Branch
ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

July 28, 2023

Donna Holt
Executive Director
Linn Benton Housing Authority
1250 Queen Avenue SE
Albany, Oregon

RE: **GEOTECHNICAL ENGINEERING INVESTIGATION**
MULTI-FAMILY RESIDENTIAL DEVELOPMENT
TAX MAP 11S-03W-08DB TAX LOT 06000
2080 QUEEN AVENUE SE
ALBANY, OREGON
BRANCH ENGINEERING INC. PROJECT NO. 23-321

Pursuant to your authorization, Branch Engineering Inc. (BEI) performed a geotechnical engineering investigation at the subject site located in Albany, Oregon for the proposed construction of a multi-family residential apartment complex. The accompanying report presents the results of our site research, field exploration and testing, data analyses, as well as our conclusions and recommended geotechnical design parameters for the project.

Based on the results of our study, no major geotechnical/geologic hazards were identified at the site that would impede the proposed development or adjacent lots, provided that the recommendations of this report are implemented in the design and construction of the project.

We appreciate the opportunity to be of service to you. Please contact the undersigned if you have questions or concerns regarding this report.

Sincerely,
Branch Engineering Inc.

REGISTERED PROFESSIONAL ENGINEER
#16,170
Ronald J. Derrick
OREGON
SEPT 15, 1992
RONALD J. DERRICK
EXPIRES: 12/31/2023

Digitally signed by Ronald J. Derrick
Date: 2023.07.28 14:01:18 -07'00'

Samuel Rabe

Ronald J. Derrick, P.E., G.E.
Principal Geotechnical Engineer

Sam Rabe EIT
Field Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose and Scope of Work

The purpose of this work is to establish and present geotechnical engineering criteria and requirements related to the site and subsurface conditions that may influence the design and construction of the proposed project. Our scope of work included a field reconnaissance with a subsurface investigation observed by BEI personnel, an engineering data review of existing geologic and geotechnical reports in the site vicinity, infiltration testing results with results presented in a separate report, and other pertinent site research activities that culminated in the preparation of this report.

1.2 Project Location and Description

The subject site consists of rectangularly shaped lot located at the coordinates of 44.624914° North Latitude, and 123.078871° West Longitude, in Albany, Oregon (see Figure-1, Vicinity Map).

The project site is located approximately 1.3-miles south of the Willamette River, and 0.8-miles west of Interstate 5. The surrounding land use is primarily multi and single-family residential, with Willow Queen Avenue SE and single-family residences on the north, an electric substation on the west, a single-family residence and vacant field to the east, and a multi-family (senior) residential complex to the south. At the time of our site visit the vegetation was limited to a turf surface with deciduous trees along the west, north, and northeast perimeter. The majority of the site is elevated above the surrounding land by 4- to 6-feet, otherwise topography on the site, and in the site vicinity is relatively flat. (See Figure-2 for Site Investigation Photo).

Historical aerial imagery dating from 1956 and 1963 is not of a high enough resolution to show the site clearly, but it is likely agricultural land with scattered rural residential housing. Google Earth imagery from 1994 to 2022 shows a structure in the southeast area of the site, with the rest of the land appearing as a vacant grass covered field. No grading or site developments appear to have occurred on the site until sometime between 1994 and 2000, with the Google Earth image dated to July 2000 showing what appears to be construction activity. By May of 2002 Clayton Meadows Senior Apartments to the south of the site are fully constructed and the site appears much as it did at the time of our site investigation. Site topography, historical imagery, and subsurface materials logged by BEI during our site investigation indicate the site was used as a repository for soil and/or aggregate fill, no documentation for placement of the fill was presented to BEI at the time this report was prepared; however, it likely occurred during construction of the Clayton Meadows Senior Apartments (See Figures 3 and 4 for historical aerial imagery.

A preliminary site plan provided to BEI by the client shows a muti-family residential structure on the western portion of the site. A parking lot system is shown with access to the structure from the south (see Figure-2 Site Investigation Photo with Project Overlay).

1.3 Site information Resources

The following site investigation activities were performed and literature resources were reviewed for pertinent site information:

- Google Earth, earth.google.com
- Linn County GIS Surveyor Map Application Online Viewer
- Seven (7) test pits were excavated to a maximum depth of 8-feet below ground surface (BGS)

on July 11, 2023.

- Review of the Web Soil Survey, United States Department of Agricultural (USDA) Natural Resources Conservation Service (NRCS) (attached in Appendix A).
- Review of Oregon Department of Water Resources Well Logs (attached in Appendix A).
- Oregon Department of Geology and Mineral Industries (DOGAMI) web hazard viewer.
- McClaughry, J.D., Wiley, T.J., Ferns, M.L., & Madin, I.P. 2010. Geology of the Southern Willamette. DOGAMI. Open-file Report O-10-03.
- Geology of Oregon, sixth edition by Orr, Orr and Baldwin, 2012.
- Historical aerial imagery. Oregon State University library online
- USGS U.S. Quaternary Faults
- Oregon Structural Specialty Code 2022 (OSSC 2022), applicable building code criteria
- The Oregon Resilience Plan, February 2013.

2.0 GEOLOGIC SETTING

The following sections describe the regional and local site geology and a brief discussion of regional seismicity.

2.1 Regional Geology

The subject site lies within the central portion of the Willamette Valley, east of the Coast Range and west of the Cascade Mountains Provinces. In Oregon, the Willamette Valley is an elongate basin which narrows at both ends before terminating in the Calapooya Divide to the south and the Columbia River to the north. The basin is approximately 130 miles long and 40 miles wide. The valley is drained by the Willamette River and drops from an elevation of approximately 400-feet at Eugene, to near sea level at the northern end of the basin where the Willamette River drains into the Columbia River.

The Willamette River Valley in the area of the subject site is believed to be heavily influenced by historic hydrology, including the movement and sediment deposition of the Willamette River and its tributaries. The Willamette River once moved frequently throughout the valley floor and often overflowed onto the low-lying floodplains. During the last deglaciation and the resulting termination of the Last Glacial Maximum in North America, the Willamette Valley was cyclically flooded by catastrophic breaks in the ice dams of Glacial Lake Missoula. Occurring several times over an approximately 2,000-year period between 13,000 to 15,000 ago, these flood events filled the valley to an elevation of 350- to 400-feet before retreating, causing sequences of upward fining deposits of silt and clay that may or may not still be present in areas depending on erosion by subsequent fluvial actions. Much of these deposits have since become developed and urbanized.

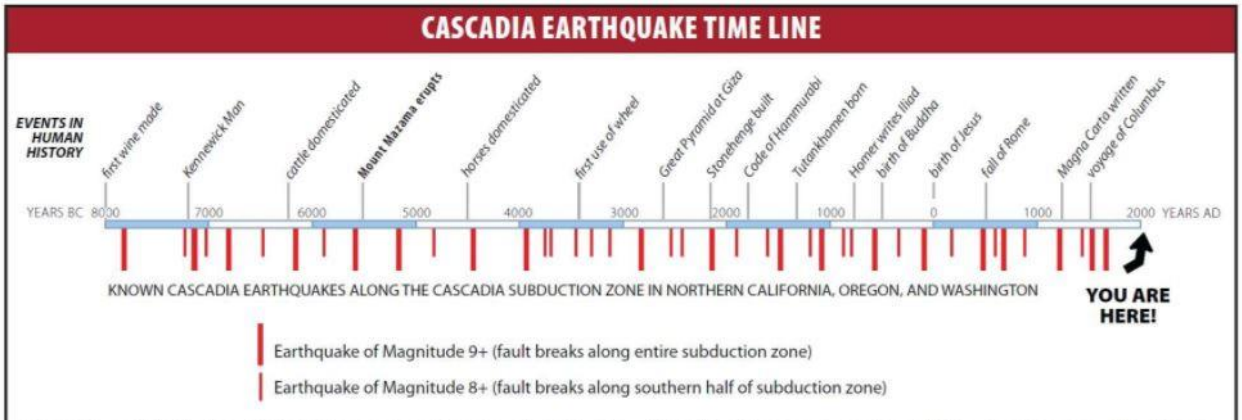
2.2 Site Geology

The DOGAMI open file reports O-71-03 (Figure-5 Site Vicinity Geology) maps the site geologic unit as Terrace and Fan Deposits (Qtf). Described as deeply dissected, unconsolidated to semi-consolidated deposits of gravel, sand, silt, and clay that form upper alluvial terraces along the Willamette. The unit is interpreted as fluvial braid plain sediments deposited in broad fans and upland terrace complexes. These descriptions are generally consistent with our investigations findings of soils derived from alluvium beneath the undocumented fill.

2.3 Regional Seismicity

The nearest mapped active fault to the site is the Corvallis Fault, located 7.5-miles to northwest across the Willamette River. The Lebanon Fault, which is aligned northwest to southeast approximately 0.8-miles to the southwest of the site. The East Albany Fault, which is aligned southwest to northeast, is located approximately 1.2-miles to the southwest. These faults are not known to be active, as they are not listed in the online United States Geologic Survey Quaternary Faults online map; however, seismic activity is not uncommon in the Willamette Valley as evidenced by the 1993 Scotts Mills Earthquake east of Salem that registered a 5.7 moment magnitude and most recently a 4.2 magnitude earthquake about 12-miles east of Eugene.

The greatest source of potential seismicity that would affect the site is the Cascadia Subduction Zone (CSZ) located off the coast of Oregon, Washington, and the northern portion of California that has the potential to produce very large earthquakes on the order of 300 to 500 years—see the published CSZ timeline below. The last known mega-thrust CSZ earthquake (Magnitude 9.0 +/-) to take place in the Pacific Northwest occurred in January of 1700.



Comparison of the history of subduction zone earthquakes along the Cascadia Subduction Zone in northern California, Oregon, and Washington, with events from human history. Ages of earthquakes are derived from study and dating of submarine landslides triggered by the earthquakes. Earthquake data provided by Chris Goldfinger, Oregon State University; time line by Ian P. Madin, DOGAMI.

3.0 SITE SUBSURFACE CONDITIONS

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist and assume that the results from the subsurface explorations presented in Appendix A are representative of the subsurface conditions throughout the site. If during construction the subsurface conditions differ from those encountered in the exploratory borings, BEI requests that we be informed to review the site conditions and adjust our recommendations, if necessary.

3.1 Subsurface Soils

Visual classification of the near surface soils was performed in accordance with the American Society of Testing and Materials (ASTM) Method D-2488 and the Unified Soil Classification System (USCS). BEI personnel observed seven (7) test pits excavated to a maximum depth of 8-feet BGS using a rubber tracked min-excavator equipped with a 12-inch-wide toothed bucket. The locations were selected to provide a generalized view of the subsurface soils present in the areas of proposed development. The results of our exploration activities are summarized below:

Test Pits 1, 3, 4, and 5.

- Sparse grass surface then brown silt with roots to a maximum depth of 0.25-feet BGS.
- Undocumented fill - primarily consisting of brown silt with subangular and angular gravel. Some plastic and asphalt. A 3-inch diameter metal pipe was found at 4-feet BGS in Test Pit 4, and at 3-feet BGS in Test Pit 5, alignment suggested it was the same pipe encountered in both test pits. The undocumented fill generally averaged 4-feet in depth on the raised area of the site.
- Brown clay (CL) - with some silt and very fine-grained sand, slight to very heavy oxidation staining. Interpreted as native alluvial deposits from a low energy fluvial environment. In Test Pit-3 we logged gray-blue clay at approximately the same elevation as we encountered the brown clay in the other excavations. The gray-blue clay extended to the maximum depth the excavator could achieve at 8-feet below the adjacent ground surface. The material appeared native.

Test Pit 2, and Infiltration Test Pits 1 and 2

- Topsoil – Bare or sparse grass surface overlying brown clay (OL-OH) with some fine roots, from the surface to 1.5-feet BGS.
- Brown clay (CL) - with some silt and very fine-grained sand, slight to very heavy oxidation staining. Interpreted as native alluvial deposits from a low energy fluvial environment.

Well logs in the site vicinity were obtained from the Oregon Department of Water Resources online database are attached in Appendix A. The logs are similar, showing fine-grained soils overlying coarse-grained soil which were found at 19-feet in Well L18999 located 400-feet to the north. The alternating fine- and coarse-grained soils shown in the well logs are consistent with an alluvial depositional history.

3.2 Laboratory Testing

Representative soil samples were collected at the site for laboratory testing. The resulting in-situ moisture contents (ASTM D2216) and Free Swell (IS-2720) test results are tabulated below.

Table 1: Lab Testing Results

Test Location	***Depth BGS (feet)***	***Soil Description***	***Moisture Content (%)***	***Free Swell (%)***	***Swell Rating***
TP-1	3	Brown clay (CL)	9 %	20%	Low
TP-2	4	Brown-gray clay (CL)	19 %	20%	Low
TP-3	5	Gray-blue clay (CL)	22%	30%	Low

Results show the underlying soils have a low shrink/swell potential which is consistent with testing of similar soil by BEI in the site vicinity.

3.3 Mapped Soils

The USDA NRCS map, shown in Appendix A, shows that the project site has one soil unit present and is summarized below. These descriptions are in general agreement with our site observations.

- Concord silt loam. Described as terrace deposits of silt loam, and silty clay derived from a parent material of silty and clayey alluvium derived from mixed sources. The soil unit is described as poorly drained and having a hydric soil rating. This description is consistent with the soil observed underlying the undocumented fill.

3.4 Groundwater

BEI staff observed the test pit excavations for the infiltration tests and the geotechnical test pits, which were advanced to a maximum depth of 8-feet BGS for deeper soil observations. We did not encounter the regional groundwater table in any of the site excavations. The attached well logs indicate that groundwater was measured between 6- and 13-feet BGS at the well's locations. The depth at which water was first found varied from 12- to 54-feet BGS, which indicates the presence of confined aquifer systems in the site vicinity.

We expect that groundwater levels (from the regional water table or perched lenses) will fluctuate with the seasons and should be expected to be highest during the late winter and spring months when rainstorms are more intense and frequent, and soils are near saturation. The presence of groundwater is not expected to impact shallow foundations, but perched lenses may occur during the wetter months of year.

4.0 GEOLOGIC HAZARDS

OSSC 2022 (1803.5.11) required criteria for hazards the geotechnical investigation shall address for seismic site class designations C through F are listed below with slope stability being addressed in the following section.

- Slope Instability: The DOGAMI geohazard viewer maps the site has having low landslide hazard present on the site. The viewer does not show any mapped landslides present on, or around, the site due to the relatively gentle slopes present on the site. It is our opinion that because of a lack of slopes susceptible to landslides, the risk to the site is low.

- Liquefaction: Liquefaction is caused by a rapid increase in porewater pressure within a saturated soil that reduces the interparticle friction between soil grains that can lead to the sudden loss of shear strength within the soil. This can cause a loss of bearing capacity, densification of subsurface soils that can lead to large surficial settlements, and the migration of soil particles to the surface in the form of sand boils. Loose, granular sands with a low fine-grained soil content and a recent depositional history are especially vulnerable to liquefaction. Saturation is required for a soil to experience liquefaction.

  The DOGAMI online hazard viewer map shows a high liquefaction risk at the site. During our explorations we observed primarily fine-grained soils that are not usually susceptible to liquefaction. Because of the depth to groundwater and the low probability of saturation occurring simultaneously with a large seismic event, it is our opinion that there is little risk for liquefaction to occur that would impact site structures. The Oregon Resilience Plan shows the potential for greater than 1-foot of ground movement because of liquefaction in the general site vicinity.

- Expected Earthquake Shaking – The site is mapped within the zone of severe shaking that would typically be associated with very large earthquakes generated from the CSZ off the Oregon coastline.

- Surface Displacement Due to Faulting or Seismically Induced Lateral Spreading or Lateral Flow: There are no known faults on the site that could cause large surficial displacements. The site soils are at a low risk for liquefaction that would allow for lateral spreading to occur, and this would likely be localized to developments along the river frontage to the south of the site. Surface displacement or seismically induced lateral spreading is not expected at the site.

- Tsunami/seiche: No major bodies of water capable of generating a Tsunami or seiche are near enough to the site to effect it. Therefore, risk of a tsunami or seiche affected the site is nonexistent.

- Shrink/swell: As discussed in section 3.2, our laboratory testing found that site soils have a low potential for expansion.

- Flood Hazard: Based on the DOGAMI HazVu viewer, the site is not mapped within a flood hazard zone.

5.0 CONCLUSIONS

Based on our field observations, subsurface explorations, and data analyses, we conclude that the site is geologic and geotechnically suitable for the proposed development provided that the recommendations of this report are incorporated into the design and construction of the project.

Our investigation revealed the presence of undocumented fill material over much of the site, with thicknesses ranging from 2- to 4.25-feet. The fill does not appear to contain sufficient organic material that would necessitate its complete removal to mitigate future settlement; however, the fill is not homogeneous and some settlement should be expected with the addition of loads on the fill material. The following recommendation is presented to address the presence of undocumented fill and the variables grades throughout the site. No site grading plan was made available to BEI at the time this report was prepared.

6.0 DESIGN RECOMMENDATIONS

The following sections present site-specific recommendations for site preparation. Earthwork shall be performed in general accordance with the standard of practice as generally described in Appendix J of the Uniform Building Code and the Oregon Structural Specialty Code, and as specified in this report. General material and construction specifications for the items discussed herein are provided in Appendix B.

The subsurface conditions observed in our site investigation only represent specific locations on the site. Should soft or unsuitable soils extend to a depth or extent greater than that described herein, or areas of distinct soil variation be discovered, this office shall be notified to perform site observations and additional excavation may be required. Once finalized plans for the site are prepared BEI asks that they be notified so that we may address any changes to our recommendations.

6.1 Foundation Subgrade Recommendations

The undocumented fill areas shall be scraped free of organics and fine-roots systems; this material can be set aside for use as fill in non-structural areas if desired. We then recommend the removal of at least 3-feet of undocumented fill material, which can either be removed from the site, stockpiled and reintroduced as structural fill, or used as structural fill in other areas of the site that require fill. Areas of the site, primarily along the northern boundary that will likely require structural fill. Areas pf native ground where structural fill will be placed shall be scraped free of vegetation and topsoil, with an estimated depth to suitable subgrade of 6- to 12-inches. Approved structural fill, consisting of either excavated on-site material, or material brought to the site shall be moisture conditioned and compacted with a padfoot roller (for soil) (minimum drum weight 7,500 lb) in loose lifts not exceeding 8-inches in height. Proper benching and mixing of fill materials shall be performed. We recommend this step of the construction process be performed during the dry season to better manage fill moisture content.

If soft soils are observed, improvement methods shall be used such as removal and replacement with crushed aggregate fill that may be underlain by geotextile fabric or geogrid composites. If foundation areas are accessible, and if performed during the dry months of the year (May through October), subgrades may be proof rolled using a loaded, tandem-axle dump truck. Areas yielding excessively shall be scarified and re-compacted, or otherwise improved at the discretion and direction of the GER. A BEI representative shall approve exposed subgrade soils, fill placement methods, and compaction testing or observation of proof rolling activities.

Due to the variability of the fill/native subgrade, a minimum of 12-inches of compacted aggregate fill shall be placed beneath all foundation elements, this may consist of existing aggregate fill, or material brought into the site. The aggregate shall extend a minimum of 2-feet beyond the perimeter of the foundations or proposed building area.

Fill compaction shall be performed with an adequately sized smooth drum vibratory roller on aggregate in conformance with the requirements in Section 6.6 of this report. The prepared building pad with aggregate cover shall have an allowable bearing capacity of 1,500 psf that may be increased by 1/3 for short term loading, such as wind or seismic events. The maximum total and differential settlement for this option is estimated at 1-inch and 3/4-inch, respectively.

6.2 Structural Slab-On-Grades

After site preparation to expose suitable subgrade or documented structural fill, load bearing concrete slabs shall be underlain by a minimum of 12-inches of compacted, crushed aggregate underlain by an undisturbed bi-axial geogrid. The geogrid layer may be “ramped” up from the depth below footings on a 3:1 (H:V) slope to minimize excavation below the slab if subgrade is suitable. If soft or saturated subgrade is encountered over-excavation and replacement with engineered fill will be required. A free draining aggregate is recommended beneath structural slabs. The modulus of subgrade reaction (K) of the native clay soils is 100 lb/in$^{3.}$

6.3 Friction Coefficient and Lateral Earth Pressures

For use in design of subsurface structures or retaining walls the following parameters are given based on an internal angle of friction of 26° for the silty sand and silt. The Coefficient of Friction for Concrete on Compacted Aggregate is 0.50. The following parameters assume there is no hydrostatic pressure or surcharge loads on the walls.

Table 2: Earth pressures and Friction Coefficient

Active Earth Pressure	45 pcf
Passive Earth Pressure	280 pcf
Lateral Earth Pressure (at Rest)	60 pcf
Coefficient of Friction	0.32

6.4 Private Paved Area Subgrade and Pavement Recommendations

We recommend the following subgrade preparation for paved areas. Undocumented fill areas shall be scraped free of organics and fine-roots systems. This material can be set aside for use as fill in non-structural areas. We then recommend the removal of at least 2-feet of material, which can either be stockpiled and reintroduced as structural fill, or used as structural fill in other areas of the site that require fill. Areas of the site, primarily along the northern boundary that will require structural fill shall be scraped free of vegetation and topsoil, with an estimated depth to suitable subgrade of 6- to 12-inches. Slopes along the perimeter of the undocumented fill will need to cleared of vegetation and fine-roots, then benched in such a way that compaction equipment can span the entire width of the bench. Approved structural fill, consisting of either excavated on-site material, or material brought to the site shall be moisture conditioned and compacted with a padfoot roller (minimum drum weight 7,500 lb) in loose lifts not exceeding 8-inches in height. We recommend this step of the construction process be performed during the dry season to better manage fill moisture. Prior to placing compacted crushed aggregate for the roadway structural section, the exposed subgrade shall be approved by the GER, or approved representative.

Proof rolls with a loaded 10 cubic yard haul truck, or equivalent vehicle, shall be conducted on the prepared aggregate section and any observed areas of deflection under load shall be corrected prior to placement of pavements. Structural fill shall be placed in accordance with Section 6.6 of this report.

If present, expansive soil beneath pavements can reduce its life. If encountered in pavement areas, we recommend that the soils not be allowed to dry out and should be covered with crushed rock in a timely manner to prevent moisture swings. Soils can be periodically wetted to maintain its in-situ moisture content if excavation takes place during the drier months. Sources of water should be prevented from saturating subgrades or becoming trapped below pavement surfaces. Drainage structures should also not be located adjacent to pavement or other hardscapes.

For new asphalt concrete (AC) pavement installation we recommend a minimum pavement thickness of 4-inches of AC over a minimum of 10-inches of compacted crushed aggregate base material (ABM). In parking areas the AC thickness can be reduced to 3-inches. A separation fabric placed on the approved subgrade surface should be considered.

Prior to placement of base rock any soft soil, wet soil, or organic soil shall be removed from the parking subgrade. We recommend that the subgrade be moisture conditioned and compacted to at least 90% of the material's maximum dry density as determined by AASHTO T-180/ASTM D-1557 (modified Proctor). Based on an estimated California Bearing Ratio of 3 for the soil subgrade the following asphalt concrete pavement sections are recommended for the anticipated wheel loading for this type of facilitity.

Table 3: Recommended Structural Pavement Section for private road section

Pavement Criteria	*Asphalt Concrete (Inches)*	*Aggregate Base Material Section (Inches)*
Parking Lot Access Route	4	10
Parking Stalls and Light Vehicles Routes	3	10

The pavement recommendations discussed above are designed for the type of vehicle use on the site after construction completion, not for construction vehicle traffic which is generally heavier, occurs over a short time, and impacts the site before full pavement sections are constructed. The construction traffic may cause subgrade failures and the site contractor should consider over-building designated haul routes through the site to mitigate soft areas at the time of final paving.

Proof rolls with a loaded 10 cubic yard haul truck shall be observed on the compacted ABM prior to pavement installation and any areas of deflection under wheel loads shall be corrected by over-excavation replacing subgrade material with additional compacted aggregate. The ABM shall be compacted to at least 95% relative compaction as determined by ASTM 1557/AASHTO T-180 (modified Proctor). The compaction of the ABM shall be tested prior to placement of asphalt concrete.

Construction traffic should not be allowed to drive directly on exposed subgrade and will require thicker rock sections to mitigate subgrade failure. Positive site drainage away from any public streets shall be maintained if site paving will not occur before the on-set of the wet season.

Mitigation of Wet and Soft Subgrade, if Encountered

Depending on the timing for the project, any soft subgrade found during proof-rolling or by visual observation can either be removed and replaced with compacted crushed aggregate, removed and dried or dried in-place and recompacted, or an area of sufficient size (generally at least 6-feet beyond the edge of soft material) may be covered with a bi-axial geogrid and covered with compacted crushed aggregate.

Consideration of Shrink/Swell and Frost Heave Conditions

The soil encountered at or below the anticipated subgrade level has a low shrink/swell potential and frost heave potential is also low provided that the subgrade does not become saturated and standing water is not trapped below the pavement surface.

6.5 Structural Fill

All engineered fill placed on the site shall consist of homogenous material and shall meet the following recommendations.

- The recommended compaction level for crushed aggregate and soil fill is 90% of the maximum dry density as determined by ASTM D-1557 (modified Proctor).

- Prior to placement onsite, the aggregate or soil to be used shall be approved by the GER. If no recent Proctor curve (moisture-density relationship) is available for the material, a material sample will be required for testing to determine the maximum dry density and optimum moisture content of the aggregate or fill material. Use of the onsite soils for fill will require careful moisture conditioning and appropriate compaction equipment selection. Compaction of clayey soils during the wet season (November through May) will be difficult, if not impossible, to achieve due to insitu moisture contents being significantly higher than optimum moisture contents.

- Compaction shall be measured by on site testing with a nuclear densometer (ASTM D-6938), or sand cone method (ASTM D-1556) on structural fill with thicknesses in excess of 12-inches. If compaction testing is not feasible for any onsite or imported material due to factors such as oversize rock content or variable material, proof rolls with a fully loaded 10 cubic yard haul-truck or equivalent equipment shall be observed at regular intervals. Any observed areas of excessive yielding or rutting will require removal and replacement with granular fill or moisture conditioning and recompaction.

- The structural fill shall be moisture conditioned to within +/- 2% of optimum moisture content and compacted in lifts with loose thicknesses not exceeding 8-inches. Periodic visits to the site to verify lift thickness, source material, and compaction effort shall be conducted by the GER, or designated representative, and documented.

- Utility trenches excavated to depths below the top of the subgrade elevation shall be backfilled with approved material and compacted to at least 90% of the maximum dry density.

6.6 Seismic Site Classification

Based on the soil properties encountered in our explorations and from nearby well logs, we recommend a Seismic Site Class D, Stiff Soil (Table 20.3-1 ASCE 7-16) for the design of site structures.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Wet Weather/Dry Weather Construction Practices

The near surface soils, if left exposed to prolonged precipitation, will become saturated and soften. Exposed subgrade soils in structural areas should not be allowed to dry out, or allow standing water to pool over them. Subgrade soil that will be below foundations, slabs, and pavements shall be covered with compacted aggregate in a timely manner after excavation to minimize moisture fluctuations. BEI recommends that foundation subgrade preparation and general site earthwork be performed during the dry season—generally May through October.

Construction during the wet season may require special drainage considerations, such as covering of excavations, pumping to mitigate standing water in footing excavations, or over-excavation of moisture softened soils. Construction traffic should not be allowed to drive directly on exposed subgrades. Construction traffic routes will also be more susceptible to “pumping” and rutting during the wet season and will likely require thicker rock sections.

7.2 Excavations

We recommend that shoring or benching be employed for in-ground excavation and utility work. Utilities deeper than 5-feet BGS will likely require shoring or laying back of sidewalls at a slope of 1:1 (H:V). The site soils are classified as typically OSHA Type B soils. Heavy equipment or stored materials should not be stored within 10-feet of open excavations. Permanent slopes (fill or cut) should not exceed a gradient of 2:1 H:V unless specifically evaluated for stability.

7.3 Site Drainage

Alteration of existing grades for this project will likely change drainage patterns that should not adversely affect adjacent properties. Perimeter landscape and hardscape grades shall be sloped away from foundations and water shall not be allowed to pond adjacent to footings during or after construction. Infiltration testing was conducted by BEI during the investigation and a separate report detailing our findings and results will be provided to the client.

7.4 Geotechnical Construction Site Observations

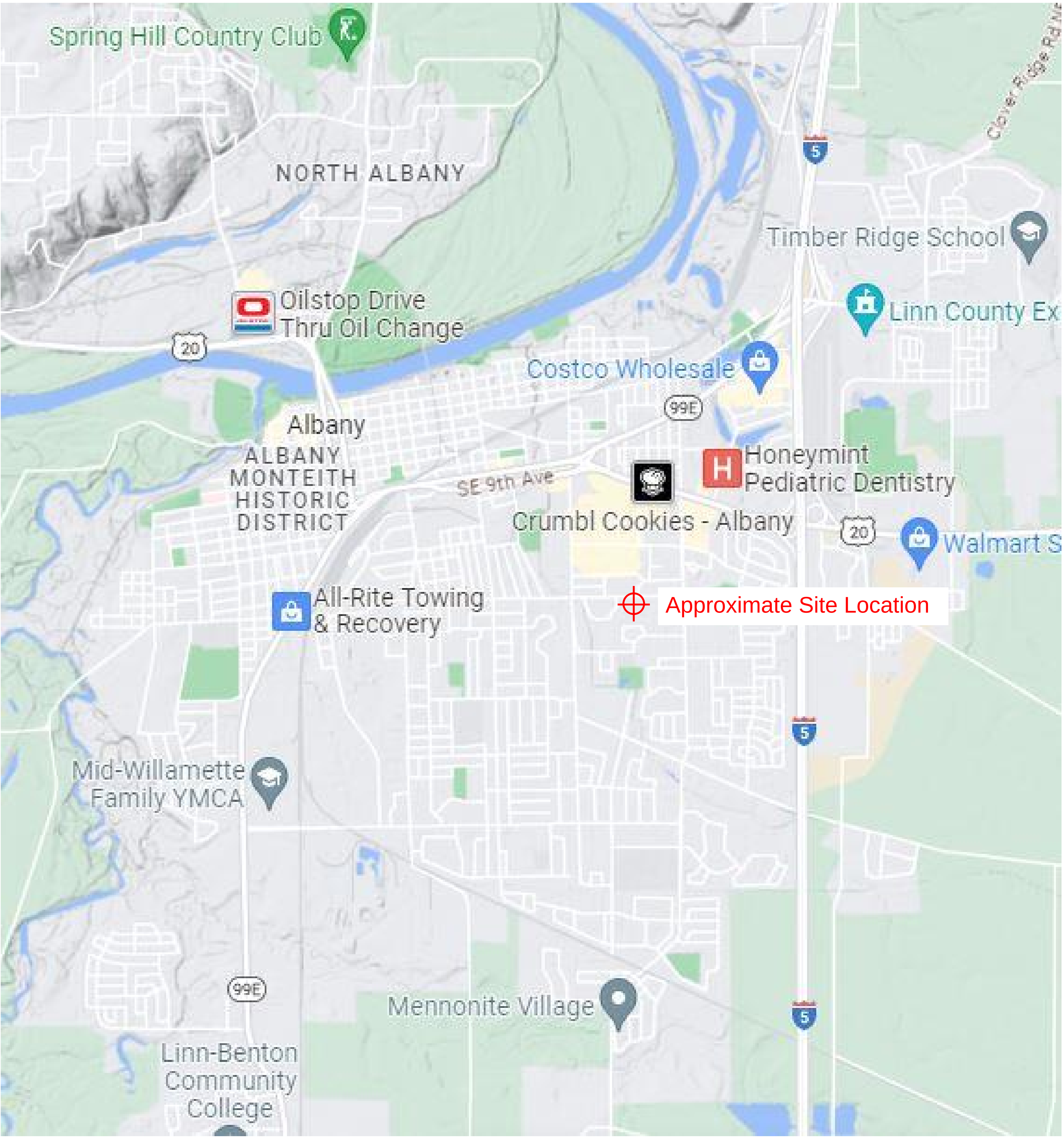
Periodic site observations by a geotechnical representative of BEI are recommended during the construction of the project; the specific phases of construction that should be observed are shown in the following table.

Recommended Construction Phases to be Observed by the Geotechnical Engineer	
At completion of subgrade excavation	Subgrade observation by the geotechnical engineer before aggregate and geogrid (if applicable) placement.
Imported fill material	Observation of material or information on material type and source.
Placement or Compaction of fill material	Observation by geotechnical engineer or test results by qualified testing agency.

8.0 REPORT LIMITATIONS

This report has presented BEI’s site observations and research, subsurface explorations, geotechnical engineering analyses, and recommendations for the proposed site development. The conclusions in this report are based on the conditions described in this report and are intended for the exclusive use of Linn Benton Housing Authority and their designated representatives for use in design and construction of the development described herein. The analysis and recommendations may not be suitable for other structures or purposes.

Services performed by the geotechnical engineer for this project have been conducted with the level of care and skill exercised by other current geotechnical professionals in this area. No warranty is herein expressed or implied. The conclusions in this report are based on the site conditions as they currently exist and it is assumed that the limited site locations that were physically investigated generally represent the subsurface conditions at the site. This report represents our findings and should site development or site conditions change, or if a substantial amount of time goes by between our site investigation and site development, we reserve the right to review this report for its applicability and adjust our recommendations. If you have any questions regarding the contents of this report, please contact our office.



Site Vicinity Map
Queen Ave Multi-Family Residential Development
2080 Queen Avenue SE Albany, Oregon

FIGURE-1

6-24-2023

BEI PROJECT NO. 23-321

Site information					
Site Address:	2080 Queen Ave. SE, Albany, OR 97322				
Map/lot	11S03W08-DB-06000				
	RMA (Residential Medium Density)				
pprox.):	32,555	s.f.	/	0.75	acres

Branch ENGINEERING Inc
Since 1977

Site Investigation Photo with Project Overlay
Queen Ave Multi-Family Residential Development
2080 Queen Avenue SE Albany, Oregon

FIGURE-2

6-24-2023

BEI PROJECT NO. 23-321

Image from Oregon State University Libraries, Not scaled

Branch ENGINEERING Inc
Since 1977

1956 Aerial Image of Site Vicinity
Queen Ave Multi-Family Residential Development
2080 Queen Avenue SE Albany, Oregon

FIGURE-3

6-24-2023

BEI PROJECT NO. 23-321

Image from Oregon State University Libraries, Not scaled

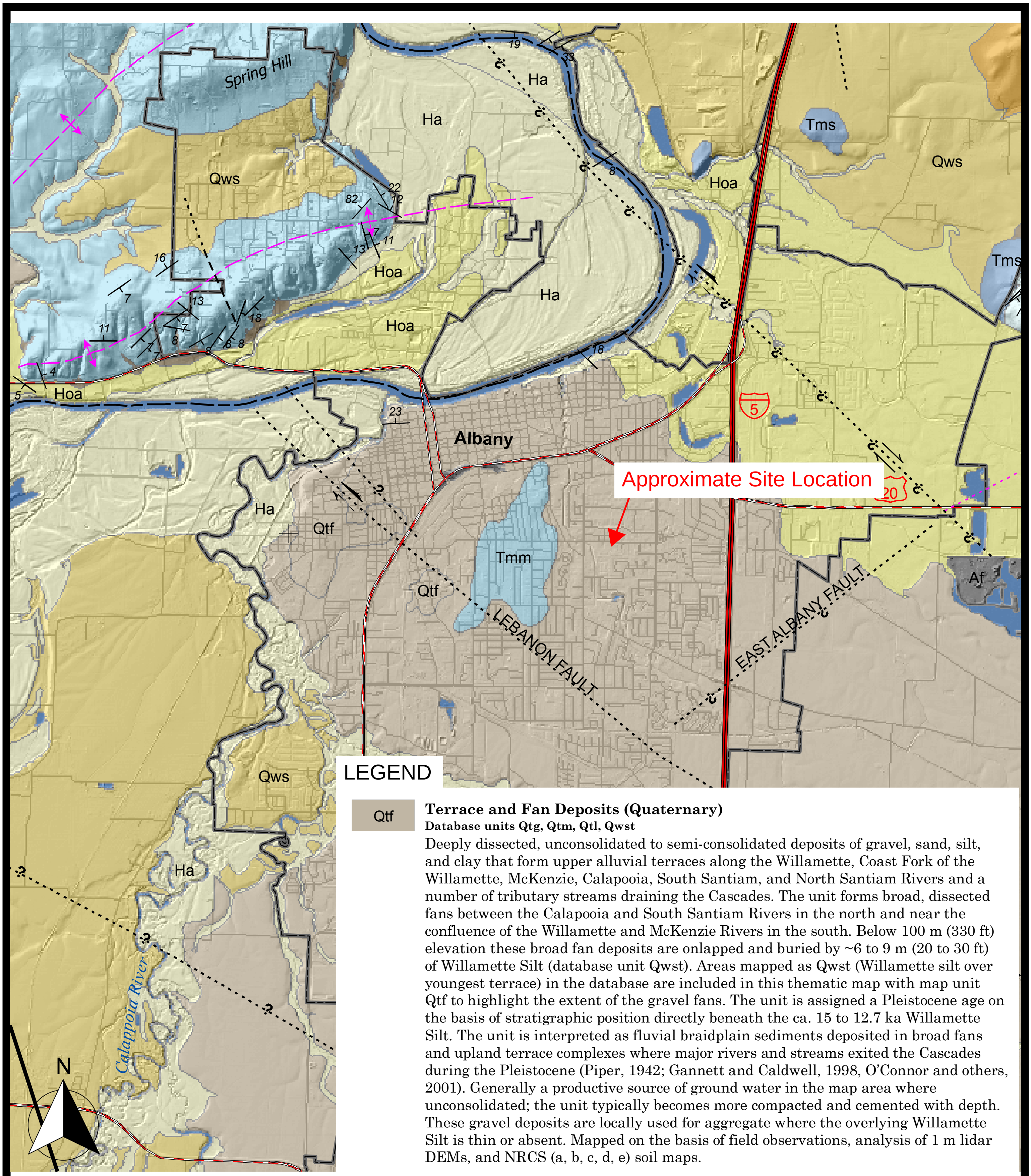
Branch ENGINEERING Inc Since 1977

1963 Aerial Image of Site Vicinity
Queen Ave Multi-Family Residential Development
2080 Queen Avenue SE Albany, Oregon

FIGURE-4

6-24-2023

BEI PROJECT NO. 23-321



LEGEND

Qtf	**Terrace and Fan Deposits (Quaternary)** **Database units Qtg, Qtm, Qtl, Qwst** Deeply dissected, unconsolidated to semi-consolidated deposits of gravel, sand, silt, and clay that form upper alluvial terraces along the Willamette, Coast Fork of the Willamette, McKenzie, Calapooia, South Santiam, and North Santiam Rivers and a number of tributary streams draining the Cascades. The unit forms broad, dissected fans between the Calapooia and South Santiam Rivers in the north and near the confluence of the Willamette and McKenzie Rivers in the south. Below 100 m (330 ft) elevation these broad fan deposits are onlapped and buried by ~6 to 9 m (20 to 30 ft) of Willamette Silt (database unit Qwst). Areas mapped as Qwst (Willamette silt over youngest terrace) in the database are included in this thematic map with map unit Qtf to highlight the extent of the gravel fans. The unit is assigned a Pleistocene age on the basis of stratigraphic position directly beneath the ca. 15 to 12.7 ka Willamette Silt. The unit is interpreted as fluvial braidplain sediments deposited in broad fans and upland terrace complexes where major rivers and streams exited the Cascades during the Pleistocene (Piper, 1942; Gannett and Caldwell, 1998, O'Connor and others, 2001). Generally a productive source of ground water in the map area where unconsolidated; the unit typically becomes more compacted and cemented with depth. These gravel deposits are locally used for aggregate where the overlying Willamette Silt is thin or absent. Mapped on the basis of field observations, analysis of 1 m lidar DEMs, and NRCS (a, b, c, d, e) soil maps.

Map from DOGAMI

Branch ENGINEERING Inc
Since 1977

Queen Ave Multi-Family Residential Development
2080 Queen Avenue SE Albany, Oregon

FIGURE-5

6-24-2023

BEI PROJECT NO. 23-321

APPENDIX A:

- USCS SOIL KEY
- TEST PIT LOGS
- OWRD WELL LOGS
- USDA SOIL SURVEY

RELATIVE DENSITY - COARSE GRAINED SOILS

RELATIVE DENSITY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)
VERY LOOSE	< 4	< 11	< 4
LOOSE	4 - 10	11 - 26	4 - 10
MEDIUM DENSE	10 - 30	26 - 74	10 - 30
DENSE	30 - 50	74 - 120	30 - 47
VERY DENSE	> 50	> 120	> 47

USCS GRAIN SIZE

FINES		< #200 (.075 mm)
SAND	Fine	#200 - #40 (.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75 mm)
GRAVEL	Fine	#4 - 0.75 inch
	Coarse	0.75 - 3 inch
COBBLES		3 - 12 inches

CONSISTENCY - FINE GRAINED SOILS

CONSISTENCY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)	POCKET PEN. / UNCONFINED (TSF)	MANUAL PENETRATION TEST
VERY SOFT	< 2	< 3	< 2	< 0.25	Easy several inches by fist
SOFT	2 - 4	3 - 6	2 - 5	0.25 - 0.50	Easy several inches by thumb
MEDIUM STIFF	4 - 8	6 - 12	5 - 9	0.50 - 1.00	Moderate several inches by thumb
STIFF	8 - 15	12 - 25	9 - 19	1.00 - 2.00	Readily indented by thumb
VERY STIFF	15 - 30	25 - 65	19 - 31	2.00 - 4.00	Readily indented by thumbnail
HARD	> 30	> 65	> 31	> 4.00	Difficult by thumbnail

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GROUP SYMBOLS AND TYPICAL NAMES	
COARSE-GRAINED SOILS: More than 50% retained on No. 200 sieve	GRAVELS: 50% or more *retained* on the No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS: 50% or more *passing* the No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly-graded sands and gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS: Less than 50% retained on No. 200 sieve	SILT AND CLAY	LIQUID LIMIT LESS THAN 50	ML	Inorganic silts, rock flour, clayey silts.
			CL	Inorganic clays of low to medium plasticity, lean clays.
			OL	Organic silt and organic silty clays of low plasticity.
		LIQUID LIMIT 50 OR GREATER	MH	Inorganic silts, clayey silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat, muck, and other highly organic soil.

MOISTURE CONTENT

DRY: Absence of moisture, dusty, dry to the touch
DAMP: Some moisture but leaves no moisture on hand
MOIST: Leaves moisture on hand
WET: Visble free water, usually saturated

	PLASTICITY	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Med.	Med. to High	None to Slow	Medium
MH	Med. to High	Low to Med.	None to Slow	Low to Med.
CH	Med. to High	High to V.High	None	High

STRUCTURE

STRATIFIED: Alternating layers of material or color > 6mm thick.
LAMINATED: Alternating layers < 6mm thick.
FISSURED: Breaks along definate fracture planes.
SLICKENSIDED: Striated, polished, or glossy fracture planes.
BLOCKY: Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
LENSES: Has small pockets of different soils, note thickness.
HOMOGENEOUS: Same color and appearance throughout.

LIST OF ABBREVIATION & EXPLANATIONS

SPT	Standard Penetration Test split barrel sampler	G	Grab sample
D&M	Dames and Moore sampler	MC	Moisture Content
LL	Atterberg Liquid Limit	MD	Moisture Density
PL	Atterberg Plastic Limit	UC	Unconfined Compressive Strength
PP	Pocket Penetrometer		
VS	Vane Shear		

TABLE A-1

Branch ENGINEERING inc
Since 1977

GEOTECHNICAL SITE INVESTIGATION EXPLORATORY KEY

Test Pit ID: TP-1
Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
		Soft, dry, brown silt with roots. Topsoil				
1		Dense, dry, brown silt with subangular and angular gravel, plastic separation fabric. Interpreted as undocumented fill.				
2 3 4 5		Medium stiff, dry to damp, brown clay (CL) with some silt and fine-grained sand, slight to heavy reddish-orange-black oxidation staining.				
6 7		Medium stiff, moist, brown-gray clay (CL) with some silt and trace fine-grained sand, slight reddish-orange oxidation staining.				
8 9 10						

Test Pit ID: TP-2

Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
Hammer Type:
Notes:

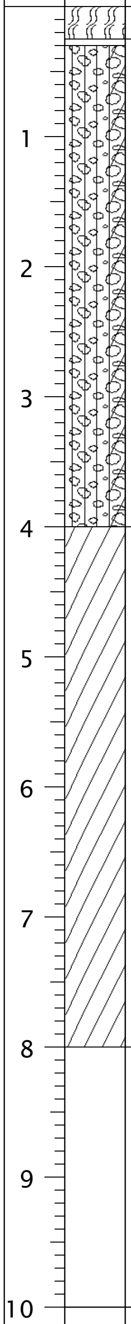
Depth	Graphic	Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
	▨	Soft to medium stiff, dry, brown clay (CL) with trace fine-grained sand and some silt. Bare surface with cracks in clay.				
1	▨					
	▨	Medium stiff to stiff, dry to moist, brown-gray clay (CL) with some silt and trace fine-grained sand. Heavy reddish-orange-black oxidation staining from 2- to 5-feet BGS.				
2	▨					
3	▨					
4	▨					
5	▨					
6	▨					
7	▨					
8						
9						
10						

Branch ENGINEERING Since 1977
civil · transportation
structural · geotechnical
SURVEYING

Test Pit ID: TP-3

Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽
Hammer Type:
▼
Notes:
▽



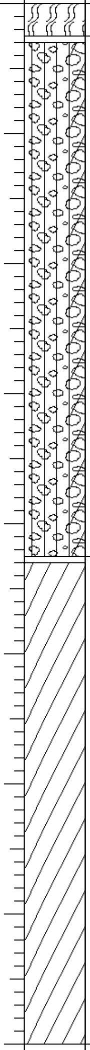
Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
Soft, dry, brown silt with roots. Topsoil.				
Dense, dry, brown silt with subangular and angular gravel-cobble, rubber mats.				
Medium stiff, moist, gray-blue clay, trace fine-grained sand. Anomalous material for the area. Appeared native.				

Branch ENGINEERING INC. Since 1977
civil · transportation · structural · geotechnical · SURVEYING

Test Pit ID: TP-4

Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽
Hammer Type:
▼
Notes:
◮



Depth	Graphic	Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
		Soft, dry, brown silt with roots. Topsoil.				
1 2 3 4		Dense, dry, brown silt with subangular and angular gravel, some asphalt. 3" metal pipe at 4-feet BGS. Interpreted as undocumented fill.				
5 6 7 8		Medium stiff, moist, brown clay (CL) with trace fine-grained sand, slight reddish-orange oxidation staining.				
9 10						

Branch ENGINEERING INC.
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

Test Pit ID: TP-5

Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽
Hammer Type:
▼
Notes:
▽

Depth	Graphic	Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
		Soft, dry, brown silt with roots. Topsoil.				
		Dense, dry, brown silt with subangular and angular gravel, some asphalt. 3" metal pipe at 3-feet BGS. Interpreted as undocumented fill.				
1						
2						
3						
4						
		Medium stiff, moist, brown clay (CL) with trace fine-grained sand, slight reddish-orange oxidation staining.				
5						
6						
7						
8						
9						
10						

INFILTRATION TEST -1

Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
▽
Hammer Type:
▼
Notes:
◣

Depth	Graphic	Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
		Loose, dry, brown silt with gravel. Interpreted as undocumented fill.				
1		Medium stiff, damp, brown-gray clay (CL), trace fine-grained sand and silt, heavy reddish-orange oxidation staining.				
2						
		Medium stiff, moist, brown clay (CL), trace fine-grained sand and silt.				
3						
4						
5						
6						
7						
8						
9						
10						

INFILTRATION TEST-2

Sheet 1 of 1

Client: Linn Benton Housing Authority
Project Name: Queen Avenue Apartments
Project Number: 23-321
Project Location: 2080 Queen Ave Albany, Oregon
Date Started: Jul 11 2023 **Completed:** Jul 11 2023
Logged By: SPR **Checked By:** RJD
Drilling Contractor: Branch Engineering Inc.
Latitude: **Longitude:** **Elevation:**
Drilling Method: Test Pit Excavation
Ground Water Levels
Equipment: Rubber Tracked Mini-Excavator
Hammer Type:
Notes:

Depth	Graphic	Material Description	Sample	Pocket Pen. (tsf)	Free Swell	Moisture Content: ⊗ PL and LL: ●–■ 10 20 30 40 50 60 70 80 90
0–1	▨	Medium stiff, dry, brown clay (CL), trace fine grained sand and silt, heavy reddish-orange oxidation staining.				
1–4	▨	Medium stiff, damp, brown clay (CL), trace fine grained sand and silt, slight reddish-orange oxidation staining.				
4–10						

LINN
14515

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

RECEIVED
AUG 16 1995
WATER RESOURCES DEPT.
SALEM, OREGON

11S/3W/8CA

(START CARD) # 76101

Instructions for completing this report are on the last page of this form.

(1) OWNER:
Well Number
Name Richard Draper
Address 2618 Waverly Dr
City Albany State Ore Zip 97321

(2) TYPE OF WORK
☑ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☑ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☑ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☑ No Depth of Completed Well 56 ft.
Explosives used ☐ Yes ☑ No Type Amount

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or ~~pounds~~
10	0	20	Cement	0	20	12
6	1+	56	Steel			

How was seal placed: Method ☐ A ☐ B ☑ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	1+	56	.250	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) 56

(7) PERFORATIONS/SCREENS: No
☐ Perforations Method
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☑ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
30	20		1 hr.

Temperature of water 53° Depth Artesian Flow Found
Was a water analysis done? No ☐ Yes By whom
Did any strata contain water not suitable for intended use? No ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Linn Latitude Longitude
Township 11S N or S Range 3W E or W. WM.
Section 8 NE 1/4 SW 1/4
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address) 1940 17 ave SE Albany ore

(10) STATIC WATER LEVEL:
13 ft. below land surface. Date 7-22-95
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 54

From	To	Estimated Flow Rate	SWL
54	56	30	13

(12) WELL LOG:
Ground Elevation 230

Material	From	To	SWL
Clay Brown Hard	0	20	
Clay Brown yellow Sandy	20	38	
Sand Brown yellow fine	38	40	
Sand & Clay Dark Brown fine	40	45	
Sand Hard Brown Gray Clay	45	54	
Gravel Med Blk Sand	54	56	13

Date started 7-19-95 Completed 7-22-95

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number
Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 610
Signed Bob Schuler Date 7-23-95

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

RECEIVED
MAR - 3 1998
WATER RESOURCES DEPT.
SALEM, OREGON

WELL I.D. # L18999

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

Linn
51536

(START CARD) # 099269

(1) OWNER: Well Number

Name Deke W. Easton
Address 453 SE Powell Ave
City Corvallis State OR Zip 97330

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 47 ft.
Explosives used ☐ Yes ☒ No Type Amount

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or pounds
10"	0	18'	cement	0	18'	13sacks
6"	18'	47'				

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
	6"	+1'8"	45' 04"	.25	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) 45' 04"

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Acetylene torch
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
37'4"	45' 04"	3/8 x12"	44	6"		☒	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☒ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
50gpm	14'		1 hr.

Temperature of water 54 Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Linn Latitude Longitude
Township 11S N or S Range 3W E or W. WM.
Section 8 SE 1/4 SW 1/4
Tax Lot 1201 Lot Block Subdivision
Street Address of Well (or nearest address)
2017 Seventeenth Ave. - Albany

(10) STATIC WATER LEVEL:
6' ft. below land surface. Date 2-24-98
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found 23

From	To	Estimated Flow Rate	SWL
23	44	50 gpm	6

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Top soil	0	2	
Brown clay	2	12	
Dark gray clay	12	19	
Brown clay & gravel	19	23	
Dirty brown sand & gravel	23	30	6
Brown sand & gravel	30	44	
Brown clay	44	47	

Date started 2-19-98 Completed 2-24-98

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number
Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 1378
Signed Date 2-26-98

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

LINN 56322

L73427

Start Card # 167716

(1) OWNER/PROJECT

WELL NO. 1

Name Steven Niskanen

Address 1521 7th Avenue SE

City Albany State OR Zip 97321

(2) TYPE OF WORK

☒ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☐ Abandonment

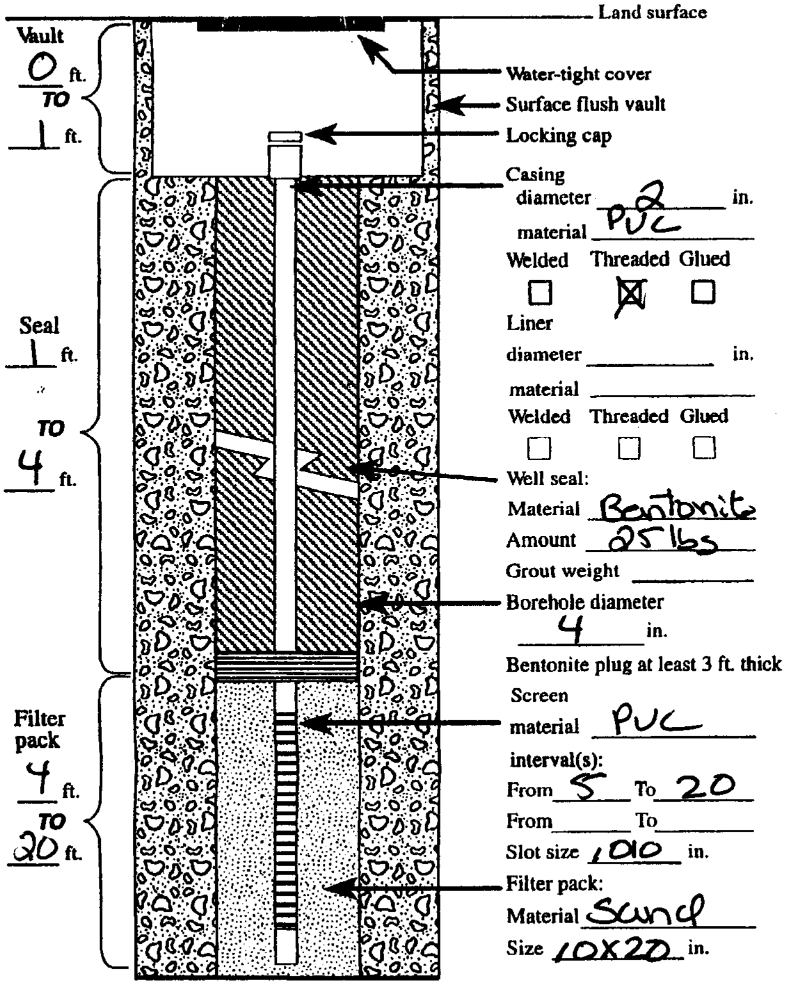
(3) DRILLING METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ ~~Hollow Stem Auger~~ ☒ Other Push Probe

(4) BORE HOLE CONSTRUCTION:

Special Standards Yes ☐ No ☒ Depth of Completed Well 20 ft.



Vault 0 ft. TO 1 ft.

Seal 1 ft. TO 4 ft.

Filter pack 4 ft. TO 20 ft.

Casing diameter 2 in.

material PVC

Welded ☐ Threaded ☒ Glued ☐

Liner diameter ____ in.

material ____

Welded ☐ Threaded ☐ Glued ☐

Well seal:

Material Bentonite

Amount 25 lbs

Grout weight ____

Borehole diameter 4 in.

Screen material PVC

interval(s):

From 5 To 20

From ____ To ____

Slot size .010 in.

Filter pack:

Material Sand

Size 10X20 in.

(5) WELL TESTS:

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability ____ Yield ____ GPM

Conductivity ____ PH ____

Temperature of water 54 °F/C Depth artesian flow found ____ ft.

Was water analysis done? ☐ Yes ☒ No

By whom? ____

Depth of strata to be analyzed. From ____ ft. to ____

Remarks: ____

Name of supervising Geologist/Engineer ____

ORIGINAL COPY – WATER RESOURCES DEPARTMENT

(6) LOCATION OF WELL By legal description:

County Linn Latitude ____ Longitude ____

Township 11 (N or [✓ S]) Range 3 (E or [✓ W]) Section 8

NW 1/4 of SE 1/4 of above section.

Street address of well location 1521 7th Ave SE

Tax lot number of well location 1200

ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

(7) STATIC WATER LEVEL:

12 Ft. below land surface. Date 10/20/04

Artesian Pressure ____ lb/sq. in. Date ____

(8) WATER BEARING ZONES:

Depth at which water was first found 12

From	To	Est. Flow Rate	SWL
12	25		12

(9) WELL LOG:

Ground Elevation ____

Material	From	To	SWL
silty sand	0	25	

RECEIVED
NOV 15 2004
WATER RESOURCES DEPT
SALEM, OREGON

Date started 10/20/04 Completed 10/20/04

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

MWC Number 10548

Signed ____ Date 11/11/04

(bonded) Monitor Well Constructor Certification:

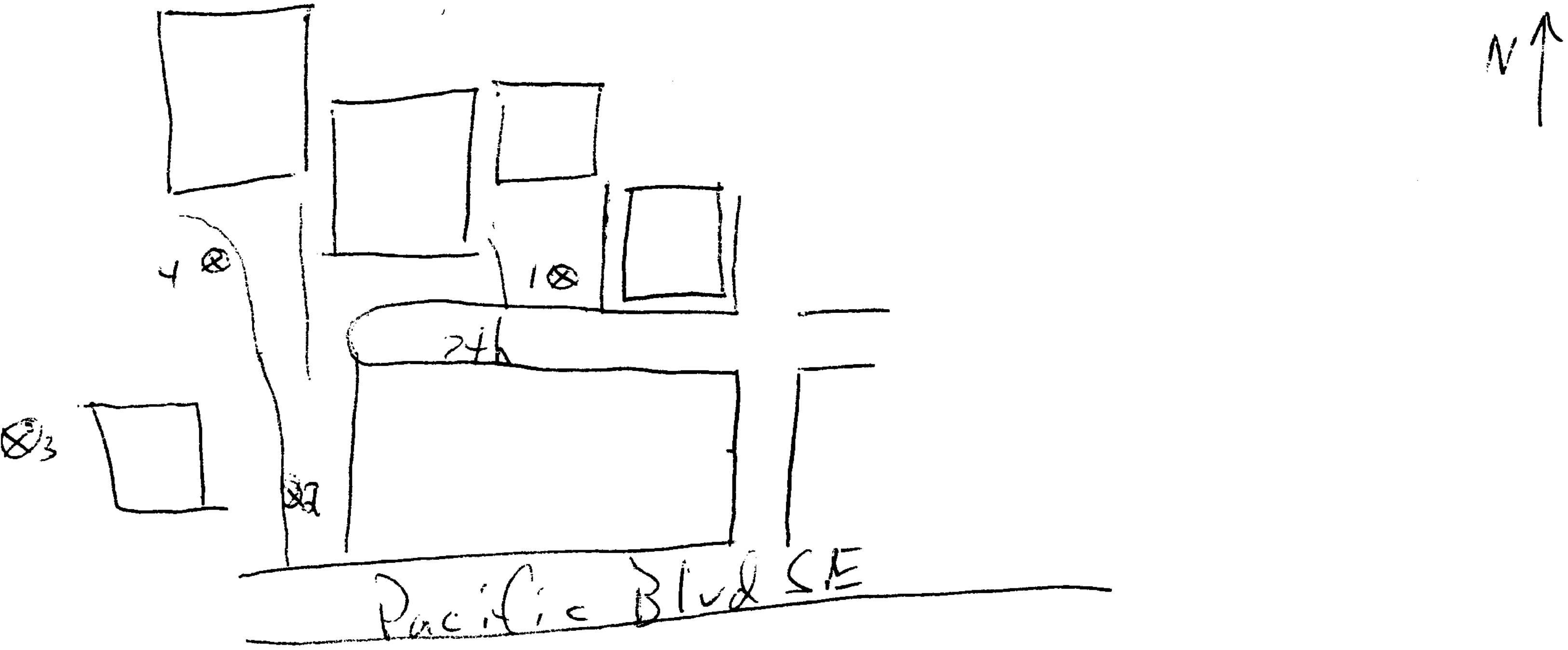
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 1011

Signed ____ Date 11/11/04

SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

LINN 56322



1 167716
2 167717
3 167718
4 167719

Soil Map—Linn County Area, Oregon
(Queen Ave Multi-Family)

Map Scale: 1:2,880 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Linn County Area, Oregon
Survey Area Data: Version 18, Sep 14, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 23, 2020—May 28, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Amity silt loam	15.9	38.3%
27	Concord silt loam	25.4	61.1%
33	Dayton silt loam	0.0	0.1%
106A	Woodburn silt loam, 0 to 3 percent slopes	0.2	0.5%
Totals for Area of Interest		**41.6**	**100.0%**

Linn County Area, Oregon

27—Concord silt loam

Map Unit Setting

National map unit symbol: 24wp
Elevation: 200 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Concord and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Concord

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Silty and clayey alluvium derived from mixed sources

Typical profile

H1 - 0 to 20 inches: silt loam
H2 - 20 to 40 inches: silty clay
H3 - 40 to 72 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: R002XC007OR - Valley Swale Group
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Dayton

Percent of map unit: 4 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Linn County Area, Oregon
Survey Area Data: Version 18, Sep 14, 2022

APPENDIX B:

Recommended Earthwork Specifications

GEOTECHNICAL SPECIFICATIONS

General Earthwork

1. All areas where structural fills, fill slopes, structures, or roadways are to be constructed shall be stripped of organic topsoil and cleared of surface and subsurface deleterious material, including but limited to vegetation, roots, or other organic material, undocumented fill, construction debris, soft or unsuitable soils as directed by the Geotechnical Engineer of Record. These materials shall be removed from the site or stockpiled in a designated location for reuse in landscape areas if suitable for that purpose. Existing utilities and structures that are not to be used as part of the project design or by neighboring facilities, shall be removed or properly abandoned, and the associated debris removed from the site.
2. Upon completion of site stripping and clearing, the exposed soil and/or rock shall be observed by the Geotechnical Engineer of Record or a designated representative to assess the subgrade condition for the intended overlying use. Pits, depressions, or holes created by the removal of root wads, utilities, structures, or deleterious material shall be properly cleared of loose material, benched and backfilled with fill material approved by the Geotechnical Engineer of Record compacted to the project specifications.
3. In structural fill areas, the subgrade soil shall be scarified to a depth of 4-inches, if soil fill is used, moisture conditioned to within 2% of the materials optimum moisture for compaction, and blended with the first lift of fill material. The fill placement and compaction equipment shall be appropriate for fill material type, required degree of blending, and uncompacted lift thickness. Assuming proper equipment selection, the total uncompacted thickness of the scarified subgrade and first fill lift shall not exceed 8-inches, subsequent lifts of uncompacted fill shall not exceed 8-inches unless otherwise approved by the Geotechnical Engineer of Record. The uncompacted lift thickness shall be assessed based on the type of compaction equipment used and the results of initial compaction testing. Fine-grain soil fill is generally most effectively compacted using a kneading style compactor, such as a sheeps-foot roller; granular materials are more effectively compacted using a smooth, vibratory roller or impact style compactor.
4. All structural soil fill shall be well blended, moisture conditioned to within 2% of the material's optimum moisture content for compaction and compacted to at least 90% of the material's maximum dry density as determined by ASTM Method D-1557, or an equivalent method. Soil fill shall not contain more than 10% rock material and no solid material over 3-inches in diameter unless approved by the Geotechnical Engineer of Record. Rocks shall be evenly distributed throughout each lift of fill that they are contained within and shall not be clumped together in such a way that voids can occur.
5. All structural granular fill shall be well blended, moisture conditioned at or up to 3% above of the material's optimum moisture content for compaction and compacted to at least 90% of the material's maximum dry density as determined by ASTM Method D-1557, or an equivalent method. 95% relative compaction may be required for pavement base rock or in upper lifts of the granular structural fill where a sufficient thickness of the fill section allows for higher compaction percentages to be achieved. The granular fill shall not contain solid particles over 2-inches in diameter unless special density testing methods or proof-rolling is approved by the Geotechnical Engineer of Record. Granular fill is generally considered to be a crushed aggregate with a fracture surface of at least 70% and a maximum size not exceeding 1.5-inches in diameter, well-graded with less than 10%, by weight, passing the No. 200 Sieve.
6. Structural fill shall be field tested for compliance with project specifications for every 2-feet in vertical rise or 500 cy placed, whichever is less. In-place field density testing shall be performed by a competent individual, trained in the testing and placement of soil and aggregate fill placement, using either ASTM Method D-1556/4959/4944 (Sand Cone), D-6938 (Nuclear Densometer), or D-2937/4959/4944 (Drive Cylinder). Should the fill materials not be suitable for testing by the above methods, then observation of placement, compaction and proof-rolling with a loaded 10 cy dump-truck, or equivalent ground pressure equipment, by a trained individual may be used to assess and document the compliance with structural fill specifications.

Utility Excavations

1. Utility excavations are to be excavated to the design depth for bedding and placement and shall not be over-excavated. Trench widths shall only be of sufficient width to allow placement and proper construction of the utility and backfill of the trench.
2. Backfilling of a utility trench will be dependent on its location, use, depth, and utility line material type. Trenches that are required to meet structural fill specifications, such as those under or near buildings, or within pavement areas, shall have granular material strategically compacted to at least the spring-line of the utility conduit to mitigate pipeline movement and deformation. The initial lift thickness of backfill overlying the pipeline will be dependent on the pipeline material, type of backfill, and the compaction equipment, so as not to cause deflection or deformation of the pipeline. Trench backfill shall conform to the General Earthwork specifications for placement, compaction, and testing of structural fill.

Geotextiles

1. All geotextiles shall be resistant to ultraviolet degradation, and to biological and chemical environments normally found in soils. Geotextiles shall be stored so that they are not in direct sunlight or exposed to chemical products. The use of a geotextile shall be specified and shall meet the following specification for each use.

<u>Subgrade/Aggregate Separation</u>

Woven or nonwoven fabric conforming to the following physical properties:

Minimum grab tensile strength	ASTM Method D-4632	180 lb
Minimum puncture strength (CBR)	ASTM Method D-6241	371 lb
Elongation	ASTM Method D-4632	15%
Maximum apparent opening size	ASTM Method D-4751	No. 40
Minimum permittivity	ASTM Method D-4491	0.05 s^{-1}

<u>Drainage Filtration</u>

Woven fabric conforming to the following physical properties:

Minimum grab tensile strength	ASTM Method D-4632	110 lb
Minimum puncture strength (CBR)	ASTM Method D-6241	220 lb
Elongation	ASTM Method D-4632	50%
Maximum apparent opening size	ASTM Method D-4751	No. 40
Minimum permittivity	ASTM Method D-4491	0.5 s^{-1}

<u>Geogrid Base Reinforcement</u>

Extruded biaxially or triaxially oriented polypropylene conforming to the following physical properties:

Peak tensile strength lb/ft	ASTM Method D-6637	925
Tensile strength at 2% strain lb/ft	ASTM Method D-6637	300
Tensile strength at 5% strain lb/ft	ASTM Method D-6637	600
Flexural Rigidity	ASTM Method D-1388	250,000 mg-cm
Effective Opening Size rock size	ASTM Method D-4751	1.5x
Pavement areas use Hanes Geocomponets or Terragrid BX1200 or Equivalent		Tensilte Strength of 1,300 lb-ft Recommended