Cascadia fore-arc blocks (e.g., Pezzopane and Weldon, 1993; Wells and others, 1998; Wells and Simpson, 2001). As a result, the southern portion of the forearc, the Oregon Coast block, is impinging on western Washington at a rate of about 8 to 12 mm/yr, causing crustal shortening in northwest Oregon and western Washington (Wells and others, 1998; Wells and Simpson, 2001; Mazzotti and others, 2002).

The combined effect of margin-normal subduction and margin-parallel shortening produces complex and diverse deformation within the northern edge of the Cascadia fore-arc and triggers large (greater than magnitude [Mw] 6.0), damaging earthquakes from three seismogenic source zones:

- The locked zone of the CSZ fault interface produces great mega-thrust earthquakes;
- The deep intraslab portion of the CSZ (i.e., the subducted portion of the Juan de Fuca Plate), the source of Wadati-Benioff zone earthquakes; and
- The overriding North American Plate, where shallow crustal faults rupture.

All three sources potentially produce earthquakes that impact the ground motion hazards at the project site. Offshore, elastic release of strain accumulated in the locked plate interface of the CSZ produces great megathrust earthquakes (greater than Mw 8.0) occurring at irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997; Clague, 1997; Goldfinger and others, 2003 and 2012); and the most recent rupture occurred in A.D. 1700 (Satake and others, 1996; Atwater and Hemphill-Haley, 1997; Clague, 1997; Yamaguchi and others, 1997; Goldfinger and others, 2003 and 2012). Onshore migration and

rotation of tectonic blocks produce deformation along shallow faults within the upper part of the crust. At depth, rupture within the subducting slab, referred to as the intraslab, has produced some of the largest recorded earthquakes (Mw 6.5 to 7.0) to strike the Pacific Northwest, the northern California Coast, and Western Washington. However, over the past century, intraslab earthquakes have been markedly infrequent in Oregon. The following sections briefly describe the location, characteristics, and seismicity of each of the sources.

4.1 Cascadia Subduction Zone: Mega-Thrust Source

CSZ mega-thrust earthquakes originate along the interface between the subducting oceanic plates and the North American plate. Because of the significant uncertainty of the landward extent of a potential rupture surface, estimates of the closest distance between the project and potential rupture surface range from about 65 to 140 horizontal miles. Focal depths for mega-thrust earthquakes are commonly on the order of about 15 to 25 miles. Rupture of the interface could result in earthquakes with Mw on the order of 8.5 to over 9.0, with strong shaking that lasts for several minutes. No large earthquakes have occurred in this zone during historic times (in the last 170 years). However, geologic evidence suggests that coastal estuaries have experienced rapid subsidence at various times within the last 2,000 years (e.g., Atwater, 1987; Atwater and Hemphill-Haley, 1997) as a result of tectonic movement associated with mega-thrust earthquakes on the CSZ. It appears that ruptures of this zone have occurred at irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997). Based on historical tsunami records in Japan (Satake and others, 1996) the most recent interplate event on the CSZ was a Mw 9.0 event on January 26, 1700.

4.2 Cascadia Subduction Zone: Intraslab Source

CSZ intraslab earthquakes originate from within the subducting oceanic plates because of down-dip tensional forces and bending caused by mineralogical and density changes in the plates at depth. These earthquakes typically occur 28 to 37 miles beneath the surface. Because intraslab events involve high-angle normal faulting, the area of the rupture surface and magnitude is strongly dependent on the thickness of the subducting slab. Young subduction zones, such as the CSZ, generally have relatively thin subducting slabs. Thermal modeling of the CSZ (Hyndman and Wang, 1993) and the observed geometry of the Wadati-Benioff Zone (Jarrard, 1986) confirm the likelihood that the subducting slab is relatively thin.

Worldwide observations indicate that the largest intraslab earthquakes are on the order of magnitude (M) 8, with the 12 largest of these occurring in older subducting slabs. The

largest recorded intraslab earthquake beneath the Puget Lowland, the 1949 Olympia earthquake, was a surface wave magnitude 7.1 event. Ludwin and others (1991) estimate that the maximum magnitude from this source zone would be about 7.5.

At the Project Site, ground shaking produced by intraslab earthquakes would generally be less intense and less prolonged than ground motions generated by large subduction zone interface earthquake events. Historic seismicity from this source zone includes the 1949 magnitude 7.1 Olympia earthquake; the 1965 magnitude 6.5 earthquake between Tacoma and Seattle; and the 2001 magnitude 6.8 Nisqually earthquake. While intraslab events have occurred frequently in the Puget Sound area, they are historically rare in Oregon.

4.3 Shallow Crustal Source

Shallow crustal earthquakes within the North American Plate have historically occurred in a diffuse pattern within western Oregon, typically within the upper 4 to 19 miles of the continental crust. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake at magnitude 6.8. Other examples include the 1993 magnitude 5.6 Scotts Mill earthquake and the 1993 magnitude 6.0 Klamath Falls earthquake.

Shallow crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS, 2024). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database.

The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.6 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

According to the USGS Quaternary Fault and Fold database, there are five Class A features within approximately 20 miles of the project vicinity. Their names, general locations relative to the site, and the time since their most recent deformation are summarized in Exhibit 4-1.

Exhibit 4-1: USGS Class A Faults Within a 20-Mile Radius of the Project Site

Fault Name	USGS Fault Number	Approximate Length	Approximate Distance & Direction from Project Site[1]	Slip Rate Category[2]	Time Since Last Deformation[3]
Portland Hills Fault	877	30.4 miles	16 miles SE	< 0.2 mm/yr	<1.6 Ma
East Bank Fault	876	18.0 miles	16 miles SE	< 0.2 mm/yr	< 750 ka
Oatfield Fault	875	18.0 miles	17 miles S	< 0.2 mm/yr	< 1.6 Ma
Helvetia Fault	714	4.3 miles	18 miles SW	< 0.2 mm/yr	< 1.6 Ma
Lacamas Lake Fault	880	14.9 miles	21 miles SE	< 0.2 mm/yr	< 750 ka

NOTES:

1 Approximate distance between nearest reservoir site and nearest extent of fault mapped at the ground surface.

2 mm = millimeters; yr = year.

3 Ma = "Mega-annum" or million years ago; ka = "Kilo-annum" or one thousand years ago.

5 FIELD EXPLORATIONS

As part of the geotechnical field exploration program for this project, three borings designated as B-1 through B-3 were completed. Boring B-1 was conducted at Site 2, B-2 at Site 3, and B-3 at Site 4. Their approximate locations are presented in Figure 2.

Explorations for this field program were completed in two mobilizations. Borings B-1 and B-2 were completed on September 24 and 25, 2025, respectively. Boring B-3 was completed on October 21, 2025. The borings were drilled to depths ranging from 36.5 to 61.5 feet bgs using a track-mounted Geoprobe 3126GT drill rig owned and operated by Western States Soil Conservation, Inc. out of Hubbard, Oregon. Standard Penetration Test (SPT) samples were collected at 2.5 and 5-foot intervals, and HQ3-wireline rock coring techniques were used to advance the boring and sample the rock at boring B-1.

A Shannon & Wilson geologist was present during the explorations to locate the borings, observe the drilling, collect the geotechnical soil and rock samples, and log the materials encountered. Disturbed SPT samples were placed in plastic sample jars and sealed, and rock core was boxed and returned to the laboratory at Shannon & Wilson for further evaluation and testing. Appendix A, Field Explorations, presents details of the field exploration program, including the techniques used to advance the explorations and the resulting logs of the materials encountered.

6 LABORATORY TESTING

The samples we obtained during our field explorations were transported to our laboratory for further examination. We then selected samples for laboratory tests. The soil testing program included moisture content tests, Atterberg limits tests, and particle-size analyses. Testing was completed by Shannon & Wilson at our in-house laboratory in Lake Oswego, Oregon, in accordance with applicable ASTM International standards. Results of the laboratory tests and brief descriptions of the test procedures are presented in Appendix B, Laboratory Test Results.

7 SUBSURFACE CONDITIONS

7.1 Site 2 Geotechnical Soil Units

Based on the results of boring B-1, Shannon & Wilson grouped the materials encountered at Site 2 into three geotechnical units as described below. This description of the subsurface conditions is based on the explorations and regional geologic information from published sources. The geotechnical units are as follows:

- **Colluvium**: Dense Clayey Gravel with Sand (GC), very dense Silty Gravel with Sand (GM), and medium dense/very stiff Sandy Silt to Sandy Silt with Gravel (ML)**;**
- **Predominantly Decomposed Grande Ronde Basalt**: Predominantly decomposed to medium dense Silty Sand (SM)**; and**
- **Grande Ronde Basalt**: Extremely weak to weak (R0-R2), slightly to highly weathered.

These geotechnical units were grouped based on their engineering properties, geologic origins, and their distribution in the subsurface. Contacts between the units may be more gradational than shown in the boring logs in Appendix A. The Standard Penetration Test (SPT) N-values shown on the boring logs are as recorded in the field (uncorrected). The following sections describe the geotechnical unit characteristics in greater detail.

7.1.1 Colluvium

The colluvium at Site 2 was encountered in the boring from ground surface to a depth of 14.5 feet bgs. The unit generally consisted of dense Clayey Gravel with Sand (GC), very dense Silty Gravel with Sand (GM), and medium dense/very stiff Sandy Silt. The sand and gravel constituents of the unit were typically fine to coarse, while the fines were generally nonplastic to medium plasticity. SPT N-values within the unit ranged from 18 to 75 blow per foot (bpf) and averaged 36 bpf. Natural moisture content within the unit ranged from

34.1 to 45.6 percent, and averaged 41.5 percent. A single fines content analysis indicated that the tested sample contained 35 percent fines by dry weight.

7.1.2 Predominantly Decomposed Grande Ronde Basalt

Predominantly decomposed Grande Ronde Basalt was encountered in the boring below the colluvium, until a depth of 17.5 feet bgs. The unit typically consisted of predominantly decomposed to medium dense Silty Sand. A relict bedrock texture was observed within the unit. Only a single SPT was attempted within the unit, registering an N-Value of 29 bpf.

7.1.3 Grande Ronde Basalt

Grande Ronde Basalt was encountered within the boring below the Predominantly Decomposed Grande Ronde Basalt until the boring's termination 36.5 feet bgs. The unit typically consisted of extremely weak to weak (R0-R2) basalt which was slightly to highly weathered. Only a single SPT was attempted within the unit, and it was met with refusal. RQD within the unit was generally low and ranged from 0 to 22 percent.

7.2 Site 3 Geotechnical Soil Units

Based on the results of boring B-2, Shannon & Wilson grouped the materials encountered in our field exploration at Site 3 into two geotechnical units as described below. This description of the subsurface conditions is based on the explorations and regional geologic information from published sources. The geotechnical units are as follows:

- **Fill**: Includes pavement and base aggregate section; very stiff Lean Clay with Sand (CL).
- **Missoula Flood Deposits - Fine-Grained Facies**: Stiff Silt with Sand (ML), and medium stiff to very stiff Lean Clay (CL).

These geotechnical units were grouped based on their engineering properties, geologic origins, and their distribution in the subsurface. Contacts between the units may be more gradational than shown in the boring logs in Appendix A. The Standard Penetration Test (SPT) N-values shown on the boring logs are as recorded in the field (uncorrected). The following sections describe the geotechnical unit characteristics in greater detail.

7.2.1 Fill

Fill was encountered within the boring from ground surface to a depth of 7 feet bgs. The unit typically consisted of very stiff Lean Clay with Sand (CL). The sand constituent of the unit was generally fine to medium, while the fines were typically low to medium plasticity. Two SPTs were attempted within the unit and yielded N-values of 19 and 23 bpf, respectively. A single natural moisture content was taken in the unit and registered

approximately 24 percent moisture by dry weight. A fines content test was also performed on the unit and yielded approximately 83 percent fines by dry weight.

7.2.2 Missoula Flood Deposits - Fine-Grained Facies

The Missoula Flood Deposits were encountered below the fill until the boring's termination at a depth of 61.5 feet bgs. The unit typically consisted of stiff Silt with Sand (ML), and medium stiff to very stiff Lean Clay (CL). The sand constituent of the unit was generally fine, while the fines were typically low to high plasticity. SPT N-values within the unit ranged from 5 to 23 bpf and averaged 11.7 bpf. Natural moisture content ranged from 30 to 40 percent and averaged approximately 36 percent. Two Atterberg limits determination tests were performed, which yielded plasticity indexes of 23 and 26 percent, with the USCS designation of CL.

7.3 Site 4 Geotechnical Soil Units

Based on the results of boring B-3, Shannon & Wilson grouped the materials encountered in our field exploration at Site 4 into three geotechnical units as described below. This description of the subsurface conditions is based on the explorations and regional geologic information from published sources. The geotechnical units are as follows:

- **Colluvium:** Medium dense Silty Sand (SM), medium dense Silt, with cobbles (ML), stiff Silt (ML), and medium stiff Elastic Silt (MH).
- **Missoula Flood Deposits - Fine-Grained Facies:** Very soft to medium stiff Lean Clay (CL) and medium stiff Fat Clay (CH).
- **Sandy River Mudstone:** Medium stiff to stiff Fat Clay (CH).

These geotechnical units were grouped based on their engineering properties, geologic origins, and their distribution in the subsurface. Contacts between the units may be more gradational than shown in the boring logs in Appendix A. The Standard Penetration Test (SPT) N-values shown on the boring logs are as recorded in the field (uncorrected). The following sections describe the geotechnical unit characteristics in greater detail.

7.3.1 Colluvium

Colluvium was encountered within the boring to a depth of 12 feet bgs. The unit typically consisted of medium dense Silty Sand (SM), medium dense, Silt, with Cobbles (ML), stiff Silt (ML), and medium dense Elastic Silt (MH). The sand constituent of the unit was generally fine to coarse, while the fines were typically nonplastic to medium plasticity. SPT N-values within the unit ranged from 6 to 15 bpf and averaged 12 bpf. Two moisture contents were performed on the unit which were 18 and 25 percent by dry weight, respectively.

7.3.2 Missoula Flood Deposits - Fine-Grained Facies

Missoula Flood Deposits were encountered within the boring below the colluvium to a depth of 37.5 feet bgs. The unit typically consisted of very soft to medium stiff Lean Clay (CL) and medium stiff Fat Clay (CH). Fines within the unit were generally medium to high plasticity. SPT N-values within the unit ranged from 0 to 6 bpf and averaged 3 bpf. Natural moisture content within the unit ranged from 25 to 42 percent and averaged 31 percent. Two Atterberg limits tests were performed on the unit and yielded plasticity indexes of 15 and 33 percent, with USCS designations of CL and CH, respectively.

7.3.3 Sand River Mudstone

Sandy River Mudstone was encountered beneath the Missoula Flood Deposits and extended to the termination depth of the boring at 61.5 feet below ground surface (bgs). The unit typically consisted of medium-stiff to stiff Fat Clay (CH). The fines within the unit were generally highly plastic. SPT N-values within the unit ranged from 5 to 16 bpf and averaged 11 bpf.

7.4 Groundwater

All borings were initially advanced using hollow-stem auger drilling methods. Groundwater levels were measured during drilling by lowering a water level indicator through the hollow-stem augers. Groundwater was encountered at a depth of 9.5 feet bgs in boring B-1, 15.7 feet bgs in boring B-2, and 15.0 feet bgs in boring B-3. It is important to note that these measurements may not represent stabilized groundwater conditions, as the boreholes were not left open for an extended period (e.g., overnight), which would allow water levels to equilibrate. Exhibit 7-1 summarizes the observed groundwater depths at each boring location.

Exhibit 7-1: Depth to Groundwater Summary

Site ID	Exploration	Date	Measured Depth of Water (feet bgs)
Site 2	B-1	9/24/2025	9.5
Site 3	B-2	9/25/2025	15.7
Site 4	B-3	10/21/2025	15

Groundwater levels should be expected to vary with changes in topography and precipitation. Generally, groundwater highs occur at the end of the wet season in late spring or early summer, and groundwater lows occur towards the end of the dry season in the early to mid-fall. Additionally, topographic high areas are generally associated with deeper water table depths than topographic low areas.

8 PRELIMINARY GEOTECHNICAL DESIGN AND CONSTRUCTION CONSIDERATIONS

Based on the results of our preliminary subsurface explorations and a review of relevant geotechnical data, Sites 2 through 4 are generally considered geotechnically feasible for the proposed reservoir development, assuming subsurface conditions are consistent with those observed in the initial borings. However, some sites may require more extensive and costly foundation support and are subject to higher seismic loading due to their estimated site class. This section presents an overview of the geologic hazards and preliminary foundation design considerations for each site, along with conceptual construction considerations. It is important to note that these findings are based on a limited subsurface exploration program; additional subsurface explorations will be necessary to fully characterize subsurface conditions. As such, these preliminary conclusions are subject to change pending further exploration.

8.1 Site 2 Design and Construction Considerations

8.1.1 Site 2 Geologic Hazards and Seismicity

Generally, the subsurface conditions encountered at Site 2 do not indicate the potential for seismic and geologic hazards. The potential for liquefaction at Site 2 is considered low, primarily due to the depth of groundwater and the presence of dense soil conditions below the water table. Similarly, the risk of lateral spreading is very low, supported by these subsurface characteristics. Landslide risk at the reservoir location at the property is also low, given the site's relatively flat surface topography and its distance from significant slopes. There may be localized slope instability near the drainage at the site's southern boundary; however, this area is located more than 200 feet from the proposed southern edge of the reservoir and is therefore not expected to impact the reservoir. Additionally, the risk of surface fault rupture is minimal, with the nearest mapped fault, the Portland Hills Fault, located more than seven miles away.

According to the 2022 Oregon Structural Specialty Code, which references Chapter 20 of ASCE 7-16 for seismic site classification, Site 2 is classified as Site Class C based on Standard Penetration Test (SPT) N-values and proximity to intact rock.

The upcoming 2025 Oregon Structural Specialty Code, effective April 1, 2026, will adopt Chapter 20 of ASCE 7-22, which bases site classification on average shear wave velocity. Although shear wave velocity measurements were not included in the scope of this study, correlations between SPT N-values and shear wave velocity suggest that the site will likely fall within Site Class C or CD under the ASCE 7-22 criteria.

8.1.2 Site 2 Foundation Considerations

Medium dense to very stiff colluvium was encountered within the upper 9.5 feet at Site 2, underlain by approximately 5 feet of decomposed basalt, which transitions into intact Grande Ronde Basalt. The decomposed basalt exhibits characteristics consistent with very dense to dense silty and clayey gravel, while the overlying colluvium consists of medium dense to very stiff sandy silt with varying amounts of gravel. These site soils are generally expected to exhibit low compressibility and appear suitable for supporting the proposed reservoir using conventional shallow foundation systems.

Based on these site soil conditions, an allowable bearing capacity of 3,000 psf could be assumed for the preliminary design of shallow foundations, provided that any localized zones of soft or loose areas of subgrade are over-excavated and replaced with compacted structural fill.

Specialized foundation systems, such as rigid structural slabs or reinforced crushed rock zones, are not anticipated to be necessary, provided the foundation deflection tolerances are specified within 1/2 inch over a span of 50 feet. If tighter deflection tolerances are needed, a reinforced crushed rock mat or structural slab may need to be incorporated in the design.

8.1.3 Site 2 Other Considerations

In general, conventional earthwork equipment in good working condition is expected to be adequate for performing the required site grading and excavation at Site 2. While some variability in contact with the underlying decomposed and intact Grande Ronde Basalt is possible, excavations deeper than 5 feet are not anticipated. Therefore, specialized rock removal methods, such as blasting or hydraulic rock breakers, are not expected to be necessary. Large track hoes equipped with bucket rock teeth should be sufficient for excavation if decomposed basalt is encountered.

Additionally, groundwater is expected to have minimal impact on construction activities, assuming it remains near the levels observed during the September 2025 subsurface exploration. Groundwater measurements were taken during a time of year when levels are typically at their seasonal low in this region. If groundwater is encountered during excavation, internal sump pits are likely to be a feasible and effective method for managing and removing collected water.

8.2 Site 3 Design and Construction Considerations

8.2.1 Site 3 Geologic Hazards and Seismicity

The subsurface conditions observed at Site 3 do not suggest a significant potential for seismic or geologic hazards. The likelihood of liquefaction is considered low, primarily due to the depth of the groundwater table and the presence of medium to high-plasticity soils beneath it. According to the criteria outlined by Bray and Sancio (2006), the soils tested at the site are not susceptible to liquefaction. As a result, the risk of lateral spreading is also low.

The potential for landslides is also low, given the site's relatively flat topography and its considerable distance from any steep or unstable slopes. Furthermore, the risk of surface fault rupture is negligible, with the nearest mapped fault, Portland Hills Fault, located over seven miles from the site.

According to the 2022 Oregon Structural Specialty Code, which references Chapter 20 of ASCE 7-16 for seismic site classification, Site 3 is classified as Site Class E based on Standard Penetration Test (SPT) N-values from boring B-2.

The upcoming 2025 Oregon Structural Specialty Code, effective April 1, 2026, will adopt Chapter 20 of ASCE 7-22, which bases site classification on average shear wave velocity. Although shear wave velocity measurements were not included in the scope of this study, correlations between SPT N-values and shear wave velocity suggest that the site will likely fall within Site Class D or DE under the ASCE 7-22 criteria.

8.2.2 Site 3 Foundation Considerations

At the southern boundary of Site 3, subsurface exploration revealed predominantly medium-stiff to stiff Missoula Flood Deposits, with occasional very stiff layers. These soils are generally expected to exhibit moderate compressibility at depths greater than 10 feet.

Based on the observed conditions, the site soils appear suitable for supporting the proposed reservoir using conventional shallow foundation systems. However, design considerations may require limiting the water stack height, incorporating a rigid structural mat foundation, or potentially implementing both strategies. Use of a membrane slab foundation will likely not be feasible for this site.

For preliminary design purposes, an allowable bearing capacity of 2,000 psf may be assumed for shallow foundations, provided that any localized zones of soft or loose subgrade are over-excavated and replaced with compacted structural fill. To maintain deflection tolerances within ½ inch over a 50-foot span, a reinforced crushed rock pad or a 3-

to 5-foot over-excavation may be necessary; however, this should be determined through a more comprehensive subsurface exploration program and consolidation testing.

8.2.3 Site 3 Other Considerations

The site is currently densely vegetated with mature trees and thick underbrush, which likely includes a substantial root zone. This root zone will need to be fully removed within the proposed improvement areas. During grubbing operations, extensive soil disturbance may occur, potentially requiring over-excavation of affected areas. Recompaction of these disturbed soils is expected to be impractical, as they are likely to be above their optimum moisture content. Consequently, removed disturbed material should be replaced with compacted imported granular structural fill.

Additionally, the use of on-site soils as general fill is expected to be infeasible during most of the year. However, if earthwork is scheduled during the dry summer months, the warmer weather may allow for adequate moisture conditioning, potentially making the native soils suitable for reuse.

Standard earthwork equipment in good working condition should be sufficient for site grading and excavation. To minimize exposure to wet conditions, earthwork should be performed in small, manageable sections, each sized to allow removal of unsuitable soils and placement and compaction of structural fill within the same day. In addition, equipment size may need to be limited to reduce subgrade disturbance.

8.3 Site 4 Design and Construction Considerations

8.3.1 Site 4 Geologic Hazards and Seismicity

Subsurface conditions at Site 4 suggest a potential for seismic hazards that warrant further evaluation. Based on the criteria outlined by Bray and Sancio (2006), portions of the saturated soils exhibit moderate susceptibility to liquefaction, whereas other portions do not exhibit susceptibility. While significant liquefaction is not anticipated, some vertical settlement may occur, and limited horizontal displacement due to lateral spreading is possible. A detailed analysis of these potential displacements is beyond the scope of the current study.

According to the Statewide Landslide Information Database for Oregon (SLIDO 4.5), landslide susceptibility is shown as "low" within the anticipated reservoir footprint. Landslide susceptibility increases to the north, where it is shown as "moderate" to "high" in the area near the slopes surrounding the stream channel of North Fork McNutty Creek (DOGAMI, 2024).

During our site reconnaissance, we observed multiple localized, shallow-seated slope failures within the upper portions of the slope above the stream channel. One area of the slope appeared to be undergoing progressive erosion and oversteepening, resulting in the uprooting and downslope movement of two large trees into the creek area. Based on our site reconnaissance, a more detailed evaluation of landslide risk and appropriate setback distances is recommended. For preliminary planning purposes, the reservoir and associated structures should be sited no closer than one-third of the slope height from the top of the slope and positioned outside the upward 1H:1V projection from the toe of the slope, in accordance with Section 1808 of the Oregon Structural Specialty Code.

The risk of surface fault rupture at Site 4 is negligible, with the nearest mapped fault, Portland Hills Fault, located over seven miles from the site.

According to the 2022 Oregon Structural Specialty Code, which references Chapter 20 of ASCE 7-16 for seismic site classification, Site 4 is classified as Site Class E based on Standard Penetration Test (SPT) N-values from boring B-3.

The upcoming 2025 Oregon Structural Specialty Code, effective April 1, 2026, will adopt Chapter 20 of ASCE 7-22, which bases site classification on average shear wave velocity. Although shear wave velocity measurements were not included in the scope of this study, correlations between SPT N-values and shear wave velocity suggest that the site will likely fall within Site Class E, DE, or D under the ASCE 7-22 criteria.

8.3.2 Site 4 Foundation Considerations

Subsurface exploration at Site 4 identified predominantly medium-stiff and medium-dense colluvium overlying Missoula Flood Deposits at approximately 12 feet bgs. Immediately beneath this contact, the flood deposits consist of very soft to soft lean clay (CL) extending to a depth of about 23 feet bgs. From 23 to 37.5 feet bgs, the deposits transition to medium stiff lean clay (CL), which are underlain by medium stiff to stiff Sandy River Mudstone.

Due to the presence of the approximately 11-foot-thick zone of very soft to soft clay between 12 and 23 feet bgs, conventional shallow foundations are unlikely to provide adequate support for the proposed reservoir. Deep foundations will likely be required to mitigate settlement and ensure structural stability. In addition, the reservoir floor will need to be structurally supported between the deep foundation elements to limit differential settlement, usually through a structural mat slab.

Based on the depth to medium stiff to stiff Sandy River Mudstone, augercast piles appear to be feasible options for supporting the proposed reservoir. Augercast piles are typically

embedded within a 2- to 3-foot-thick structural mat, which transfers the reservoir loads to the piles and is structurally connected through steel reinforcement.

Driven piles may be a viable foundation option for supporting the reservoir; however, their use should be carefully evaluated due to the proximity of nearby residences. According to Caltrans guidance (2020), pile driving operations are generally not expected to cause significant structural damage to the adjacent residential structures. Nonetheless, significant nuisance impacts, such as vibration and noise are likely and should be considered. In addition, there is a significant risk that property owners may still report minor damage or cite pre-existing conditions not documented in pre-construction surveys.

If driven piles are pursued, a comprehensive vibration study should be conducted to assess potential impacts to the residences and guide decisions if driven piles are feasible.

8.3.3 Site 4 Other Considerations

Installation of deep foundations requires a specialty contractor with appropriate equipment and expertise. Augercast piles are generally preferred over driven piles due to their non-vibratory installation methods, which help minimize noise and vibration impacts. However, augercast piles typically come at a higher cost. Their performance is highly dependent on the contractor's procedure, workmanship, and equipment quality.

Based on our experience, the unit cost for augercast piles may range from approximately $100 to $150 per linear foot, excluding contingencies. Actual costs will vary depending on factors such as pile depth and the amount of steel reinforcement used in the cage. To support deep foundation equipment and protect the subgrade from construction traffic, a granular working pad should be constructed.

Similar to Site 3, the northern portion of Site 4 is densely vegetated with mature trees and thick underbrush, likely to contain a substantial root zone. This vegetation will need to be fully cleared from proposed improvement areas. Grubbing operations may cause significant soil disturbance, potentially requiring over-excavation. Recompaction of these disturbed soils is expected to be impractical due to their likely elevated moisture content. Consequently, removed disturbed material should be replaced with compacted imported granular structural fill.

9 LIMITATIONS

The conceptual analysis, conclusions, and recommendations contained in this preliminary report are based upon site conditions as they presently exist and further assume that the

explorations are representative of subsurface conditions throughout the site, i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the field explorations. Within the limitations of our scope, schedule, budget, and analyses presented in this report, our geotechnical data and findings were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no warranty, either express or implied. Our conceptual conclusions and recommendations are based on our understanding of the project as described in this report and the site conditions as interpreted from the explorations.

This report was prepared for the exclusive use of Keller and the City of St. Helens. The conceptual conclusions and recommendations portion of the report is interpretive information and is based on conceptual project information. Therefore, this report should be considered for planning and conceptual design use only. It should not be provided to future prospective Contractors as a basis for bidding. Also, this report is not a warranty of subsurface conditions. Our findings are the result of explorations at particular locations and at the time the explorations were performed. When additional project information is developed on the proposed structures, additional explorations and evaluations will likely be required.

The scope of our geotechnical services did not include any environmental assessment or evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below the site, or for evaluation of disposal of contaminated soils or groundwater, should any be encountered, except as noted in this report.

Shannon & Wilson, Inc. has prepared the attached document, “Important Information About Your Geotechnical Report”, to assist you and others in understanding the use and limitations of this document.

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0 0.5 1 2

Scale in Miles

N

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VICINITY MAP

December 2025 115125

SHANNON & WILSON | FIG. 1

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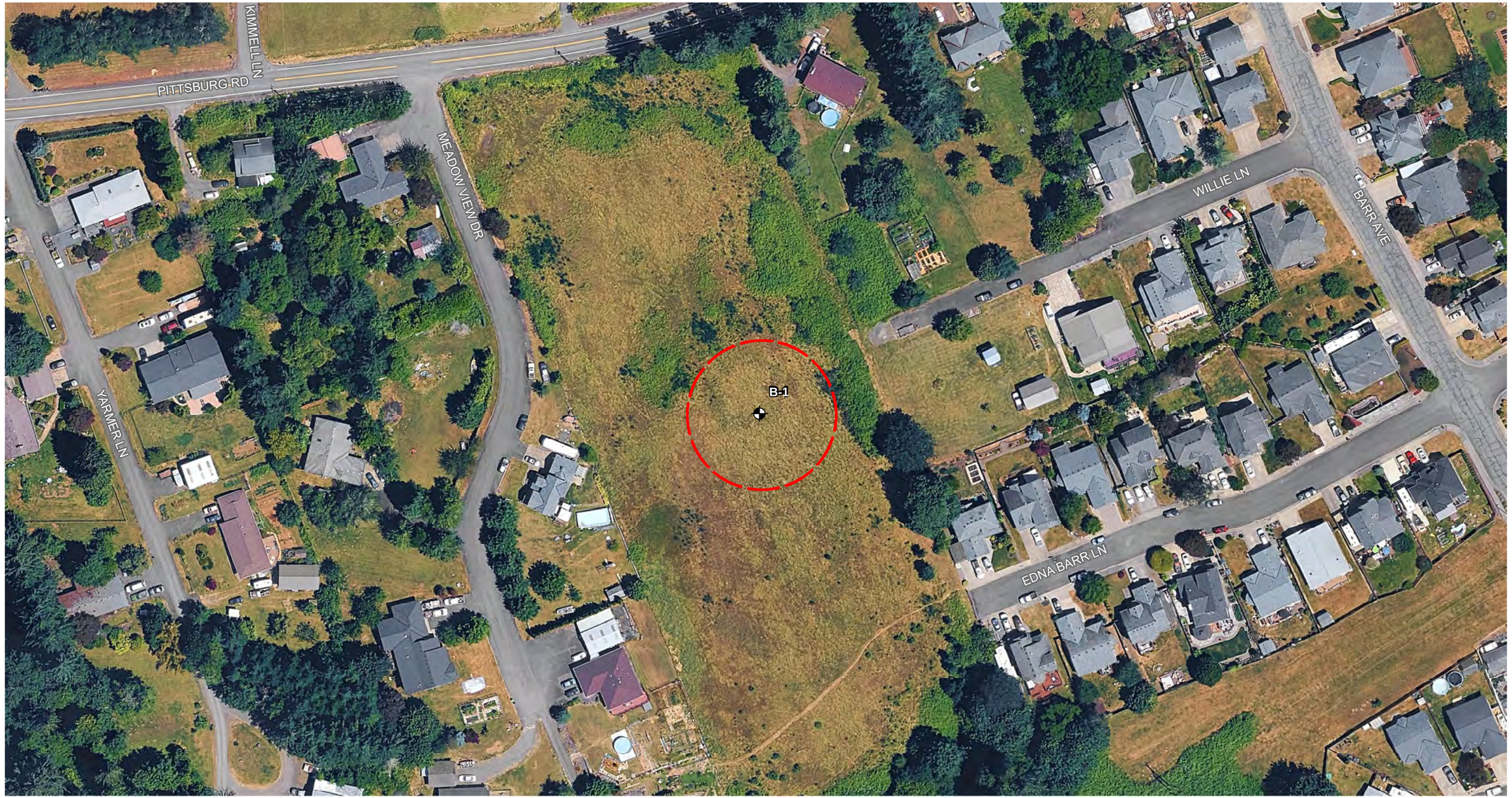

N

LEGEND

Approximate Location and Designation of Geotechnical Boring

Approximate Reservoir Footprint

0 50 100 200

Scale in Feet

NOTES

1. Satellite imagery obtained through Google Maps.

St. Helens Reservoir Siting Study
St. Helens, Oregon

SITE AND EXPLORATION PLAN
SITE 2

December 2025 115125

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FIG. 2
Sheet 1 of 3

Filename: \\shanwil.net\EF\GIS\PDX\115000s\115125 St Helens Reservoir Siting\Fig 2 - Site and Exploration Plan.mxd Date: 11/4/2025 Login: DSJ

LEGEND

Approximate Location and Designation of Geotechnical Boring

Approximate Reservoir Footprint

0 50 100 200

Scale in Feet

NOTES

1. Satellite imagery obtained through Google Maps.

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SITE AND EXPLORATION PLAN
SITE 3

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FIG. 2
Sheet 2 of 3

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LEGEND

Approximate Location and Designation of Geotechnical Boring

Approximate Reservoir Footprint

0 50 100 200

Scale in Feet

NOTES

1. Satellite imagery obtained through Google Maps.

St. Helens Reservoir Siting Study
St. Helens, Oregon

SITE AND EXPLORATION PLAN
SITE 4

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FIG. 2
Sheet 3 of 3

Filename: \\shanwil.net\ER\GIS\PDX\115000s\115125 St Helens Reservoir Siting\Fig 2 - Site and Exploration Plan.mxd Date: 11/4/2025 Login: DSJ

APPENDIX A: FIELD EXPLORATIONS

Appendix A

Field Explorations

CONTENTS

Figures

APPENDIX A: FIELD EXPLORATIONS

A.1 GENERAL

The geotechnical field exploration program included three (3) borings, designated B-1 through B-3. Completed exploration locations were measured in the field and are shown on the Site and Exploration Plan, Figure 2. A Shannon & Wilson geologist was present during the drilling of the geotechnical borings to locate the drilling sites, log the materials encountered, and collect soil samples.

This appendix describes the techniques used to advance and sample the borings and presents logs of the materials encountered.

A.2 GEOTECHNICAL DRILLING

The geotechnical borings were in two mobilizations. The first mobilization, which included the drilling of borings B-1 and B-2 was between September 24, 2025 and September 25, 2025. The second mobilization to drill boring B-3 was on October 21, 2025. All borings were drilled using a track mounted Geoprobe 3126GT drill rig owned and operated by Western States Soil Conservation, Inc. out of Hubbard, Oregon. The borings were drilled to depths ranging from 36.5 and 61.5 feet below ground surface (bgs). Sampling methods are detailed in the following sections.

A.2.1 Disturbed Sampling

Disturbed samples were collected in the borings at 2.5-foot depth intervals, using a standard 2-inch outside diameter (O.D.) split spoon sampler in conjunction with Standard Penetration Testing (SPT). In a Standard Penetration Test, ASTM D1586, the 2-inch O.D. sampler is driven 18 inches into the soil using a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler the last 12 inches is defined as the standard penetration resistance or N-value. The SPT N-value provides a measure of in situ relative density of granular soils such as sand and gravel, and the consistency of cohesive soils such as silt and clay. All disturbed samples were visually identified and described in the field, sealed to retain moisture, and returned to our laboratory for additional examination and testing.

SPT N-values can be significantly affected by several factors, including the efficiency of the hammer used. Automatic hammers, like the hammer used for this project, generally have higher energy transfer efficiencies than cathead (manual) hammers. For reference, cathead hammers are typically assumed to have an average energy efficiency of 60 percent. All N-values presented in this report are in blows per foot, as counted in the field. No corrections of any kind have been applied. N-values of zero indicate that the sampler advanced the last

12 inches of the 18-inch sampling interval without a single hammer strike. That is, the weight of the drilling rods or the weight of the drilling rods plus the weight of the hammer (not in motion) was sufficient to advance the sampler.

An SPT was considered to have met "refusal" when 50 blows were required to drive the sampler 6 inches or less. If refusal was encountered in the first 6-inch interval (for example, 50 for 1.5"), the count is reported as 50/1st 1.5". If refusal was encountered in the second 6-inch interval (for example, 48, 50 for 1.5"), the count is reported as 50/1.5". If refusal was encountered in the last 6-inch interval (for example, 39, 48, 50 for 2"), the count is reported as 98/8".

A.2.2 Continuous Coring

Continuous HQ-wireline rock coring was used in boring B-1 to sample and advance through rock. Core samples were visually described in the field and then boxed for transport to our laboratory for further examination. The rock core recovery (presented on the Drill Logs) was calculated by dividing the length of core recovered in the barrel by the length of the total drilled run. This ratio is expressed as a percent.

The rock quality designation (RQD), also presented on the Drill Logs, is a modified core recovery percentage including only the total length of the specimens of intact rock more than 4 inches in length, divided by the total length of the core run. The smaller pieces are considered to be the result of close jointing, fracturing, or weathering in the rock mass and are excluded from the determination. Difficulties such as distinguishing natural fractures in the rock core from mechanical breaks due to drilling operations restrict the use of the RQD in evaluating in situ rock properties. However, it does provide a subjective estimate of rock mass quality and a comparison of rock quality in the borings.

A.3 MATERIAL DESCRIPTIONS

Soil samples were described and identified visually in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The specific terminology used is defined in the Soil Description and Log Key, Figure A1. Consistency, color, relative moisture, degree of plasticity, and other distinguishing characteristics of the samples were noted. Once transported to Shannon & Wilson, Inc., the SPT samples were re-examined and the field descriptions and identifications were modified where necessary. We refined our visual-manual soil descriptions and identifications based on the results of the laboratory tests, using elements of the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. However, ASTM D2487 was not followed in full,

because it requires a suite of tests to be performed to classify a single sample. The specific terminology used in the soil and rock classifications are defined in the Soil Description and Log Key, Figure A1 and Rock Classification and Log Key, Figure A2.

A.4 BORING LOGS

The summary logs of the borings are presented in the Logs of Borings, Figures A2 to A5. Material descriptions and interfaces on the logs are interpretive, and actual changes may be gradual. The left-hand portion of the boring logs provides descriptions, identifications, and geotechnical unit designations for the materials encountered in the boring. The right-hand portion of the boring logs shows a graphic log, sample locations and designations, backfill details, and a graphical representation of N-values, natural water contents, Atterberg Limits, percent passing the No. 200 sieve, and sample recovery

A.5 BOREHOLE ABANDONMENT

All borings were backfilled with bentonite chips or bentonite grout in accordance with State of Oregon regulations. Boring B-2 was performed within the roadway and was finished at the surface with asphalt concrete. B-1 and B-3 were finished at the surface with native soil.

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

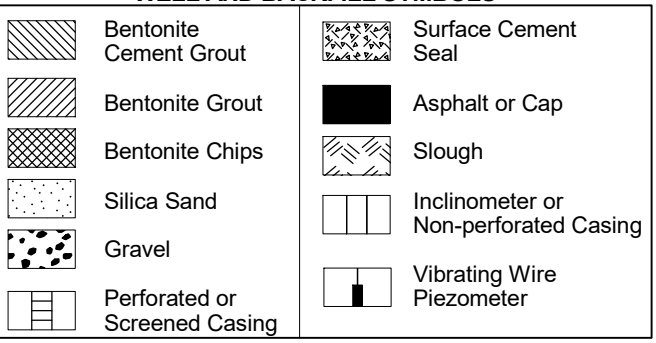
PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS



PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

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SOIL DESCRIPTION AND LOG KEY

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FIG. A1
Sheet 1 of 3

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)
FILL	Placed by humans, both engineered and nonengineered. May include various soil materials and debris.				The Fill graphic symbol is combined with the soil graphic that best represents the observed material

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the *CL-ML* area of the plasticity chart.
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.
3. The soil graphics above represent the various USCS identifications (i.e., *GP*, *SM*, etc.) and may be augmented with additional symbology to represent differences within USCS designations. *Sandy Silt (ML)*, for example, may be accompanied by the *ML* soil graphic with sand grains added. Non-USCS materials may be represented by other graphic symbols; see log for descriptions.

St. Helens Reservoir Siting Study
St. Helens Oregon

SOIL DESCRIPTION AND LOG KEY

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FIG. A1
Sheet 2 of 3

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4%
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10%
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20%
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20%

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
approx.	Approximate/Approximately
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

St. Helens Reservoir Siting Study
St. Helens Oregon

SOIL DESCRIPTION AND LOG KEY

December 2025

115125

SHANNON & WILSON

FIG. A1
Sheet 3 of 3

BASED ON INTERNATIONAL SOCIETY FOR ROCK MECHANICS (ISRM) ROCK CLASSIFICATION METHODS[R]

FABRIC TERMS

SEDIMENTARY ROCKS

MASSIVE - Rock without significant structure

BEDDED - Regular layering from sedimentation

FISSILE - Tendency to break along laminations

METAMORPHIC ROCKS

FOLIATED - Parallel arrangement or distribution of minerals

SCHISTOSE - Parallel arrangement of tabular minerals giving a planar fissility

GNEISSOSE - Segregation of minerals into bands

CLEAVAGE - Tendency to split along secondary, planar textures or structures

STRENGTH

GRADE	DESCRIPTION	FIELD IDENTIFICATION	APPROXIMATE RANGE OF UNIAXIAL COMPRESSIVE STRENGTH (MPa)	(psi)
R0	Extremely Weak Rock	Indented by thumbnail	0.25 to 1	36 to 145
R1	Very Weak Rock	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	1 to 5	145 to 700
R2	Weak Rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	5 to 25	700 to 3,600
R3	Medium Strong Rock	Cannot be scraped or peeled by a pocket knife, specimen can be fractured with single firm blow of geological hammer	25 to 50	3,600 to 7,200
R4	Strong Rock	Specimen requires more than one blow of geological hammer to fracture it	50 to 100	7,200 to 14,500
R5	Very Strong Rock	Specimen requires many blows of geological hammer to fracture it	100 to 250	14,500 to 36,250
R6	Extremely Strong Rock	Specimen can only be chipped with geological hammer	>250	>36,250

VESCULARITY

Slightly Vesicular	1 to 10%
Moderately Vesicular	10 to 30%
Highly Vesicular	30 to 50%
Scoriaceous	>50%

JOINT ROUGHNESS

SMALL SCALE	INTERMEDIATE SCALE
Rough	Stepped
Smooth	Undulating
Slickensided	Planar

WEATHERING

TERM	DESCRIPTION
Fresh	No visible signs of rock material weathering: perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and somewhat weaker than in its fresh condition.
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely Weathered	All rock is decomposed and/or disintegrated to soil. The original mass is still largely intact.
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

DISCONTINUITY TERMS

FRACTURE - Collective term for any natural break excluding shears, shear zones, and faults

JOINT (JT) - Planar break with little or no displacement

FOLIATION JOINT (FJ) or BEDDING JOINT (BJ) - Joint along foliation or bedding

INCIPIENT JOINT (IJ) or INCIPIENT FRACTURE (IF) - Joint or fracture not evident until wetted and dried; breaks along existing surface

RANDOM FRACTURE (RF) - Natural, very irregular fracture that does not belong to a set

BEDDING PLANE SEPARATION or PARTING - A separation along bedding after extraction from stress relief or slaking

FRACTURE ZONE (FZ) - Planar zone of broken rock without gouge

MECHANICAL BREAK (MB) - Breaks due to drilling or handling; drilling break (DB), hammer break (HB)

SHEAR (SH) - Surface of differential movement evident by presence of slickensides, striations, or polishing

SHEAR ZONE (SZ) - Zone of gouge and rock fragments bounded by planar shear surfaces

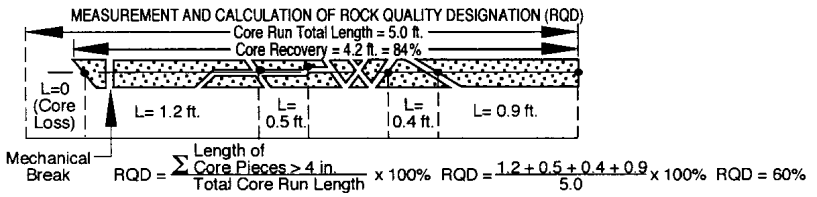
FAULT (FT) - Shear zone of significant extent; differentiation from shear zone may be site-specific

STRUCTURE SPACING TERMS

STRATIGRAPHIC	SPACING	DISCONTINUITY *
Extremely Thick	> 20 ft. (> 6 m)	Extremely Wide
Very Thick	6 to 20 ft. (2 to 6 m)	Very Wide
Thick	2 to 6 ft. (0.6 to 2 m)	Wide
Medium	8 to 24 in. (0.2 to 0.6 m)	Moderate
Thin	2.5 to 8 in. (60 to 200 mm)	Close
Very Thin	1 to 2.5 in. (20 to 60 mm)	Very Close
Laminated: Thickly	0.25 to 1 in. (6 to 20 mm)	Extremely Close
Laminated: Thinly	<0.25 in. (<6 mm)	Extremely Close

* Refers to apparent spacing along core axis unless measured orthogonal to discontinuity; should then report for each set

[R] *Reference: Brown, E.T., ed., 1981, Rock Characterization Testing and Monitoring ISRM Suggested methods. New York, International Society for Rock Mechanics (ISRM).*



St. Helens Reservoir Siting Study
St. Helens Oregon

ROCK CLASSIFICATION AND LOG KEY

December 2025

115125

SHANNON & WILSON

FIG. A2

Total Depth:	36.5 ft.	Northing:	~	Drilling Method:	HSA and Rock Core	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 | 20 | 40 | 60 | 80 | 100

Topsoil: 3-inches thick

0.3

Medium dense/very stiff, red-yellow and red-brown, *Sandy Silt to Sandy Silt with Gravel (ML)*; moist; fine to coarse, angular to subrounded gravel; fine to coarse sand; nonplastic to low plasticity; trace organics; heavy iron oxidation and staining.

COLLUVIUM

S-1, S-2, S-3, S-4, S-5

During Drilling ▽

18, 22, 19, 75, 47

5

9.5

Very dense, red-yellow and red-brown, *Silty Gravel with Sand (GM)*; moist; fine to coarse, angular to subrounded gravel; fine to coarse sand; nonplastic to low plasticity fines; heavy iron oxidation and staining.

10

12.0

Dense, red-yellow and red-brown, *Clayey Gravel with Sand (GC)*; moist; fine to coarse, angular to subrounded gravel; fine to coarse sand; low to medium plasticity fines; heavy iron oxidation and staining.

14.5

CONTINUED NEXT SHEET

0 | 20 | 40 | 60 | 80 | 100

LEGEND

- Standard Penetration Test
- Rock Core - HQ
- ▽ Groundwater Level ATD
- Recovery (%) / RQD (%)
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit — Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-1 (Site 2)

December 2025 115125

SHANNON & WILSON

FIG. A3
Sheet 1 of 3

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	36.5 ft.	Northing:	~	Drilling Method:	HSA and Rock Core	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

PREDOMINANTLY DECOMPOSED BASALT: Predominantly decomposed to medium dense, red-brown and red-yellow, *Silty Sand (SM)*; moist; trace to few, fine to coarse, angular to subangular gravel-sized rock fragments; fine to coarse sand; low plasticity fines; relict bedrock texture; heavy iron oxidation and staining.

S-6 — 29

17.5

PREDOMINANTLY DECOMPOSED GRANDE RONDE BASALT

S-7 — 50/5"

BASALT: Extremely weak to very weak (R0-R1), olive-brown and red-yellow, fine-grained, moderately vesicular; extremely close to closely spaced, smooth to rough, low to high angle joints with iron oxidation and staining, and clay and mineral infilling of joints and vesicles; healed joints and rubble zones throughout; highly weathered.

C-1

20

C-2

GRANDE RONDE BASALT

25

C-3

BASALT: Very weak to weak (R1-R2).

28.8

CONTINUED NEXT SHEET

0 20 40 60 80 100

LEGEND

- Standard Penetration Test
- Rock Core - HQ
- Groundwater Level ATD
- Recovery (%) RQD (%)
- ◇ % Fines (<0.075mm)
- ● % Water Content
- Plastic Limit — Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-1 (Site 2)

December 2025 115125

SHANNON & WILSON

FIG. A3
Sheet 2 of 3

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	36.5 ft.	Northing:	~	Drilling Method:	HSA and Rock Core	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

BASALT: Very weak to weak (R1-R2), olive-brown and dark red-brown, fine-grained, slightly vesicular; extremely close to closely spaced, smooth, low to high angle joints with iron oxidation and staining, and clay and mineral infilling; moderately weathered.

GRANDE RONDE BASALT

33.0

BASALT: Very weak to weak (R1-R2), olive-brown an dark gray-brown, fine-grained, slightly vesicular; extremely close to closely spaced, smooth, low to high angle joints with iron oxidation and staining, and clay and mineral infilling; healed joints and rubble zones throughout; slightly to moderately weathered.

C-4

35

Completed: September 24, 2025

36.5

40

0 20 40 60 80 100

LEGEND

- Standard Penetration Test
- Rock Core - HQ
- Groundwater Level ATD
- Recovery (%) RQD (%)
- % Fines (<0.075mm)
- % Water Content
- Plastic Limit — Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-1 (Site 2)

December 2025 115125

SHANNON & WILSON

FIG. A3
Sheet 3 of 3

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Asphalt Concrete: 3-inches thick
Base Aggregate: 12-inches thick — 0.3

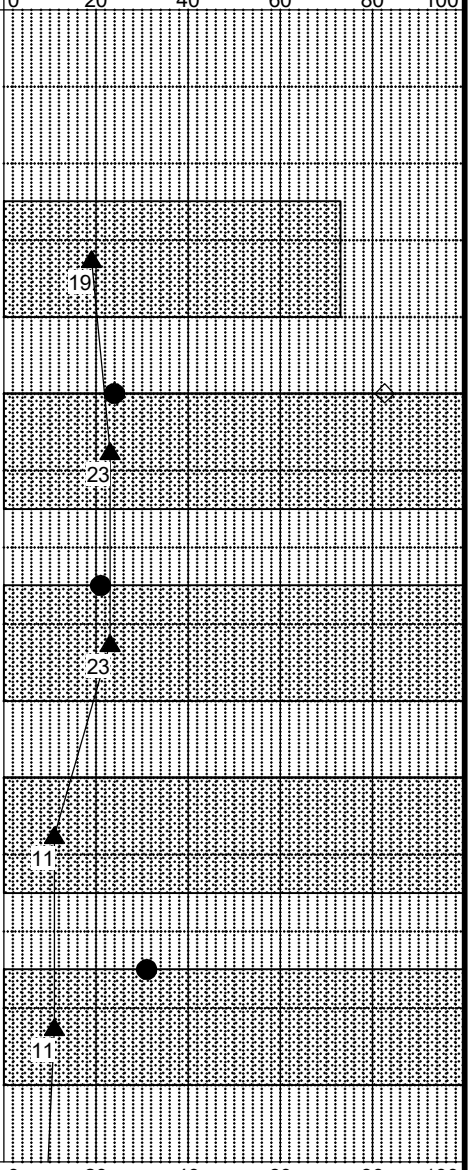
Very stiff, light gray-brown to red-yellow, *Lean Clay with Sand (CL)*; moist; trace, fine, angular to subangular gravel; fine to medium sand; low to medium plasticity; slightly micaceous; moderate to heavy iron oxidation and staining; disturbed texture. — 1.3

FILL

Stiff to very stiff, brown, *Lean Clay (CL)*; moist; trace fine sand; medium plasticity; micaceous; moderate to heavy iron oxidation and staining. — 7.0

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

Medium stiff to stiff, brown to yellow-brown, *Lean Clay (CL)*; moist; trace, fine, subrounded gravel; fine sand; high plasticity; micaceous; slight to moderate iron oxidation and staining. — 12.0



CONTINUED NEXT SHEET

LEGEND

Standard Penetration Test — Groundwater Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-2 (Site 3)

December 2025 115125

SHANNON & WILSON

FIG. A4
Sheet 1 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60 80 100

Continued:

Medium stiff to stiff, brown to yellow-brown, *Lean Clay (CL)*; moist; trace, fine, subrounded gravel; fine sand; high plasticity; micaceous; slight to moderate iron oxidation and staining

S-6 S-7 S-8 S-9

During Drilling

9 6 8 5

20 25

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

Stiff, brown, *Silt with Sand (ML)*; moist to wet; interbedded with *Lean Clay (CL)*; fine to medium sand; low plasticity; slow to rapid dilatancy; micaceous.

28.0

CONTINUED NEXT SHEET

0 20 40 60 80 100

LEGEND

Standard Penetration Test

Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ——— Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-2 (Site 3)

December 2025 115125

SHANNON & WILSON

FIG. A4
Sheet 2 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60 80 100

Continued:

Stiff, brown, *Silt with Sand (ML)*; moist to wet, interbedded with *Lean Clay (CL)*; fine to medium sand; low plasticity; slow to rapid dilatancy; micaceous

S-10

12

35

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

S-11

11

Stiff, brown, *Lean Clay (CL)*; moist; fine sand; low to medium plasticity; micaceoous; slight to moderate iron oxidation and staining.

38.0

40

S-12

10

CONTINUED NEXT SHEET

0 20 40 60 80 100

LEGEND

⌶ Standard Penetration Test

▽ Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-2 (Site 3)

December 2025 115125

SHANNON & WILSON

FIG. A4
Sheet 3 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Stiff, brown, *Lean Clay (CL)*; moist; fine sand; low to medium plasticity; micaceoous; slight to moderate iron oxidation and staining

S-13

10

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

Very stiff, brown, *Lean Clay (CL)*; moist; fine sand; medium to high plasticity; micaceous.

48.0

50

S-14

19

55

S-15

19

Stiff, brown to red-brown, *Lean Clay (CL)*; moist; fine sand; medium to high plasticity; micaceous; slight iron oxide staining.

58.0

CONTINUED NEXT SHEET

0 20 40 60 80 100

LEGEND

Standard Penetration Test

Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ——— Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-2 (Site 3)

December 2025 115125

SHANNON & WILSON

FIG. A4
Sheet 4 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60 80 100

Continued:

Stiff, brown and red-brown, *Lean Clay (CL)*; moist; fine sand; medium to high plasticity; micaceous; slight iron oxide staining

S-16

10

61.5

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

Completed: September 25, 2025

65

70

0 20 40 60 80 100

LEGEND

Standard Penetration Test

Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-2 (Site 3)

December 2025 115125

SHANNON & WILSON

FIG. A4
Sheet 5 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: CXM Rev: DSJ Typ: CXM

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Medium dense, light brown, *Silt, with Cobbles (ML)*; dry to moist; trace to few, fine to coarse, subangular gravel; trace to few, fine to coarse sand; nonplastic; slight iron oxide staining.

COLLUVIUM

S-1

14

4.5

Medium stiff, light brown, *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity; slight iron oxide staining; micaceous.

S-2

6

5

7.0

Medium dense, dark brown, *Silty Sand (SM)*; moist; trace to few, fine to coarse, subangular gravel; fine to coarse sand; low plasticity fines; heavy iron oxide staining, decomposed basalt clasts.

S-3

13

9.0

Medium dense, light brown, *Silty Sand (SM)*; wet; fine sand; nonplastic fines; micaceous.

10

S-4

15

11.0

Stiff, brown, *Silt (ML)*; moist; trace to few, fine to medium sand; low plasticity; heavy iron oxide staining; micaceous.

12.0

Very soft to soft, gray, *Lean Clay (CL)*; moist to wet; medium to high plasticity.

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

S-5

0

CONTINUED NEXT SHEET

0 20 40 60 80 100

Recovery (%)

LEGEND

Standard Penetration Test

3" O.D. Shelby Tube

Groundwater Level ATD

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-3 (Site 4)

December 2025 115125

SHANNON & WILSON

FIG. A5
Sheet 1 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: SCS Rev: DSJ Typ: SCS

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Very soft to soft, gray, *Lean Clay (CL)*; wet; medium to high plasticity.

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

S-6, S-7, S-8, S-9, S-10

During Drilling

0

20

3

25

6

Medium stiff, gray, *Lean Clay (CL)*; moist to wet; high plasticity. — 23.0

Medium stiff, brown, *Lean Clay (CL)*; moist to wet; medium plasticity; slight iron oxide staining. — 27.5

CONTINUED NEXT SHEET

0 20 40 60 80 100

Recovery (%)

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

LEGEND

Standard Penetration Test

3" O.D. Shelby Tube

Groundwater Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-3 (Site 4)

December 2025 115125

SHANNON & WILSON

FIG. A5
Sheet 2 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: SCS Rev: DSJ Typ: SCS

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Medium stiff, brown, *Lean Clay (CL)*; moist to wet; medium plasticity; slight iron oxide staining.

S-11

6

MISSOULA FLOOD DEPOSITS
FINE-GRAINED FACIES

32.5

Medium stiff, brown mottled, *Fat Clay (CH)*; moist; high plasticity; slight iron oxide staining.

35

S-12

2

Medium stiff to stiff, red-brown mottled, *Fat Clay (CH)*; moist; high plasticity; slight to moderate iron oxide staining.

37.5

SANDY RIVER MUDSTONE

40

S-13

8

CONTINUED NEXT SHEET

0 20 40 60 80 100

Recovery (%)

LEGEND

- Standard Penetration Test
- 3" O.D. Shelby Tube
- Groundwater Level ATD
- ● % Water Content
- Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-3 (Site 4)

December 2025 115125

SHANNON & WILSON

FIG. A5
Sheet 3 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: SCS Rev: DSJ Typ: SCS

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Medium stiff to stiff, red-brown mottled, *Fat Clay (CH)*; moist; high plasticity; slight to moderate iron oxide staining.

S-14

5

SANDY RIVER MUDSTONE

Stiff, red-brown, *Fat Clay (CH)*; moist; fine subangular to subrounded gravel; high plasticity; moderate iron oxidation and staining.

48.0

50

S-15

16

Stiff, gray, *Fat Clay (CH)*; moist; high plasticity; micaceous.

52.5

55

S-16

13

CONTINUED NEXT SHEET

0 20 40 60 80 100

Recovery (%)

LEGEND

Standard Penetration Test

3" O.D. Shelby Tube

Groundwater Level ATD

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-3 (Site 4)

December 2025 115125

SHANNON & WILSON

FIG. A5
Sheet 4 of 5

REV 2

Total Depth:	61.5 ft.	Northing:	~	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	8 in.
Top Elevation:	~	Easting:	~	Drilling Company:	Western States	Rod Type:	NWJ
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 3126GT	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION	Elev. Depth (ft.)	Symbol	Samples	Ground Water	Depth, ft.	PENETRATION RESISTANCE, N (blows/ft.)
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.						▲ Hammer Wt. & Drop: 140 lbs / 30 inches
Continued: Stiff, gray, *Fat Clay (CH)*; moist; high plasticity; micaceous.			S-17			0 20 40 60 80 100
SANDY RIVER MUDSTONE						▲ 14
Completed: October 21, 2025	61.5				65	
					70	

0 20 40 60 80 100 Recovery (%)

LEGEND

- Standard Penetration Test
- 3" O.D. Shelby Tube
- Groundwater Level ATD
- ● % Water Content
- Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

LOG OF BORING B-3 (Site 4)

December 2025 115125

SHANNON & WILSON

FIG. A5
Sheet 5 of 5

REV 2

MASTER_LOG_E 115125.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 12/12/25 Log: SCS Rev: DSJ Typ: SCS

St. Helens Reservoir
Siting Study
St. Helens, Oregon

CORE PHOTOGRAPHS
B-1 (Site 2)

December 2025 115125

SHANNON & WILSON | **FIG. A6**

APPENDIX B: LABORATORY TEST RESULTS

Appendix B

Laboratory Test Results

CONTENTS

Figures

APPENDIX B: LABORATORY TEST RESULTS

B.1 GENERAL

Soil samples obtained during the field explorations were described and identified in the field in general accordance with the Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM D2488. The specific terminology used is defined in the Soil Description and Log Key, Figure A1, Appendix A. The physical characteristics of the collected samples were noted, and field descriptions and identifications were modified, as necessary, in accordance with the terminology presented in Appendix A, Figure A1.

The rock core was classified based on the International Society for Rock Mechanics methods. The specific terminology used in the rock classification is defined in the Rock Classification and Log Key, Appendix A, Figure A2.

During the review, some samples were selected for further testing. The material descriptions and identifications were refined/revised, as necessary, based on the results of the laboratory tests. The soil testing program included natural moisture contents, Atterberg limits testing, and particle size analyses. The rock testing program included unconfined compressive strength. All laboratory tests were performed in accordance with applicable ASTM International (ASTM) standards.

B.2 SOIL TESTING

B.2.1 Moisture (Natural Water) Content

Natural moisture content determinations were performed in accordance with ASTM D2216, on selected soil samples. The natural moisture content is a measure of the amount of moisture in the soil at the time of exploration. It is defined as the ratio of the weight of water to the dry weight of the soil, expressed as a percentage. The results of moisture content determinations are presented on the Logs of Borings in Appendix A.

B.2.2 Atterberg Limits

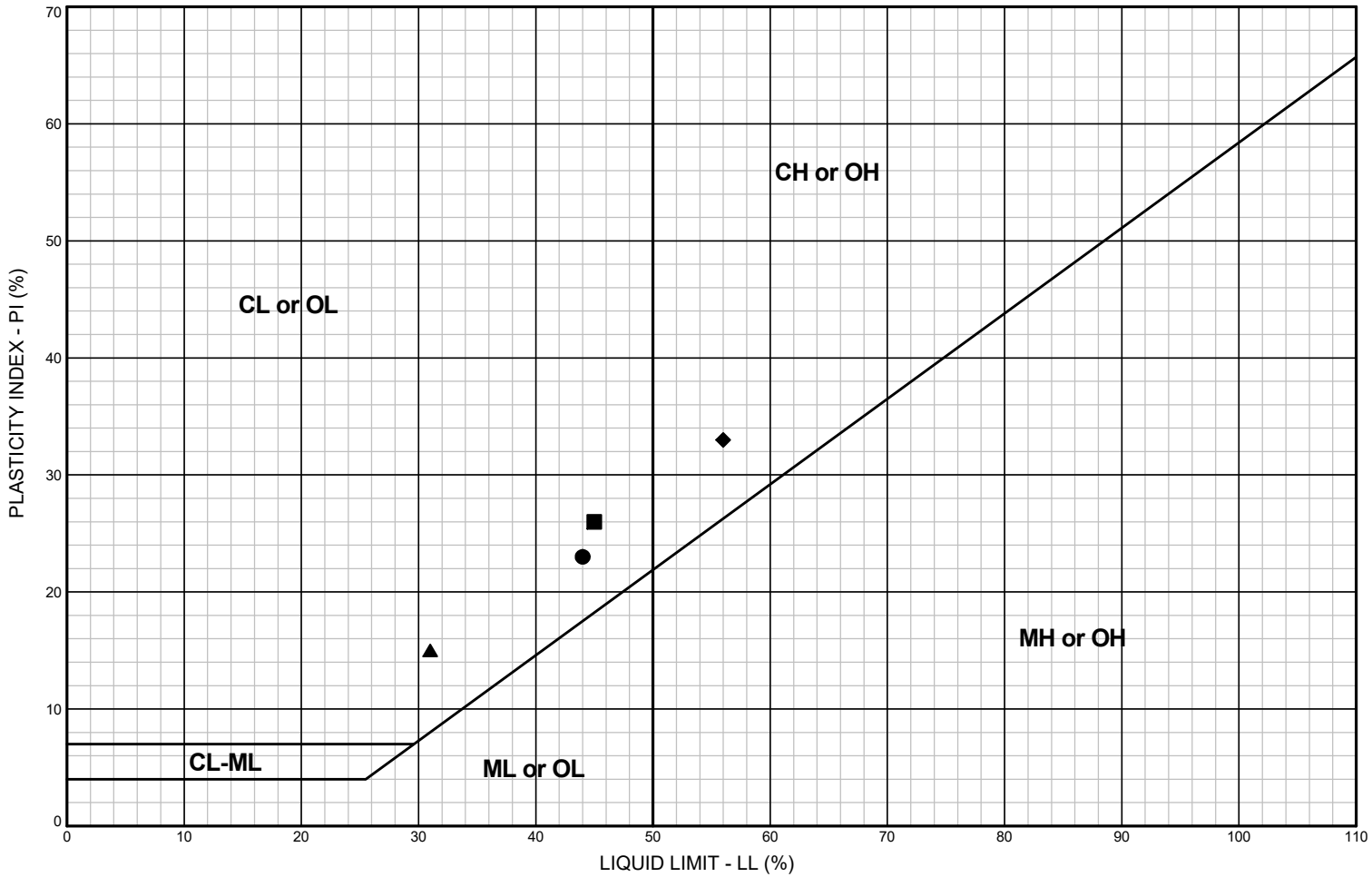
Atterberg limits were determined for a single sample in accordance with ASTM D4318. This analysis yields index parameters of the soil that are useful in soil identification, as well as in a number of analyses, including liquefaction analysis. An Atterberg limits test determines a soil's liquid limit (LL) and plastic limit (PL). These are the maximum and minimum moisture contents at which the soil exhibits plastic behavior. A soil's plasticity index (PI) can be determined by subtracting PL from LL. The LL, PL, and PI of the tested sample are

presented in Figure B1, Atterberg Limits Results. The result is also presented in the Logs of Borings in Appendix A.

For the purposes of soil description, Shannon & Wilson uses the term nonplastic to refer to soils with a PI less than 4, low plasticity for soils with a PI range of 4 to 10, medium plasticity for soils with a PI range of 10 to 20, and high plasticity for soils with a PI greater than 20.

B.2.3 Particle-Size Analyses

Particle-size analyses were conducted on samples to determine their grain-size distributions. Grain size distributions were determined in accordance with ASTM D1140. For all samples, only a wet sieve analysis was performed to determine the percentage (by weight) of each sample passing the No. 200 (0.075 mm) sieve. Results of all particle-size analyses are presented in Figure B2, Grain Size Distribution. The fines percentages are also presented on the Logs of Borings in Appendix A.



NOTES

1) Atterberg limits tests were performed in general accordance with ASTM D4318 unless otherwise noted in the report.

2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

3) Plasticity adjectives used in sample descriptions correspond to plasticity index as follows:
- Nonplastic (NP) (< 4%)
- Low Plasticity (4 to 10%)
- Medium Plasticity (10 to 20%)
- High Plasticity (> 20%)

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	LL %	PL %	PI %[3]	NAT. W.C. %	FINES %
● B-2, S-7	17.5	*CL*	*Lean Clay*	44	21	23	39	
■ B-2, S-9	25.0	*CL*	*Lean Clay*	45	19	26	40	
▲ B-3, S-7	16.0	*CL*	*Lean Clay*	31	16	15	31	
◆ B-3, S-12	35.0	*CH*	*Fat Clay*	56	23	33	42	

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

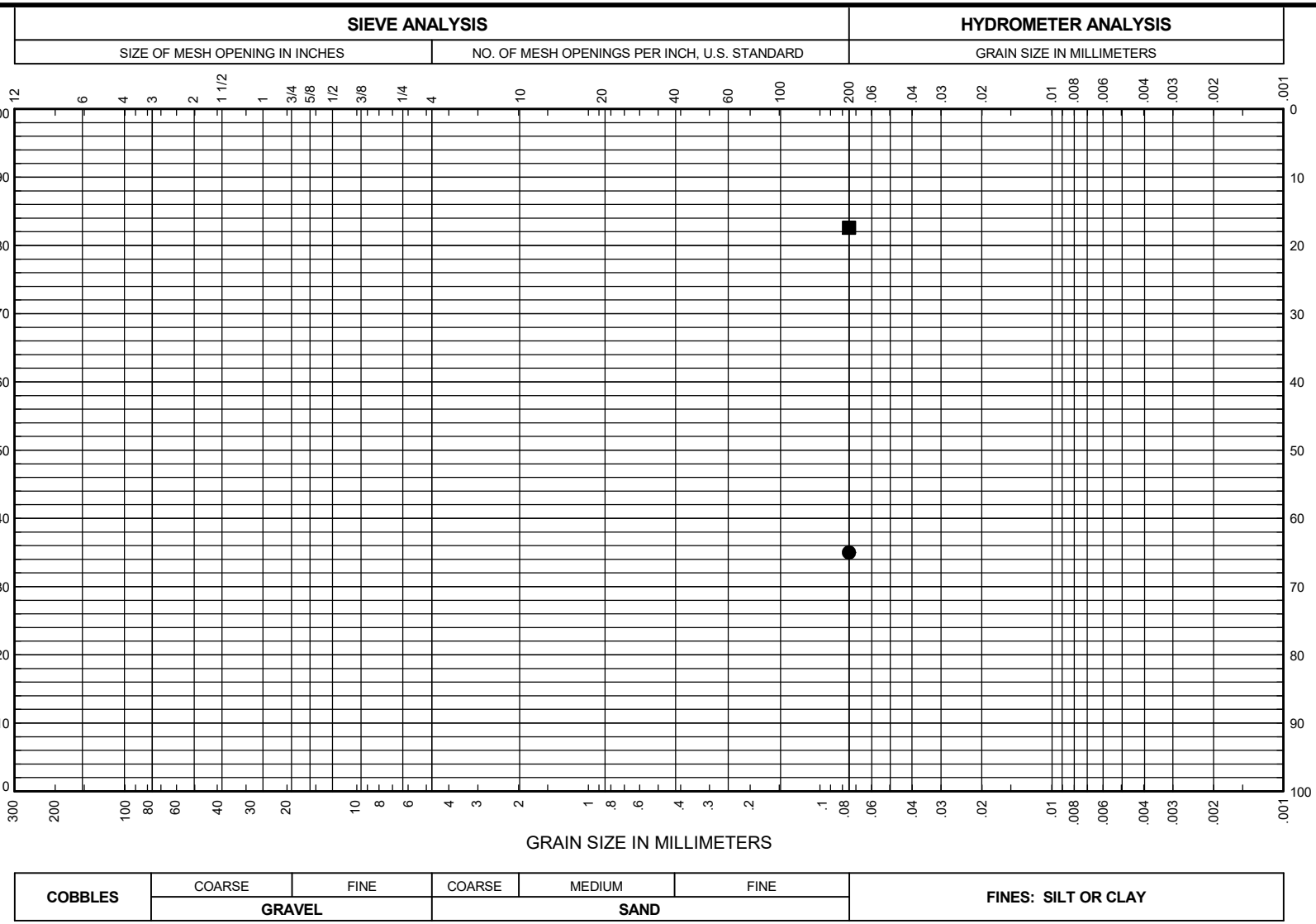
ATTERBERG LIMITS RESULTS

December 2025 115125

SHANNON & WILSON

FIG. B1

FIG. B1



NOTES:
1) Sieve analyses were performed in general accordance with ASTM D6913, sieve with hydrometer analyses were performed in general accordance with ASTM D422, and amount finer than #200 sieve analyses were performed in general accordance with ASTM D1140 unless otherwise noted in the report.
2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	GRAVEL %	SAND %	FINES %	NAT. W.C. %	DRY DENSITY PCF
● B-1, S-4	10.0	*GM*	*Silty Gravel with Sand*	-	-	35	34	
■ B-2, S-2	5.0	*CL*	*Lean Clay with Sand*	-	-	83	24	

St. Helens Reservoir
Siting Study
Saint Helens, Oregon

GRAIN SIZE DISTRIBUTION

December 2025 115125

SHANNON & WILSON

FIG. B2

FIG. B2

GSA MAIN 115125.GPJ SHAN WIL.GDT 10/1/25

IMPORTANT INFORMATION

Important Information

About Your Geotechnical/Environmental Report

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the Geoprofessional Business Association (https://www.geoprofessional.org)

APPENDIX D

SWCA Environmental and Permitting Report, December 2025

Permitting and Environmental Constraints Report for the City of St. Helens Reservoir Siting Study

DECEMBER 2025

PREPARED FOR

City of St. Helens

PREPARED BY

SWCA Environmental Consultants

PERMITTING AND ENVIRONMENTAL CONSTRAINTS REPORT FOR THE CITY OF ST. HELENS RESERVOIR SITING STUDY

Prepared for

City of St. Helens
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St. Helens, Oregon 97051

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SWCA Project No. 97131

December 2025

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Appendices

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INTRODUCTION

The City of St. Helens (City) is investigating siting a new 5-million-gallon water storage reservoir to support existing needs and future growth. This environmental constraints report summarizes potential environmental siting constraints for four proposed reservoir (hereafter referred to as "tank site") locations. The proposed tank sites and associated water line connections and overflow paths evaluated in this report are shown in Figure 1. The constraints reviewed include those associated with land use and zoning restrictions, vegetation and habitat, special-status species, aquatic resources, historical and cultural resources, visual resources, and hazardous materials. Constraints were identified based on a desktop review of publicly available information and evaluated using best professional judgement, experience with similar projects, and regional knowledge. Results from this report can be used to inform the City's overall site screening and selection process, which will also consider other non-environmental factors.

LAND OWNERSHIP AND USE

Land ownership information for the four proposed tank sites is summarized in Table 1 and shown in Figure 2. Tank Site 1 is located just outside (north of) the St. Helens city boundary, west of Highway 30 and south of Liberty Hill Road. Site 1 overlaps two tax lots east of Wapiti Drive, which are privately owned by Weyerhaeuser and appear undeveloped but are surrounded by residential uses to the west and industrial uses to the east. Sites 2 and 3 are located within the St. Helens City boundary, south of Pittsburgh Road and north of Sykes Road. Both sites overlap privately owned tax lots which are currently undeveloped but surrounded by residential development. Site 4 is located just outside (west of) the St. Helens City boundary, north of Bachelor Flat Road. Site 4 overlaps one publicly owned tax lot and is within the Columbia County Fairgrounds with residential development in surrounding areas.

All the proposed overflow paths would be within the same tax lots as their associated tank, whereas all the proposed water line connections would extend outside of the tax lot boundaries and would follow along existing public road rights-of-way.

Table 1. Land Ownership of Tank Sites

Tank Site No.	Land Ownership	Owner	Acres	Tax Lot ID	PLSS Land Description
1	Private	Weyerhaeuser NR Company	75	5N1W3200 1600; 5N1W32DD 100	Section 32, Township 5 North, Range 1 West
2	Private	Comstock Chieko Revocable Trust	12	4N1W 6AD 2600; 4N1W 6D0 604	Section 6, Township 4 North, Range 1 West
3	Private	Thayer Paul L and Laura R	13	4N1W 6DB 1203	Section 6, Township 4 North, Range 1 West
4	Public – County	Columbia County	22	4N1W 7BB 400	Section 7, Township 4 North, Range 1 West

Note: PLSS = Public Land Survey System.

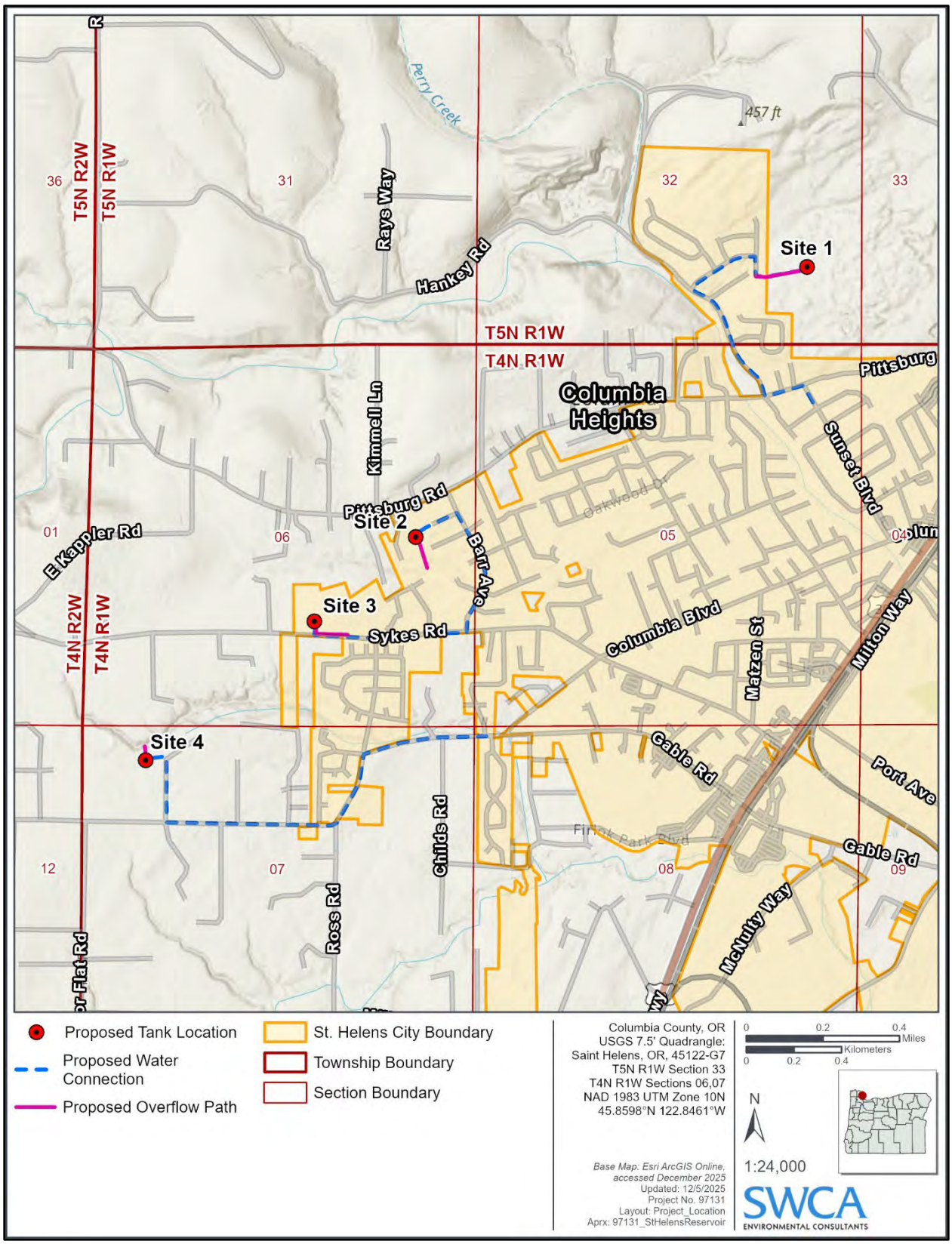

Figure 1. Project location.

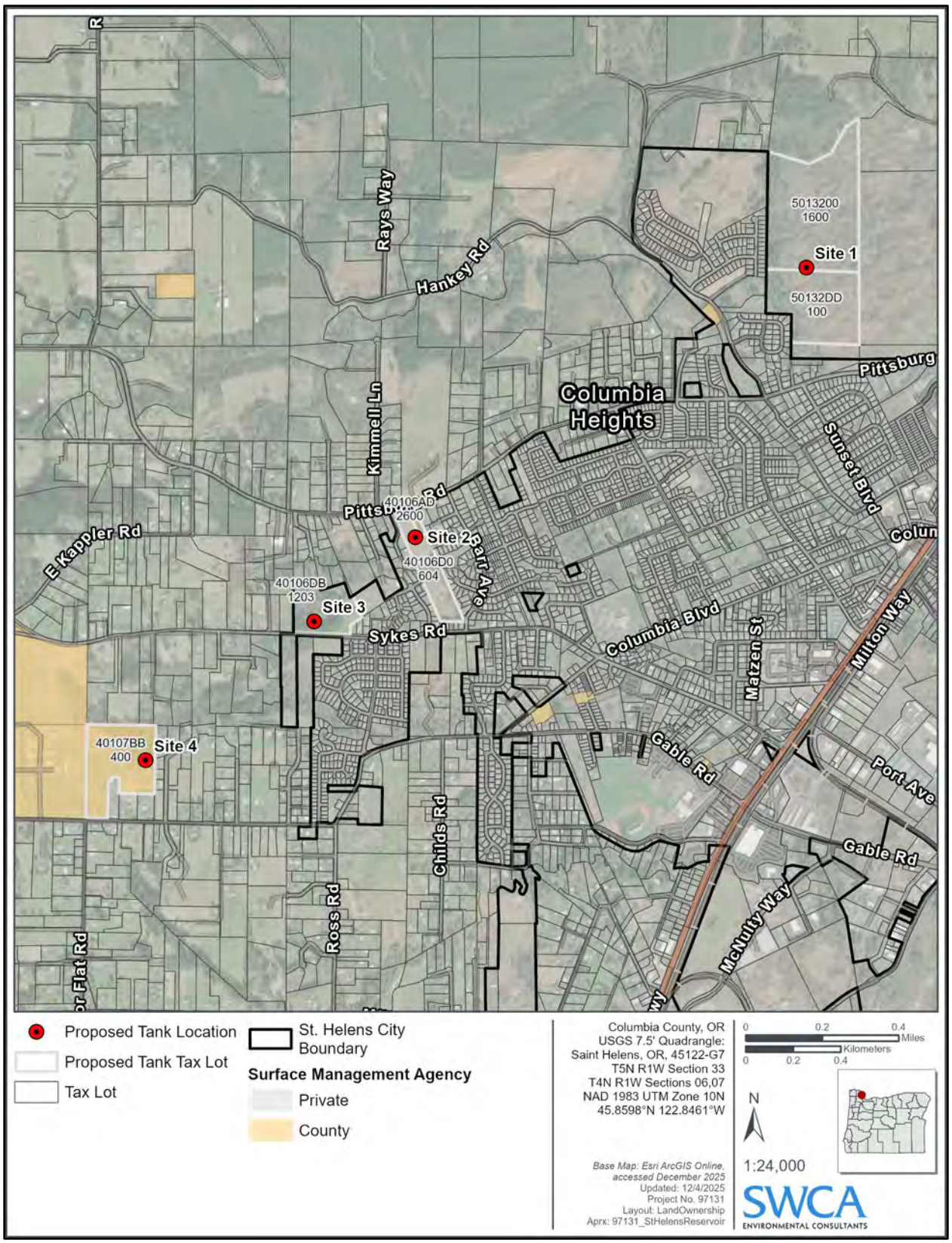

Figure 2. Land ownership of tank sites.

ZONING

A review of the Columbia County Interactive Zoning Map and the St. Helens, Oregon, Online Mapping Service was conducted to assess land use and zoning designations of the tank sites (City of St. Helens 2025; Columbia County 2025). The zoning designations for the tax lot parcels intersecting each of the tank sites are shown in Figure 3 and are further discussed below. Based on review of Natural Resources Conservation Service (NRCS) data, none of the tank sites overlap designated prime farmland (NRCS 2025).

Site 1 is located outside St. Helens City limits in Columbia County. The site is within Columbia County's (the County's) Primary Forest (PF-80) zoning designation. The PF-80 zone is designed to conserve and manage forest lands for timber production and related uses, while also allowing other types of compatible uses such as recreational uses, locationally dependent uses, or dwellings under certain conditions. In Section 504.13 of the Columbia County Zoning Ordinance (CCZO), "reservoirs and water impoundments" are listed as a permitted use, subject to administrative review under Section 1601 of the CCZO (Columbia County 1984). In addition, proposed uses must comply with applicable development standards for the PF-80 zone (see CCZO Article VI, Sections 508–510), which generally require that the use will not significantly change or impact existing forest uses, will not increase risk of fire, will comply with setbacks and fire siting standards, and is consistent with the County's comprehensive plan. Administrative zoning reviews are subject to review by the Planning Director, and do not require a pre-application conference or public meeting; however, a public hearing may be requested by the public. In addition to administrative review for zoning consistency, the project would also require site design review under CCZO Section 1550, which applies to all new development of community or governmental uses, among other things. For the site design review, the project would likely qualify as a Type 2 project (i.e., over 5,000 square feet, and causes a change in category of use), which entails review by the Planning Commission, and requires a pre-application conference and public hearing.

Sites 2 and 3 are both located within the St. Helens City boundary, and are within the City's Moderate Residential (R7) zoning designation (City of St. Helens 2025). The R7 Zone is intended for residential purposes and more specifically, moderate density urban residential development. As listed in Section 17.32.060(3)(h) of the St. Helens Community Development Code (SHCDC) "major public facilities," which includes but is not limited to "water system reservoirs," are allowed as a conditional use in the R-7 zone. Conditional Use Permits (CUPs) are reviewed by the Planning Commission and require a pre-application conference and a public hearing (SHCDC 17.24).

Site 4 is located outside St. Helens City limits in Columbia County. The site is within the County's Community Service – Institutional (CS-I) zoning designation. The CS-I zone is intended to provide a mechanism for the establishment of public and private facilities necessary to meet the demand for the various types of public assemblies and public and private institutional facilities. Section 1000 of the CCZO lists the types of uses that are permitted in the CS-I zone. Public water supply facilities, such as reservoirs, are not explicitly listed as a type of permitted use in this zone; however, the code identifies "other uses found similar by the Commission" as a permitted use, which means the County would have some discretion in deciding whether the proposed storage reservoir would be allowed within this zone. Given the intent of this zone to meet the demands of public institutions, the proposed reservoir tank may be considered compatible with this zone, provided adverse impacts on adjacent land uses could be avoided or mitigated. The project would need to apply for a Determination of Similar Use (DSU) from the County to confirm whether the proposed use aligns with the intent of the CS-I zoning designation and is considered a permitted use.

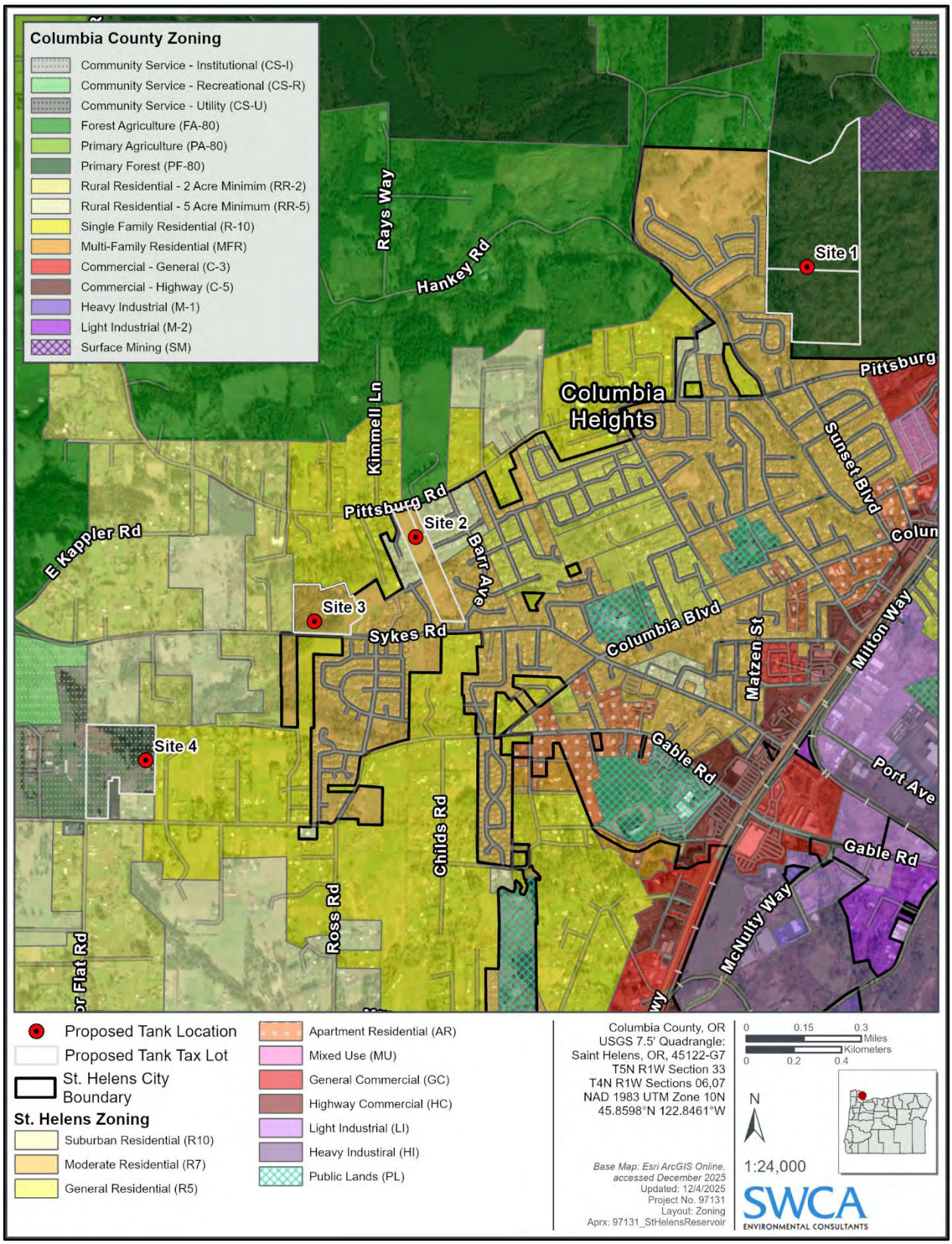

Figure 3. Zoning designations for tank sites.

The project would also require site design review under CCZO Section 1550, which applies to all new development of community or governmental uses, among other things. Similar to Site 1, the site design process entails review by the Planning Commission, and requires a pre-application conference and public hearing. The DSU and site design applications would be reviewed concurrently by the Planning Commission in a consolidated public hearing.

AQUATIC RESOURCES

The Oregon Department of State Lands (DSL), Oregon Department of Environmental Quality (ODEQ), and U.S. Army Corps of Engineers (USACE) regulate aquatic resources in the state of Oregon. At the federal level, USACE oversees the discharge of dredged or fill material into waters of the United States (WOTUS) under Section 404 of the Clean Water Act (CWA). WOTUS include wetlands and non-wetland water bodies that meet specific criteria. USACE has jurisdiction over the following:

- Traditional navigable waters
- Wetlands adjacent to traditional navigable waters
- Relatively permanent non-navigable tributaries that flow continuously for at least 3 months per year
- Wetlands that directly border relatively permanent tributaries

For non-navigable waters, tributaries that are not relatively permanent, and adjacent wetlands that do not meet the above criteria, USACE determines jurisdiction based on a significant nexus evaluation. Common WOTUS can include wetland and stream habitat types, but WOTUS may also consist of mudflats, playas, and natural ponds.

USACE has the authority to assert jurisdiction over perennial and intermittent streams and wetlands abutting or adjacent to these features. Ephemeral streams or washes may also be regulated if they possess indicators of ordinary high water and if they significantly affect the chemical, physical, and biological integrity of a downstream jurisdictional water. Erosional features characterized by low volume, infrequent flow, or short duration are not regulated.

At the state level, DSL regulates discharges of dredged or fill material into waters of the state in accordance with Oregon's removal-fill law (Oregon Revised Statute [ORS] Chapter 196) and requires a permit for removal-fill activities in most wetlands or waters that exceed 50 cubic yards. Waters of the state that fall under the jurisdiction of DSL include jurisdictional portions of the Pacific Ocean, tidal bays, tidal rivers, estuaries, non-tidal rivers, perennial and intermittent streams, lakes, ponds, wetlands, and reservoirs. In addition, certain ditches and created wetlands and ponds are also considered waters of this state.

Direct impacts on wetlands and waters may be avoided during siting of project infrastructure. If, however, impacts on jurisdictional wetlands or waters are unavoidable, a removal-fill permit from the USACE and/or DSL may be required. Both the USACE and DSL use the same Joint Permit Application (JPA) form for removal-fill permits, and the JPA can be submitted to both agencies for concurrent reviews. Additionally, under the CWA Section 401, a water quality certification (WQC) is required for projects that need CWA Section 402 or Section 404 permits. ODEQ regulates and oversees the WQC program in Oregon.

For USACE permits, projects that result in minimal permanent impacts to jurisdictional WOTUS (typically 0.5 acre or less) may qualify for coverage under a Nationwide Permit (NWP) which involves a

simpler, streamlined authorization process, requiring pre-construction notification and Section 401 WQC only. Otherwise, an Individual Permit (IP) is required if permanent impacts exceed the NWP threshold.

While USACE and DSL do not mandate uniform buffer requirements for jurisdictional wetlands and waters, buffers are often considered in the permitting process as a way to avoid and minimize impacts and may be attached as conditions to the permits. Based on SWCA's experience with wetland and water permitting, buffers typically can range anywhere from 50 to 250 feet, depending on the type of feature, its relative quality (in terms of habitat value or water treatment), and other site-specific factors such as topography, vegetation cover, etc.

The U.S. Environmental Protection Agency requires construction projects to be covered under a National Pollutant Discharge Elimination System (NPDES) construction general permit if they involve clearing, grading, and excavating activities that disturb 1 acre or more and discharge stormwater to surface waters of the state. The U.S. Environmental Protection Agency transferred permitting authority for stormwater permitting to ODEQ. A 1200-C Stormwater General Permit is required under the same conditions and satisfies the requirement for an NPDES permit. In addition, the applicant is required to prepare and implement a stormwater pollution prevention plan in accordance with the general permit conditions before construction begins. ODEQ is also responsible for issuing NPDES permits for point-source discharges of operational wastewater into surface waters. The specific type of NPDES permit needed depends on the nature of the discharge, such as whether it is stormwater, filter backwash, or an emergency overflow, and what pollutants it may contain. If discharges of pollutants into waters of the state can be avoided by project design during construction and/or operation, then NPDES permits may not be required.

At the local level, the City and County have ordinances that impose development restrictions in wetlands, waters, and riparian corridors. In Columbia County, Section 1170 of the CCZO prohibits development activities, such as placement of infrastructure, vegetation removal, grading, or removal and fill, within water bodies and their associated riparian corridors, which range from 50 to 75 feet from top of bank. If impacts are unavoidable, the County defers to USACE and DSL for issuing removal-fill permits. In the City of St. Helens, Section 17.40 of the St. Helens Municipal Code (SHMC) prohibits development within significant wetlands, riparian corridors, and protective buffers which range from 50 to 75 feet from the delineated wetland edge or top of bank, depending on the type or wetland or streamflow volumes. If development is unavoidable in these areas, a sensitive land permit (outlined under SHMC 17.44) may be required from the City, in addition to those required by state and federal agencies. In some cases, the geographic extent of protected sensitive lands (e.g., wetland, waters, and their regulated buffers) per the City code (SHMC 17.44) may be larger than what is recognized by USACE and DSL.

Based on review of National Wetlands Inventory (NWI) and National Hydrography Dataset (NHD) data sets, there are mapped wetland and water features within Sites 2 and 4, which are further described below (Table 2; Figure 4). No floodplains are mapped within any of the sites.

Table 2. Mapped Aquatic Resources within Sites

Site	Mapped Wetland features	Mapped Water features
Site 2	Riverine, Intermittent Streambed, Seasonally Flooded (0.06 acre)* Palustrine emergent (0.55 acre)*	Perennial Stream/River (317 linear feet)
Site 4	Riverine, Intermittent Streambed, Seasonally Flooded (0.36 acre)	Intermittent Stream/River (1,056 linear feet)

Source: USFWS (2025b), USGS (2023).

* Data from Wetland Solutions Northwest LLC (2021)

The parcels encompassing the tank footprints for Sites 1 and 3 do not intersect any mapped wetland or water features, nor is there any visible indication of potential wetland or water features based on review of aerial imagery (Appendix A). The proposed water connection and overflow path for Site 3 also do not intersect any mapped wetland or water features. However, the proposed water connection line for Site 1 intersects two mapped streams (see Figure 4). These crossings are along existing roadways (Elk Meadows Drive and Pittsburg Road) which are presumed to include existing culverts. It is assumed that construction of the proposed connections would not require new discharges (i.e., removal-fill) at these crossings.

Site 2 contains one NWI-mapped mapped riverine wetland (mapped as 0.13 acre) and one NHD-mapped perennial stream (317 linear feet), both of which overlap the same topographic drainage that flows through the central portion of the site (see Figure 4). In addition, a wetland and water delineation was previously completed for Site 2 in 2021 (Wetland Solutions Northwest LLC 2021) which confirmed the presence of the NWI/NHD-mapped stream/riverine wetland (delineated as 0.06 acre) and also identified two palustrine emergent wetlands (totaling 0.55 acre) just south of the stream. The City considers these features significant, as defined under SHMC 17.44, and would require upland protective buffers of 50 feet (for the emergent wetlands) or 75 feet (for the stream/riverine wetland) should any development be proposed at this site. The previous wetlands and waters delineation estimated these buffers would encompass an additional 2.04 acres (including 1.09 acres for the 75-foot stream buffer and 0.95 acre for the 50-foot emergent wetland buffer) (Wetland Solutions Northwest LLC 2021). Collectively, these aquatic features and protective buffers cover approximately 22% (2.65 acre) of the total parcel acreage for Site 2 (12 acres).

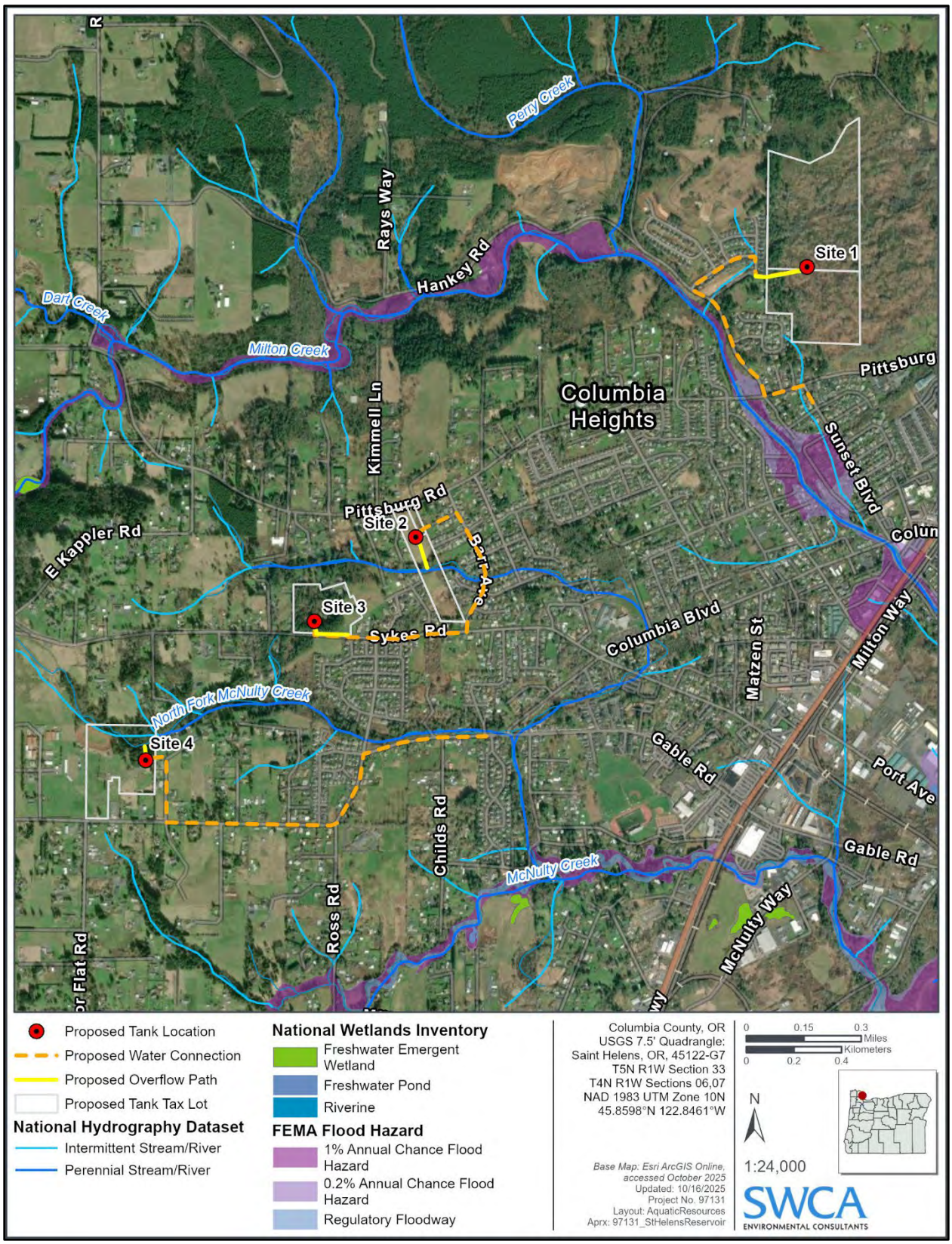

Figure 4. Aquatic resources within sites.

The Site 2 tank site itself does not intersect any mapped wetland and water features but comes within approximately 240 feet of the stream's protective buffer, and approximately 630 feet of the protective buffer for the mapped wetlands south of the stream. Given the proposed tank location relative to delineated features and buffers, it is reasonable to assume that the footprint of the tank itself could be sited to avoid these features and buffers. The proposed water connection line for Site 2 also crosses the same NWI/NHD-mapped stream that is mapped through the central portion of the site; however, the crossing is along an existing roadway (Barr Avenue) which is presumed to include a culvert crossing and it is assumed new discharges (i.e., removal-fill) would not be required at this crossing. The proposed overflow path for Site 2 would discharge treated water into the stream, as needed, when there is excess flow to the reservoir. The point of discharge for the overflow path is expected to occur above the ordinary high water line, which would avoid the need for removal or fill within the stream channel itself. Additionally, construction of the overflow path can be done with directional drilling to minimize the need for open trenching within the riparian buffer. Therefore, while construction of the overflow path is not expected to directly impact the stream channel, development within the stream's regulated buffer is likely to require a sensitive land permit from the City, depending on the level of disturbance needed for construction. In addition, proposed discharges would need to be permitted through ODEQ to ensure compliance with relevant water quality standards for the receiving water.

Site 4 contains one NWI-mapped riverine wetland (0.36 acre) and NHD-mapped intermittent stream (1,056 linear feet) which are in close proximity and may be associated with the same topographic drainage. These features cover approximately 1.6% of the total parcel acreage for Site 4 (22 acres) and, if required by the County or state agencies, protective buffers would add to this acreage (estimated at approximately 2 acre or less). The tank site itself does not intersect any mapped wetland or water features but comes within approximately 100 feet of them. Therefore, it is reasonable to assume that the footprint of the tank itself could be sited to avoid these features as well as protective buffers up to approximately 100 feet. Similar to Site 2, the proposed overflow path for Site 4 would also discharge treated water into the on-site stream, but is expected to be above the ordinary high water line, and directional drilling methods could be used to minimize the need for open trenching within the riparian buffer. Therefore, development within the stream's regulated buffer may require a permit from the County under CCZO Section 1170, and proposed discharges would need to be permitted through ODEQ to ensure compliance with relevant water quality standards for the receiving water. No mapped wetland or water features intersect the proposed connection line corridor for Site 4.

Aquatic features within Sites 2 and 4 are likely to be considered jurisdictional by DSL and USACE based on their proximity and potential connectivity to McNulty Creek, which is a tributary of Scappoose Bay and ultimately flows to the Columbia River. However, formal wetland and water delineation surveys within the project footprint would be necessary to confirm wetland and water boundaries, affirm their state and federal jurisdictional status, and determine permitting requirements. Section 10, Permit Matrix, includes additional information on federal, state, and local wetland- and water-related permit triggers, application requirements, and timelines.

VEGETATION AND HABITAT

A review of U.S. Geological Survey (USGS) National Land Cover Database (NLCD) data revealed eight broad land cover types across all four sites and their associated tax lot parcel boundaries. Table 3 and Figure 5 show the land cover classifications for each site. The general land cover within the footprint of each tank site is described below based on review of NLCD data compared against aerial imagery; figures showing aerial imagery at each site are included in Appendix A.

Table 3. Acres of NLCD Land Cover Types Within Each Site

Land Cover Type	Site 1	Site 2	Site 3	Site 4
Developed	30.23	7.72	4.91	3.00
Developed Open Space	3.77	3.83	6.50	8.42
Evergreen Forest	8.62	–	1.32	1.82
Grassland/Herbaceous	0.21	–	–	–
Mixed Forest	26.10	–	–	–
Pasture/Hay	5.28	–	–	9.10
Shrub/Scrub	0.64	–	–	–
Woody Wetlands	–	0.34	–	–
Total	**74.85**	**11.89**	**12.73**	**22.34**

Source: USGS (2025).

Note: Total site acreages vary slightly due to rounding. Acres are based on tax lot size; the actual project footprint (i.e., for the tanks and connection lines) at each site would be smaller than the parcels.

Based on aerial image review, the NLCD land cover types "developed" and "developed open space" appear to be associated with fragmented open space areas that are undeveloped (have no aboveground infrastructure) but have likely been subject to previous disturbance associated with surrounding residential and urban developments. Therefore, these NLCD classifications should not be construed to mean they lack vegetative cover, but instead that they have likely been disturbed and/or modified from their natural conditions to some degree.

According to NLCD data, the Site 1 parcels are primarily classified as developed land (40.4%) and mixed forest (34.9%). The proposed footprint of the tank is also mapped as developed land, which appears to be characterized by a mixture of herbaceous and wooded land cover based on aerial imagery (Google Earth 2025; see Appendix A, Figure A-1). The water connections would be placed parallel to existing roads within developed areas as well (e.g., residential setting).

The Site 2 parcels are primarily classified as developed lands (64.9%), and the proposed footprint of the tank itself is mapped as developed open space, which appears to be characterized by herbaceous land cover based on aerial imagery (Google Earth 2025; see Appendix A, Figure A-2). The water connections would be placed parallel to existing roads within developed areas as well (e.g., residential setting).

The Site 3 parcel is predominantly classified as developed open space (51.1%), and the proposed footprint of the tank itself is mapped as developed/developed open space, which appears to be characterized by forested land cover based on aerial imagery (Google Earth 2025; see Appendix A, Figure A-3). The water connections would be placed parallel to existing roads within developed areas as well (e.g., residential setting).

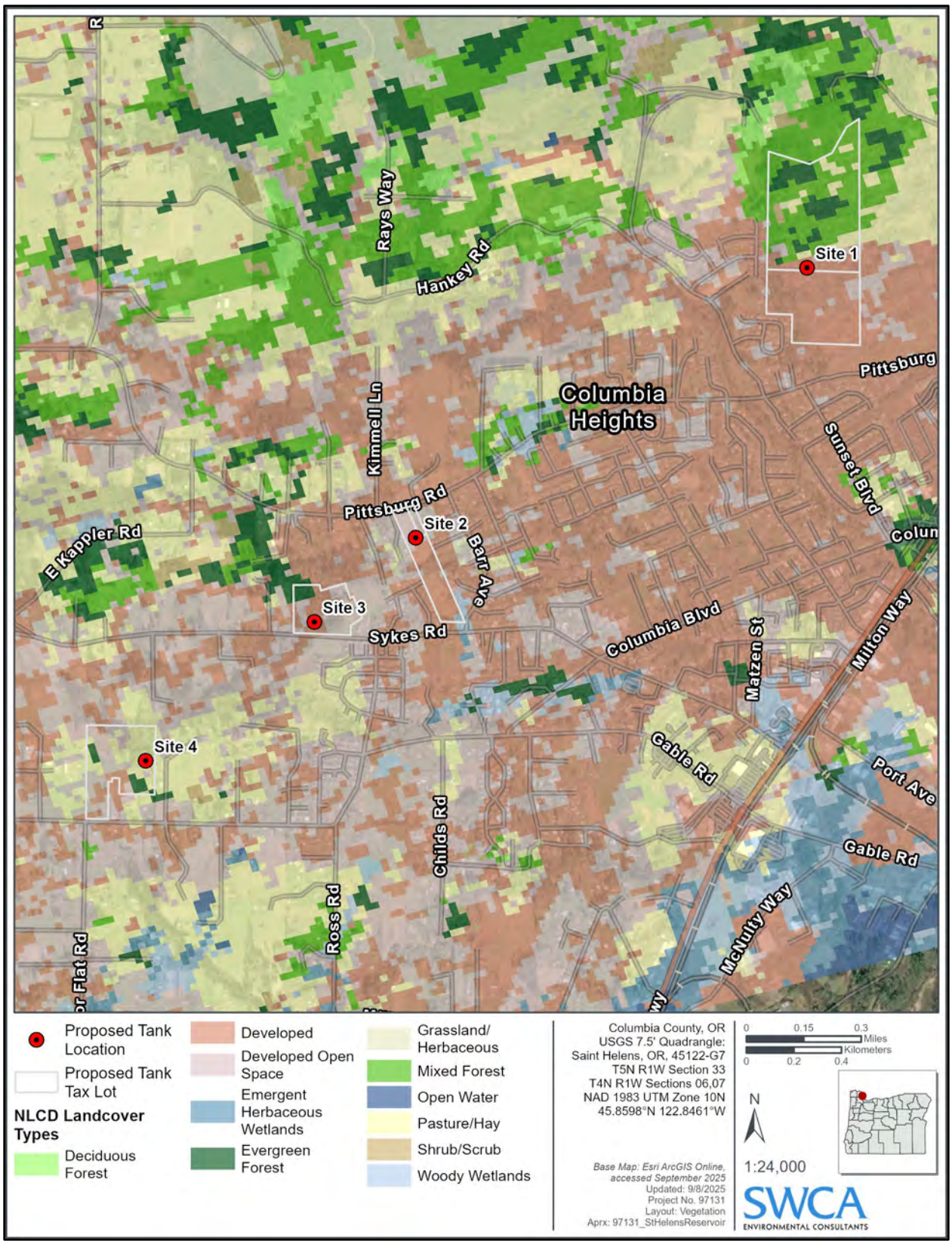

Figure 5. USGS NLCD land cover of sites.

The Site 4 parcel is predominantly classified as pasture (40.7%) and developed open space (37.7%). The proposed footprint of the tank itself is mapped as pasture, which appears to be characterized by open grasslands and forest based on aerial imagery (Google Earth 2025; see Appendix A, Figure A-4). The water connections would be placed parallel to existing roads within developed areas as well (e.g., residential setting).

Additionally, a review of the Institute of Natural Resources (INR) NW ReGAP Ecological Systems Map of Oregon revealed nine ecological systems throughout the sites and their associated tax lot boundaries. Site 1 consists primarily of Douglas-fir-Western Hemlock Forest and Woodland (42.1%) and Introduced Perennial Grassland and Forbland (15.9%). Site 2 consists primarily of Developed-Upland Forest/Herbaceous/Shrubland (68.8%). Site 3 consists primarily of Douglas-fir-Western Hemlock Forest and Woodland (47.8%) and Developed land (18.7%). Site 4 consists primarily of Agricultural Pasture (34.3%) and Developed land (25.0%). Table 4 shows the system types and area for each.

Table 4. Acres of NW ReGAP Ecological Systems within Each Site

Land Cover Type	Site 1	Site 2	Site 3	Site 4
Agricultural-Pasture and Hayland	5.35	1.03	1.52	7.66
Conifer-Oak Forest and Woodland	7.85	0.26	0.51	0.81
Developed	0.39	2.16	2.38	5.58
Developed-Upland Forest/Herbaceous/Shrubland	4.55	8.20	2.23	3.60
Douglas-fir-Western Hemlock Forest and Woodland	31.50	0.26	6.08	4.69
Introduced Perennial Grassland and Forbland	11.87	–	–	–
Introduced Upland Vegetation-Shrub	8.96	–	–	–
Red Alder Forest and Woodland	0.13	–	–	–
Western Oak Woodland and Savanna	4.20	–	–	–
Total	**74.80**	**11.91**	**12.72**	**22.34**

Source: USGS (2025).

Notes: Total site acreages vary slightly due to rounding. Acres are based on tax lot size; actual the project footprint (i.e., for the tanks and connection lines) at each site would be smaller than the parcels.

Compared to NLCD land cover types, these NW ReGAP ecological systems are generally more useful in understanding the actual types of vegetation present on-site, since NLCD data tends to conceal disturbed vegetation types under the label of "developed" lands.

In the state of Oregon, the Oregon Department of Fish and Wildlife (ODFW) is responsible for making recommendations on wildlife habitat avoidance, minimization, and mitigation strategies. The ODFW Fish and Wildlife Habitat Mitigation Policy (Oregon Administrative Rule [OAR] 635-415-0015) provides a framework for assigning one of six category types to habitats (Category 1 being the highest quality habitat and Category 6 being the lowest quality habitat) based on the relative importance of these habitats to fish and wildlife species (Table 5). Based on these category values, ODFW identifies preferred strategies to avoid or mitigate the impact of projects on fish and wildlife habitat. Mitigation goals and ratios for habitat impacts range from total avoidance for Category 1; in-kind, in-proximity mitigation at a 2:1 ratio for Category 2; in-kind, in-proximity mitigation at a 1:1 ratio for Categories 3 through 5; and minimizing impacts for Category 6. Generally speaking, shrubland, forest, grassland, and wetland habitat types typically qualify as Categories 1 through 4, depending on the quality of the habitat, and all other habitat types (e.g., cultivated crops and developed) typically qualify as Category 5 or 6. ODFW would likely encourage avoidance of wetland habitats to the extent possible, if present on any of the sites (see Section 6, Aquatic Resources).

Table 5. Estimated ODFW Habitat Mitigation Categories in the Tank Sites

ODFW Habitat Mitigation Category	Description	Example	Goal for Mitigation	Mitigation Strategy	Estimated Acreage[1]			
					Site 1	Site 2	Site 3	Site 4
1	Irreplaceable, essential habitat for fish or wildlife species, population, or unique assemblage of species that is limited on either a physiographic province or site-specific basis.	Bogs and fens, certain springs, seeps, and heron rookeries; caves that provide roosts and hibernacula for bats; trees or structures that contain a special-status raptor nest.	No loss of habitat quantity or quality.	Avoidance.	0	0	0	0
2	Essential habitat for fish* or wildlife species, population, or unique assemblage of species that is limited either on a physiographic province or site-specific basis.	Salt marshes, cottonwood galleries, subtidal habitat; elk winter range; mule deer winter range; pronghorn essential and limited habitat; fish-bearing streams; bat roosts and hibernacula other than caves; higher quality forested habitat.	No net loss of habitat quantity or quality; provide a net benefit to habitat quantity or quality.	In-kind, in-proximity mitigation at a 2:1 ratio.	0	0	0	0
3	Essential habitat for fish* and wildlife, or important habitat for fish and wildlife that is limited either on a physiographic province or site-specific basis.	Elk summer range; mule deer summer range; non-fish-bearing streams; lower quality forested habitat. Specific to the tank sites, Category 3 includes mapped aquatic resources on Sites 2 and 4.	No net loss of habitat quantity or quality.	In-kind, in-proximity mitigation at a 1:1 ratio.	0	0.61*	0	5.05*
4	Important habitat for fish and wildlife species.	Isolated or degraded wetlands.	No net loss of habitat quantity or quality.	In-kind or out-of-kind, in-proximity or off-proximity mitigation at a 1:1 ratio.	0	0	0	0
5	Habitat for fish and wildlife with high potential to become either essential or important habitat.	Restorable rye grass fields or diked or drained coastal marshes. Specific to the tank sites, Category 5 includes open spaces with degraded herbaceous, shrub, or forested cover.	Net benefit to habitat quantity or quality.	Actions that improve habitat conditions at a 1:1 ratio.	74.80	9.89	12.0	0
6	Habitat that has low potential to become essential or important habitat for fish and wildlife.	Urban areas and other areas with little or no restoration potential. Specific to the tank sites, Category 6 includes the developed portions of Sites 2, 3, and 4 that include community facilities, residences, or roads.	Minimize impacts.	Minimize direct habitat loss and avoid off-site impacts.	0	2.16	0.75	17.29

*Includes 0.68 acre of mapped wetlands/waters for Site 2 and 0.36 acre of mapped wetland/waters for Site 4; see Section 6, Aquatic Resources

Table 5 provides a preliminary estimate of the acreage of ODFW habitat categories on each site based on review of NLCD, NW ReGAP, aquatic resources data (see Aquatic Resources section), and professional interpretation of these data sources against aerial imagery for each site. SWCA anticipates minimal representation of Categories 1 and 2 and expects the majority of the sites to fall within Categories 3, 5, and/or 6 (typically associated with lower quality habitat or developed areas). Field-verification of habitat type and quality is needed to inform further discussion and negotiations with ODFW regarding final habitat category determinations. Other local and state agencies typically coordinate with, and defer to, ODFW on matters relating to wildlife and habitat when reviewing and approving development permits. Thus, consultation with ODFW would be required as part of the City or County land use permitting process to determine the appropriate habitat categories and mitigation strategies at the project level.

SPECIAL-STATUS SPECIES

Special-status species include species protected or managed under the federal Endangered Species Act (ESA), Oregon Endangered Species Act, Migratory Bird and Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act (BGEPA).

Each listed species was considered for its potential to occur within the parcel(s) on which each site is located and was categorized as follows:

- *Known to occur*: The species has been documented within the survey area by a reliable observer.
- *Likely to occur*: The species has been documented in the vicinity (within 5 miles), and the survey area may contain suitable habitat.
- *May occur:* The survey area is within the species' currently known range, and vegetation communities, soils, etc., resemble those known to be used by the species.
- *Unlikely to occur*: The survey area is within the species' currently known range, but vegetation communities, soils, etc., do not resemble those known to be used by the species, or the project site is clearly outside the species' currently known range.

Federal and State Threatened and Endangered Species and Critical Habitat

SWCA used data from the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) database (USFWS 2025a), the Oregon Biodiversity Information Center (ORBIC) database, the Oregon Department of Agriculture (ODA) list of special-status plant species for Columbia County, and StreamNet fish distribution data, to determine if federally or state-listed candidate, threatened, or endangered species have the potential to occur within 2 miles of the proposed tank sites. The State of Oregon and the federal government maintain separate lists of threatened and endangered species. ODFW is the regulatory agency for wildlife and ODA is the regulatory agency for plants within the state of Oregon. ODA only regulates listed plants on Oregon non-federal public lands.

Based on review of USFWS IPaC data, eight ESA species have the potential to occur across all four sites: five threatened species (Columbian white-tailed deer [*Odocoileus virginianus leucurus*], marbled murrelet [*Brachyramphus marmoratus*], northern spotted owl [*Strix occidentalis caurina*], streaked horned lark [*Eremophila alpestris strigata*], and yellow-billed cuckoo [*Coccyzus americanus*]), two proposed threatened species (northwestern pond turtle [*Actinemys marmorata*] and monarch butterfly [*Danaus plexippus*]), and one proposed endangered species (Suckley's cuckoo bumble bee [*Bombus suckleyi*]). Although Columbian white-tailed deer was only identified in the IPaC report for Site 4, it was evaluated

for all sites in Table 6 given the species' range and habitat preferences. The IPaC report did not identify any designated critical habitat for threatened and endangered species within any of the sites (Appendix A).

Based on review of ORBIC data covering the four tank sites and an approximately 2-mile buffer surrounding them, there are no documented occurrences of candidate, threatened, or endangered species within the tank site parcels. However, five ESA species are documented within 2 miles of the tank sites, all of which are federally threatened fish species (Chinook salmon [*Oncorhynchus tshawytscha*], coho salmon [*Oncorhynchus kisutch*], chum salmon [*Oncorhynchus keta*], steelhead [*Oncorhynchus mykiss*], and eulachon [*Thaleichthys pacificus*]). These species occurrences are shown on Figure 6. Review of StreamNet data confirmed that there are no ESA-listed fish species documented as occurring within any of the sites (Figure 7).

Based on review of USFWS and National Marine Fisheries Service critical habitat data, critical habitat does not occur within any of the tank sites but does occur within a 2-mile buffer. This includes: the Columbia River, which is designated as critical habitat for eulachon, chinook salmon, chum salmon, coho salmon, sockeye salmon, steelhead, and bull trout; and Milton and McNulty Creeks, which are both designated as critical habitat for coho salmon.

Based on review of the ODA's special-status plant species list for Columbia County, two state-listed threatened plant species were identified (water howellia [*Howellia aquatilis*] and Nelson's checkermallow [*Howellia aquatilis*]). Of these, water howellia is the only species documented to occur within 2 miles of the sites in ORBIC data.

Table 6 summarizes all federally and state-listed species identified in the data queries previously described, and provides a preliminary determination of their potential to occur within each site based on consideration of land cover present at each site and species-specific habitat preferences. Because existing data indicating lack of presence may be, in part, due to lack of data, the potential for occurrence of special-status species at the tank sites should be field-verified once preferred tank sites are selected.

The majority of federally and state-listed ESA species are unlikely to occur in the sites; however, Columbian white-tailed deer may occur on Site 1; northwestern pond turtle may occur on Sites 2 and 4; Nelson's checkermallow may occur on Site 2; and the monarch butterfly and Suckley's cuckoo bumble bee may occur on Sites 1, 2, and 4.

Prior to construction, field surveys are recommended to determine whether suitable habitat is present for these species. If suitable habitat is identified, consultation with federal and/or state agencies (e.g., ODFW, USFWS, or ODA) may be warranted to identify best management practices (BMPs) and other measures to avoid and minimize impacts to these species.

Under the federal ESA, if the project has a federal nexus and has the potential to adversely affect threatened or endangered species, consultation with USFWS under Section 7 of the ESA is required. Based on the lack of critical habitat, it is likely the project activities could avoid adverse effects to ESA species, provided pre-construction habitat assessment or presence/absence surveys are completed to verify the lack of species' presence and/or a lack of suitable habitat and conservation measures are incorporated into the project, as needed, to further avoid and minimize the potential for impacts.

Table 6. Potential for State and Federally Listed Species to Occur Within Each Site

Species	ESA Status	Habitat Description	Site 1	Site 2	Site 3	Site 4
Mammals						
Columbian white-tailed deer *Odocoileus virginianus leucurus*	FT	Columbian white-tailed deer inhabit wet prairies and lightly wooded tidelands along streams and rivers and woodlands that are interspersed with grasslands or pastures. Found along the Columbia River where Sitka spruce, dogwood, cottonwood, red alder, and willow dominate the vegetation.	**May occur.** The site is located within 1 mile of the Columbia River in an unpopulated area of forested land; however, U.S. Highway 30 divides Site 1 from the river, potentially acting as a barrier.	**Unlikely to Occur.** The site is located within a fragmented matrix of residential/urban development and is approximately 2.5 miles from the Columbia River with urban settings and major roadways as barriers between the two locations.	**Unlikely to Occur.** The site is not located within a wet prairie or along a stream or river that would provide suitable habitat for this species. Site 3 is approximately 3 miles from the Columbia River with urban settings and major roadways as barriers between the two locations.	**Unlikely to Occur.** The site is not located within a wet prairie and is located within a fragmented matrix of residential/urban development. Site 4 is approximately 3.25 miles from the Columbia River with urban settings and major roadways as barriers between the two locations.
Birds						
Marbled murrelet *Brachyramphus marmoratus*	FT	Marbled murrelets prefer coastal regions, foraging in bays and sounds and occasionally on rivers and lakes within 12 miles of the ocean (especially during breeding season), and nesting in old growth forests.	**Unlikely to Occur.** The site is not located near the coast and all rivers and streams are too far inland to be viable options for breeding grounds. The site also lacks suitable nesting habitat. No observations of the species have been documented near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site is not located near the coast and all rivers and streams are too far inland to be viable options for breeding grounds. The site also lacks suitable nesting habitat. No observations of the species have been documented near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site is not located near the coast and all rivers and streams are too far inland to be viable options for breeding grounds. The site also lacks suitable nesting habitat. No observations of the species have been documented near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site is not located near the coast and all rivers and streams are too far inland to be viable options for breeding grounds. The site also lacks suitable nesting habitat. No observations of the species have been documented near the site (eBird 2025; ORBIC 2025).
Northern spotted owl *Strix occidentalis caurina*	FT	Northern spotted owls occupy old growth forests (at least 150–200 years old) but sometimes occur in younger forests that include patches of old growth. Within this habitat, they prefer areas with moderate to high canopy closure, with a multilayered, multispecies canopy dominated by large overstory trees with cavities, broken tops, and other signs of decadence. The forest floor contains numerous large snags and substantial accumulations of logs and woody debris where there is considerable open space both within and beneath the canopy.	**Unlikely to Occur.** Old growth forest is not present near the site and there are no observations of the species near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** Old growth forest is not present near the site and there are no observations of the species near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** Old growth forest is not present near the site and there are no observations of the species near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** Old growth forest is not present near the site and there are no observations of the species near the site (eBird 2025; ORBIC 2025).
Streaked horned lark *Eremophila alpestris strigata*	FT	Streaked horned larks occupy large expanses of bare or thinly vegetated land free of visual obstructions, including fields, prairies, dunes, upper beaches, airports, and similar areas with low/sparse grassy vegetation.	**Unlikely to Occur.** The site does not contain expansive, sparsely vegetated habitat free of visual obstructions, which the species prefers. In addition, there are no observations of the species near the site with the closest observation approximately 15 miles south near the Heron Lake golf course in Portland (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site does not contain expansive, sparsely vegetated habitat free of visual obstructions, which the species prefers. In addition, there are no observations of the species near the site with the closest observation approximately 15 miles south near the Heron Lake golf course in Portland (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site does not contain expansive, sparsely vegetated habitat free of visual obstructions, which the species prefers. In addition, there are no observations of the species near the site with the closest observation approximately 15 miles south near the Heron Lake golf course in Portland (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site does not contain expansive, sparsely vegetated habitat free of visual obstructions, which the species prefers. In addition, there are no observations of the species near the site with the closest observation approximately 15 miles south near the Heron Lake golf course in Portland (eBird 2025; ORBIC 2025).
Yellow-billed cuckoo *Coccyzus americanus*	FT	Yellow-billed cuckoos occur in deciduous riparian woodland of 50 acres or more, especially those including dense stands of multistoried cottonwood and willow. Occasionally, they will also use mesquite and salt-cedar in some areas. They have not been found nesting in isolated patches (1–2 acres) or narrow, linear riparian habitats that are less than 33 to 66 feet wide.	**Unlikely to Occur.** The site does not contain dense riparian woodlands preferred by the yellow-billed cuckoo and forested areas are too patchy or narrow. There are no observations of the species near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site does not contain dense riparian woodlands preferred by the yellow-billed cuckoo and forested areas are too patchy or narrow. There are no observations of the species near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site does not contain dense riparian woodlands preferred by the yellow-billed cuckoo. There are no observations of the species near the site (eBird 2025; ORBIC 2025).	**Unlikely to Occur.** The site does not contain dense riparian woodlands preferred by the yellow-billed cuckoo and forested areas are too patchy or narrow. There are no observations of the species near the site (eBird 2025; ORBIC 2025).
Reptiles						
Northwestern Pond Turtle *Actinemys marmorata*	FPT	Northwestern pond turtles occupy aquatic habitats including a wide variety of permanent or semi-permanent bodies of water such as rivers, creeks, small lakes, ponds, and marshes. Populations can also exist in a variety of human-made or human-modified aquatic habitats in rural and urban settings including reservoirs, canals, cattle ponds, and sewage-treatment ponds. Preferred characteristics within a given water body generally involve deeper pools and sections with ample basking sites such as logs, rocks, or floating mats of vegetation. Nesting sites often have open canopies and can include sandy banks and bars along water bodies, or fields or sunny spots up to a few hundred meters from water.	**Unlikely to Occur.** Site 1 does not contain any aquatic features to support this species.	**May Occur.** Site 2 contains an intermittent riverine feature that could provide suitable habitat for this species.	**Unlikely to Occur.** Site 3 does not contain any aquatic features to support this species.	**May Occur.** contains an intermittent riverine feature that could provide suitable habitat for this species.

Species	ESA Status	Habitat Description	Site 1	Site 2	Site 3	Site 4
Fishes						
Lower Columbia River Chinook salmon *Oncorhynchus tshawytscha*	FT	Chinook salmon generally spend most of their lives in the ocean. For spawning, they migrate up to several hundred miles upstream to their natal stream, where eggs are deposited in gravel bottoms of large streams and rivers.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to the Columbia River; however, Chinook salmon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper best management practices (BMPs).	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to the Columbia River; however, Chinook salmon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.
Bull Trout *Salvelinus confluentus*	FT	Bull trout need cold water (where temperatures do not exceed 59 to 64 F°), require stable stream channels, clean spawning and rearing gravel, complex and diverse cover, and unblocked migratory corridors.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to the Columbia River; however, **bull trout** are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to the Columbia River; however, bull trout are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.
Columbia River Chum salmon *Oncorhynchus keta*	FT	Chum salmon generally spend most of their lives in the ocean. For spawning, they migrate several hundred miles upstream to their natal stream, where spawning occurs in gravel riffles.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to the Columbia River; however, chum salmon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to the Columbia River; however, chum salmon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.
Lower Columbia River Coho salmon *Oncorhynchus kisutch*	FT, SE	Adult coho salmon generally spend most of their lives in the ocean. Spawning occurs in coastal streams with canopy cover, in loose coarse gravel at heads of riffles. Young coho salmon spend up to 2 years in freshwater streams before migrating to the ocean.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to McNulty Creek, which is designated as critical habitat for coho. Coho salmon are not documented as occurring within this stream (StreamNet 2025). Site 2 is far enough away from McNulty Creek (approximately 0.7 mile) that any downstream impacts would not affect critical habitat with proper BMPs.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to McNulty Creek, which is designated as critical habitat for coho. Coho salmon are not documented as occurring within this stream (StreamNet 2025). Site 4 is far enough away from McNulty Creek (approximately 0.7 mile) that any downstream impacts would not affect critical habitat with proper BMPs.
Eulachon *Thaleichthys pacificus*	FT	Eulachon spend most of their lives in the ocean. Spawning occurs is coastal freshwater streams with bar and riffle habitat containing sand or pre-gravel, but will also they select silt, sand, gravel, cobble, or detritus bottoms.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to the Columbia River; however, eulachon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to the Columbia River; however, eulachon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.
Snake River Sockeye salmon *Oncorhynchus nerka*	FE	Most sockeye salmon spawn in or near lakes. Spawning can take place in lake tributaries, lake outlets, rivers between lakes, and on lake shorelines or beaches where suitable upwelling or intra-gravel flow is present.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to the Columbia River; however, sockeye salmon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to the Columbia River; however, sockeye salmon are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.
Lower Columbia River Steelhead *Oncorhynchus mykiss*	FT	Steelhead spend 1 to 3 years at sea and return to spawn at their natal streams at 4 to 5 years old.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 2 contains a mapped perennial stream that eventually flows to the Columbia River; however, steelhead are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are expected to be minimal due to the considerable distance from the Columbia River.	**Unlikely to Occur.** No aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Site 4 contains a mapped intermittent stream that eventually flows to the Columbia River; however, steelhead are not documented as occurring within this stream (StreamNet 2025). Downstream impacts are not expected due to the considerable distance from the Columbia River and use of proper BMPs.

Species	ESA Status	Habitat Description	Site 1	Site 2	Site 3	Site 4
Insects						
Monarch butterfly *Danaus plexippus*	FPT	Monarch butterfly breeding habitat consists of agricultural fields, pastureland, and other grassland habitat but is highly dependent on the presence of milkweed species (*Asclepias* spp.).	**May Occur.** Site 1 contains grassland and pasture habitat that could support flowering species such as milkweed.	**May Occur.** Site 2 contains overgrowth vegetation throughout the parcel that could support flowering species such as milkweed.	**Unlikely to Occur.** Site 3 is heavily wooded upland area that does not contain suitable habitat for this species.	**May Occur.** Site 4 contains open grasslands and pastures that could support flowering species such as milkweed.
Suckley's cuckoo bumble bee *Bombus suckleyi*	FPE	Suckley's cuckoo bumble bee occupies open grassy areas, urban parks and gardens, chaparral and shrub areas, and mountain meadows.	**May Occur.** Site 1 contains grassland, pasture, and shrubland habitat that could support this species.	**May Occur.** Site 2 contains open grassy areas that could support this species.	**Unlikely to Occur.** Site 3 is heavily wooded upland area that does not contain suitable habitat for this species	**May Occur.** Site 4 contain open grasslands and pastures that could support this species.
Plants						
Nelson's checkermallow *Sidalcea nelsoniana*	ST	Willamette Valley populations of Nelson's checkermallow are commonly found in open prairie remnants along stream margins, sloughs, ditches, roadsides, fence lines, drainage swales, and fallow fields. Occasionally, the species is also present in the understory or at the edges of ash woodlands and among woody shrubs. Soils at these sites range from gravelly, well-drained loams to poorly drained, hydric clays.	**Unlikely to Occur.** Site 1 does not contain open habitat suitable to support this species. Site 1 is a dry upland area with intermixed wooded, bare, and shrub covered patches.	**May Occur.** Site 2 contain a riverine and wetland feature that could potentially support this species. The species has not been previously documented within the site (ORBIC 2025).	**Unlikely to Occur.** Site 3 is heavily wooded upland area that does not contain suitable habitat for this species.	**Unlikely to Occur.** Site 4 does not contain habitat suitable to support this species. Site 4 is a dry upland area with agricultural pastures, developed areas, and woodlands.
Water howelia *Howellia aquatilis*	ST	Water howellia occurs in low-elevation ponds and marshes, where it is either submerged or floating along the surface of slow-moving or still water.	**Unlikely to Occur.** The site is outside of the range documented by ORBIC and no aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Aquatic features located within the parcel for this site are not suitable for this species. The species has not been previously documented within the site (ORBIC 2025).	**Unlikely to Occur.** The site is outside of the range documented by ORBIC and no aquatic features are located within the parcel for this site.	**Unlikely to Occur.** Aquatic features located within the parcel for this site are intermittent and not suitable for this species. The species has not been previously documented within the site (ORBIC 2025).

Source: eBird (2025), NatureServe (2025), ORBIC (2025).

Note: FT = federally threatened; St. = state threatened; FPT = federally proposed threatened; FPE = federally proposed endangered.

Green cells indicate species is unlikely to occur, whereas yellow cells indicate the species may occur.

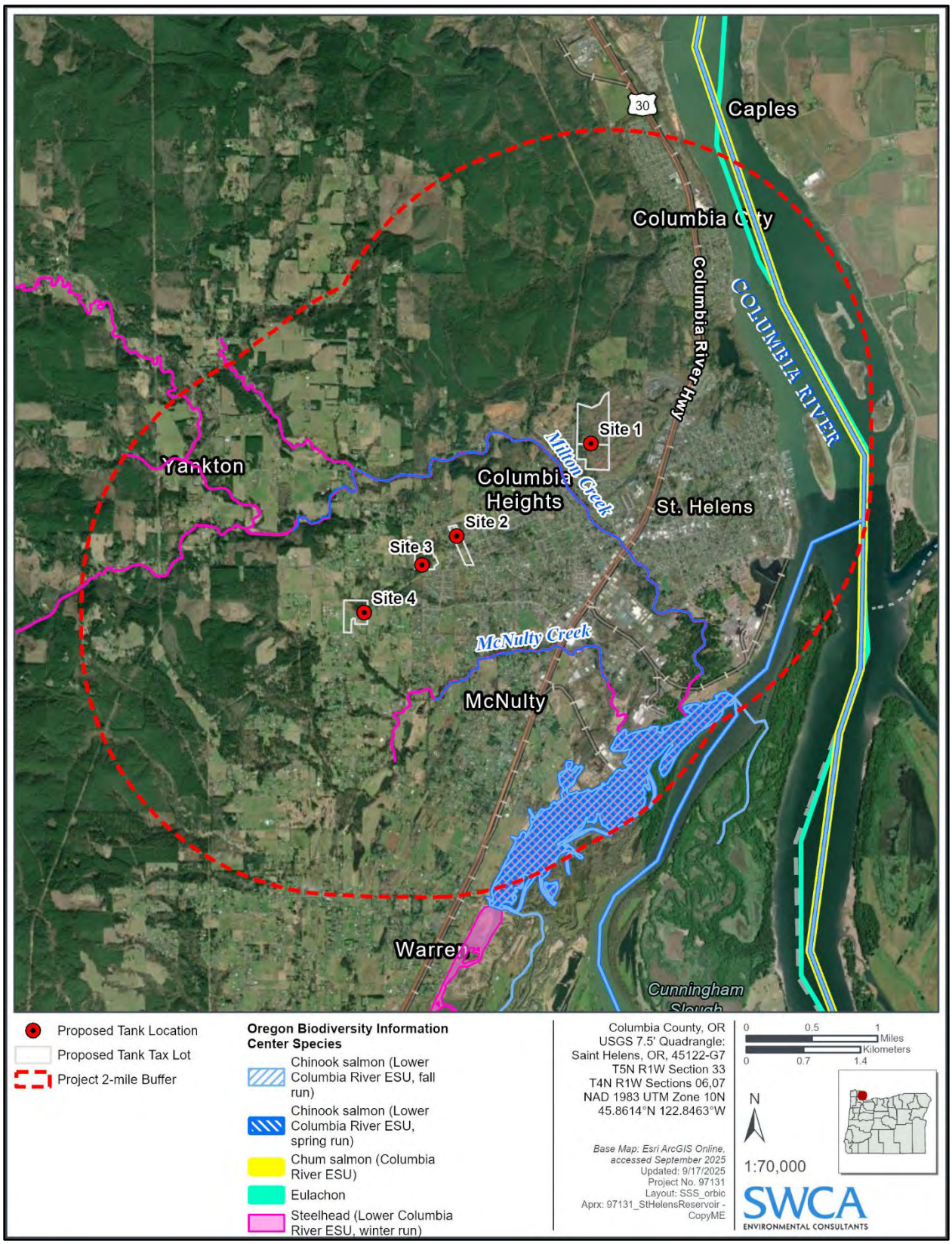

Figure 6. Special-status species data within 2 miles of sites.

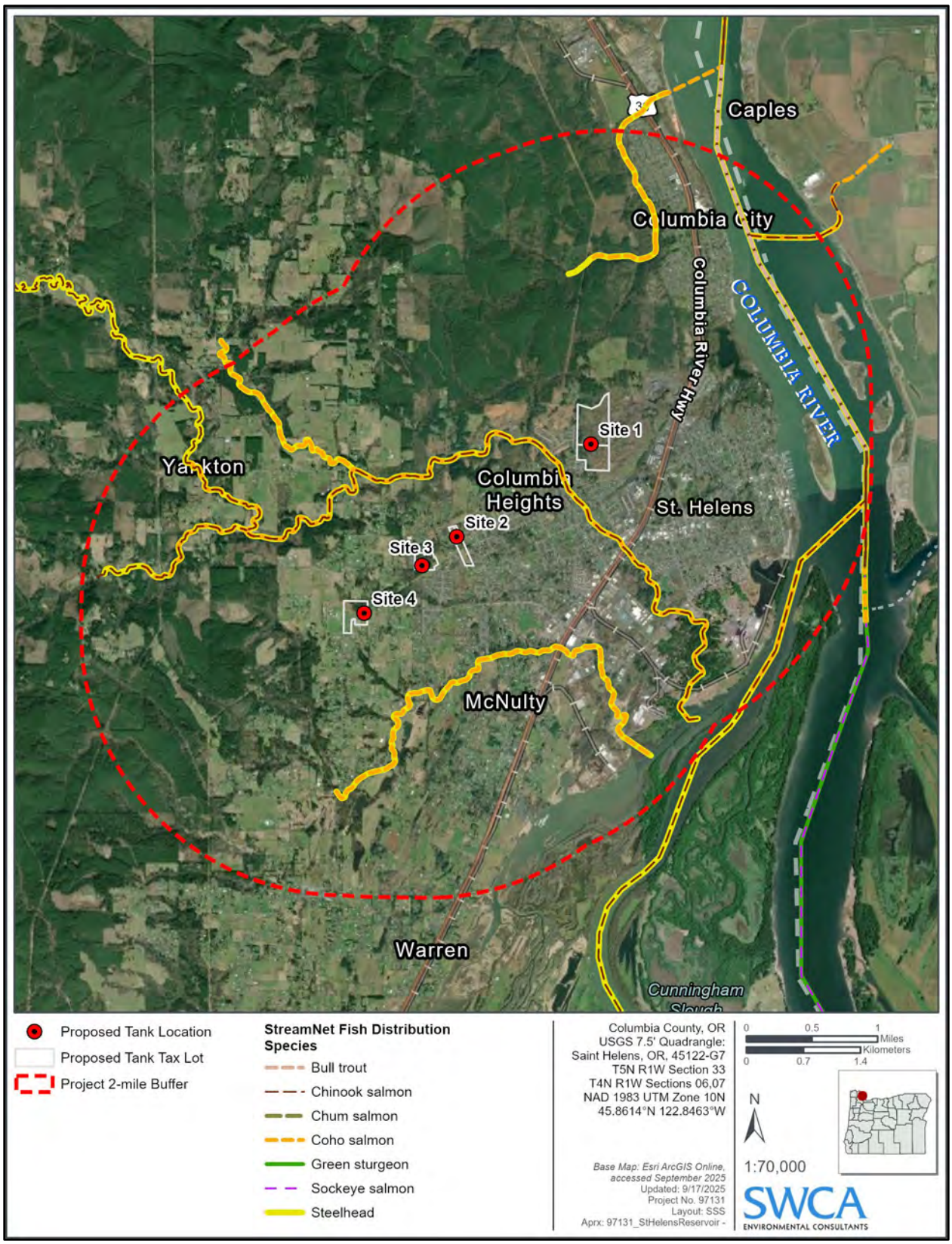

Figure 7. Fish distribution data within 2 miles of sites.

Bald and Golden Eagles

The bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) are protected under the BGEPA, which prohibits the take of eagles, including their parts, nests, or eggs (16 United States Code [USC] 668–668d).

Bald eagles prefer habitat with large trees near rivers, lakes, marshes, and other large bodies of water where fish are abundant. Suitable habitat for bald eagle is present along the Columbia River and Multnomah Channel area. Local sightings have occurred near McCormick Park where Milton Creek feeds into the Multnomah Channel; this area contains suitable nesting habitat and is approximately 1.5 to 2.5 miles from the proposed tank sites, with Site 1 being the closest. No bald or golden eagle nests have been documented at any of the sites, and the only documented nest within 2 miles of the tank sites is from 2003, and is located within 2 miles of Site 1. Studies have found that urban areas are no longer as much of a deterrent for nesting eagles as once believed, as bald eagles are becoming more "urbanized" and part of the human environment (Castle et al. 2023). Site 1 is the only location near the Columbia River with large trees to support nesting bald eagles.

Golden eagles prefer grassland or shrubland habitat for foraging and typically nests and breed in areas of mountain cliffs or canyons adjacent to open desert or grassland vegetation communities. During the winter, golden eagles forage in open or shrubland habitats. No suitable nesting habitat is located near the site locations, and no nests have been documented within 2 miles of the sites by ORBIC. However, there is potential for individuals to use the areas for foraging.

If construction is proposed within the eagle nesting season (January 1–August 15), SWCA recommends conducting a survey for eagle nests within 1 mile of the project area to identify potential nests and maintain compliance with the BGEPA and MBTA.

Migratory Birds

Fifteen bird species are listed as Birds of Conservation Concern (BCC) in the USFWS IPaC resource list for the tank sites (see Appendix A) (Table 7). BCC are nongame migratory birds in greatest need of conservation attention and those that are likely to become candidates for listing under the ESA without conservation actions. IPaC identified the same BCC species for Sites 1 through 4.

Table 7. BCC with Potential to Occur at All Site Locations

Species	Habitat Description
Black swift *Cypseloides niger*	Black swifts are an aerial species that forages over forests and in open areas. They nest behind or next to waterfalls and wet cliffs, on sea cliffs and in sea caves, and occasionally in limestone caves. Breeds June 15 to September 10
California gull *Larus californicus*	California gulls occupy a wide range of habitats, including seacoasts, bays, estuaries, mudflats, marshes, irrigated fields, lakes, ponds, urban areas, landfills, and agricultural lands. Nesting typically occurs inland on open sandy or gravelly substrates, often on islands or along lake and pond shorelines, where scattered grasses are present. Nests are built directly on the ground, with a preference for relatively open areas featuring irregular terrain near shorelines. Breeds March 1 to July 31
Cassin's finch *Haemorhous cassinii*	Cassin's finches prefer open montane coniferous forest and mixed woodlands at mid- to high elevations, typically between 6,00 and 10,000 feet above mean sea level, where it favors pine, spruce, and fir forests. Breeds May 15 to July 15

Species	Habitat Description
Chestnut-backed chickadee *Poecile rufescens rufescens*	Chestnut-back chickadees occupy coniferous and mixed forests, primarily Douglas-fir forests in humid regions, less frequently in pine forest, oak woodlands, pine-oak associated forests, and thickets. They nest in tree cavities usually less than 9 feet above the ground. Breeds March 1 to July 31
Clark's grebe *Aechmophorus clarkii*	Clark's grebes nest on edges of large freshwater lakes and marshes whose edges have emergent vegetation, such as reeds and rushes. Breeds June 1 to August 31
Evening grosbeak *Coccothraustes vespertinus*	Evening grosbeaks inhabit coniferous and mixed coniferous, deciduous, and second growth forests and uncommonly, parks. This species nests within deciduous or coniferous trees. Breeds May 15 to August 10
Lesser yellowlegs *Tringa flavipes*	Lesser yellowlegs use open or semi-open woodlands and wet meadows interspersed with marshes, bogs, and ponds. Breeds elsewhere
Olive-sided flycatcher *Contopus cooperi*	Olive-sided flycatchers are found in forest and woodland habitats: taiga, subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, spruce or tamarack bogs and other forested wetlands, and along the forested edges of lakes, ponds, and streams. Most nesting sites contain dead standing trees, which are used as singing and feeding perches. Nests are placed most often in conifers, on horizontal limbs. Breeds May 20 to August 31
Oregon vesper sparrow *Pooecetes gramineus affinis*	Oregon vesper sparrows are found in prairies and occasionally pastures. They nest on the ground in sparsely vegetated grasslands and savannas that include scattered trees or shrubs. Structural diversity is important as this species uses the taller perches for singing and open areas for foraging. Breeds April 21 to August 31
Red knot *Calidris canutus roselaari*	Red knots breed in areas of dry tundra, like hillsides with sparse vegetation. Outside of breeding season, they prefer intertidal marine habitats, primarily near coastal inlets, estuaries, and bays. Breeds elsewhere
Rufous hummingbird *Selasphorus rufus*	Rufous hummingbird breeding habitat includes coniferous forest, second growth forest, thickets, and brushy hillsides, with foraging extending into adjacent scrubby areas and meadows with abundant nectar flowers. Habitat is chiefly secondary succession communities and forest openings. Habitat in migration and winter includes open situations where flowers are present. Breeds April 15 to July 15
Short-billed dowitcher *Limnodromus griseus*	Short-billed dowitcher nest in grassy or mossy tundra and wet meadows, in muskeg. Outside of breeding, they prefer mudflats, estuaries, shallow marshes, pools, ponds, flooded fields and sandy beaches. Breeds June 1 to August 10
Western grebe *Aechmophorus occidentalis*	Western grebes nest on large freshwater lakes and marshes edged with reeds and rushes, less frequently along rivers. Nesting in tidal areas is unusual. On very large lakes, colonies may number in the hundreds of pairs. After the breeding season, many move first to lakes where they molt their wing feathers, becoming flightless during that period. Breeds June 1 to August 31
Western gull *Larus occidentalis*	Western gulls nest on rocky ledges or grassy slopes near beaches on offshore islands on relatively open areas with bare rock or low vegetation. Outside of breeding, they occupy the coastlines, sea, rocky shores and cliffs, bays, estuaries, beaches, garbage dumps. Breeds April 21 to August 25
Western screech-owl *Megascops kennicottii cardonensis*	Western screech-owls occupy woodlands, especially broadleaf and riparian woodlands, moist coniferous forest and woodlands on the northwestern coast. Typically found at lower elevations, they nest in natural tree cavities, abandoned woodpecker holes, or artificial nest boxes. Breeds March 1 to June 30

Source: Cornell Lab of Ornithology (2019), eBird (2025), NatureServe (2025), USFWS (2025a),

The MBTA prohibits incidental take of native birds. The USFWS maintains a list of all species protected by the MBTA (50 Code of Federal Regulations [CFR] 10.13) which includes more than 1,000 species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and

passerines and their parts, eggs, or nests (50 CFR 21.4). Take is defined by this regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). Relevant to construction and operations activities, destruction of inactive migratory bird nests (i.e., those without viable eggs or nestlings) is not prohibited, provided that no possession occurs, and no permit or other regulatory authorization is required. Destruction or alteration of bird habitat that does not result in the direct taking of birds, nests, or eggs is also not prohibited by the MBTA.

The legal and regulatory interpretations of the MBTA are currently aligned to prohibit incidental take consistent with judicial precedent. Construction and operation of the project will be subject to MBTA compliance prohibiting incidental take. SWCA recommends avoiding surface use, ground disturbance, vegetation clearing, and disruptive maintenance activities within the nesting season for migratory birds (generally anywhere from February 1 through August 31). If construction is proposed within the migratory bird nesting season, SWCA recommends conducting a pre-construction survey for migratory bird nests within the construction footprint to identify potential nests and maintain compliance with the MBTA. Consultation with ODFW is also recommended to determine the most appropriate nesting season window to avoid during construction, which can vary depending on the species present (see Table 7).

ARCHAEOLOGICAL, HISTORICAL, AND CULTURAL RESOURCES

In September 2025, SWCA conducted archival research to identify all known and potential cultural resources and previously conducted cultural resource investigations within a 1-mile radius of the four tank sites and their associated parcel boundaries (study area). Based on a review of the Oregon State Historic Preservation Office (SHPO) online records database, Oregon Archaeological Records Remote Access (OARRA), there are no previously recorded cultural resources within any of the sites and one previously conducted investigation has occurred within the study area for Sites 1 through 4 (SHPO 2025).

All of the tank sites are on the traditional land of Kalapuya Indigenous peoples, specifically the Santiam Tribe, incorporated today in the Confederated Tribes of Grand Ronde (Zenk 1990) as well as the territory of the Confederated Tribes of Siletz Indians and the Confederated Tribes of the Umatilla Indian Reservation. Consultation with these Tribal confederations is recommended. An inadvertent discovery plan will likely be required by the Tribes during construction and additional protection standards, such as Tribal monitoring during ground disturbance, may apply if cultural resources are discovered or deemed likely to be present in the footprint of construction.

Previously Conducted Cultural Resource Investigations

In total, five cultural resource investigations have been conducted within the study area for Sites 1 through 4 (Table 8) (SHPO 2025). Only one of these investigations overlaps or intersects with the tank sites. One of the five investigations has been conducted within the last 10 years. Four of the five total investigations included pedestrian survey in their methodologies, and one investigation included subsurface testing. One investigation consisted of desktop analysis alone (Ames et al. 1992).

Table 8. Previous Cultural Resource Investigations Within the Study Area

SHPO No.	Methodology	Report Title *Citation*	Conducted By	Intersects Tank Site(s)?
18254	Pedestrian survey	Letter: Sone Circle on Bluff NW of St. Helens *Pierce 2002*	–	No
20025	Desktop analysis	Archeological Context Statement – Portland Basin *Ames, Parchman, and Hickey 1992*	Portland State University	Yes (all)
22482	Pedestrian survey	A Cultural Resources Survey for the OR1 Yankton Cellular Communications Tower Site, Columbia County, Oregon *Stipe 2009*	Tetra Tech, Inc.	No
23638	Pedestrian survey, subsurface testing	A Cultural Resources Survey of the St. Johns-St. Helens Tap at Tower 21/6 *Oliver and Schmidt 2010*	Bonneville Power Administration	No
28134	Pedestrian survey	Cultural Resources Survey for the Ross District Priority Poles Replacement Project in Columbia, Multnomah, and Washington Counties, Oregon *Hennessey and Perkins 2016*	Bonneville Power Administration	No

Previously Recorded Cultural Resources

The OARRA database shows there are no previously recorded cultural resources within the tank sites themselves (i.e., parcel boundary) and a single resource, the Berdahl Site (35CO19), a lithic scatter composed of approximately 120 projectile points in a plowed field, is within 1 mile of Site 4 (SHPO 2025) (Table 9). The Oregon Historic Sites Database shows no historic properties within the study area for any of the sites (Oregon Historic Sites Database 2025).

Table 9. Previously Identified Cultural Resources within the Study Area

Resource No.	Type	Description	NRHP Eligibility	Intersects Tank Site(s)?
35CO19	Precontact	Berdahl Site lithic scatter	Unevaluated	No

Note: NRHP = National Register of Historic Places.

Historical Map Review

The cultural resources historical map review was designed to determine if any historic-era resources, features, or structures are in the tank sites or surrounding areas. The earliest General Land Office (GLO) map for Site 1 in 1862 shows it within the land claim of Francis A. Clement with no infrastructural development intersecting or adjacent to the site (GLO 1862). The earliest GLO map for Sites 2, 3, 4 from 1854 shows the surrounding region undeveloped with clay loam soil (GLO 1854), a later map from 1866 shows Site 2 within land claim of Francis Perry. Sites 3 and 4 are on undeveloped, unclaimed parcels (GLO 1866).

A historical topographic map from 1943 (USGS 1943) shows the area immediately adjacent to Site 1 is largely undeveloped. The modern-day road infrastructure is not visible in topographic maps until 2014 (USGS 2014). The topographic map from 1957 (USGS 1954) shows the areas surrounding Sites 2, 3, and 4 as sparsely developed with only Sykes Road to the south of Sites 2 and 3 visible. It is not until 2014 that

the residential neighborhoods around Sites 2 and 3 are present in their modern configuration (USGS 2014). The athletics compound and subsequent county fairgrounds adjacent to Site 4 are present in the 1990 and 2014 topographic maps respectively (USGS 1990, 2014)

Aerial imagery from 1951 shows agricultural fields occupying all the proposed sites and surrounding areas. By 1970 the residential community and associated roadway infrastructure immediately adjacent to Sites 2 and 3 begin to appear, and 1995 the athletics field adjacent to Site 4 is visible. By 2014 the project area appears as it does in its current configuration (NETEROnline 2025).

Summary: Archaeological, Historical, and Cultural Resources

SWCA anticipates that archaeological, historic, and cultural resources could require surveys, studies, and agency coordination as part of the overarching land use permitting process. The results of the background review indicate that none of the sites have been surveyed for cultural resources with only a regional desktop analysis having occurred across the four sites. There are no previously documented resources within any of the sites, and while some surveys have occurred within the surrounding area, those did not result in any cultural resources being located. While the potential sites and the surrounding area have not been extensively surveyed, the probability of identifying cultural resources is considered low to moderate-low.

The project setting of St. Helens, Oregon, is adjacent to the Columbia River and contains perennial streams, tributaries, and springs. Indigenous peoples may have used the project sites to access springs and perennial water sources if they were available during the precontact era or they may have used upland areas seasonally to procure game and other subsistence resources. Archaeological evidence from environmentally similar areas in the Columbia River Basin suggests that precontact lithic scatters and isolates may be encountered on the ground surface within the proposed tank sites. If these cultural resources are present, the extent of disturbances to them caused by natural erosional processes and historical and modern farming and transportation activities in the area is unknown. These processes may limit the potential for the presence of intact archaeological sites within the project parcels, but such sites may be present on the ground surface in upland areas and drainages. Therefore, the probability of identifying precontact cultural resources is considered moderate across all four tank sites.

If there is a federal- or state-level regulatory nexus, formal consultation with interested Tribal entities and SHPO under Section 106 of the National Historic Preservation Act (NHPA) is required and would be the responsibility of the lead federal agency charged with issuing the federal permit (see Section 10). The lead federal agency may require surveys and assessment of identified cultural resources and avoidance or mitigation measures for significant resources. This may also include an assessment of potential indirect effects (e.g., viewshed, auditory) of potentially National Register of Historic Places (NRHP)-eligible sites near project activities.

VISUAL IMPACTS AND AESTHETICS

As previously discussed in Section 2, all of the tank sites are surrounded by either residential or public (fairgrounds and sports fields) land uses which may experience visual and aesthetic impacts from the proposed development. Community input on visual aspects of the project would likely be solicited and considered as part of the City or County local land use permitting processes outlined in Section 3, and further summarized in Section 10.

Site 1 is less than 0.25 mile from a residential neighborhood and may be visible to some residents; however, views of the tank may be screened by intervening forested vegetation to some degree.

Site 2 is in an undeveloped lot with herbaceous cover and is surrounded by dense residential areas to the east and south, and more sparse residential areas to the west and north. The nearest residences are approximately 70 to 100 feet away from the proposed tank location. The tank would be most visible to immediately neighboring residences and may become less visible to residences further removed due to intervening infrastructure and vegetation.

Site 3 is situated in an undeveloped, but forested lot, surrounded by dense residential areas to the southeast, and sparse residential areas to the northwest. The nearest residences are approximately 200 to 300 feet away from the proposed tank location. The tank may be visible to some residents; however, views of the tank may be screened by intervening forested vegetation to some degree.

Site 4 is at the east end of the Columbia County Fairgrounds, which includes a baseball field approximately 80 feet south of the proposed tank location and a racing track approximately 400 feet west of the tank location. Sparse residential areas also are present, primarily to the east and south of the tank location. The closest residences are approximately 50 to 100 feet from the proposed tank location. The tank would be visible to nearby residents and viewers from the county fairgrounds, particularly from the immediately adjacent baseball field. Views from the north (including the racing track) would likely be obstructed to some degree by intervening vegetation.

Overall, Sites 2 and 4 are expected to result in greater visual impacts compared to Sites 1 and 3 as they appear less likely to be visible based on the presence of intervening vegetation and the distance between tanks and nearby residents.

HAZARDOUS MATERIALS

A review was conducted through ODEQ and the Environmental Protection Agency (EPA) to determine if hazardous materials sites are present within the tank sites.

The EPA manages the identification, investigation, and remediation of Superfund sites to protect human health and the environment. Superfund sites are polluted locations in the United States that require long-term cleanup of hazardous material contamination. No EPA Superfund sites are in Columbia County, therefore none are near the site parcels (EPA 2025).

Brownfield sites are properties where the presence or potential presence of hazardous substances, pollutants, or contaminants may complicate their expansion, redevelopment, or reuse. These sites are typically previously developed land, often industrial or commercial, that is not currently in use due to environmental concerns but has the potential for redevelopment after proper assessment and cleanup. There are five brownfield sites within the City of St. Helens, and none of them are within or near any of the sites (ODEQ 2025). One private landfill occurs approximately 0.8 miles west of Site 4. This site is classified by ODEQ as a cleanup site based on documented contamination of nearby surface and groundwater from landfill leachate; however, the site is not designated as a superfund or brownfield site and no remedial actions have been prescribed. This site is not expected to present any constraints for the potential development of Site 4.

Based on review of the Oregon State Fire Marshall's Hazardous Substance Incidents database, there are nine recorded incidents within a 0.5-mile buffer of the sites (Table 10). Given that these incidents did not occur within the sites themselves, they are not expected to impact or be impacted by the project.

Table 10. Hazardous Substance Incidents near the Tank Sites

Incident Description	Address	Incident Date	Distance to Site (miles) (Site No.)
Unknown chemical	795 Columbia River Hwy, St. Helens	5/4/99	0.45 (Site 1)
Carbon monoxide incident	325 Hankins Dr, St. Helens	5/25/25	0.22 (Site 1)
Gas leak (natural gas or liquid natural gas [LPG])	61 Shore Dr, St. Helens	5/4/25	0.33 (Site 1)
Gas leak (natural gas or LPG)	59351 Mountain View Dr, St. Helens	2/5/25	0.05 (Site 2)
HazMat release investigation with no HazMat	58848 Parkwood Dr, St. Helens	10/27/24	0.46 (Site 2)
Gas leak (natural gas or LPG)	58740 Noble Ct, St. Helens	7/27/24	0.27 (Site 3)
Gas leak (natural gas or LPG)	75 Shore Dr, St. Helens	7/17/24	0.42 (Site 1)
HazMat release investigation with no HazMat	59894 Suncrest Dr, St. Helens	5/19/24	0.43 (Site 1)
Gas leak (natural gas or LPG)	35630 Valley View Dr, St. Helens	1/18/24	0.15 (Site 1)

PERMIT MATRIX

Table 11 lists the relevant federal, state, and local permits or approvals that may be required for each of the tank sites, based on the initial assessment of environmental and land use constraints presented herein. Since the constraints identified in this report are based solely on desktop data sources, additional field data collection is needed to verify the accuracy of mapped data sources, and additional coordination with permitting authorities is also needed to confirm applicable permitting requirements. Thus, permit requirements for each site are categorized in terms of their likelihood to be triggered (low, moderate, or high) to reflect the tentative nature of these initial findings. A blank cell means the permit is not anticipated to be triggered for the site (pending field/agency verification). Though the potential for a permit to be triggered may be low, field-verification may be required to confirm the permit is not needed.

SUMMARY AND CONCLUSION

The environmental and land use constraints that were found to be present are summarized for each tank site below and in Table 12. The anticipated field surveys and studies that would be required to support the permitting efforts for each site are also listed in Table 12 in red text.

Site 1

The development of Site 1 would require standard land use permits and environmental due diligence efforts related to wildlife and habitat; however, the overall complexity of anticipated land use and environmental permitting and due diligence efforts is anticipated to be low due to the avoidance of aquatic resources and a lack of any federal nexus.

Site 1 is considered a permitted use in its underlying zoning designation and would require a combined zoning review and site design review by the Planning Commission. Of the four sites, Site 1 is the only site that is explicitly listed as a permitted use in its underlying zoning designation, which provides a level of certainty that the proposed use would be compatible with the surrounding land uses that other sites do not have.

Table 11. Anticipated Permits and Approvals for Tank Sites

Agency	Permit or Approval	Regulation	Permit or Compliance Trigger	Permit or Compliance Process	Potential to be Triggered			
					Site 1	Site 2	Site 3	Site 4
Federal								
USACE	Removal-Fill Permit (IP or NWP)	CWA Section 404	Discharges of dredged or fill material into WOTUS, including their adjacent wetlands.	Prior to application, conduct a survey of WOTUS (i.e., wetland and water delineation) for the proposed project footprint and request an approved jurisdictional determination to determine if a permit is required. A pre-application conference is recommended to obtain agency input and buy-off on the proposed permitting pathway prior to submittal of the application. If the project qualifies for a NWP (e.g. N WP 18, which applies to minor discharges <0.1 acres or < 25 cubic yards, or NWP 33 which applies to temporary construction, access, and dewatering activities), application submittal requirements include preconstruction notification and possibly a JPA. Timeline for review is approximately 60 days, with no opportunity for public comment. If the project requires an IP, application submittal requirements include a JPA, project drawings, an aquatic resources delineation report, and compensatory mitigation plan (if needed). USACE's review includes opportunities for public comment and a public hearing can be requested by members of the public. Timeline for review is a minimum of 120 days from receipt of a complete application. A CWA Section 401 WQC from ODEQ is required before permit can be issued.	–	Low	–	Moderate
USFWS	ESA Section 7 consultation	ESA Section 7	Actions that have a federal nexus (e.g., federal funding or federal permit) and may affect federally listed species or their critical habitat.	Prior to consultation, complete site-specific habitat assessments to determine whether the project has the potential to affect any federally listed ESA species. If the project is "likely to adversely affect" a species, formal consultation would be needed, which entails preparation of a biological assessment (higher level of effort) that analyzes the project's potential impacts on listed species. If USFWS concurs, they issue a biological opinion. Timeline for review is approximately 60 days after a complete application is submitted. If the project "may affect, but is not likely to adversely affect" species, informal consultation would be required, which entails preparation of a biological evaluation (lower level of effort). If USFWS concurs, they issue a Letter of Concurrence. Timeline for review is approximately 135 days after a complete application is submitted.	Low	Low	Low	Low
USFWS	BGEPA compliance	BGEPA	Projects that may result in the take of eagles, including their parts, nests, or eggs.	The compliance process is often self-directed and achieved by ensuring the avoidance of take by conducting pre-construction clearance surveys to confirm a lack of active eagle nest within 660 feet of construction activities. If needed, consultation regarding bald and golden eagles can be conducted during ESA Section 7 consultation. USFWS encourages development of an eagle conservation plan when incidental take may occur.	Low	–	–	–
USFWS	MBTA compliance	MBTA	Projects and activities that have the potential to result in take of migratory birds.	No permit; compliance only. A good faith effort to avoid and minimize impacts to migratory birds should be made by avoiding construction activities within the nesting season (generally February 1–August 31), and/or completion of pre-construction clearance surveys.	High	High	High	High
State								
DSL	Removal-Fill permit	ORS 196.795–196.910 Oregon Administrative Rule (OAR) 141-85	Removal of material from, or placement of fill in, waters of the state (50 cubic yards or greater), or any amount of removal/fill in state-designated Essential Salmonid Habitat.	Prior to application, conduct a wetland and water delineation for the proposed project footprint and request a jurisdictional determination to determine if a permit is required. Application submittal requirements include a JPA, project drawings, an aquatic resources delineation report, and compensatory mitigation plan (if needed). DSL's review includes opportunities for public comment. Timeline for review is approximately 120 days from receipt of a complete application.	–	Low	–	Moderate
ODEQ	CWA Section 401 WQC	CWA, 33 USC 1341 OAR 340-48	Discharge of fill material into or removal of substrate or sediment in WOTUS and waters of the state that also require a federal Removal-Fill Permit from the USACE.	A pre-application consultation is recommended for large, complex projects prior to application submittal. Application submittal requirements include a WQC application and stormwater management plan. Can be submitted to ODEQ concurrently with federal CWA Section 404 permit application submittal to USACE. USACE's public comment period for the CWA Section 404 permit would also apply to the associated CWA Section 401 WQC request. Timeline for review is similar to USACE's CWA Section 404 permit (minimum 120 days after a complete application is submitted).	–	Low	–	Moderate
ODEQ	1200-C Permit	ORS 468B.050	Construction Stormwater General Discharge Permit	Application submittal requirements include an application form, project narrative, land use compatibility statement, and an erosion and sediment control plan (ESCP) that identifies the BMPs that will be used during construction to prevent or minimize erosion and control sediment runoff from the site. Activities that disturb 5 or more acres will be subject to a 14-calendar day public review period. Timeline for review is not specified by ODEQ and generally depends on the complexity of the project and quality of the application materials (i.e., ESCP).	High	High	Low	High

Agency	Permit or Approval	Regulation	Permit or Compliance Trigger	Permit or Compliance Process	Potential to be Triggered			
					Site 1	Site 2	Site 3	Site 4
ODEQ	NPDES Permit	OAR 340-045	Discharges of pollutants into surface waters of the state.	Application submittal requirements include an application form, project narrative, and supporting studies that describe the type/method of discharge, and plans for treating and monitoring the water quality of the discharge. Timeline for review is not specified by ODEQ and generally depends on the complexity of the project and quality of the application materials (i.e., ESCP).	–	Moderate	–	Moderate
ODA	Listed Plant Permit or Consultation	ORS 564 OAR 603-73	Any land action on Oregon non-federal public lands which results in, or might result in, the taking of a threatened or endangered plant species.	Prior to consultation, complete site-specific surveys for listed plant species to verify presence/absence. If present, submit a survey report to ODA. ODA would review the report and provide comments within 90 days, including a determination on whether formal consultation or a permit is required. If consultation is required, an evaluation of potential impacts on listed plant species would be required. If a permit is required, submit application form and supporting documentation to ODA. ODA would review the application and request additional information as needed. Timeline for review is approximately 120 days from a complete application.	–	Moderate	–	–
SHPO	Section 106 Consultation/Concurrence	NHPA Section 106	Required if there are potential impacts to cultural and/or historical resources that are listed in or eligible for listing in the NRHP; consultation triggered by another federal discretionary action (e.g., USACE permit).	Prior to initiating consultation, complete records search, fieldwork, and cultural resources report. Lead federal agency would initiate and lead consultation efforts. Timeline for consultation would be included in the overall timeline for the lead federal agency permit, as issuance of the federal permit would be contingent on completion of NHPA Section 106 consultation obligations.	–	Low	–	Moderate
Local								
Columbia County	Zoning Review	CCZO Sections 500 and 1601	Development of “reservoirs and water impoundments” in the PF-80 zoning designation.	Application submittal requirements include application form, site plans (e.g., existing/proposed conditions, grading, landscape, architecture), and narrative (typically a burden of proof statement outlining how the proposed use meets applicable requirements of the code). Process would be combined with the site design review, which entails a mandatory pre-application conference followed by Planning Commission review and a public hearing. Timeline for review is not specified in code but is typically around 120 days after an application is deemed complete.	High	–	–	–
Columbia County	Determination of Similar Use (DSU)	CCZO Section 1000	Proposed uses in the CS-I zoning designation that are not explicitly permitted, but may qualify as “other uses found similar by the Planning Commission” .	Application must include a burden of proof narrative providing evidence of how the proposed use is similar to other uses permitted within the zone and is therefore in alignment with the purpose of the zone (CCZO 1001). Process would be combined with the site design review, which entails a mandatory pre-application conference followed by Planning Commission review and a public hearing. Timeline for review is not specified in code but is typically around 120 days after an application is deemed complete.	–	–	–	High
Columbia County	Type 2 Site Design Review	CCZO Section 1550	All new development of community or governmental uses which is not explicitly exempted.	Application submittal requirements include project narrative, site development plans (e.g., site layout, grading, landscape, architecture, access, etc.), impact assessment, and wetland mitigation plan (if applicable). Process entails a mandatory pre-application conference, followed by Planning Commission review and a public hearing. Timeline for review is not specified in code but is typically around 120 days after an application is deemed complete.	High	–	–	High
City of St. Helens	CUP	SHMC Sections 17.24; 17.32; and 17.100	Development of “major public facility” within the R7 zoning designation.	Application submittal requirements include application form, site plans (e.g., existing/proposed conditions, grading, landscape, architecture), and conditional use data and narrative (typically a burden of proof statement outlining the proposed use meets applicable requirements of the code). Process entails a mandatory pre-application conference, followed by Planning Commission review and a public hearing. Timeline for review is 120 days from receipt of a complete application.	–	High	High	–
City of St. Helens	Sensitive Land Permit	SHMC 17.44	Development (excluding those which are exempted) within significant wetlands, riparian corridors, and protective buffers, as defined under SHMC 17.40.	Application submittal requirements include a project narrative and impact analysis, burden of proof statement outlining how the project would comply with applicable standards in the SHMC, and detailed site plans and drawings. Mandatory pre-application conference, followed by review and approval by the Planning Director. Timeline for review is not specified in City code but is typically around 120 days after an application is deemed complete.	–	Low	–	–
City of St. Helens	Erosion Control and Sediment Prevention Permit	SHMC 18.36	Sites disturbing 5,000 square feet or greater, or sites disturbing 1,000 square feet that are within 50 feet of a water body or wetland.	Application submittal requirements include an application form, site plans, and an ESCP that identifies the BMPs that will be used during construction to prevent or minimize erosion and control sediment runoff from the site. Timeline for review is not specified in the City code.	–	High	High	–

Table 12. Summary of Environmental Siting Constraints at Tank Sites

Constraint	Site 1	Site 2	Site 3	Site 4
Land Ownership	Private	Private	Private	Public – County
Zoning	Columbia County PF-80: requires review by the Planning Director and site design review by the Planning Commission, including pre-application conference, and public hearing.	City of St. Helens R7: requires CUP review by the Planning Commission and site design review by the Planning Commission, including pre-application conference, and public hearing. Sensitive Lands Permit may also apply due to riparian zone impacts.	City of St. Helens R7: requires CUP review by the Planning Commission and site design review by the Planning Commission, including pre-application conference, and public hearing.	Columbia County CS-I: requires either a CUP or zoning variance, as well as site design review, all of which are reviewed by the Planning Commission, including pre-application conference, and public hearing. If needed, a zoning variance would require a strong rationale for the need, public interest, and compatibility of the project with surrounding uses and the comprehensive plan.
ODFW Habitat Categories	Estimated as Category 5 (1:1 mitigation ratio) Habitat assessment required	Estimated as categories 3, 5 (1:1 mitigation ratio) and Category 6 (minimize impacts) Habitat assessment required	Estimated as Categories 5 (1:1 mitigation ratio) and 6 (minimize impacts) Habitat assessment required	Estimated as Category 3 (1:1 mitigation ratio) and Category 6 (minimize impacts). Habitat assessment required.
Special-Status Species	3 species may occur Habitat for bald eagles Habitat assessment and nest survey required	4 species may occur Habitat assessment and sensitive plant survey required	0 species may occur	3 species may occur. Habitat assessment required.
Aquatic Resources	None	Tax lot contains 0.61 acre of wetlands and 317 linear feet of perennial stream, which may be avoidable, and 2.04 acres of upland protective buffers, a portion of which is likely to be impacted by the overflow path only Wetland/water delineation required. Potential permits for overflow path include a Sensitive Lands Permit (City) and an NPDES permit (ODEQ) for operational discharge.	None	Tax lot contains 0.36 acre of wetlands and 1,056 linear feet of intermittent stream, which may be avoidable, and an estimated 2 acres or less of upland protective buffers, a portion of which is likely to be impacted by the overflow path. Wetland/water delineation required. Potential permits for overflow path include riparian development permit (County) and an NPDES permit (ODEQ) for operational discharge.
Cultural Resources	No previously recorded cultural resources Probability of identifying cultural resources: low to moderate-low	No previously recorded cultural resources Probability of identifying cultural resources: low to moderate-low	No previously recorded cultural resources Probability of identifying cultural resources: low to moderate-low	No previously recorded cultural resources. Probability of identifying cultural resources: low to moderate-low.

Constraint	Site 1	Site 2	Site 3	Site 4
Visual Impacts	<0.25 mile from a residential neighborhood Existing vegetation could partially screen tank	70 to 100 feet from residences	200 to 300 feet from residences Existing vegetation could partially screen tank	50 to 100 feet from residences. Within viewshed of county fairgrounds, and visible from the adjacent baseball field.
Potential for Encountering Hazardous Materials	Low	Low	Low	Low.
Permitting Requirements	Low likelihood for 2 permits High likelihood for 4 permits	Low likelihood for 6 permits Moderate likelihood for 2 permits High likelihood for 4 permits	Low likelihood for 2 permits High likelihood for 3 permits	Low likelihood for 1 permit. Moderate likelihood for 5 permits. High likelihood for 4 permits.

Site 1 contains potentially suitable habitat for three ESA species (Columbia white-tailed deer, monarch butterfly, and Suckley's cuckoo bumble bee), several MBTA species, and one BGEPA species (bald eagle). Given the previously disturbed site conditions, most species are not anticipated to have a strong association with habitat on-site, and it is reasonable to assume that the need for incidental take permits under the ESA, MBTA, and BGEPA can be avoided through the completion of a site-specific habitat survey, designing the project to avoid sensitive habitat, and incorporation of wildlife-related BMPs (e.g., avoiding vegetation removal during nesting season). Some coordination with wildlife agencies at the state or federal level may be needed regarding special-status species.

In this initial constraints analysis, SWCA did not identify fatal flaws for Site 1. Siting and project layout will be important components of project planning and mitigating any resource issues described in this document.

Site 2

The development of Site 2 would require standard land use permits and environmental due diligence efforts related to aquatic resources, wildlife, and habitat. The overall complexity of anticipated land use and environmental permitting and due diligence efforts has the potential to be moderate due to presence of aquatic resources and the corresponding potential for a federal nexus.

The use of Site 2 as a tank site would be considered a conditional use per the City zoning designation and would require a CUP from the City involving a quasi-judicial review by the Planning Commission. Because the proposed use would be considered a conditional use per City zoning designation, Site 2 (and Site 3) may be subject to greater conditions of approval relative to Site 1. The conditional use is explicitly allowed in its designated zone, but would have less uncertainty in its compatibility with surrounding uses relative to Site 4, which may or may not be allowed in its underlying zoning designation.

Site 2 contains documented wetlands, waters, and associated protective upland buffers (covering approximately 22% of the total parcel acreage), which could either be avoided through project design, or if impacts are unavoidable, would trigger the need for removal-fill permits from local, state, and/or federal agencies. Formal wetland and water delineations are needed to determine the jurisdictional status of features and to facilitate the micro-siting of project components outside of these features and their regulated buffers, to the maximum extent possible. If impacts to wetlands and waters are unavoidable, but are minor (i.e., less than 0.1 to 0.5 acre or less than 50 cubic yards), the project may qualify for an NWP from USACE, and may also be exempt from DSL permit requirements. However, if impacts exceed NWP and DSL thresholds, the level of permitting needs from USACE, DSL, and ODEQ would greatly increase. Any permit from USACE would also create a federal nexus for the project, which could require consultation under Section 106 of the NHPA, unless effects to historic resources are dismissed through site-specific analysis and reporting. In either impact scenario (minor or not minor) coordination with the City would also be needed regarding sensitive land regulations and associated permitting requirements (SHMC 17.40 and 17.44). If unavoidable impacts are confined to upland buffers only (i.e., where the proposed overflow path is located) the City would require a sensitive lands permit for development in the buffer; however, removal-fill permits from USACE and DSL would not likely be required. Further, the site's proposed overflow discharge into a surface water may require an NPDES permit from ODEQ to ensure compliance with relevant water quality standards for the receiving water. The need for an NPDES permit would depend on the makeup of the discharge and whether it constitutes a "pollutant" per ODEQ's definition. For reservoirs specifically, water may need to be de-chlorinated prior to discharge to meet state water quality standards.

Site 2 contains potentially suitable habitat for three federal ESA species (northwestern pond turtle, monarch butterfly, and Suckley's cuckoo bumble bee), one state ESA species (Nelson's checkermallow),

and several MBTA species. Given the previously disturbed site conditions, most species are not anticipated to have a strong association with site habitats, and it is reasonable to assume that the need for incidental take permits under the ESA and MBTA can be avoided through the completion of a site-specific habitat survey, designing the project to avoid sensitive habitat, and incorporation of wildlife-related BMPs (e.g., avoiding vegetation removal during nesting season). Some coordination with wildlife and plant agencies at the state or federal level may be needed regarding special-status species.

In this initial constraints analysis, SWCA did not identify fatal flaws for Site 2. Siting and project layout will be important components of project planning and mitigating any resource issues described in this document.

Site 3

The development of Site 3 would require standard land use permits and environmental due diligence efforts related to wildlife and habitat; however, the overall complexity of anticipated land use and environmental permitting and due diligence efforts is anticipated to be low due to the avoidance of aquatic resources and a lack of any federal nexus.

The use of Site 3 as a tank site would be a conditional use per the City zoning designation and would require a CUP from the City involving a quasi-judicial review by the Planning Commission. Because the proposed use would be considered a conditional use per the City zoning designation, Site 3 (and Site 2) may be subject to greater conditions of approval relative to Site 1. The conditional use is explicitly allowed in its designated zone, but would have less uncertainty in its compatibility with surrounding uses relative to Site 4, which may or may not be allowed in its underlying zoning designation.

Site 3 contains potentially suitable habitat for several MBTA species, but lacks suitable habitat for ESA species. It is reasonable to assume that the need for incidental take permits under the MBTA can be avoided through the completion of a site-specific habitat survey, designing the project to avoid sensitive habitat, and incorporation of wildlife-related BMPs (e.g., avoiding vegetation removal during nesting season). Some coordination with wildlife agencies at the state or federal level may be needed regarding special-status species.

In this initial constraints analysis, SWCA did not identify fatal flaws for Site 3. Siting and project layout will be important components of project planning and mitigating any resource issues described in this document.

Site 4

Because Site 4 is not explicitly permitted in its underlying zoning designation, the development of Site 4 would require a DSU from the Planning Commission, which would involve a greater level of effort and uncertainty compared to other sites. Although the site's environmental due diligence efforts related to aquatic resources, wildlife, and habitat would be standard, the overall complexity of anticipated land use and environmental permitting and due diligence efforts has the potential to be high due to uncertainty surrounding land use compatibility as well as the presence of aquatic resources and the corresponding potential for a federal nexus.

The development of Site 4 would require a combined DSU and site design review by the Planning Commission. For the DSU, the burden falls upon the applicant to provide evidence that the proposed use is similar to other uses permitted within the zone and is therefore compatible and in alignment with the purpose of the zone.

Site 4 contains documented wetland and waters (covering approximately 1.6% of the total parcel averages), plus an estimated 2 acres or less of upland buffers, which could either be avoided through project design, or if impacts are unavoidable, would trigger the need for removal-fill permits from local, state, and/or federal agencies. Formal wetland and water delineations are needed to determine the jurisdictional status of features and to facilitate the micro-siting of project components outside of these features and their regulated buffers to the maximum extent possible. If impacts to wetlands and waters are unavoidable, but are minor (i.e., less than 0.1 to 0.5 acre or less than 50 cubic yards), the project may qualify for an NWP from USACE, and may also be exempt from DSL permit requirements. However, if impacts exceed NWP and DSL thresholds, the level of permitting needs from USACE, DSL, and ODEQ would greatly increase. Any permit from USACE would also create a federal nexus for the project, which could require consultation under Section 106 of the NHPA, unless effects to historic resources are dismissed through site-specific analysis and reporting. In either impact scenario (minor or not minor) coordination with the City would also be needed to determine if sensitive land regulations and associated permitting requirements (SHMC 17.40 and 17.44) apply to the project. If unavoidable impacts are confined to upland buffers only (i.e., where the proposed overflow path is located) the County may require a permit for development in the riparian zone; however, removal-fill permits from USACE and DSL would not likely be required. Further, the site's proposed overflow discharge into a surface water may require an NPDES permit from ODEQ to ensure compliance with relevant water quality standards for the receiving water. The need for an NPDES permit would depend on the makeup of the discharge and whether it constitutes a "pollutant" per ODEQ's definition. For reservoirs specifically, water may need to be de-chlorinated prior to discharge to meet state water quality standards.

Site 4 contains potentially suitable habitat for three ESA species (northwestern pond turtle, monarch butterfly, and Suckley's cuckoo bumble bee), and several MBTA species. Given the previously disturbed site conditions, most species are not anticipated to have a strong association with site habitats, and it is reasonable to assume that the need for incidental take permits under the ESA and MBTA can be avoided through the completion of a site-specific habitat survey, designing the project to avoid sensitive habitat, and incorporation of wildlife-related BMPs (e.g., avoiding vegetation removal during nesting season). Some coordination with wildlife agencies at the state or federal level may be needed regarding special-status species.

Based on this initial constraints analysis, the requirement for a DSU at Site 4 would increase the complexity of the permitting pathway, but would not be a fatal flaw. Additionally, siting and project layout will be important components of project planning and mitigating any resource issues described in this document.

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APPENDIX A

Aerial Imagery

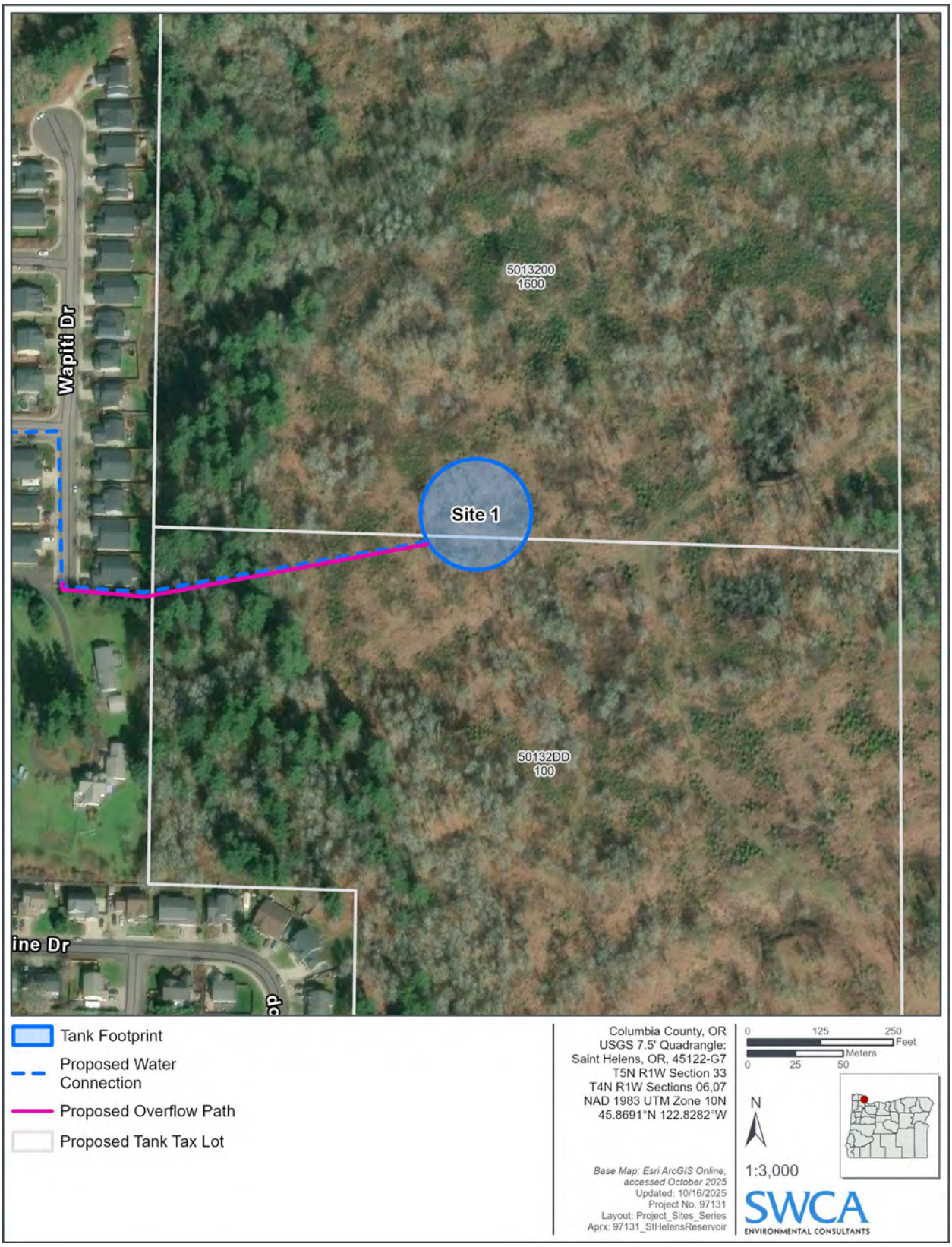

Figure A-1. Aerial imagery showing Site 1.

Figure A-2. Aerial imagery showing Site 2.

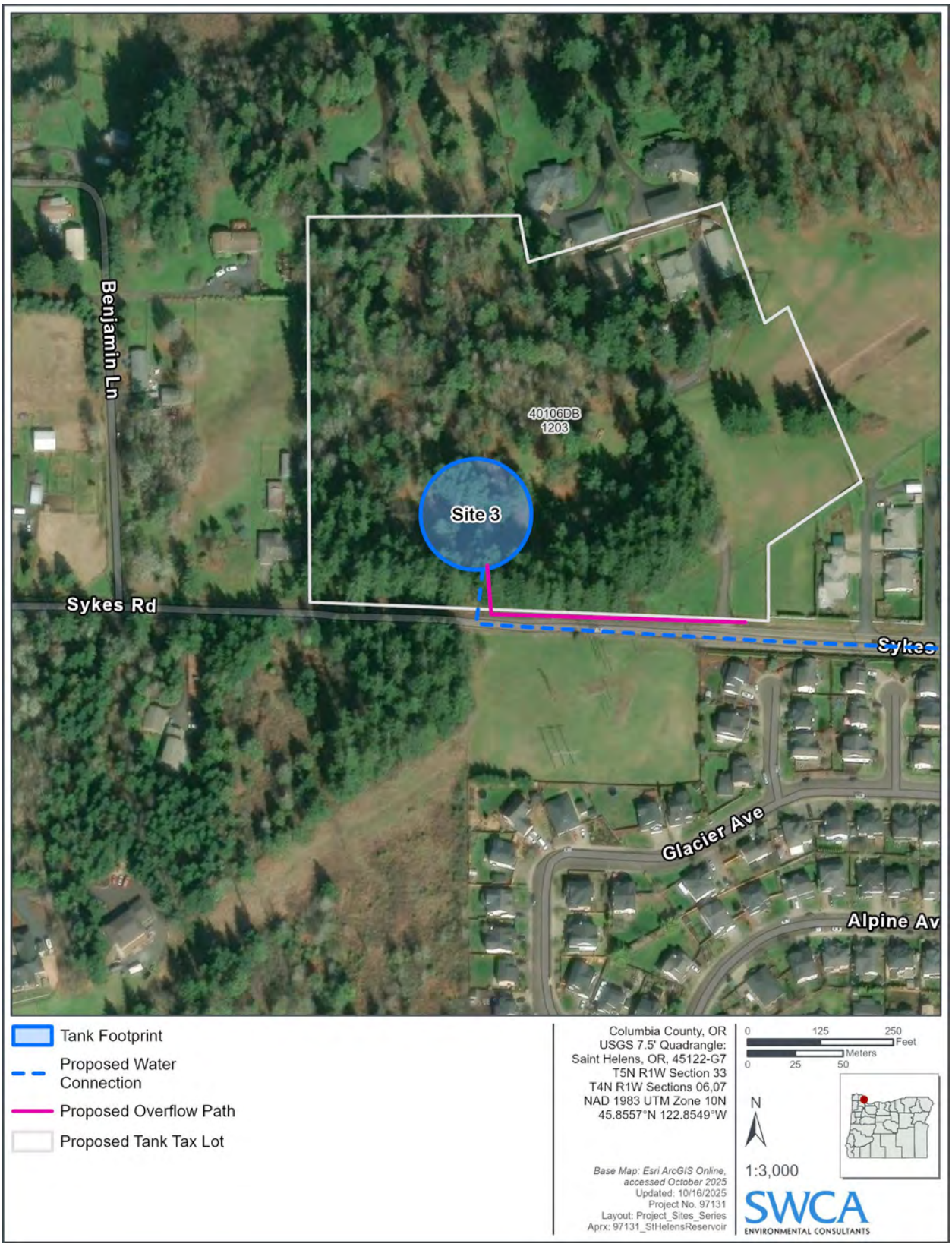

Figure A-3. Aerial imagery showing Site 3.

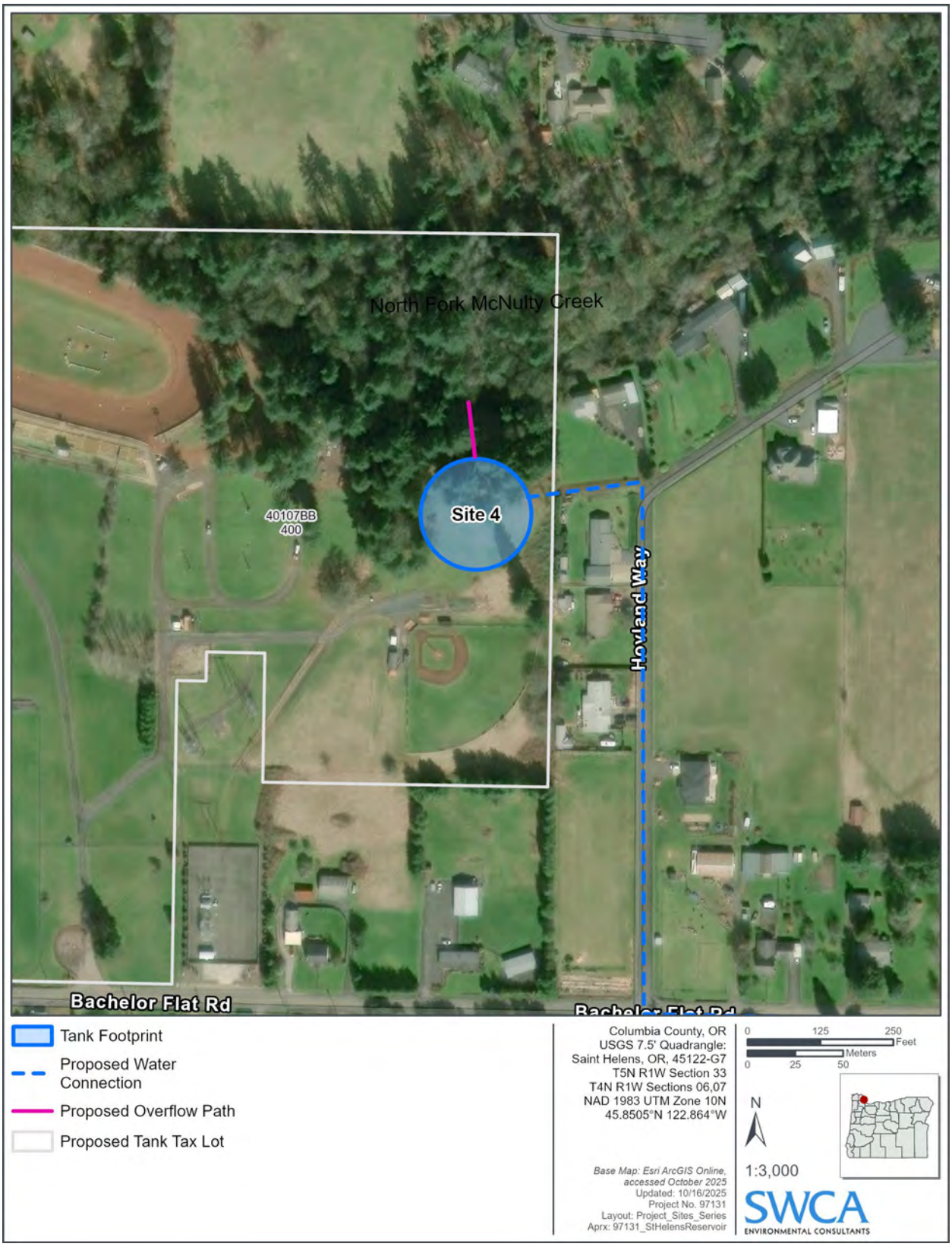

Figure A-4. Aerial imagery showing Site 4.

APPENDIX B

Information for Planning and Consultation Resource List

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Columbia County, Oregon

Local office

Oregon Fish And Wildlife Office

(503) 231-6179
(503) 231-6195

2600 Southeast 98th Avenue, Suite 100

Portland, OR 97266-1398

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened
Northern Spotted Owl Strix occidentalis caurina Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/1123	Threatened
Streaked Horned Lark Eremophila alpestris strigata Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/7268	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Northwestern Pond Turtle Actinemys marmorata Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1111	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

Suckley's Cuckoo Bumble Bee Bombus suckleyi Proposed Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/10885

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts

For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and

minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete

If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Mar 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

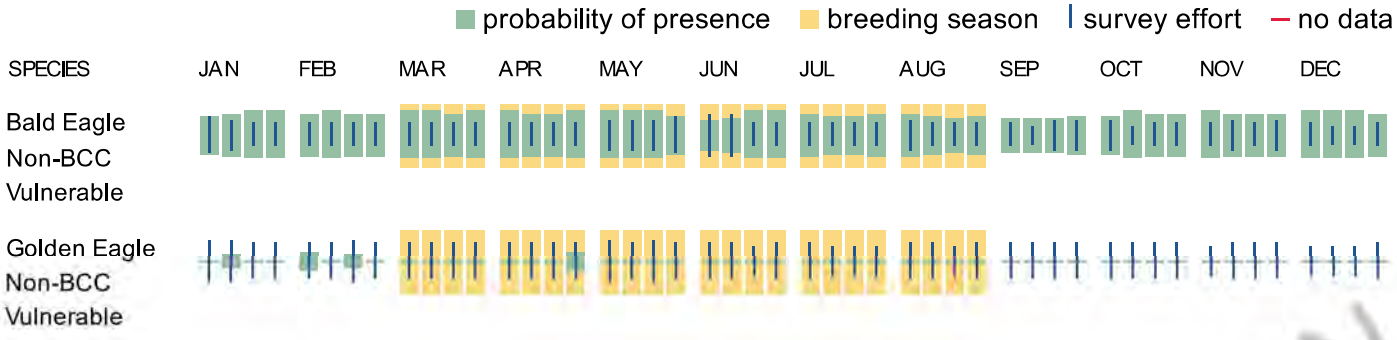
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds

- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31
Black Swift Cypseloides niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8878	Breeds Jun 15 to Sep 10
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31

Cassin's Finch Haemorhous cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Chestnut-backed Chickadee Poecile rufescens rufescens — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Clark's Grebe Aechmophorus clarkii — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Evening Grosbeak Coccothraustes vespertinus — Breeds May 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Golden Eagle Aquila chrysaetos — Breeds Mar 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Oregon Vesper Sparrow Pooecetes gramineus affinis — Breeds Apr 21 to Aug 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/5141

Red Knot Calidris canutus roselaari — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8880

Rufous Hummingbird Selasphorus rufus — Breeds Apr 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Short-billed Dowitcher Limnodromus griseus — Breeds Jun 1 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Western Gull Larus occidentalis — Breeds Apr 21 to Aug 25
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Western Screech-owl Megascops kennicottii cardonensis — Breeds Mar 1 to Jun 30
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

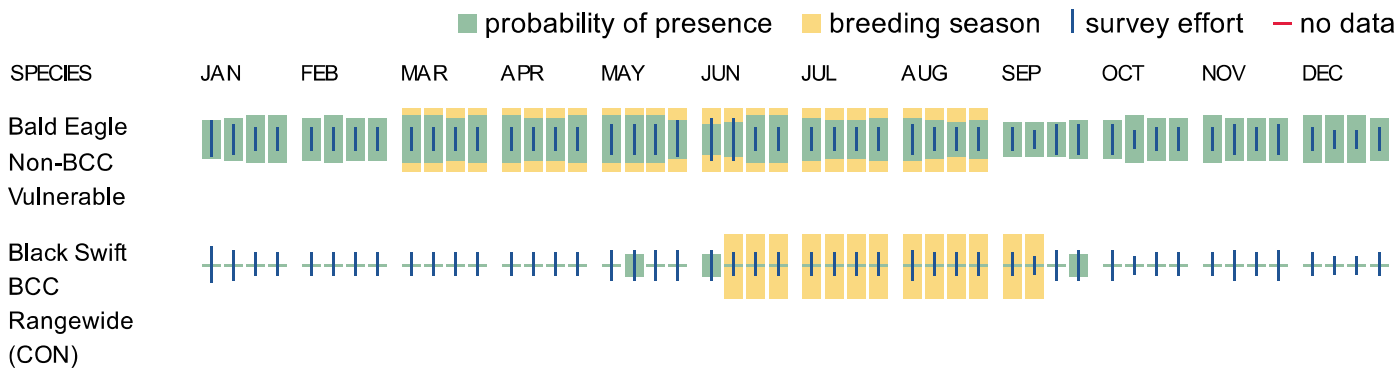
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

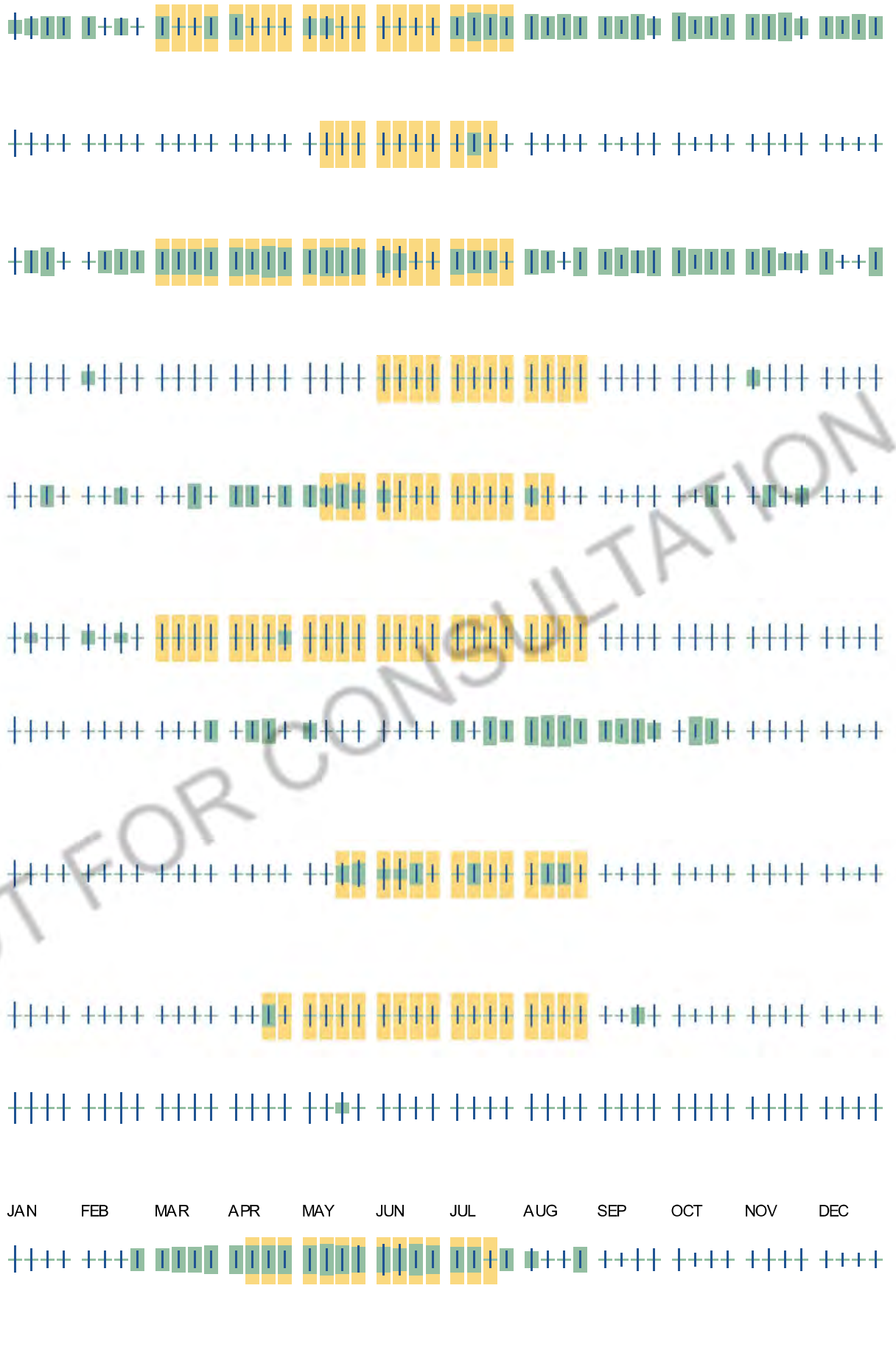
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

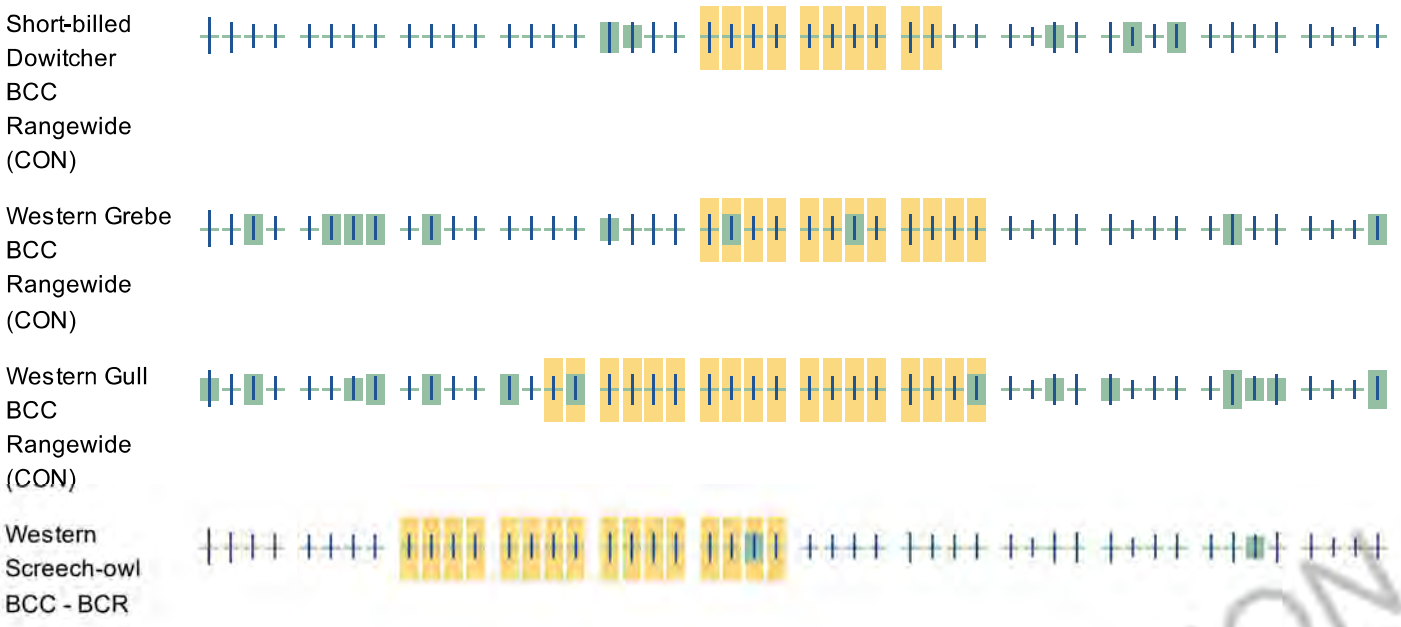
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.







Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as "Vulnerable". See the FAQ "What are the levels of concern for migratory birds?" for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ "Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs
Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Columbia County, Oregon

Local office

Oregon Fish And Wildlife Office

(503) 231-6179
(503) 231-6195

2600 Southeast 98th Avenue, Suite 100

Portland, OR 97266-1398

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened
Northern Spotted Owl Strix occidentalis caurina Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/1123	Threatened
Streaked Horned Lark Eremophila alpestris strigata Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/7268	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Northwestern Pond Turtle Actinemys marmorata Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1111	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

Suckley's Cuckoo Bumble Bee Bombus suckleyi Proposed Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/10885

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts

For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and

minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete

If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Mar 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

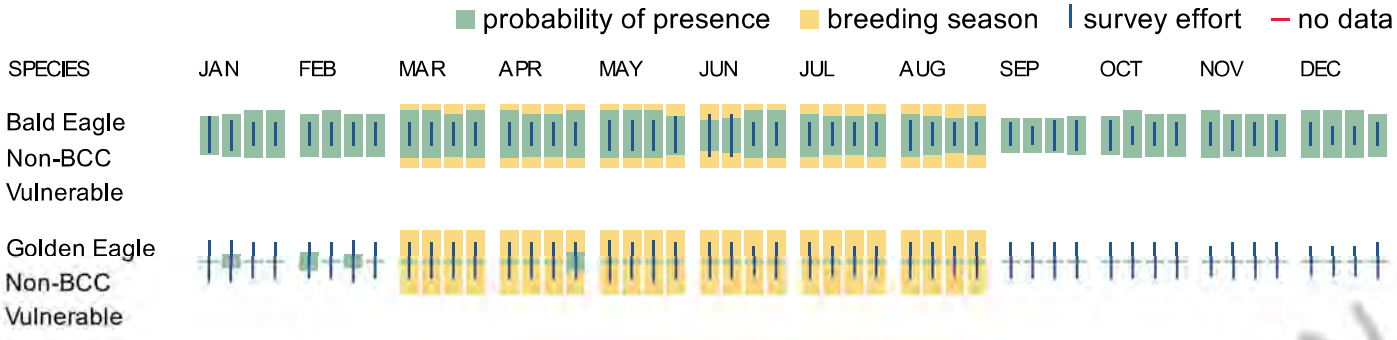
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds

- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31
Black Swift Cypseloides niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8878	Breeds Jun 15 to Sep 10
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31

Cassin's Finch Haemorhous cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Chestnut-backed Chickadee Poecile rufescens rufescens — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Clark's Grebe Aechmophorus clarkii — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Evening Grosbeak Coccothraustes vespertinus — Breeds May 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Golden Eagle Aquila chrysaetos — Breeds Mar 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Oregon Vesper Sparrow Pooecetes gramineus affinis — Breeds Apr 21 to Aug 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/5141

Red Knot Calidris canutus roselaari — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8880

Rufous Hummingbird Selasphorus rufus — Breeds Apr 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Short-billed Dowitcher Limnodromus griseus — Breeds Jun 1 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Western Gull Larus occidentalis — Breeds Apr 21 to Aug 25
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Western Screech-owl Megascops kennicottii cardonensis — Breeds Mar 1 to Jun 30
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ( )

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

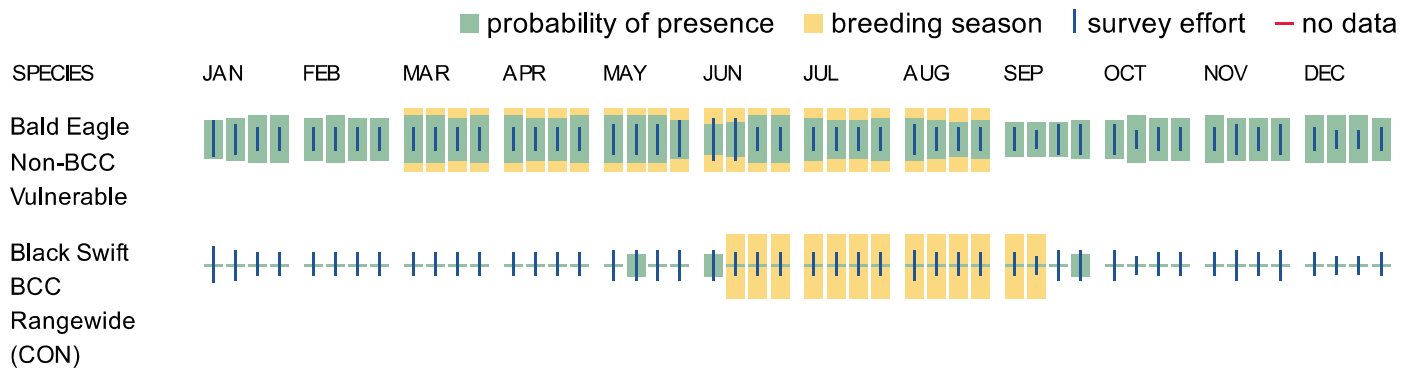
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

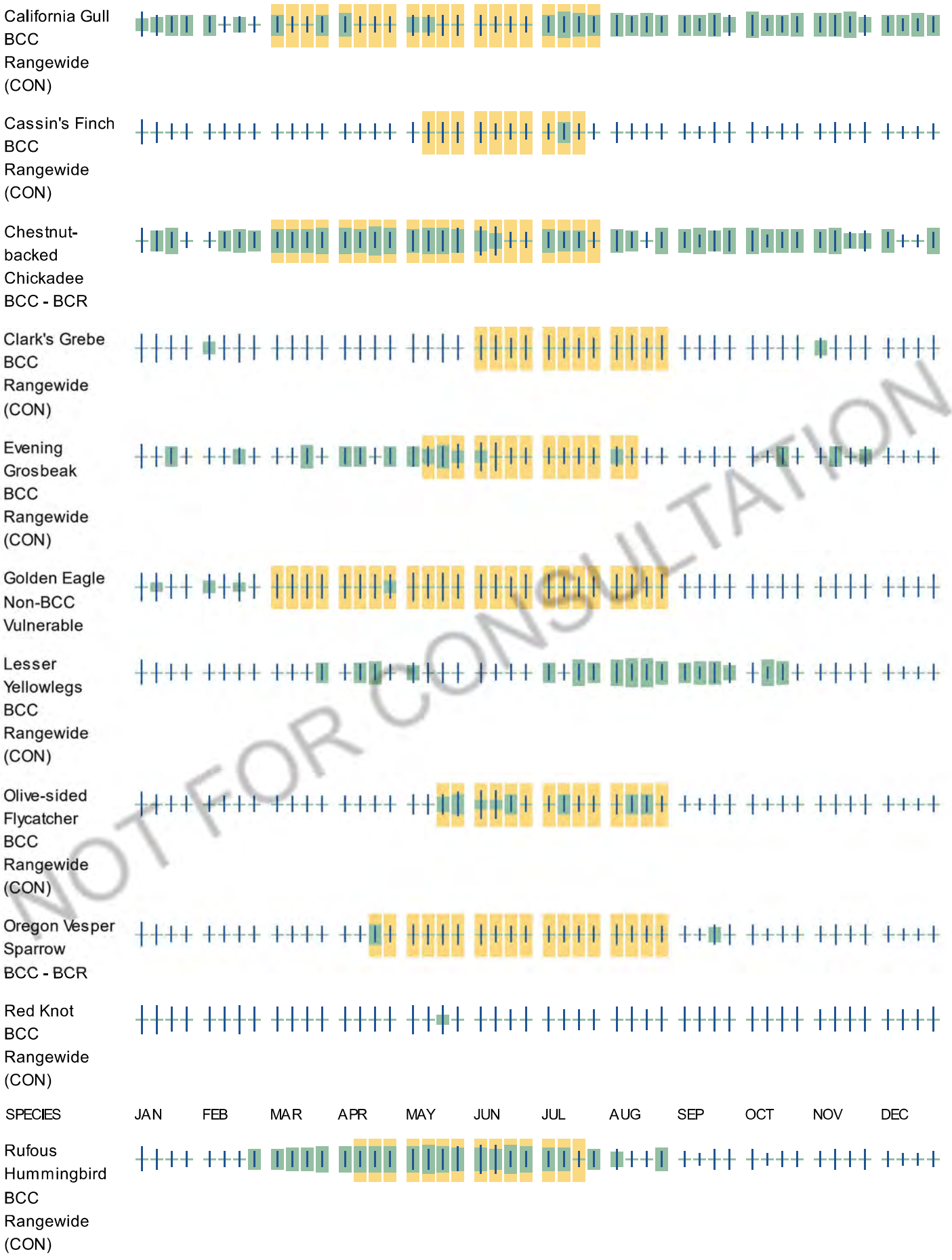
No Data (–)

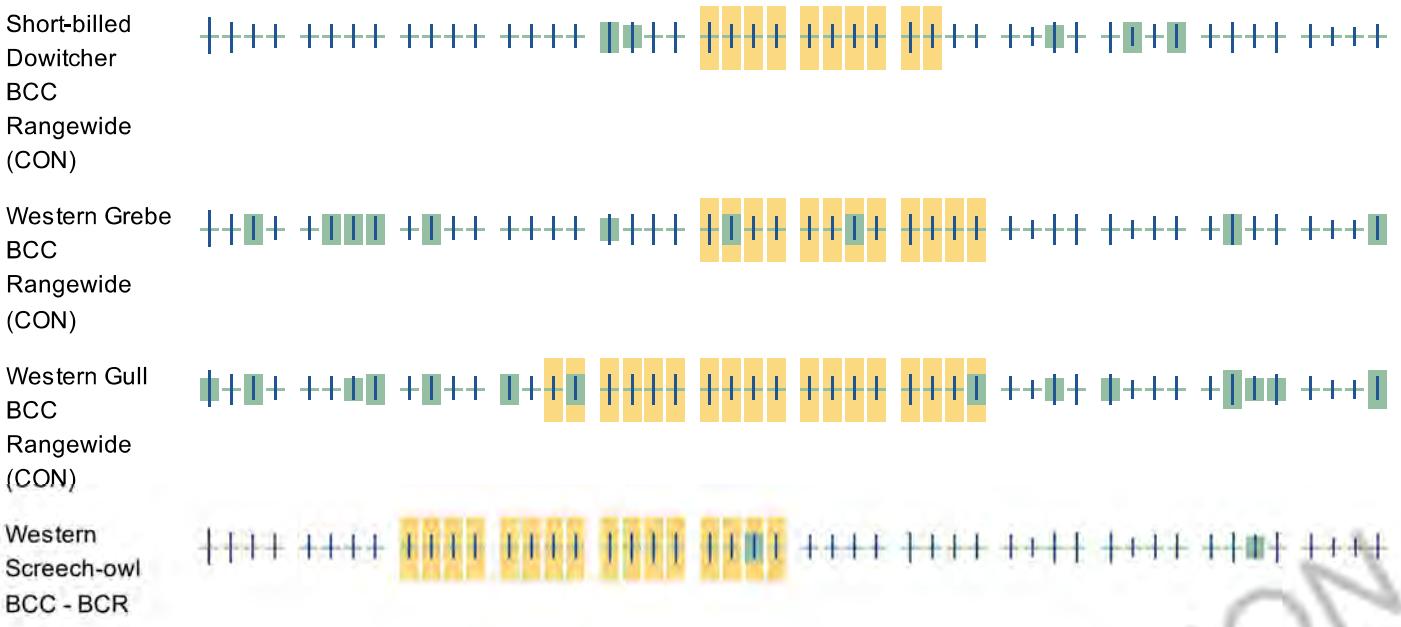
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.







Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as "Vulnerable". See the FAQ "What are the levels of concern for migratory birds?" for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ "Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs
Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE

R4SBC

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Columbia County, Oregon

Local office

Oregon Fish And Wildlife Office

(503) 231-6179
(503) 231-6195

2600 Southeast 98th Avenue, Suite 100

Portland, OR 97266-1398

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened
Northern Spotted Owl Strix occidentalis caurina Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/1123	Threatened
Streaked Horned Lark Eremophila alpestris strigata Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/7268	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Northwestern Pond Turtle Actinemys marmorata Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1111	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

Suckley's Cuckoo Bumble Bee Bombus suckleyi Proposed Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/10885

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts

For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and

minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete

If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Mar 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

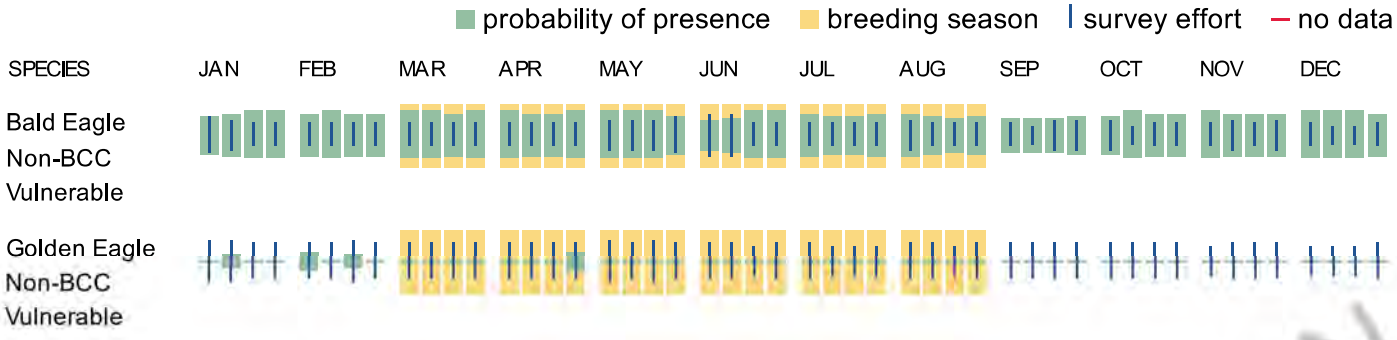
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds

- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31
Black Swift Cypseloides niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8878	Breeds Jun 15 to Sep 10
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31

Cassin's Finch Haemorhous cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Chestnut-backed Chickadee Poecile rufescens rufescens — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Clark's Grebe Aechmophorus clarkii — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Evening Grosbeak Coccothraustes vespertinus — Breeds May 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Golden Eagle Aquila chrysaetos — Breeds Mar 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Oregon Vesper Sparrow Pooecetes gramineus affinis — Breeds Apr 21 to Aug 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/5141

Red Knot Calidris canutus roselaari — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8880

Rufous Hummingbird Selasphorus rufus — Breeds Apr 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Short-billed Dowitcher Limnodromus griseus — Breeds Jun 1 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Western Gull Larus occidentalis — Breeds Apr 21 to Aug 25
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Western Screech-owl Megascops kennicottii cardonensis — Breeds Mar 1 to Jun 30
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ( )

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

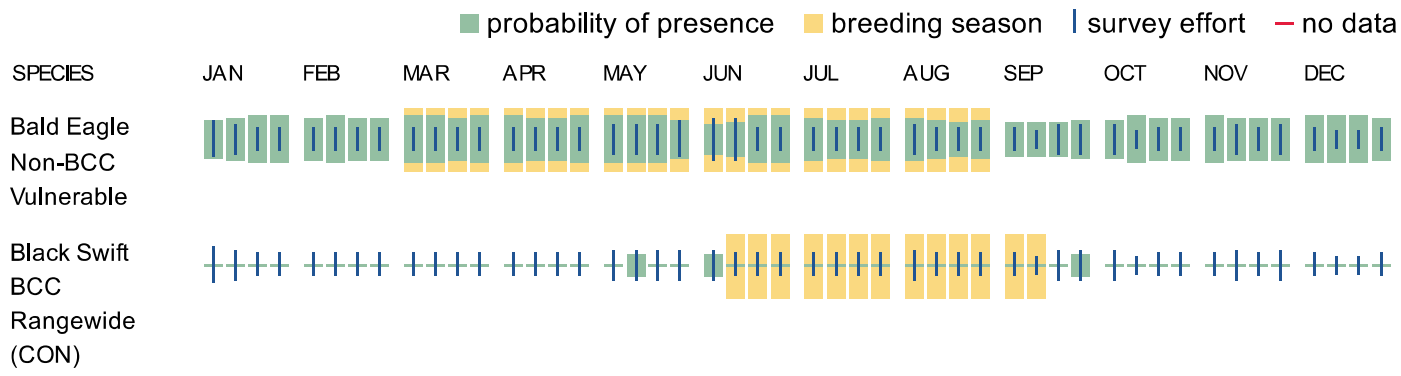
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

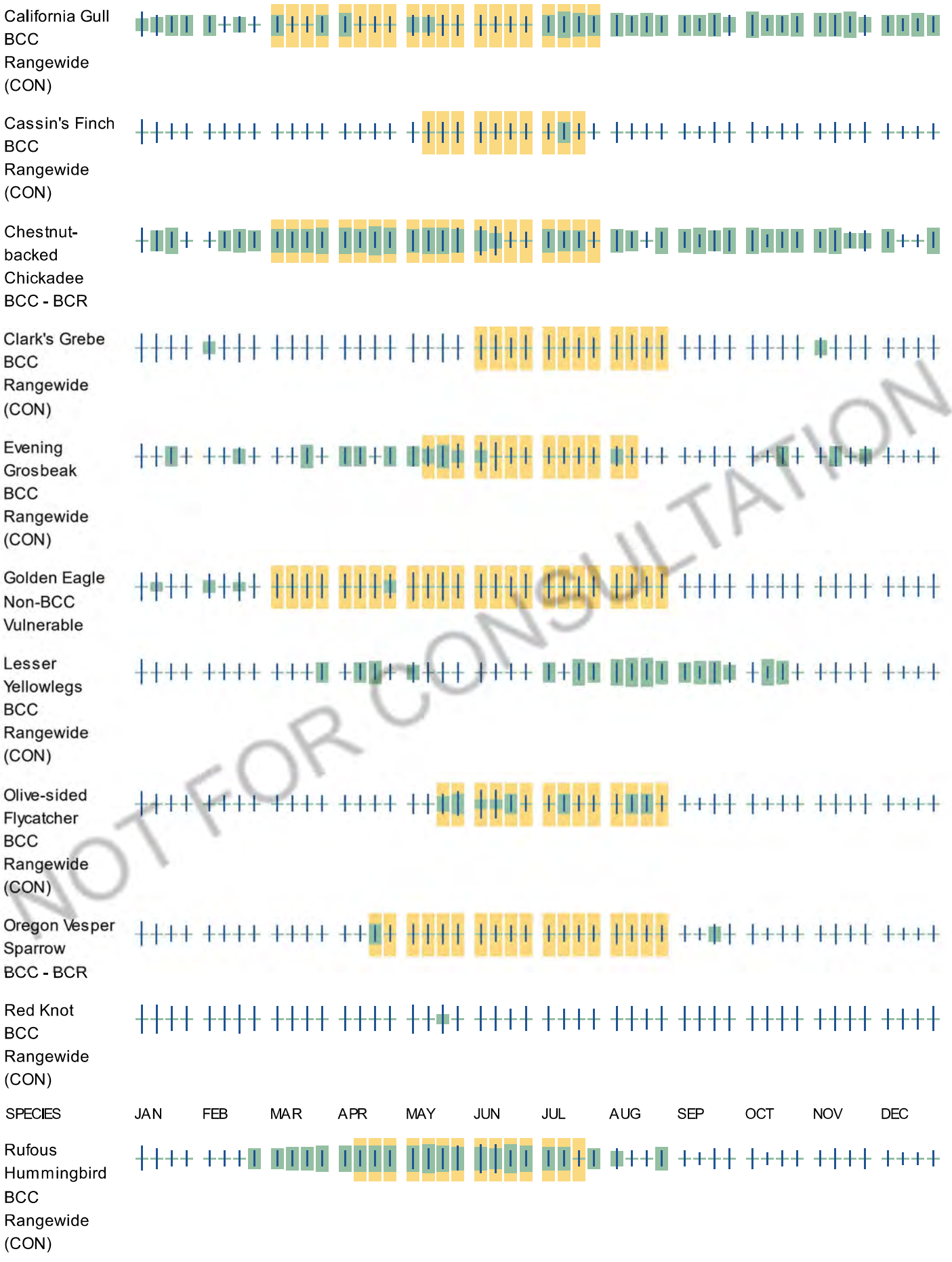
No Data (–)

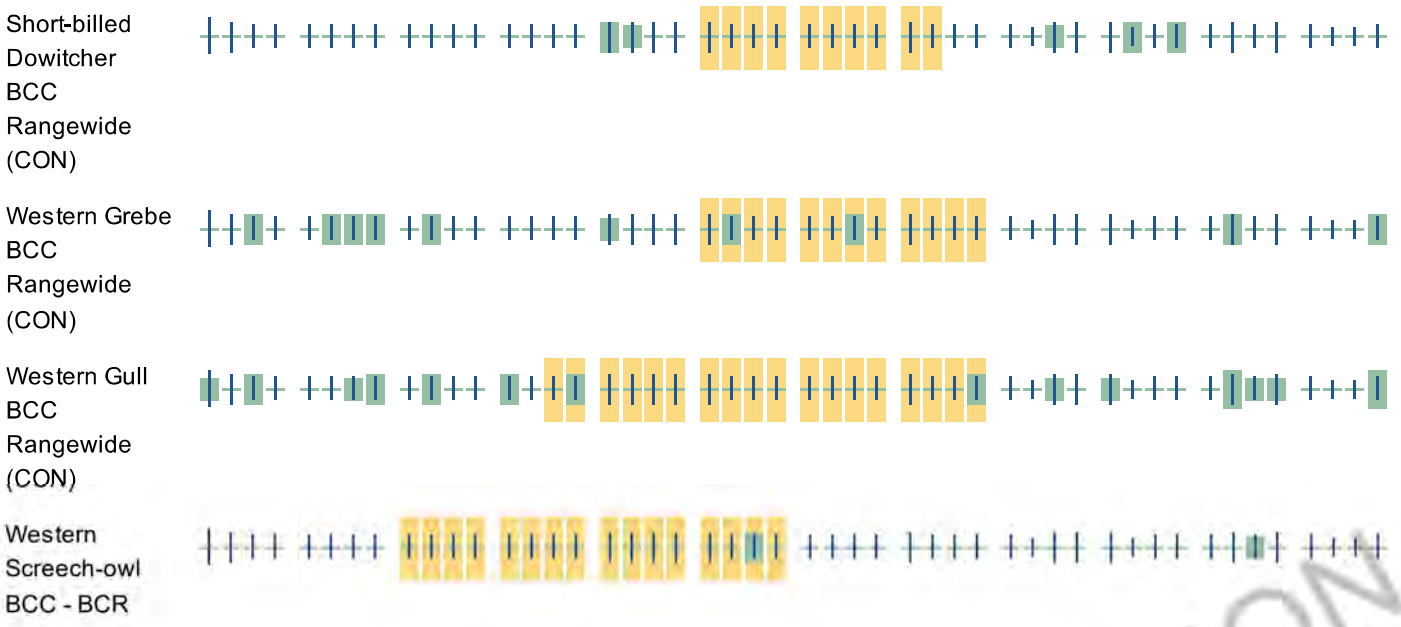
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.







Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as "Vulnerable". See the FAQ "What are the levels of concern for migratory birds?" for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ "Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs
Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Columbia County, Oregon

Local office

Oregon Fish And Wildlife Office

(503) 231-6179
(503) 231-6195

2600 Southeast 98th Avenue, Suite 100

Portland, OR 97266-1398

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Columbian White-tailed Deer Odocoileus virginianus leucurus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/154	Threatened

Birds

NAME	STATUS
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened
Northern Spotted Owl Strix occidentalis caurina Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/1123	Threatened
Streaked Horned Lark Eremophila alpestris strigata Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/7268	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Northwestern Pond Turtle Actinemys marmorata Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1111	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's Cuckoo Bumble Bee Bombus suckleyi No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts

For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete

If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31

Golden Eagle Aquila chrysaetos — Breeds Mar 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

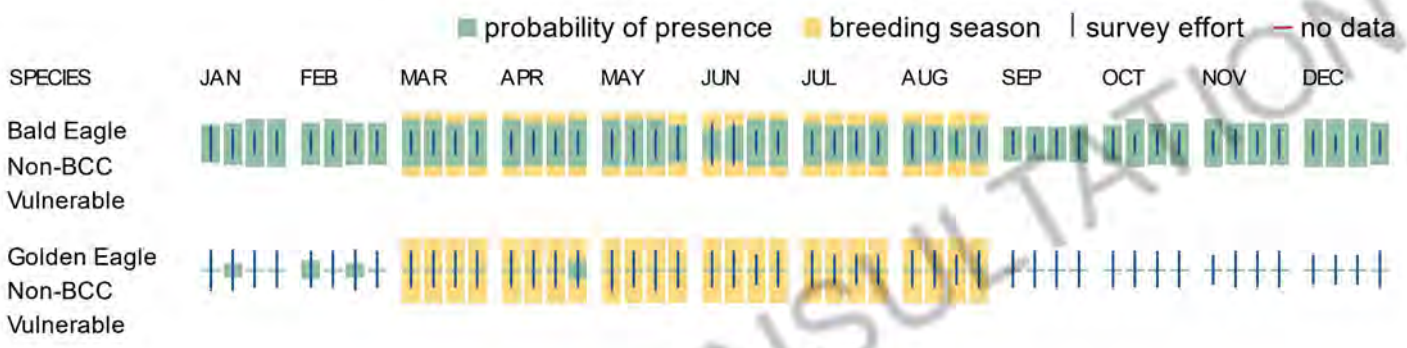
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report
On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Mar 1 to Aug 31

Black Swift Cypseloides niger — Breeds Jun 15 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8878

California Gull Larus californicus — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Cassin's Finch Haemorhous cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Chestnut-backed Chickadee Poecile rufescens rufescens — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Clark's Grebe Aechmophorus clarkii — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Evening Grosbeak Coccothraustes vespertinus — Breeds May 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Golden Eagle Aquila chrysaetos — Breeds Mar 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Oregon Vesper Sparrow Pooecetes gramineus affinis This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/5141	Breeds Apr 21 to Aug 31
Red Knot Calidris canutus roselaari This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8880	Breeds elsewhere
Rufous Hummingbird Selasphorus rufus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15
Short-billed Dowitcher Limnodromus griseus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds Jun 1 to Aug 10
Western Grebe aechmophorus occidentalis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Western Gull Larus occidentalis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 21 to Aug 25
Western Screech-owl Megascops kennicottii cardonensis This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Jun 30

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

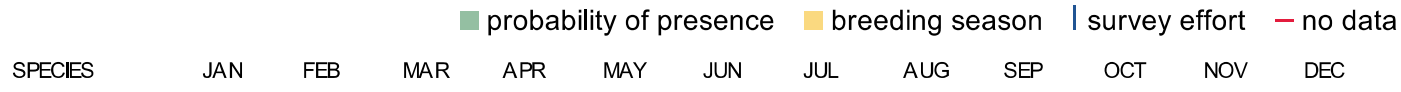
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

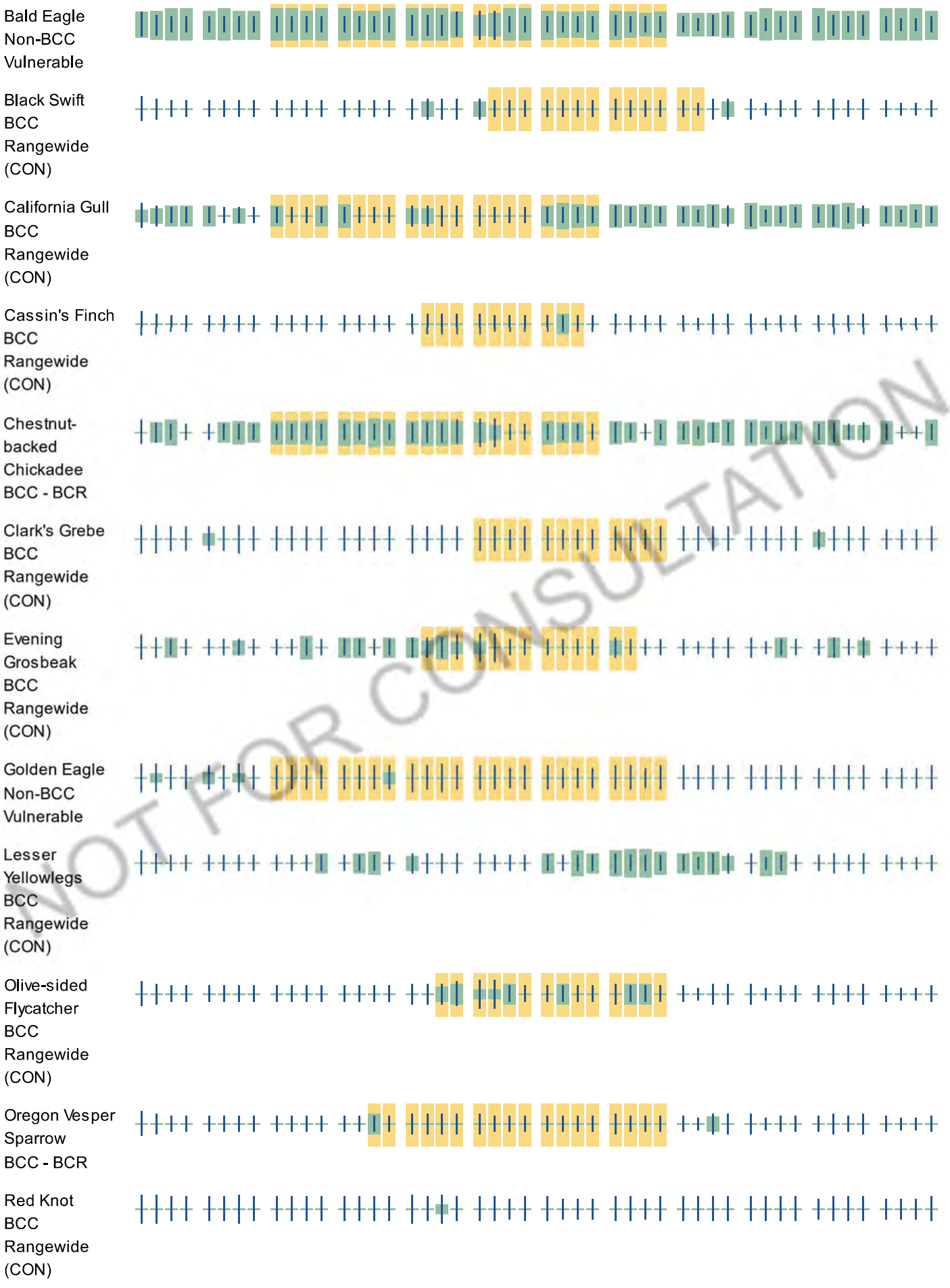
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

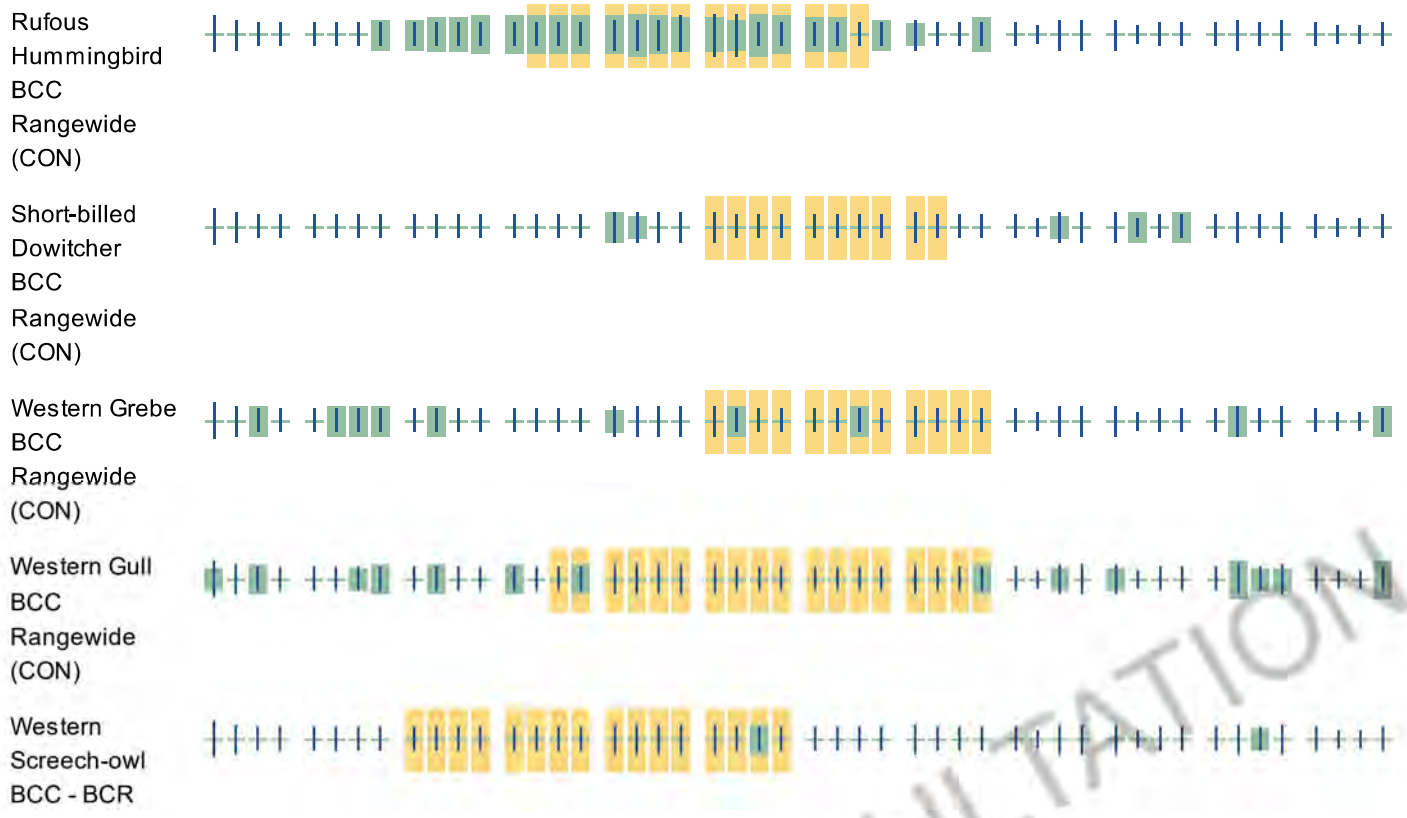
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.







Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as “Vulnerable”. See the FAQ “What are the levels of concern for migratory birds?” for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ "Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs
Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

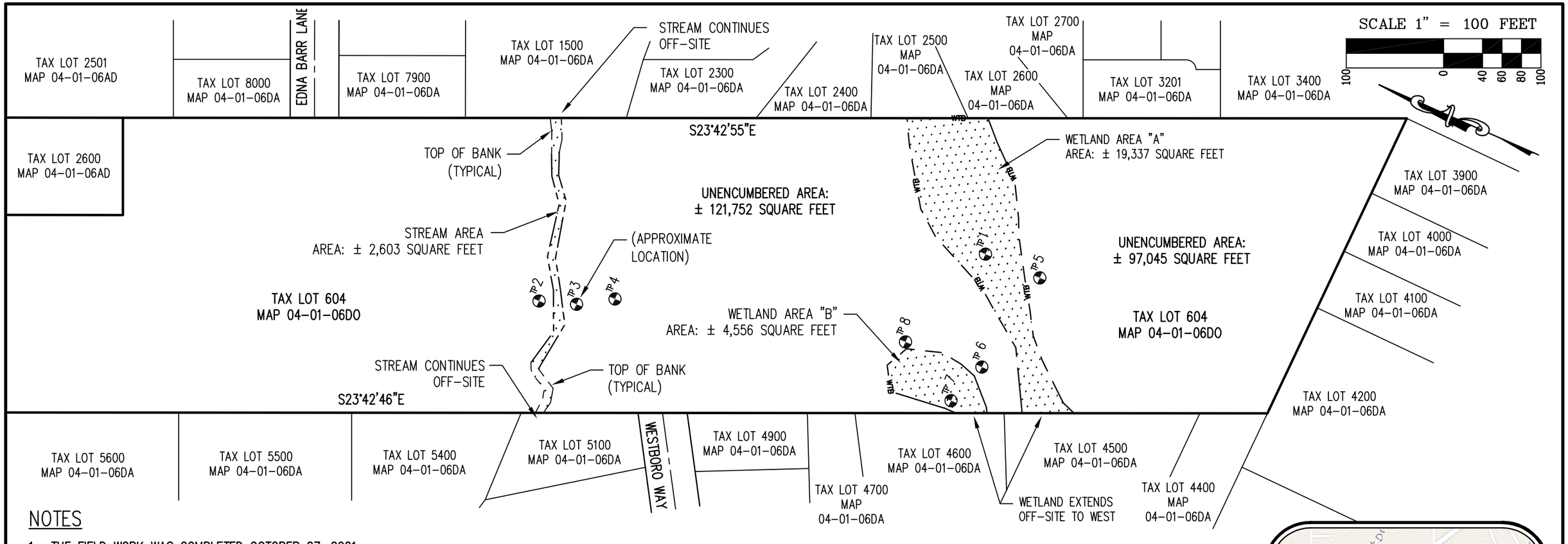
Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

APPENDIX E

Historical Site 2 Wetland and Waters Maps and Report, November 2021



NOTES

1. THE FIELD WORK WAS COMPLETED OCTOBER 27, 2021.

2. THE NORTHEASTERLY AND SOUTHWESTERLY PROPERTY LINES WERE DETERMINED BY TIES TO RECOVERED SURVEY MONUMENTS AND ARE ACCURATELY DEPICTED. THE SOUTH LINE WAS CALCULATED FROM RECORD SURVEY INFORMATION.

3. WETLAND BOUNDARY, TOP OF STREAM BANK AND SAMPLE PLOT FLAGGING PLACED BY WETLAND SOLUTIONS NORTHWEST. THEIR LOCATIONS WERE DETERMINED BY SURVEY WITH ACCURACY OF +/- 1 FOOT.

LEGEND

SAMPLE PLOT — TP #

WETLAND AREA

WETLAND BOUNDARY — — — WTB — — — WTB —

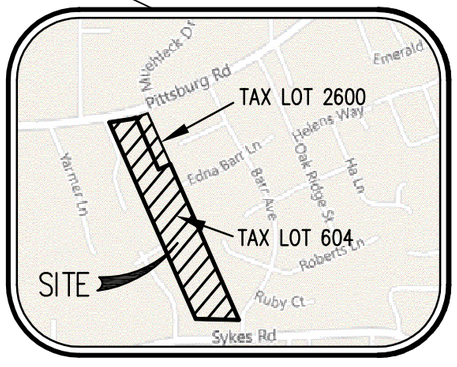
ORDINARY HIGH WATER LINE

RIGHT-OF-WAY LINE

PROPERTY LINE

WETLAND SURVEY

**LOCATED IN THE EAST 1/2 OF SECTION 6,
TOWNSHIP 4 NORTH, RANGE 1 WEST, W.M.,
COLUMBIA COUNTY, OREGON
DATE: NOVEMBER 8, 2021**



VICINITY MAP NOT TO SCALE

PREPARED FOR

JEANNIE MORAIN
2799 E. LINDA COURT
GILBERT, AZ 85234

REGISTERED
PROFESSIONAL
LAND SURVEYOR

PRELIMINARY

OREGON
JUNE 30, 1997
SCOTT F. FIELD
2844

RENEWS: 12/31/2021

JOB NAME:	MORAIN
JOB NUMBER:	2346
DRAWN BY:	BJA
CHECKED BY:	SFF
DRAWING NO:	2346 EXH WL1

BOUNDARY TOPOGRAPHIC CONSTRUCTION CADASTRAL

NORTHWEST SURVEYING, Inc.
1815 NW 169th PLACE, SUITE 2090
BEAVERTON, OR 97006
PHONE: 503-848-2127 FAX: 503-848-2179
www.nwsrvy.com

SCALE 1" = 100 FEET

100 0 40 60 80 100

TAX LOT 2501
MAP 04-01-06AD

TAX LOT 8000
MAP 04-01-06DA

EDNA BARR LANE

TAX LOT 7900
MAP 04-01-06DA

TAX LOT 1500
MAP 04-01-06DA

STREAM CONTINUES
OFF-SITE

TAX LOT 2300
MAP 04-01-06DA

TAX LOT 2400
MAP 04-01-06DA

TAX LOT 2500
MAP
04-01-06DA

TAX LOT 2700
MAP
04-01-06DA

TAX LOT 2600
MAP
04-01-06DA

TAX LOT 3201
MAP 04-01-06DA

TAX LOT 3400
MAP 04-01-06DA

TAX LOT 2600
MAP 04-01-06AD

S23°42'55"E

TOP OF BANK
(TYPICAL)

RIPARIAN BUFFER LINE

UNENCUMBERED AREA:
± 72,634 SQUARE FEET

75.0'

STREAM AREA
AREA: ± 2,603 SQUARE FEET

(APPROXIMATE
LOCATION)

WTB

WETLAND AREA "A"
AREA: ± 19,337 SQUARE FEET

WTB

BUFFER AREA:
± 25,391 SQUARE FEET

50.0'

50.0'

WETLAND BUFFER LINE

BUFFER AREA:
± 15,887 SQUARE FEET

TP 1

TP 5

WTB

WTB

TAX LOT 604
MAP 04-01-06DO

BUFFER AREA:
± 23,730 SQUARE FEET

TP 2

TP 3

TP 4

BUFFER AREA:
± 23,727 SQUARE FEET

WETLAND BUFFER LINE

WETLAND AREA "B"
AREA: ± 4,556 SQUARE FEET

TP 8

TP 6

TP 7

WTB

50.0'

RIPARIAN BUFFER LINE

75.0'

TOP OF BANK (TYPICAL)

WETLAND BUFFER LINE

S23°42'46"E

UNENCUMBERED AREA:
± 81,158 SQUARE FEET

TAX LOT 604
MAP 04-01-06DO

TAX LOT 3900
MAP 04-01-06DA

TAX LOT 4000
MAP 04-01-06DA

TAX LOT 4100
MAP 04-01-06DA

TAX LOT 4200
MAP 04-01-06DA

TAX LOT 5600
MAP 04-01-06DA

TAX LOT 5500
MAP 04-01-06DA

TAX LOT 5400
MAP 04-01-06DA

TAX LOT 5100
MAP 04-01-06DA

WESTBORO WAY

TAX LOT 4900
MAP 04-01-06DA

TAX LOT 4700
MAP
04-01-06DA

TAX LOT 4600
MAP 04-01-06DA

TAX LOT 4500
MAP 04-01-06DA

TAX LOT 4400
MAP
04-01-06DA

WETLAND EXTENDS
OFF-SITE TO WEST

STREAM CONTINUES
OFF-SITE

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LEGEND

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WETLAND BOUNDARY — WTB —

ORDINARY HIGH WATER LINE

RIGHT-OF-WAY LINE

PROPERTY LINE

REGISTERED
PROFESSIONAL
LAND SURVEYOR

PRELIMINARY

OREGON
JUNE 30, 1997
SCOTT F. FIELD
2844

RENEWS: 12/31/2021

WETLAND AND BUFFER MAP

LOCATED IN THE EAST 1/2 OF SECTION 6, TOWNSHIP 4 NORTH, RANGE 1 WEST, W.M., COLUMBIA COUNTY, OREGON

DATE: NOVEMBER 8, 2021

PREPARED FOR

JEANNIE MORAIN
2799 E. LINDA COURT
GILBERT, AZ 85234

JOB NAME:	MORAIN
JOB NUMBER:	2346
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CHECKED BY:	SFF
DRAWING NO:	2346 EXH WL2

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BEAVERTON, OR 97006
PHONE: 503-848-2127 FAX: 503-848-2179
www.nwsrvy.com

COMSTOCK PROPERTY
WETLAND & WATERS DELINEATION REPORT

T4N, R1W, Sec. 6; tax lots 604 & 2600
St. Helens, Columbia County, Oregon

Prepared for

Jeanne Morain
2799 E Linda Ct
Gilbert, AZ 85234

Prepared by

Wetland Solutions Northwest, LLC
59446 Lytle Dr.
St. Helens, OR 97051

November 2021

Project No. 21091

CONTENTS

Appendices

Tables

Introduction

Wetland Solutions Northwest, LLC (WSNW) conducted a wetland and waters delineation on behalf of the property owner for site appraisal purposes. The subject property consists of two undeveloped tax lots located south of Pittsburg Road, north of Sykes Road, and east of Mountain View Drive in St. Helens, Oregon (Figure 1; Appendix A). The study area consists of tax lot 604 on tax lot map 04 01 06 D0 and tax lot 2600 on tax lot map 04 01 06AD. (Figure 2). The study area is located in Township 4N, Range 1W, Section 6 and totals 12 acres.

A. Landscape Setting and Land Use

The subject property is located in a residential area of west St. Helens. The property is entirely undeveloped. The northern half of the study area slopes down to the south towards an unnamed tributary to the North Fork Milton Creek. The unnamed tributary flows east through the central portion of the property. Topography rises steeply from the south bank of the unnamed tributary, and the south half of the study area is a fairly level terrace that slopes gently to the southeast. The elevation ranges from approximately 180 feet above sea level in the south portion of the study area to approximately 270 feet above sea level in the north portion of the study area.

B. Site Alterations

No site alterations were noted.

C. Precipitation Data and Analysis

Recent precipitation data were obtained for the Scappoose area via the NOAA Regional Climate Data Centers for the Scappoose Industrial Airpark, which is the closest weather station to the study area with a sufficiently long record for precipitation analysis. The WETS table provides a month by month summary and probability analysis of temperature and precipitation. According to the WETS table, monthly observed precipitation was below normal for July and August, but it was within the normal range for September. The WETS table and raw precipitation data are summarized in the tables below and included in Appendix D.

Table 1. Precipitation Data for the Scappoose Industrial Airpark Station (inches)

Field Date	Rainfall on Field Date	Rainfall Two Weeks Prior to Field Date	Rainfall for the Water Year-to- Date (WYTD)
September 29, 2021	0.02	3.14	32.77
October 18, 2021	0.00	1.19	1.19

Table 2. Average Precipitation Data (WETS) for the Scappoose Industrial Airpark Station (inches)

Prior Three Months	Average	30% Chance Will Have Less Than	More Than	Observed Precipitation	Within Normal Range?
September	1.56	0.60	1.86	3.25	No, above normal
August	0.52	0.19	0.57	0.02	No, below normal
July	0.48	0.13	0.37	0.01	No, below normal
June	1.37	0.88	1.63	1.57	Yes

D. Methods

The methodology used for determining the presence of wetlands and delineating wetland boundaries followed the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)*. The National Wetland Plant List was used to assign wetland indicator status for the appropriate region.

Field work was conducted on September 29 and October 18, 2021 by Stacy Benjamin. Soils, vegetation, and indicators of hydrology were recorded at 8 sample plot locations on standardized wetland determination data forms (Appendix B) to document site conditions. Prior to conducting the field work, available background maps were reviewed for the potential presence of wetlands or waters on or near the site.

The following soil units are mapped in the study area on the Natural Resources Conservation Service web soil survey map for Columbia County (Figure 3).

- 1A, B - Aloha silt loam; 0 – 3 and 3 – 8 percent slopes
- 10C - Cascade silt loam; 8 – 15 percent slopes
- 40B,C - Quatama silt loam; 3 – 8 and 8 – 15 percent slopes
- 31 - Wollent silt loam (hydric)

The City of St. Helens Local Wetlands Inventory (LWI) maps two wetlands in the study area. A tributary to the North Fork Milton Creek is mapped in the central portion of the study area as unit MC-1, and an emergent wetland (MC-2) is mapped in the south portion of the study area (Figure 4).

A current aerial photograph is included as Figure 5. Representative ground level site photographs are included in Appendix C. References are listed in Appendix F.

E. Description of All Wetlands and Other Non-Wetland Waters

Wetlands

Two emergent wetlands were delineated in the southern portion of the study area. An off-

site forested wetland is located on the west side of Mountain View Drive and is the source of on-site wetland hydrology. Shallow surface water flow was observed at the outlet of two off-site culverts that outlet onto the east side of Mountain View Drive, located approximately 100 feet west of the study area. The wetlands delineated in the study area are palustrine, emergent wetlands in the slope/flats hydrogeomorphic class. The wetlands are located in a very subtle depressional area that trends downward to the east.

Wetland vegetation in the larger wetland 'A' consists of bent grass (*Agrostis* species), tall false rye grass (*Schedonorus arundinaceus*) and scattered lamp rush (*Juncus effusus*) in the higher elevation areas, and in the slightly lower elevation eastern portion of wetland A, vegetation is dominated by reed canarygrass (*Phalaris arundinacea*) and slough sedge (*Carex obnupta*) with a few scattered patches of Douglas spirea (*Spiraea douglasii*) and Oregon ash (*Fraxinus latifolia*) small trees and saplings. Wetland soils at plot 1 met the redox dark surface (F6) hydric soil indicator. Wetland soils were saturated below 12 inches at the time of field work; therefore, the wetland hydrology criterion was determined to be met based on secondary indicators of wetland hydrology including geomorphic position and the FAC-neutral test. The wetland boundary was delineated based on an increase in topography that occurred along with a change in the vegetation community. Adjacent upland vegetation includes sword fern (*Polystichum munitum*), Scot's broom (*Cytisus scoparius*) weedy upland forbs and Himalayan blackberry (*Rubus armeniacus*) in the western portion, and beaked hazelnut (*Corylus cornuta*), Douglas fir (*Pseudotsuga menziesii*), and Oregon white oak (*Quercus garryana*) in the eastern portion of the study area. Adjacent upland areas displayed an absence of hydric soils and did not meet hydrology criteria.

Wetland vegetation in the smaller wetland 'B' was dominated by bent grass and tall false rye grass. Wetland soils at plot 7 met the redox dark surface (F6) hydric soil indicator. Wetland soils were saturated to the surface in the far western portion of wetland B. Scattered shallow ponding was present in the off-site wetland area to the west of the study area. The wetland hydrology criterion at plot 7 was determined to be met based on secondary indicators of wetland hydrology including geomorphic position and the FAC-neutral test. Soils in wetland B were hummocky, and the wetland boundary was delineated based on a subtle increase in topography in upland areas which occurred along with a decrease in hummocks and an increase in the presence of upland forbs including ox-eye daisy (*Leucanthemum vulgare*), tiny vetch (*Vicia hirsuta*), and English plantain (*Plantago lanceolata*) in uplands. Adjacent upland areas displayed an absence of hydric soils and did not meet hydrology criteria.

Unnamed Tributary

An unnamed tributary to the North Fork Milton Creek flows east through the central portion of the property. The stream was flowing shallowly approximately 3 to 5 feet wide during the September 2021 site visit. The stream displayed a bed and banks, with the stream banks being steeper and more incised in the western portion of the study area. Stream banks are densely vegetated with Himalayan blackberry along the eastern section and on the upland hillslope on the southern side of the stream. The riparian community is comprised of more native species along the north side of the stream. Native shrubs include Pacific ninebark (*Physocarpus capitatus*), beaked hazelnut, and black hawthorn (*Crataegus douglasii*). The tree canopy is dominated by western red cedar (*Thuja plicata*), including some multi-stemmed and large diameter mature trees.

Uplands

The majority of the study area is comprised of an upland plant community consisting of non-

native grasses and forbs including bent grass, tall false rye grass, velvet grass (*Holcus lanatus*), sweet vernal grass (*Anthoxanthum odoratum*), Queen Anne's-lace (*Daucus carota*), ox-eye daisy, English plantain and scattered Himalayan blackberry and Scot's broom. Several mature Oregon white oak trees are present along the southern study area boundary.

F. Deviation from Local Wetlands Inventory

The location of the wetlands and stream delineated in the study area are consistent with the LWI mapping, although the shape of the wetlands delineated differs from the LWI mapping.

G. Mapping Method

The wetland boundaries, top of stream bank, and sample plot locations were flagged in the field and were professionally land surveyed by Northwest Surveying Inc. The wetland map is included as Figure 6.

H. Additional Information

The wetlands and water delineated in this study are likely to be determined to be jurisdictional by the Oregon Department of State Lands and the U.S. Army Corps of Engineers based on their proximity to Milton Creek. Milton Creek is a tributary to Scappoose Bay, which flows to the Multnomah Channel, which is a tributary to the Columbia River.

I. Results and Conclusions

Two emergent wetlands totaling 23,893 SF (0.55 acre) and a section of an unnamed tributary to the North Fork Milton Creek totaling 2,603 SF (0.06 acre) were delineated in the study area and are likely to be considered jurisdictional by the Oregon Department of State Lands and the U.S. Army Corps of Engineers.

J. Required Disclaimer

This report documents the investigation, best professional judgment and conclusions of the investigators. It is correct and complete to the best of our knowledge. It should be considered a Preliminary Jurisdictional Determination of wetlands and other waters and used at your own risk unless it has been reviewed and approved in writing by the Oregon Department of State Lands in accordance with Oregon Administrative Rule (OAR) 141-090-0005 through 141-090-0055.

K. Preparer

Stacy Benjamin

Stacy Benjamin
Principal Ecologist

APPENDIX A

Maps

Figure 1. Site location map.

Figure 2. Tax lot map.

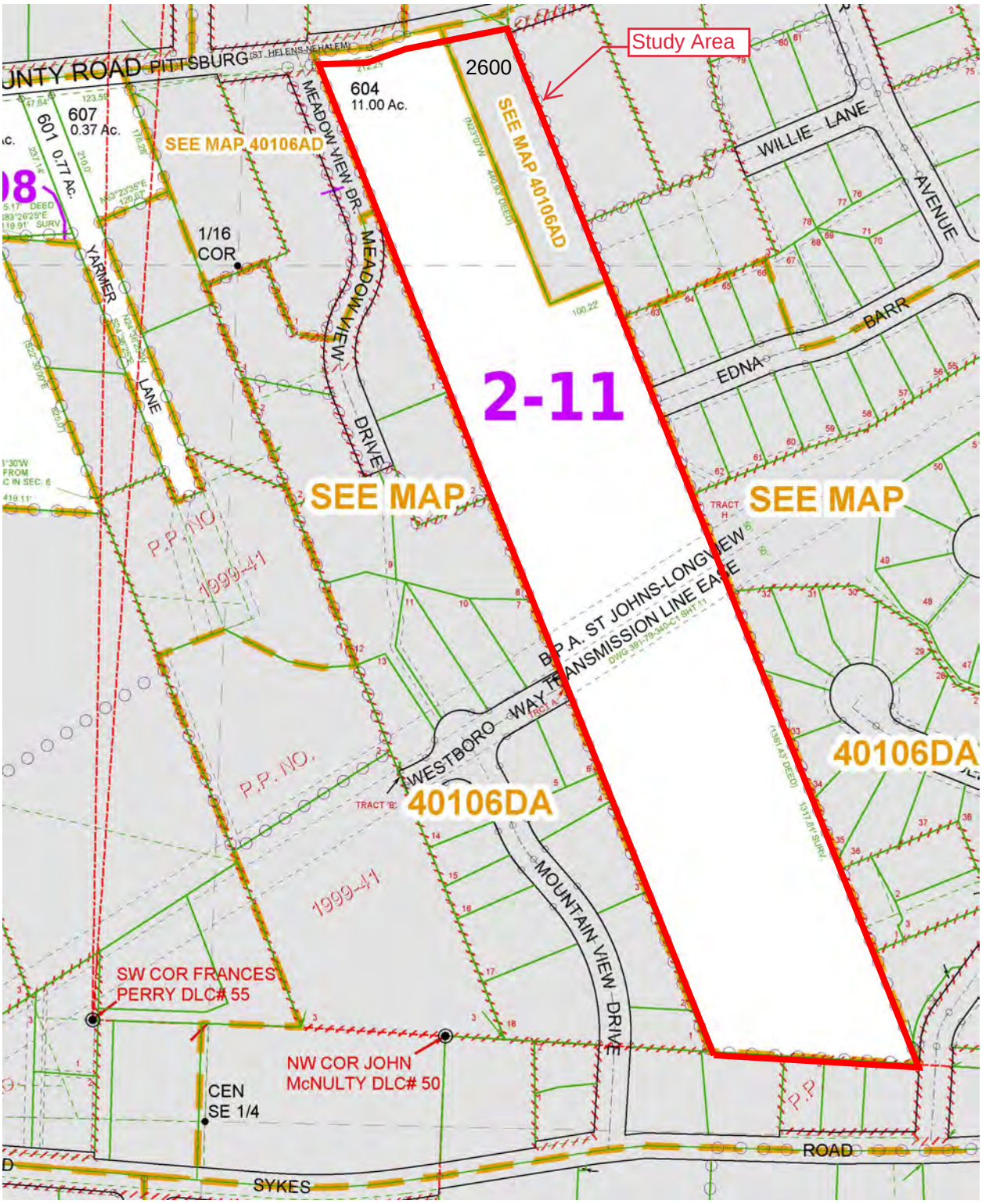
Figure 3. Soil map.

Figure 4. Local wetland inventory map.

Figure 5. Recent aerial photo.

Figure 6. Wetland map.

Comstock Property, St. Helens Wetland & Waters Delineation Figure 1. Site Location Map	0 1,500	Wetland Solutions Northwest, LLC
Source: USGS. St. Helens, OR-WA 7.5' quadrangle. Available at: https://viewer.nationalmap.gov/basic. Accessed 10/2021.		November 2021



Comstock Property, St. Helens Wetland & Waters Delineation Figure 2. Tax Lot Map	0 250	Wetland Solutions Northwest, LLC
Source: Tax lot maps 04 01 06 D0 & 04 01 06AD downloaded from: www.ormap.net, Columbia County. Accessed 10/2021.		November 2021

Map Unit	Map Unit Name
1A, B	Aloha silt loam, 0 – 3 and 3 – 8 percent slopes
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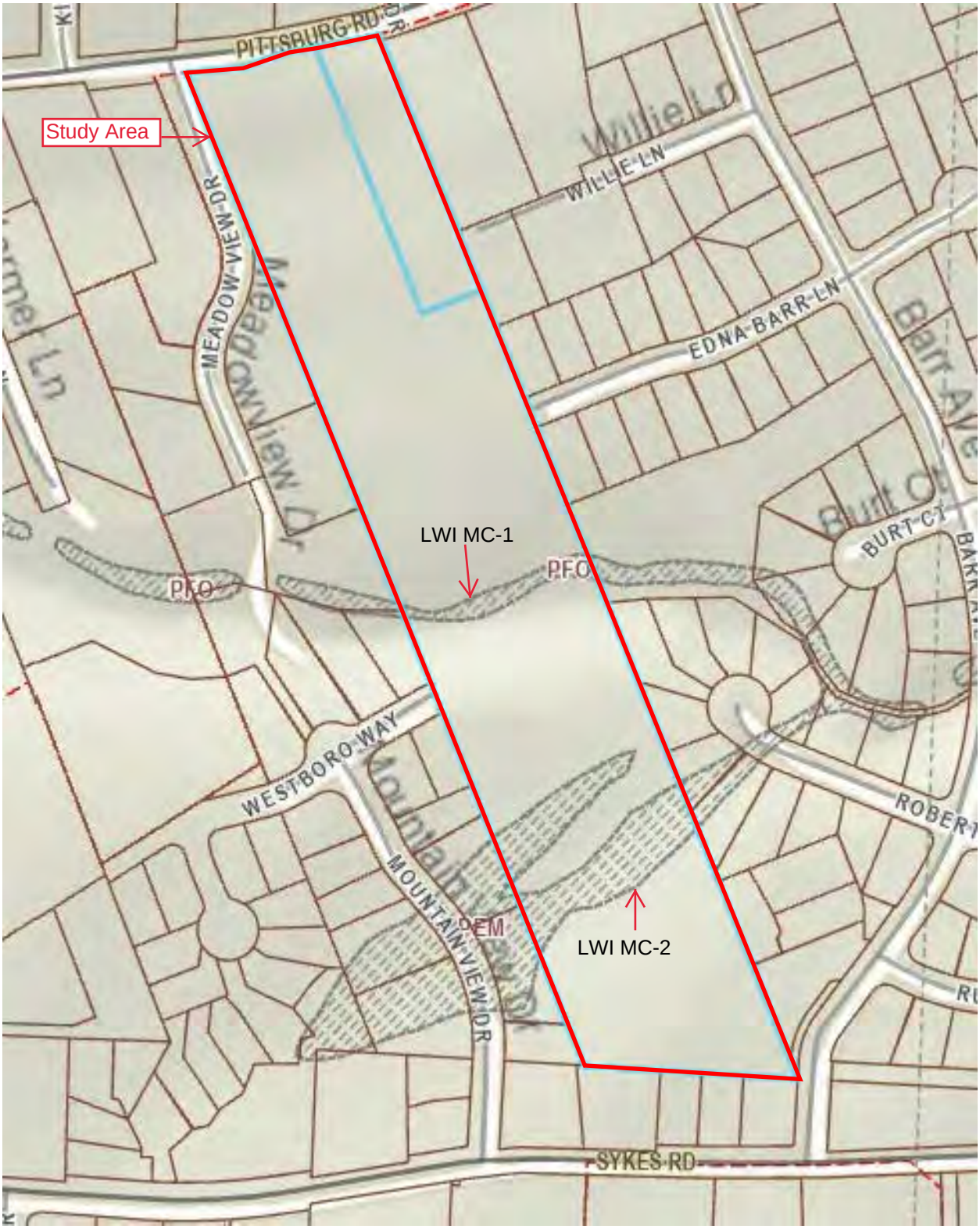
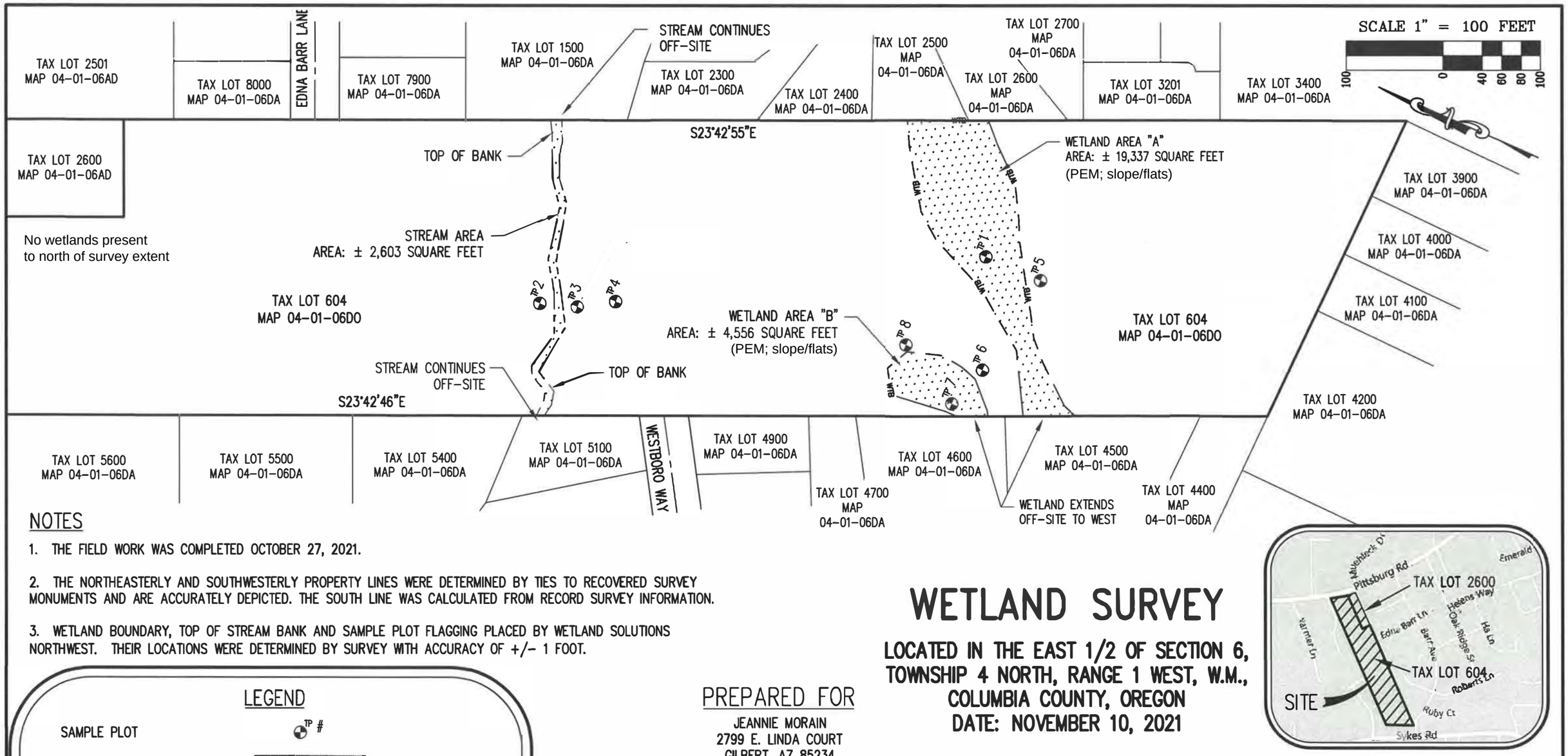
40B, C	Quatama silt loam, 3 – 8 and 8 – 15 percent slopes
31	Wollent silt loam (hydric)

Comstock Property, St. Helens Wetland & Waters Delineation Figure 3. Soil Survey Map	0 400	Wetland Solutions Northwest, LLC
Source: USDA NRCS Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 10/2021.		November 2021



Comstock Property, St. Helens Wetland & Waters Delineation Figure 4. Local Wetlands Inventory Map	0 250	Wetland Solutions Northwest, LLC
Source: Columbia County Webmaps. Available at: http://webmap.co.columbia.or.us/geomoose2 Accessed 10/2021.		November 2021

Comstock Property, St. Helens Wetland & Waters Delineation Figure 5. Recent Aerial Photo	0 325	Wetland Solutions Northwest, LLC
Source: Google Earth. Imagery date 6/17/2021.		November 2021



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LEGEND

- SAMPLE PLOT — TP #
- WETLAND AREA
- WETLAND BOUNDARY — WTB —
- ORDINARY HIGH WATER LINE
- RIGHT-OF-WAY LINE
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WETLAND SURVEY

**LOCATED IN THE EAST 1/2 OF SECTION 6,
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DATE: NOVEMBER 10, 2021**

PREPARED FOR

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FIGURE 6. WETLAND MAP

APPENDIX B

Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property City/County: St. Helens / Columbia Sampling Date: 10/18/2021
Applicant/Owner: Jeanne Morain/Comstock Trust State: OR Sampling Point: 1
Investigator(s): Stacy Benjamin Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 3
Subregion (LRR): A – NW Forests & Coast Lat: Long: Datum:
Soil Map Unit Name: 40B – Quatama silt loam; 3 – 8% slopes NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes	X	No	**Is the Sampled Area within a Wetland?** **Yes X No**
Wetland Hydrology Present?	Yes	X	No	

Remarks: Plot located in south fork of LWI-mapped wetland MC-2.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Fraxinus latifolia	5	Y	FACW
2.			
3.			
4.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot size: 10')			
1. Spiraea douglasii	5	Y	FACW
2.			
3.			
4.			
5.			
	5	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Phalaris arundinacea	50	Y	FACW
2. Carex obnupta	50	Y	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100					sicl	
6-10	10YR 3/2	90	10YR 4/4	10	C	M	sicl	
10-18	10YR 4/2	90	10YR 4/4	10	C	M	sicl	
18-28	10YR 4/2	80	10YR 4/4	20	C	M	sicl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes	___	No	X	Depth (inches):	
Water Table Present?	Yes	___	No	X	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes	X	No	___	Depth (inches):	18

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: On 9/29/21 soils were moist from 0 – 10 inches becoming dryer with depth. Plot was resampled on 10/18/21 after additional precipitation, and soils were saturated at 18 inches below the ground surface and very moist above.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property City/County: St. Helens / Columbia Sampling Date: 9/29/2021
Applicant/Owner: Jeanne Morain/Comstock Trust State: OR Sampling Point: 2
Investigator(s): Stacy Benjamin Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 10
Subregion (LRR): A – NW Forests & Coast Lat: Long: Datum:
Soil Map Unit Name: 40C – Quatama silt loam; 8 – 15% slopes NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes		No	X
Wetland Hydrology Present?	Yes		No	X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks: Plot located 15 feet north of stream channel mapped as LWI MC-1. Plot located on hillslope, few feet higher than elevation of stream channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Frangula purshiana	60	Y	FAC
2. Thuja plicata	30	Y	FAC
3. Acer macropyllum	10	N	FACU
4.			
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size: 10')			
1. Corylus cornuta	50	Y	FACU
2. Rubus armeniacus	25	Y	FAC
3.			
4.			
5.			
	75	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Polystichum munitum	25	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25	= Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 75

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 60 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-16	10YR 3/4	100					sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes	___	No	X	Depth (inches):	
Water Table Present?	Yes	___	No	X	Depth (inches):	>16
Saturation Present? (includes capillary fringe)	Yes	___	No	X	Depth (inches):	>16

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soils slightly moist throughout.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property City/County: St. Helens / Columbia Sampling Date: 9/29/2021
Applicant/Owner: Jeanne Morain/Comstock Trust State: OR Sampling Point: 3
Investigator(s): Stacy Benjamin Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 20
Subregion (LRR): A – NW Forests & Coast Lat: Long: Datum:
Soil Map Unit Name: 40C – Quatama silt loam; 8 – 15% slopes NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes		No	X
Wetland Hydrology Present?	Yes		No	X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks: Plot located midway up hillslope on south side of stream.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 10')			
1. Rubus armeniacus	100	Y	FAC
2.			
3.			
4.			
5.			
	100 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Cirsium arvense	10	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 90

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-16	10YR 3/4	100					sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): >16

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): >16

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soils slightly moist throughout.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property City/County: St. Helens / Columbia Sampling Date: 9/29/2021
Applicant/Owner: Jeanne Morain/Comstock Trust State: OR Sampling Point: 4
Investigator(s): Stacy Benjamin Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 1
Subregion (LRR): A – NW Forests & Coast Lat: Long: Datum:
Soil Map Unit Name: 40C – Quatama silt loam; 8 – 15% slopes NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes		No	X
Wetland Hydrology Present?	Yes		No	X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks: Plot located at top of steep hillslope on south side of stream.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 10')			
1. Rubus armeniacus	100	Y	FAC
2.			
3.			
4.			
5.			
	100 = Total Cover		
Herb Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 100

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/4	100					sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes	___	No	X	Depth (inches):	
Water Table Present?	Yes	___	No	X	Depth (inches):	>16
Saturation Present? (includes capillary fringe)	Yes	___	No	X	Depth (inches):	>16

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soils slightly moist throughout.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property | City/County: St. Helens / Columbia | Sampling Date: 10/18/2021
Applicant/Owner: Jeanne Morain/Comstock Trust | State: OR | Sampling Point: 5
Investigator(s): Stacy Benjamin | Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Terrace | Local relief (concave, convex, none): Convex | Slope (%): 3
Subregion (LRR): A – NW Forests & Coast | Lat: | Long: | Datum:
Soil Map Unit Name: 40B – Quatama silt loam; 3 – 8% slopes | NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes		No	X
Wetland Hydrology Present?	Yes		No	X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks: Plot located south of wetland boundary of LWI-mapped wetland MC-2. Few feet higher in elevation than Plot 1.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 10')			
1. Rubus armeniacus	10	Y	FAC
2. Cytisus scoparius	10	Y	UPL
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Agrostis species	50	Y	FAC
2. Schedonorus arundinaceus	15	N	FAC
3. Daucus carota	10	N	FACU
4. Hypericum perforatum	10	N	FACU
5. Plantago lanceolata	10	N	FACU
6. Holcus lanatus	5	N	FAC
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	10YR 3/3	100					sil	
9-18	10YR 4/3	95	10YR 4/4	5	C	M	sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): >18

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): >18

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soils slightly moist throughout.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property City/County: St. Helens / Columbia Sampling Date: 10/18/2021
Applicant/Owner: Jeanne Morain/Comstock Trust State: OR Sampling Point: 6
Investigator(s): Stacy Benjamin Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 3
Subregion (LRR): A – NW Forests & Coast Lat: Long: Datum:
Soil Map Unit Name: 40B – Quatama silt loam; 3 – 8% slopes NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes		No	X
Wetland Hydrology Present?	Yes		No	X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks: Plot located in upland area between two forks of LWI-mapped wetland MC-2. Slightly higher elevation than adjacent wetlands.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 10')			
1. Rubus armeniacus	10	Y	FAC
2. Cytisus scoparius	10	Y	UPL
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Schedonorus arundinaceus	40	Y	FAC
2. Anthoxanthum odoratum	20	Y	FACU
3. Agrostis species	20	Y	FAC
4. Leucanthemum vulgare	5	N	FACU
5. Polystichum munitum	5	N	FACU
6. Plantago lanceolata	5	N	FACU
7. Lotus corniculatus	5	N	FAC
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 60 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/3	100					sil	
10-18+	10YR 4/3	95	10YR 4/4	5	C	M	sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): >28

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): >28

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Probed below bottom of test plot to 28 inches, no saturation observed.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property City/County: St. Helens / Columbia Sampling Date: 10/18/2021
Applicant/Owner: Jeanne Morain/Comstock Trust State: OR Sampling Point: 7
Investigator(s): Stacy Benjamin Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 3
Subregion (LRR): A – NW Forests & Coast Lat: Long: Datum:
Soil Map Unit Name: 69 – Wollent silt loam NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes	X	No	**Is the Sampled Area within a Wetland?** **Yes X No**
Wetland Hydrology Present?	Yes	X	No	

Remarks: Plot located in north fork of LWI-wetland MC-2.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Fraxinus latifolia	30	Y	FACW
2.			
3.			
4.			
	30	= Total Cover	
Sapling/Shrub Stratum (Plot size: 10')			
1. Fraxinus latifolia	15	Y	FACW
2.			
3.			
4.			
5.			
	15	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Agrostis species	35	Y	FAC
2. Schedonorus arundinaceus	30	Y	FAC
3. Holcus lanatus	10	N	FAC
4. Anthoxanthum odoratum	10	N	FACU
5. Juncus effusus	5	N	FACW
6. Lotus corniculatus	5	N	FAC
7. Vicia hirsuta	5	N	UPL
8.			
9.			
10.			
11.			
	100	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

SOIL

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100					sicl	
6-15	10YR 3/2	95	10YR 4/4	5	C	M	sicl	
15-30	10YR 4/2	90	10YR 4/4	10	C	M	sicl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes	___	No	X	Depth (inches):	
Water Table Present?	Yes	___	No	X	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes	X	No	___	Depth (inches):	18

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soils very moist above 18 inches. Probed below bottom of test plot to 30 inches, no water table detected. Very hummocky in vicinity of plot, indicating seasonally saturated soils.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Comstock Property | City/County: St. Helens / Columbia | Sampling Date: 10/18/2021
Applicant/Owner: Jeanne Morain/Comstock Trust | State: OR | Sampling Point: 8
Investigator(s): Stacy Benjamin | Section, Township, Range: Sec. 6.; T4N; R1W
Landform (hillslope, terrace, etc.): Terrace | Local relief (concave, convex, none): Convex | Slope (%): 3
Subregion (LRR): A – NW Forests & Coast | Lat: | Long: | Datum:
Soil Map Unit Name: 69 – Wollent silt loam | NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	___	No	X
Hydric Soil Present?	Yes	___	No	X
Wetland Hydrology Present?	Yes	___	No	X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks: Plot located approx. 50 feet east of Plot 7, east of the wetland boundary and the end of scattered Oregon ash shrubs.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	___ = Total Cover		
Sapling/Shrub Stratum (Plot size: 10')			
1.			
2.			
3.			
4.			
5.			
	___ = Total Cover		
Herb Stratum (Plot size: 5')			
1. Schedonorus arundinaceus	30	Y	FAC
2. Agrostis species	30	Y	FAC
3. Leucanthemum vulgare	20	Y	FACU
4. Vicia hirsuta	20	Y	UPL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	___ = Total Cover		

% Bare Ground in Herb Stratum ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	60	x 3 =	180
FACU species	20	x 4 =	80
UPL species	20	x 5 =	100
Column Totals:	100 (A)		360 (B)

Prevalence Index = B/A = 3.6

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:

SOIL

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-12	10YR 3/2	100						
12-19	10YR 3/2	95	10YR 4/4	5	C	M	sil	
19-20+	10YR 4/2	90	10YR 4/4	10	C	M	sil	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** **X**

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): >28

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): >28

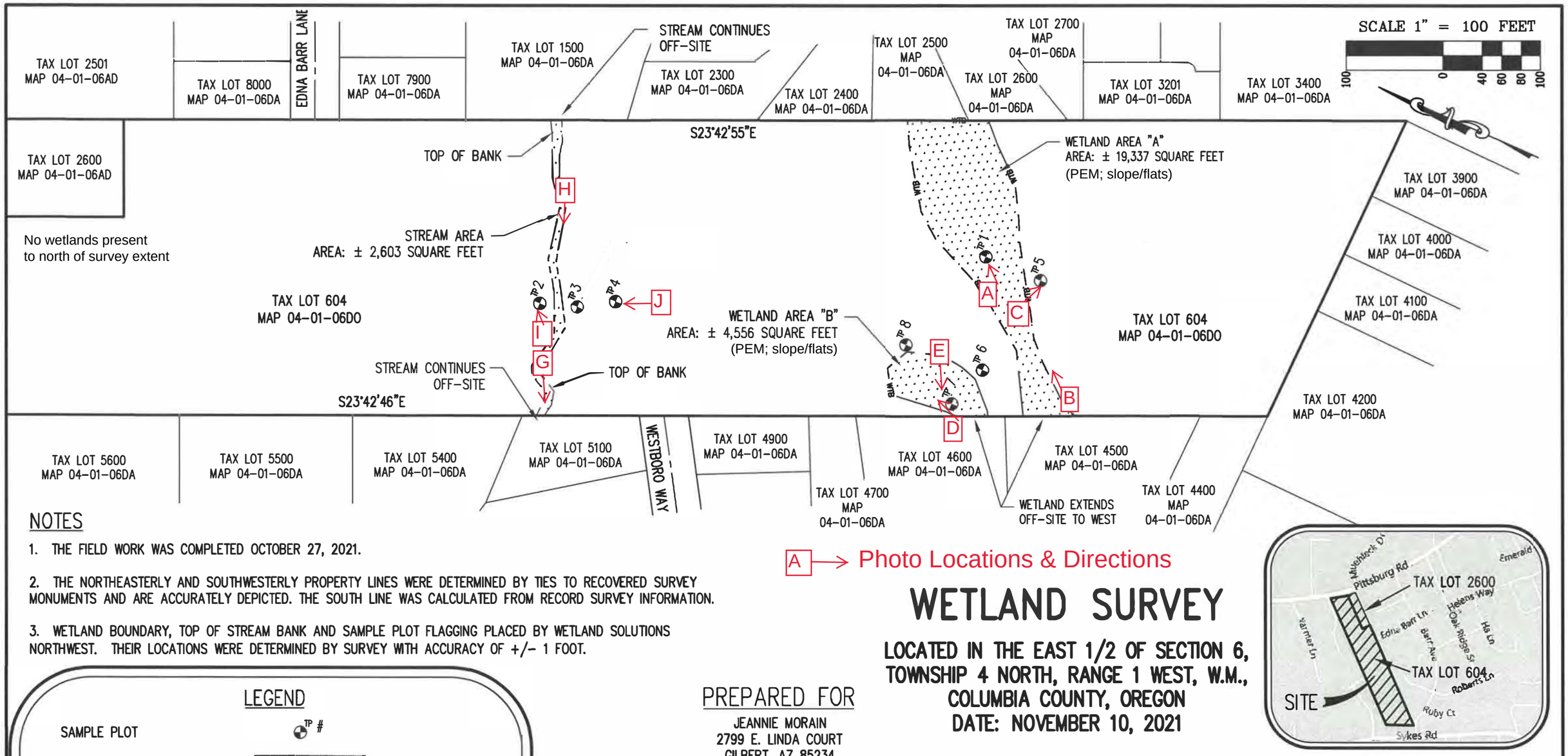
Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Probed below bottom of test plot to 28 inches, no saturation observed.

APPENDIX C

Ground-level Site Photographs



NOTES

1. THE FIELD WORK WAS COMPLETED OCTOBER 27, 2021.

2. THE NORTHEASTERLY AND SOUTHWESTERLY PROPERTY LINES WERE DETERMINED BY TIES TO RECOVERED SURVEY MONUMENTS AND ARE ACCURATELY DEPICTED. THE SOUTH LINE WAS CALCULATED FROM RECORD SURVEY INFORMATION.

3. WETLAND BOUNDARY, TOP OF STREAM BANK AND SAMPLE PLOT FLAGGING PLACED BY WETLAND SOLUTIONS NORTHWEST. THEIR LOCATIONS WERE DETERMINED BY SURVEY WITH ACCURACY OF +/- 1 FOOT.

A → Photo Locations & Directions

WETLAND SURVEY

LOCATED IN THE EAST 1/2 OF SECTION 6, TOWNSHIP 4 NORTH, RANGE 1 WEST, W.M., COLUMBIA COUNTY, OREGON
DATE: NOVEMBER 10, 2021

VICINITY MAP NOT TO SCALE

LEGEND

- SAMPLE PLOT — TP #
- WETLAND AREA
- WETLAND BOUNDARY — WTB —
- ORDINARY HIGH WATER LINE
- RIGHT-OF-WAY LINE
- PROPERTY LINE

PREPARED FOR

JEANNIE MORAIN
2799 E. LINDA COURT
GILBERT, AZ 85234

REGISTERED
PROFESSIONAL
LAND SURVEYOR
Scott Field
OREGON
JUNE 30, 1997
SCOTT F. FIELD
2844
RENEWS: 12/31/2021

JOB NAME:	MORAIN
JOB NUMBER:	2346
DRAWN BY:	BJA
CHECKED BY:	SFF
DRAWING NO:	2346 EXH WL1

BOUNDARY TOPOGRAPHIC CONSTRUCTION CADASTRAL

NORTHWEST SURVEYING, Inc.
1815 NW 169th PLACE, SUITE 2090
BEAVERTON, OR 97006
PHONE: 503-848-2127 FAX: 503-848-2179
www.nwsrvy.com

Photo A. View northeast of wetland plot 1 (yellow flag).

Photo B. View northeast of south boundary of wetland 'A' (pink flag).

Photo C. View southeast of upland plot 5.

Photo D. View north of wetland 'B' and wetland boundary (pink flag) and upland plot 8 (yellow flag) in background.

Photo E. View southwest of wetland plot 7.

Photo F. View southwest of culvert inflow into off-site portion of wetland 'B'.

Photo G. View southwest of top of bank of unnamed tributary to North Fork McNulty Creek.

Photo H. View southwest of top of bank of unnamed tributary to North Fork McNulty Creek.

Photo I. View northeast of upland plot 2 (yellow flag).

Photo J. View northwest of upland plot 4 (yellow flag).

APPENDIX D

Precipitation

Climatological Data for SCAPPOOSE INDUSTRIAL AP, OR - October 2021

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation	Snowfall	Snow Depth
2021-10-01	68	47	57.5	18	8	0.00	M	M
2021-10-02	73	43	58.0	18	8	0.00	M	M
2021-10-03	70	42	56.0	16	6	0.00	M	M
2021-10-04	70	53	61.5	22	12	0.00	M	M
2021-10-05	59	43	51.0	11	1	0.28	M	M
2021-10-06	64	42	53.0	13	3	0.17	M	M
2021-10-07	62	37	49.5	10	0	0.00	M	M
2021-10-08	60	38	49.0	9	0	0.00	M	M
2021-10-09	61	40	50.5	11	1	0.01	M	M
2021-10-10	62	39	50.5	11	1	0.05	M	M
2021-10-11	60	37	48.5	9	0	0.00	M	M
2021-10-12	53	33	43.0	3	0	0.22	M	M
2021-10-13	54	38	46.0	6	0	0.09	M	M
2021-10-14	57	49	53.0	13	3	0.05	M	M
2021-10-15	64	46	55.0	15	5	0.00	M	M
2021-10-16	66	45	55.5	16	6	0.00	M	M
2021-10-17	61	50	55.5	16	6	0.32	M	M
2021-10-18	58	41	49.5	10	0	0.00	M	M
2021-10-19	61	36	48.5	9	0	0.02	M	M
2021-10-20	61	50	55.5	16	6	0.25	M	M
2021-10-21	68	47	57.5	18	8	0.84	M	M
2021-10-22	61	51	56.0	16	6	0.04	M	M
2021-10-23	56	51	53.5	14	4	0.44	M	M
2021-10-24	58	51	54.5	15	5	0.51	M	M
2021-10-25	56	51	53.5	14	4	0.25	M	M
2021-10-26	59	51	55.0	15	5	0.11	M	M
2021-10-27	59	48	53.5	14	4	0.15	M	M
2021-10-28	70	52	61.0	21	11	0.45	M	M
2021-10-29	59	46	52.5	13	3	0.26	M	M
2021-10-30	63	38	50.5	11	1	0.00	M	M
2021-10-31	64	37	50.5	11	1	0.00	M	M
Average|Sum	**61.8**	**44.3**	**53.0**	**414**	**118**	**4.51**	**M**	**M**

Climatological Data for SCAPPOOSE INDUSTRIAL AP, OR - September 2021

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation	Snowfall	Snow Depth
2021-09-01	80	64	72.0	32	22	0.00	M	M
2021-09-02	86	51	68.5	29	19	0.00	M	M
2021-09-03	86	50	68.0	28	18	0.00	M	M
2021-09-04	88	50	69.0	29	19	0.00	M	M
2021-09-05	87	57	72.0	32	22	0.00	M	M
2021-09-06	84	56	70.0	30	20	0.00	M	M
2021-09-07	89	53	71.0	31	21	0.00	M	M
2021-09-08	88	57	72.5	33	23	T	M	M
2021-09-09	85	56	70.5	31	21	0.00	M	M
2021-09-10	70	59	64.5	25	15	0.00	M	M
2021-09-11	81	47	64.0	24	14	0.00	M	M
2021-09-12	77	61	69.0	29	19	0.00	M	M
2021-09-13	76	46	61.0	21	11	0.00	M	M
2021-09-14	83	49	66.0	26	16	0.00	M	M
2021-09-15	73	53	63.0	23	13	T	M	M
2021-09-16	78	39	58.5	19	9	0.00	M	M
2021-09-17	76	51	63.5	24	14	0.09	M	M
2021-09-18	69	54	61.5	22	12	2.28	M	M
2021-09-19	70	51	60.5	21	11	0.22	M	M
2021-09-20	73	46	59.5	20	10	0.00	M	M
2021-09-21	86	46	66.0	26	16	0.00	M	M
2021-09-22	69	53	61.0	21	11	0.06	M	M
2021-09-23	75	53	64.0	24	14	0.00	M	M
2021-09-24	90	50	70.0	30	20	0.00	M	M
2021-09-25	83	50	66.5	27	17	0.00	M	M
2021-09-26	75	54	64.5	25	15	0.06	M	M
2021-09-27	65	50	57.5	18	8	0.28	M	M
2021-09-28	62	50	56.0	16	6	0.15	M	M
2021-09-29	66	46	56.0	16	6	0.02	M	M
2021-09-30	62	47	54.5	15	5	0.09	M	M
Average|Sum	**77.7**	**51.6**	**64.7**	**747**	**447**	**3.25**	**M**	**M**

Climatological Data for SCAPPOOSE INDUSTRIAL AP, OR - August 2021

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation	Snowfall	Snow Depth
2021-08-01	90	62	76.0	36	26	0.00	M	M
2021-08-02	93	61	77.0	37	27	0.00	M	M
2021-08-03	91	59	75.0	35	25	0.00	M	M
2021-08-04	96	57	76.5	37	27	0.00	M	M
2021-08-05	84	64	74.0	34	24	0.00	M	M
2021-08-06	80	61	70.5	31	21	T	M	M
2021-08-07	80	57	68.5	29	19	0.02	M	M
2021-08-08	78	53	65.5	26	16	0.00	M	M
2021-08-09	87	60	73.5	34	24	0.00	M	M
2021-08-10	93	66	79.5	40	30	0.00	M	M
2021-08-11	104	66	85.0	45	35	0.00	M	M
2021-08-12	108	65	86.5	47	37	0.00	M	M
2021-08-13	95	66	80.5	41	31	0.00	M	M
2021-08-14	92	63	77.5	38	28	0.00	M	M
2021-08-15	94	60	77.0	37	27	0.00	M	M
2021-08-16	85	55	70.0	30	20	0.00	M	M
2021-08-17	73	56	64.5	25	15	0.00	M	M
2021-08-18	83	51	67.0	27	17	0.00	M	M
2021-08-19	82	53	67.5	28	18	0.00	M	M
2021-08-20	72	60	66.0	26	16	T	M	M
2021-08-21	70	57	63.5	24	14	T	M	M
2021-08-22	70	54	62.0	22	12	T	M	M
2021-08-23	76	44	60.0	20	10	0.00	M	M
2021-08-24	88	54	71.0	31	21	0.00	M	M
2021-08-25	M	M	M	M	M	M	M	M
2021-08-26	M	M	M	M	M	0.00	M	M
2021-08-27	M	M	M	M	M	0.00	M	M
2021-08-28	M	M	M	M	M	0.00	M	M
2021-08-29	M	M	M	M	M	0.00	M	M
2021-08-30	M	M	M	M	M	0.00	M	M
2021-08-31	M	M	M	M	M	0.00	M	M
Average|Sum	**86.0**	**58.5**	**72.3**	**780**	**540**	**0.02**	**M**	**M**

Climatological Data for SCAPPOOSE INDUSTRIAL AP, OR - July 2021

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation	Snowfall	Snow Depth
2021-07-01	74	65	69.5	30	20	0.00	M	M
2021-07-02	86	60	73.0	33	23	0.00	M	M
2021-07-03	88	61	74.5	35	25	0.00	M	M
2021-07-04	87	57	72.0	32	22	0.00	M	M
2021-07-05	86	58	72.0	32	22	0.00	M	M
2021-07-06	91	58	74.5	35	25	0.00	M	M
2021-07-07	75	59	67.0	27	17	0.01	M	M
2021-07-08	80	56	68.0	28	18	0.00	M	M
2021-07-09	89	55	72.0	32	22	0.00	M	M
2021-07-10	86	59	72.5	33	23	0.00	M	M
2021-07-11	87	56	71.5	32	22	0.00	M	M
2021-07-12	87	58	72.5	33	23	0.00	M	M
2021-07-13	87	57	72.0	32	22	0.00	M	M
2021-07-14	82	58	70.0	30	20	0.00	M	M
2021-07-15	80	58	69.0	29	19	0.00	M	M
2021-07-16	76	56	66.0	26	16	0.00	M	M
2021-07-17	82	51	66.5	27	17	0.00	M	M
2021-07-18	87	58	72.5	33	23	0.00	M	M
2021-07-19	90	55	72.5	33	23	0.00	M	M
2021-07-20	80	59	69.5	30	20	0.00	M	M
2021-07-21	76	50	63.0	23	13	0.00	M	M
2021-07-22	82	51	66.5	27	17	0.00	M	M
2021-07-23	86	50	68.0	28	18	0.00	M	M
2021-07-24	91	65	78.0	38	28	0.00	M	M
2021-07-25	90	62	76.0	36	26	0.00	M	M
2021-07-26	90	59	74.5	35	25	0.00	M	M
2021-07-27	89	62	75.5	36	26	0.00	M	M
2021-07-28	95	56	75.5	36	26	0.00	M	M
2021-07-29	98	60	79.0	39	29	0.00	M	M
2021-07-30	101	73	87.0	47	37	0.00	M	M
2021-07-31	86	67	76.5	37	27	0.00	M	M
Average|Sum	**85.9**	**58.4**	**72.1**	**1004**	**694**	**0.01**	**M**	**M**

Climatological Data for SCAPPOOSE INDUSTRIAL AP, OR - June 2021

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation	Snowfall	Snow Depth
2021-06-01	96	67	81.5	42	32	0.00	M	M
2021-06-02	90	60	75.0	35	25	0.00	M	M
2021-06-03	85	57	71.0	31	21	0.00	M	M
2021-06-04	77	51	64.0	24	14	0.00	M	M
2021-06-05	69	44	56.5	17	7	T	M	M
2021-06-06	64	42	53.0	13	3	0.02	M	M
2021-06-07	67	43	55.0	15	5	0.00	M	M
2021-06-08	67	49	58.0	18	8	T	M	M
2021-06-09	69	44	56.5	17	7	T	M	M
2021-06-10	68	44	56.0	16	6	T	M	M
2021-06-11	63	52	57.5	18	8	0.24	M	M
2021-06-12	77	50	63.5	24	14	0.30	M	M
2021-06-13	68	62	65.0	25	15	0.89	M	M
2021-06-14	72	53	62.5	23	13	0.12	M	M
2021-06-15	72	48	60.0	20	10	T	M	M
2021-06-16	80	46	63.0	23	13	0.00	M	M
2021-06-17	84	56	70.0	30	20	0.00	M	M
2021-06-18	80	56	68.0	28	18	0.00	M	M
2021-06-19	83	51	67.0	27	17	0.00	M	M
2021-06-20	91	61	76.0	36	26	0.00	M	M
2021-06-21	96	61	78.5	39	29	0.00	M	M
2021-06-22	86	57	71.5	32	22	0.00	M	M
2021-06-23	82	57	69.5	30	20	0.00	M	M
2021-06-24	90	52	71.0	31	21	0.00	M	M
2021-06-25	96	60	78.0	38	28	0.00	M	M
2021-06-26	107	64	85.5	46	36	0.00	M	M
2021-06-27	112	69	90.5	51	41	0.00	M	M
2021-06-28	116	68	92.0	52	42	0.00	M	M
2021-06-29	91	62	76.5	37	27	0.00	M	M
2021-06-30	76	61	68.5	29	19	0.00	M	M
Average|Sum	**82.5**	**54.9**	**68.7**	**867**	**567**	**1.57**	**M**	**M**

WETS Station: SCAPPOOSE INDUSTRIAL AP, OR

Requested years: 1991 - 2020

Month	Temperature (°F)			Precipitation (inches)				
	Avg daily max*	Avg daily min*	Avg daily mean*	Avg*	30% chance will have		Avg number of days with 0.10 inch or more	Average total snowfall*
					less than	more than		
Jan	46.8	33.8	40.3	6.54	4.24	7.15	13	-
Feb	51.2	34.2	42.7	4.62	2.74	5.31	11	-
Mar	56.3	36.9	46.6	4.54	3.17	5.53	11	-
Apr	61.0	39.9	50.5	3.08	2.18	3.36	9	-
May	68.2	46.2	57.2	2.49	1.18	2.73	7	-
Jun	73.1	50.6	61.9	1.37	0.88	1.63	5	-
Jul	81.0	54.5	67.8	0.48	0.13	0.37	1	-
Aug	82.0	54.4	68.2	0.52	0.19	0.57	2	-
Sep	76.3	49.8	63.1	1.56	0.60	1.86	4	-
Oct	63.6	42.8	53.2	3.60	2.22	4.27	8	-
Nov	52.6	37.0	44.8	6.26	3.63	6.99	12	-
Dec	46.1	33.7	39.9	7.25	4.95	8.16	13	-
Annual:					35.13	43.99		
Average	63.2	42.8	53.0	-	-	-	-	-
Total	-	-	-	42.31			96	-

APPENDIX E

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APPENDIX F

SWCA Stakeholder Engagement Plan, October 2025

St. Helens Reservoir Siting Stakeholder Outreach Plan

OCTOBER 2025

PREPARED FOR

City of St. Helens

PREPARED BY

SWCA Environmental Consultants

ST. HELENS RESERVOIR SITING
STAKEHOLDER OUTREACH PLAN

Prepared for

City of St. Helens
265 Strand Street
St. Helens, Oregon 97051

SWCA Environmental Consultants
1800 NW Upshur St Unit 100
Portland, OR 97209
www.swca.com

SWCA Project No. 97131

October 2025

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PROJECT OVERVIEW

The City of St. Helens, Oregon (City), is investigating siting a new water reservoir with a storage capacity of at least 5.0 million gallons (MG) to support existing needs and future growth. The existing water system is supplied by two Ranney collector wells, located north of St. Helens in Columbia City. These wells draw water from shallow sand and gravel deposits near the Columbia River through a process called induced infiltration. After collection, the water is pumped to the City's water filtration facility, where it is filtered and then distributed throughout the city.

Currently, water is stored in three active reservoirs: a 2.5-MG reservoir, a 0.2-MG Green Tank and the 0.5-MG Elk Ridge Reservoir. The city's oldest reservoir, a 2.0-MG tank located at the same site as the 2.5-MG reservoir, is no longer in use due to significant leaks that could not be repaired.

In 2023, the City considered rehabilitating the 2.0-MG reservoir or replacing it with a new tank at the same location. However, this project was discontinued because the estimated costs were more than double the original budget, and the site was too small to accommodate a larger reservoir that would meet future water storage needs identified in the City's Water Master Plan.

With the 2.0-MG reservoir out of service, St. Helens currently faces a water storage shortfall of 0.8 MG. Looking ahead 20 years, this deficit is projected to grow to 2.8 MG.

STAKEHOLDER OUTREACH PURPOSE AND GOALS

This stakeholder outreach plan outlines efforts the City will take to provide information to the public about the project. Two main goals were identified for successful public outreach:

Goal 1: Ensure that the public is well informed about the project and siting process.

- Inform and educate community members with clear, easily understood, factual, and timely information regarding reservoir siting and any related regulatory processes
- Develop an effective process for project updates throughout the process
- Communicate milestones, decision points, and opportunities for input in advance to the public
- Ensure transparency by sharing relevant technical, environmental, and social information in plain, easy-to-understand language

Goal 2: Convey the importance and value of public, agency, and stakeholder understanding throughout the siting process.

- Establish and maintain open lines of communication
- Emphasize how community and stakeholder input helps shape project outcomes and ensures local needs are considered
- Provide reasonable opportunities for the public to ask questions about the project
- Demonstrate the City's commitment to listening, addressing concerns, and incorporating feedback where feasible

PROJECT SCHEDULE

Table 1 summarizes the proposed schedule for public outreach.

Table 1. Project Schedule

Milestone	Scheduled Completion (2025)
City review of: • Draft stakeholder outreach plan • Advertisement • Mailing City provides mailing list and list of stakeholders	September 10–19
Final stakeholder outreach plan, advertisement, and mailing	October 3
Drilling results available	October 17
Submit advertisements for public meeting	October 31 for publication (1 week prior to meeting) (The *Columbia County Spotlight* is published every Friday. The deadline is for ads is noon, Friday, the week prior to publication.)
SWCA sends project mailings	October 31 (2 weeks prior to meeting)
City review of draft public meeting materials: • Map boards • Project handout or factsheet	October 24–30
Final public meeting materials (SWCA begins printing materials)	October 24
Public meeting	November 13

POTENTIALLY INTERESTED PARTY IDENTIFICATION

Table 2 summarizes potentially interested audiences for stakeholder engagement.

Table 2. Stakeholder Roles and Influence

Stakeholder Group	Interest or Role	Potential Stakeholder Concerns or Needs	Level of Influence/Impact
Mayor and City Council	Decision-makers	Community support, project success	High
Local Residents (surrounding property owners)	Directly impacted	Property values, construction impacts	High
State Agencies (Oregon Department of Environmental Quality, Oregon Department of Health)	Regulatory oversight	Compliance, environmental protection	High
Local Governments or Agencies (Columbia County)	Regulatory oversight	Land use compatibility, environmental compliance	High
Local Governments or Agencies (Columbia Soil & Water Conservation District)	Environmental impacts	Water quality protection, and soil stability and erosion	Medium
Media	Information dissemination	Accurate, timely updates	Low

OUTREACH METHODS

Table 3 summarizes the public outreach activities and their anticipated schedule.

Table 3. Public Outreach Methods

Outreach Method	Description	Responsible	Target Date
Mailing List	Contact information for potentially interested parties will be maintained in a mailing list. This list will include individuals and organizations that may be affected by or have an interest in the project. It will serve as the primary distribution list for project-related communications and updates.	City, SWCA	3 weeks prior to public meeting
Public Mailing	Informational postcards will be mailed to adjacent landowners for up to four potential reservoir sites. Postcards will be sent prior to the public meeting, and will include information about the project and the public meeting, along with a link to the project website.	SWCA	2 weeks prior to public meeting
Public email blast	Informational emails will be emailed to adjacent landowners for the four potential reservoir sites considered. Emails will be sent prior to the public meeting and will include information about the project and the public meeting, along with a link to the project website.	City	2 weeks prior to public meeting
Newspaper Advertisement	Public meeting details will be advertised in the *Columbia County Spotlight* newspaper to broaden public awareness.	SWCA	Ad will run once: 1 week prior to public meeting
Public Meeting	One in-person public open house will occur on a weekday evening. Meeting materials will include sign-in sheets, informational boards, and a project handout or factsheet.	SWCA, Keller, City	November 13, 2025

APPENDIX G

Opinion of Most Probable Cost for Recommended Site

Client: City of St. Helens

Project: 5.0 MG Reservoir Siting Study

Project Title: 5.0 MG Reservoir Construction

Need for Project:
- Insufficient storage capacity is projected for the City and existing infrastructure is outdated and past design life.

Objective:
- Install a new 5.0 MG Reservoir to replace the 2.0 MG Reservoir, meet 2041 storage projections, and provide a surplus of 2.0 MG beyond the study period.

Design Considerations:
- Note costs are based on the Meadowview Drive location.

Location: Site 2 (Off Meadowview Drive)

General Line Item	Estimated Quantity	Unit	Unit Price	Item Cost (Rounded)	Total Cost (2025 Dollars)
Goods and Services					
New 5.0 MG Concrete Storage Reservoir (includes tank and foundation only)	1	LS	$ 7,000,000	$ 7,000,000	
Reservoir Site Preparation (Foundation Prep)	1	LS	$ 300,000	$ 300,000	
24-inch DIP Water Connection Pipe - Excavation, Backfill, Fittings	2,400	LF	$ 460	$ 1,104,000	
24-inch DIP Overflow Pipe - Excavation, Backfill, Valves, Hydrants, Fittings, Services	400	LF	$ 460	$ 184,000	
Altitude Valve at Existing Reservoir	1	LS	$ 50,000	$ 50,000	
General Site Improvements, Landscaping, and Grading	1	LS	$ 100,000	$ 100,000	
Asphalt Access Road	9,200	SF	$ 6	$ 57,000	
Gravel Road Surface On Site	13,200	SF	$ 2	$ 27,000	
Detention Pond (210'x50'x3')	1	LS	$ 250,000	$ 250,000	
Traffic Control w/ Flaggers	1	LS	$ 50,000	$ 50,000	
Frontage Improvements	1	LS	$ 300,000	$ 300,000	
Electrical and Controls	1	LS	$ 250,000	$ 250,000	
Tank Mixing System	1	LS	$ 250,000	$ 250,000	
Misc. Metals (Hatch, stairs, etc.)	1	LS	$ 80,000	$ 80,000	
				Construction Subtotal	***$ 9,422,000***
Additional Elements (estimated % of above)					
Mobilization and Administration			10%	$ 942,000	
Bonding			2.5%	$ 236,000	
Contractor Overhead and Profit			15%	$ 1,413,000	
Contingency			30%	$ 2,827,000	
				Total Construction Subtotal	***$ 14,840,000***
Plans and Contract Documents					
Engineering Design and Bid Phase Services			10%	$ 1,484,000	
Engineering - Construction Contract Administration			5%	$ 742,000	
Engineering -- Observation			5%	$ 742,000	
Permitting			LS	$ 50,000	
Geotechnical Investigation			LS	$ 30,000	
Surveying			LS	$ 25,000	
Environmental			LS	$ 35,000	
Land Acquisition	12	AC	$ 140,000	$ 1,680,000	
Legal, Administrative, and Funding			2.0%	$ 297,000	
				Total Project Costs (rounded)	**$ 19,930,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.

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