Ages Engineering

A Geotechnical Engineering Services Company

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GEOTECHNICAL REPORT

Shaw Road Residential

2317 Shaw Road
Puyallup, Washington

Project No. A-1692

Prepared For:

Mingqi Shao
12319 NE 68th Place
Kirkland, WA 98033

February 24, 2024
Revised August 6, 2024

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Mingqi Shao
12319 NE 68th Place
Kirkland, WA 98033

Subject: Geotechnical Report
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington
Parcel Number: 0419021061

Dear Mr. Shao,

As requested, we have conducted a geotechnical study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our field exploration indicates the site is generally underlain with either Old Fill soils or sand with silt consistent with Recessional Outwash overlying silty sand with gravel consistent with glacial till. We did not encounter groundwater seepage in any of our explorations.

In our opinion, the soil and groundwater conditions at the site are suitable for the planned development. The new structures can be supported on typical spread footing foundations bearing on the organic-free native soils observed at 0.0 to 5.5 feet below surface grades. Infiltration of the development storm water is feasible.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Respectfully Submitted,

Ages Engineering

8-6-24

Bernard P. Knoll, II
Principal

BPK:bpk

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Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

1.0 PROJECT DESCRIPTION

The project will consist of a residential development. We were provided with a preliminary site plan showing the planned development. Based on the plan provided to us, we understand the site will be divided into four single-family residential lots. The lots will extend east from Shaw Road. The existing residence on the western end of the site will remain and be remodeled. The development storm water on each lot will discharge to infiltration facilities constructed on each lot.

The conclusions and recommendations presented in this report are based on our understanding of the above-stated site and the planned project design features. If actual site conditions differ, the planned project design features are different than we expect, or if changes are made, we should review them in order to modify or supplement our conclusions and recommendations as necessary.

2.0 SCOPE

On February 1, 2024, we excavated one hand-augured test holes to a maximum depth of 3.0 feet below surface grades. We returned to the site on February 13, 2024, to excavate seven additional machine-excavated test pits to a maximum depth of 7.0 feet, install groundwater monitoring wells, and perform one Small Pilot Infiltration Test. Using the information obtained from our subsurface exploration, we developed geotechnical design and construction recommendations for the project. Specifically, this Geotechnical Report addresses the following:

- Reviewing the available geologic, hydrogeologic and geotechnical data for the site area, and conducting a geologic reconnaissance of the site area.
- Addressing the appropriate geotechnical regulatory requirements for the planned site development, including a Geologic Hazard evaluation.
- Advancing eight hand-augured test holes in the planned new development area to a maximum depth of approximately 7.0 feet below surface grades.
- Providing geotechnical recommendations for site grading including site preparation, subgrade preparation, fill placement criteria, suitability of on-site soils for use as structural fill, temporary and permanent cut and fill slopes, and drainage and erosion control measures.
- Providing geotechnical recommendations for design and construction of new foundations and floor slabs, including allowable bearing capacity and estimates of settlement.
- Providing geotechnical recommendations for lower-level building or retaining walls, including backfill and drainage requirements, lateral design loads, and lateral resistance values.
- Providing geotechnical recommendations for new site retaining walls.

- Performing one Small Pilot Infiltration Test (Small PIT) on the site.
- Providing preliminary recommendations for the discharge of the development storm water.
- Providing recommendations for site drainage.

After visiting the site on February 1, 2024, to explore the subsurface conditions on the site, it was determined that groundwater monitoring would be required. Therefor our scope was expanded to include the following:

- Performing periodic monitoring of the groundwater levels in the groundwater monitoring wells installed on the site.

3.0 SITE CONDITIONS

3.1 Surface

The subject site is a 1.63-acre irregularly shaped residential parcel located at 2317 Shaw Road in Puyallup, Washington. The site is currently occupied with a single-family residence located in the western end of the site, a detached structure to the SE of the residence, and a barn in the central eastern portion of the site. A short roadway with a cul-de-sac exists along the south property line. The cul-de-sac ends near the center of the site, and an easement driveway extends from the cul-de-sac to a single-family residence located along the south side of the eastern end of the site. The subject site is bordered by residential parcels to the north, east, and to the south of the eastern end of the site. The remaining portions to the south of the site consist of a roadway with cul-de-sac. The location of the site is shown on the Site Vicinity Map provided in Figure 1. The current site layout is shown on the Exploration Location Plan provided in Figure 2.

In general surface grades in the vicinity of the site slope down to the north and east. Surface grades on the west end of the subject site are flat in the front yard of the existing residence. Behind the residence, the site slopes down to the east at inclinations ranging from 10 to 13 percent. The center of the site is generally flat to sloping down to the north at an approximate 2 to 5 percent grade. Behind the barn along the east end of the site, the surface slopes down to the east at an inclination of 10 to 33 percent. Site vegetation around the residence that occupies the site consists of typical landscape bushes and trees. The center of the site is a grass field. The east end of the site consists of native medium sized evergreen and deciduous with moderately thin underbrush.

3.2 Mapped Soils

According to *The Geologic Map of Seattle- A Progress Report,* by Kathy Goetz Troost, Derek B. Booth, Aaron P. Wisher, and Scott A. Shimel, the surface soils in the vicinity of the site are mapped as Recessional Outwash (Qvr). Glacial Till (Qvt) is mapped as being under the Recessional Outwash. The Recessional Outwash and Glacial Till were deposited during the Vashon Stade of the Frasier Glaciation that occurred 12,000 to 15,000 years ago. The Glacial Till was deposited beneath the advancing glacial ice sheet and was consequently overridden by the glacial ice mass.

The Recessional Outwash deposited by meltwaters and streams that emanated from the receding glacial ice mass. The Glacial Till will typically be found in a very dense condition where undisturbed and the Recessional Outwash in a medium dense condition where undisturbed. The near surface soils at the site have been disturbed by natural weathering processes that have occurred since their deposition. No springs or groundwater seepage was observed on the surface of the site at the time of our site visit. A copy of the Geologic Map for the subject site is provided in Figure 3.

The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) maps the soils in the vicinity of the site as Kitsap Silt Loam (20C) soils that form on 8 to 15 percent slopes. According to the USDA NRCS, the site soil will have a moderate potential erosion when exposed.

3.3 Soils

The soils we observed at the site generally consist of Recessional Outwash at the east and west ends and Old Fill soils overlying glacial till along the majority of the center of the site.

The soils observed in Test Hole TH-1 consisted of 12 inches of topsoil overlying Old Fill soils consisting of reddish orange silty sand with gravel and cobbles.

In Test Hole TH-2, we encountered 2.0 feet of Old Fill soils consisting of tan, gray and brown silty sand with gravel and cobbles to 8 inches. Below 2.0 feet, we encountered topsoil to a depth of 3.0 feet below surface grades. Below 3.0 feet, the soil became native reddish-orange, medium dense to dense, slightly cemented silty sand with gravel consistent with glacial till.

In Test Hole TH-3, we encountered 6 inches of topsoil overlying Old Fill soils consisting of brown, reddish-orange and gray and silty sand with gravel and cobbles to 8 inches to a depth of 4.5 feet below surface grades. Below 4.5 feet we encountered 6 inches of topsoil. Below 5.0 feet, the soil became native tan and gray mottled reddish-orange, medium dense to dense, slightly cemented silty sand with gravel consistent with glacial till.

In Test Hole TH-4, we encountered 5.5 feet of Old Fill soils consisting of tan, gray and brown silty sand with gravel and cobbles to 8 inches. At a depth of 5.5 feet, we encountered a boulder that could be excavated past.

In Test Hole TH-5, we encountered 3.5 feet of Old Fill soils consisting of tan, gray and brown silty sand with gravel and cobbles to 8 inches. Below 3.5 feet, we encountered topsoil to a depth of 4.5 feet below surface grades. Below 4.5 feet, the soil became native gray, medium dense to dense, slightly cemented silty sand with gravel consistent with glacial till.

In Test Hole TH-6, we encountered 4.0 feet of Old Fill soils consisting of tan, gray and brown silty sand with gravel and cobbles to 8 inches. Below 4.0 feet, we encountered topsoil to a depth of 5.0 feet below surface grades. Below 5.0 feet, the soil became native gray, medium dense to dense, slightly cemented silty sand with gravel consistent with glacial till.

In Test Hole TH-7, we encountered 7.0 feet of sand with varying amounts of silt consistent with Recessional Outwash. The Outwash was predominantly medium grained, tan in the upper 3.0 feet and gray in the lower 4.0 feet. Below 7.0 feet, the soil became native gray, medium dense to dense, slightly cemented silty sand with gravel consistent with glacial till.

In Test Hole TH-8, we encountered 12 inches of topsoil overlying reddish orange silty sand and tan sand with silt consistent with Recessional Outwash.

Figures A-1 and A-2 present more detailed descriptions of the subsurface conditions encountered in the test holes. The approximate test hole and test boring locations are shown on the Exploration Location Plan provided in Figure 2.

3.4 Groundwater

We did not encounter groundwater during our site exploration on (February 13, 2024) to the depths explored. We installed groundwater monitoring wells in six of the eight test pits on the site. The wells were extended through the upper loose to medium dense soils and into the underlying dense glacial till. We returned to the site on February 17th and 23rd to check the water levels in the wells. At no time did we find groundwater had accumulated in the well. We did not find a seasonal perched water table beneath the site. The groundwater levels and flow rates will fluctuate seasonally and typically reach their highest levels during and shortly following the wet winter months (October through May).

4.0 GEOLOGIC HAZARDS

4.1 General

According to Chapter 21.06.1210 in the City of Puyallup Municipal Code (PMC) geologic hazard areas are defined as "...areas that, because of their susceptibility to erosion, sliding, earthquake, or other geological events, are not suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns."

4.2 Erosion

According to Chapter 21.06.1210 in the City of Puyallup Municipal Code (PMC) Erosion Hazard Areas are defined as "...those areas identified by the U.S. Department of Agriculture's Natural Resources Conservation Service or identified by a special study as having a "moderate to severe," "severe," or "very severe" erosion potential."

According to the USDA NRCS, the soils on the subject site are classified as having a "moderate" potential for erosion when exposed. According to the USDA NRCS classification of the site, the site is not classified as having erosion hazard areas.

Regardless of the erosion classification on the site, Temporary Erosion and Sediment Control (TESC) measures must be in place prior to and maintained during construction activity at the site. In our opinion, the potential for erosion is not a limiting factor in site development. Erosion hazards can be mitigated by applying Best Management Practices (BMPs) outlined in the Washington State Department of Ecology's (Ecology) *Stormwater Management Manual for Western Washington.*

Temporary Erosion and Sediment Control (TESC) measures, as required by the City of Puyallup, should be in place prior to the start of construction activities at the site.

4.3 Landslide

According to Chapter 21.06.1210 in the City of Puyallup Municipal Code (PMC) Landslide Hazard Areas are defined as "...areas include areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include any areas susceptible to landslide because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors, and include, at a minimum, the following:

(i) Areas of historic failures, such as:

(A) Those areas delineated by the United States Department of Agriculture Natural Resources Conservation Service as having a significant limitation for building site development;

(B) Those coastal areas mapped as class u (unstable), uos (unstable old slides), and urs (unstable recent slides) in the Department of Ecology Washington coastal atlas; or

(C) Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the United States Geological Survey or Washington Department of Natural Resources.

(ii) Areas with all three of the following characteristics:

(A) Slopes steeper than 15 percent;

(B) Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and

(C) Springs or groundwater seepage.

(iii) Areas that have shown movement during the Holocene epoch (from 10,000 years ago to the present) or which are underlain or covered by mass wastage debris of this epoch;

(iv) Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;

(v) Slopes having gradients steeper than eighty percent subject to rockfall during seismic shaking;

(vi) Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action, including stream channel migration zones;

(vii) Areas that show evidence of, or are at risk from snow avalanches;

(viii) Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding; and

(ix) Any area with a slope of 40 percent or steeper and with a vertical relief of 10 or more feet except areas composed of bedrock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief.

The site does not contain areas of historic failures. The United States Department of Agriculture Natural Resources Conservation Service does not describe the site as having a significant limitation for building site development. The site is not located on a coastal shoreline and is therefore not mapped by the Department of Ecology Washington coastal atlas. We observed no areas having quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the United States Geological Survey or Washington Department of Natural Resources. We observed no areas that have shown movement during the holocene epoch (from 10,000 years ago to the present) or which are underlain or covered by mass wastage debris of this epoch. We observed no slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials. We observed no slopes having gradients steeper than eighty percent subject to rockfall during seismic shaking. We observed no areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action, including stream channel migration zones. We observed no areas that show evidence of, or are at risk from, snow avalanches. We observed no areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding. The site does not have slopes with an inclination of 40 percent or more within a vertical elevation change of at least 10 feet. The site does have slopes steeper than 15 percent and hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock. We did not observe groundwater seepage on the site. Based on these factors, according to the City of Puyallup, the site is not classified as a landslide hazard area.

Regardless of the landslide hazard classification of the site, the site appears stable. Based on these soil and slope conditions, the potential for a landslide to occur at this site should be considered negligible.

4.4 Seismic

According to Chapter 21.06.1210 in the City of Puyallup Municipal Code (PMC) Landslide Hazard Areas are defined as "...areas that are subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, or soil liquefaction."

Liquefaction can be described as a phenomenon where there is a reduction or complete loss of soil strength due to an increase in pore water pressure. The increase in water pressure is typically induced by vibrations. Liquefaction mainly affects geologically recent deposits of loose, fine-grained sands that are below the groundwater table.

The site is located in an area underlain with medium dense, predominantly medium-grained Recessional Outwash soils and dense glacial till soils. Based on the medium dense to dense consistency and relatively well-graded nature of the native soils that underly the site, the risk for liquefaction to occur at the site should be considered negligible. According to the City of Puyallup Municipal Code, the site is located in a seismic hazard area.

The state of Washington has adopted the International Building Code (IBC). Based on the soil conditions encountered and the local geology, per the IBC, site class "D" can be used in structural design. This is based on the inferred range of SPT (Standard Penetration Test) blow counts for the upper 100 feet of the site relative to hand excavation progress and probing with a ½-inch diameter steel probe rod. The presence of glacially consolidated soil conditions were assumed to be representative for the site conditions beyond the depths explored.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

Based on our study, in our opinion, soil and groundwater conditions at the site are suitable for the proposed development. The new residences can be supported on conventional spread footing foundations bearing on the native soils underlying the site. We found no seasonal groundwater table underlying the site. Infiltration of the development storm water will not be feasible.

Based on our evaluation, it appears the subsurface soils along the center of the site previously consisted of Recessional outwash similar to the soils observed along the eastern and western ends of the site. This soil was likely excavated and removed from the site. The existing fill soils we observed in our explorations were brought to the site to restore grades. The fill is a relatively consistent depth across the center of the site but appears to become much deeper behind the barn along the crest of the sites' eastern slope area. We reviewed past aerial photos and according to the USDA NRCS, this slope should be inclined at a much shallower slope inclination. We believe the fill soils used to restore grades were extended eastward past the barn area and created the current 33 percent slope. Additionally, the native deciduous trees along the slope crest are typical for those that naturally grow quickly in cleared or filled areas.

The native soils encountered at the site contain a high enough percentage of fines (silt and clay-size particles) that will make them difficult to compact as structural fill when too wet. Accordingly, the ability to use the soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction. If grading activities take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

The following sections provide detailed recommendations regarding these issues and other geotechnical design considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

5.2 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials including any existing structures, foundations or abandoned utility lines should be stripped and removed from the new development areas. Organic topsoil will not be suitable for use as structural fill but may be used for limited depths in non-structural areas. The Old Fill soil observed in the upper 3.0 to 5.5 feet of the site will not be suitable for supporting structural elements. Prior to construction these soils should be removed from under new foundation and slab areas.

Once clearing and stripping operations are complete, cut and fill operations can be initiated to establish desired grades. To achieve proper compaction of structural fill, and to provide adequate foundation and floor slab support, the existing subgrade must be in a stable condition. Due to the depth and consistency of the fill underlying the site, compaction of structural fill will be very difficult. If structural fill is necessary, it will likely have to be placed on a prepared subgrade surface consisting of either reinforcement fabric or quarry rock, or a combination of both. Once final design details become evident, we can provide specific recommendations for any structural fill on the site.

Our study indicates the native surface soils encountered at the site contain a sufficient percentage of fines (silt and clay-size particles) that will make them difficult to compact as structural fill when too wet. Accordingly, the ability to use the soil from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction. If grading activities are planned during the wet winter months, or the on-site soil becomes too wet to achieve adequate compaction, the owner should be prepared to import a wet-weather structural fill. For wet weather structural fill, we recommend importing a granular soil that meets the following gradation requirements:

U. S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

* Based on the ¾ inch fraction

Prior to use, Ages Engineering should examine and test all materials to be imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soils' laboratory maximum dry density as determined by American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this same ASTM standard. In non-structural areas, the degree of compaction can be reduced to 90 percent.

5.3 Excavations

General,

The inclination for a safe and stable excavation slope cut is determined based on two factors, the current Washington State Safety and Health Administration (WSHA) regulations for confined spaces and global stability of the slope cut. Most often, the WSHA regulations are more conservative than the global stability requirements.

According to WAC 296-809-099, a confined space is defined as: "A space that is all of the following:

> (a) Large enough and arranged so an employee could fully enter the space and work.
>
> (b) Has limited or restricted entry or exit. Examples of spaces with limited or restricted entry are tanks, vessels, silos, storage bins, hoppers, vaults, excavations, and pits.
>
> (c) Not primarily designed for human occupancy."

In the context of site excavation and grading, the Washington State Department of Labor and Industries considers a confined space as a space in which a worker enters an excavation that is tall enough and/or narrow enough to inundate the worker and cause bodily harm if a cave-in occurs. This does not include excavations that are less than 4.0 feet in depth.

WSHA Approved Slope Cuts,

All excavations at the site associated with confined spaces, such as utility trenches and lower level building and retaining walls, must be completed in accordance with local, state, and/or federal requirements. Based on current Washington State Safety and Health Administration (WSHA) regulations, the existing Old Fill and Recessional Outwash soils are classified as Type C soils. The deeper unweathered till soils are classified as Type A soils.

According to WSHA, for temporary excavations of less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5:1 (Horizontal:Vertical) or flatter from the toe to the crest of the slope and the side slopes in Type A soils should be laid back at a slope inclination of 0.75:1 (Horizontal:Vertical) or flatter from the toe to the crest of the slope. All exposed slope faces should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation. These guidelines assume that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the excavation slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant raveling or seepage occurs, or if construction materials will be stockpiled along the slope crest. If these safe temporary slope inclinations cannot be achieved due to property line constraints, shoring may be necessary.

This information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Ages Engineering assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

Global Stability Excavations,

Based on the composition and consistency of the site soils, stable slope cuts to provide adequate global stability can be steeper than WSHA standards in areas that are not considered confined spaces. Excavations into the native glacial till soils on the site that will not result in WSHA regulated confined spaces can be cut to an inclination of 0.5:1. Some raveling of the gravel and cobbles exposed on the slope surface may occur at an inclination of 0.5:1. Due to the potential for raveling to occur, and to prevent erosion, the slope face should be covered with durable plastic sheeting.

This information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Ages Engineering assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

5.4 Foundations

The new residential foundations may be supported on conventional spread footing foundations bearing on the existing organic-free native soils, or on new structural fill placed above the existing site soils. Foundation subgrades should be prepared as recommended in the "Site Preparation and Grading" section of this report. As discussed in the "Site Preparation and Grading" section of this report, the existing topsoil and fill observed in the upper 0.5 to 1.0 feet of the site will not be suitable for support of structural elements. Prior to construction, these old fill soils should be removed from under new foundation areas.

Perimeter foundations exposed to the weather should bear at a minimum depth of 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth below the floor slab. We recommend designing new foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-quarter inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent soil and backfilled with structural fill, as described in the "Site Preparation and Grading" section of this report. The values recommended include a safety factor of 1.5.

Foundation Parameter Summary	
Description	***Design Value**
Net Allowable Bearing Capacity	2,500 psf
Friction Coefficient	0.35
Lateral Resistance	300 pcf

*Details regarding the use of these parameters are provided in the section above.

5.5 Slab-On-Grade

Slab-on-grade floors should be supported on subgrades prepared as recommended in the "Site Preparation and Grading" section of this report. As discussed in the "Site Preparation and Grading" section of this report, the existing topsoil and fill observed in the upper 0.5 to 1.0 feet of the site will not be suitable for support of structural elements. Prior to construction, these old fill soils should be removed from under new slab areas.

Immediately below the floor slab, we recommend placing a four-inch-thick capillary break layer of clean, free-draining, coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slabs. The drainage material should be placed in one lift and compacted to a firm and unyielding condition.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will not assist in uniform curing of the slab and may serve as a water supply for moisture transmission through the slab and affecting floor coverings. Additionally, if the sand is too dry, it can effectively drain the fresh concrete, thereby lowering its strength. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided.

5.6 Lower Level and Building Walls

The magnitude of earth pressure development on below-grade walls, such as basement or retaining walls, will greatly depend on the quality of the wall backfill and the wall drainage. We recommend placing and compacting wall backfill as structural fill. Wall backfill below structurally loaded areas, such as pavements or floor slabs, should be compacted to a minimum of 95 percent of its maximum dry density, as determined by ASTM Test Designation D-1557 (Modified Proctor). In unimproved areas, the relative compaction can be reduced to 90 percent.

To guard against hydrostatic pressure development, drainage must be installed behind the wall. We recommend that wall drainage consist of a minimum 12 inches of clean sand and/or gravel with less than three percent fines placed against the back of the wall. In addition, a drainage collector system consisting of 4-inch perforated PVC pipe should be placed behind the wall to provide an outlet for any accumulated water. The drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once every year. The wall drainage material should be capped at the ground surface with 1-foot of relatively impermeable soil to prevent surface intrusion into the drainage zone. Alternatively, the 12-inch wide drainage layer placed against the back of the wall can be replaced with a Mirafi G100N Drainage Board, or an approved equivalent. If drainage board is used, the 4-inch perforated PVC pipe should be covered with at least 12 inches of clean washed gravel and the drainage board should be hydraulically connected to drainpipe and surrounding gravel.

With wall backfill placed and compacted as recommended and the wall drainage properly installed, unrestrained walls can be designed for an active earth pressure equivalent to a fluid weighing 35 pcf. For restrained walls, an additional uniform lateral pressure of 100 psf should be included. These values assume a horizontal backfill condition and that no other surcharge loading, such as traffic, sloping embankments, or adjacent buildings, will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of the wall foundation and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in the "Foundations" section of this report.

Lower Level Building and Retaining Wall Parameter Summary		
Description	**Condition**	***Design Value**
Earth Pressure	Unrestrained	35 pcf
Earth Pressure	Restrained	Additional 100 psf
Earth Pressure	Surcharge	Dependant upon magnitude

*Details regarding the use of these parameters are provided in the section above.

5.7 Storm Water

We visited the site to perform one Small PIT in the approximate center of the west end of the subject site. The infiltration test was performed in accordance with the City of Puyallup specifications during the wet season.

To prepare the infiltration test area, we utilized an excavator to excavate the area around the location. The test area was excavated to a depth of 6.0 feet below surface grades to get to the native soils. We then excavated an additional 2.0 feet into the native glacial till soils. The size was approximately 5.0 feet by 4.0 feet equating to a top surface area of 20.0 square feet. The side slopes were laid back at an approximate 0.5:1 inclination to avoid caving during the testing procedure. The bottom of the infiltration test pit measured approximately 4.0 feet by 3.0 feet equating to a surface area of 12.0 square feet. The test was performed in the medium dense till soils.

A vertical measuring rod was placed in the infiltration test hole to allow accurate measuring of the infiltration rate during testing. We utilized a ½ inch diameter garden hose to convey water from the house spigot into the test hole. The water was discharged onto a splash block placed in the center of the infiltration test hole. The infiltration test hole was filled with 12 to 18 inches of water and allowed to soak for 6 hours. During the pre-soak period, the water flow through the hose was slightly altered to try and match the infiltration rate. After the 6-hour soak period, the Steady State period was performed. Water was added to the test hole at a rate that maintained a depth of 12 inches of water in the hole for 1 hour. Every 15 minutes during that hour, we estimated the cumulative volume and instantaneous flow rate (in gallons per minute) necessary to maintain 12 inches of water in the test hole. The hose did not have any devices that were able to accurately measure the cumulative volume and instantaneous flow rate. Therefor we had to calculate these values by periodically placing a one-cup container between the hose and the pit. After the 1-hour Steady State period, the water was turned off and the infiltration rate was measured every 15 minutes for 1 hour. The measured steady state rate in PIT 1 was 0.4 inches per hour. The correction factors are 1.0 for Uniformity of Site Conditions, 0.5 for the small PIT, and 0.9 for Potential Siltation.

We performed the infiltration testing on the site during a period of wet weather near the middle of the wet season. We obtained a soil sample during our site exploration and delivered it to an outside testing laboratory for determination of the cation exchange capacity (CEC) of the soil.

Based on our infiltration testing on the site, it is our opinion the infiltration of the development storm water is feasible. The City of Puyallup requires a minimum measured infiltration rate of 0.30 inches per hour for feasibility. Based on the results of our Small PIT, the measured infiltration rate was 0.4 inches per hour. After correction factors, the rate would be 0.18 in/hr. The completed Pilot Infiltration Test (PIT) Checklist is provided in Appendix B.

5.8 Permanent Slopes and Embankments

All permanent cut and fill slopes should be graded with a finished inclination of no greater than 2:1 (Horizontal:Vertical). Upon completion of grading, the slope face should be appropriately vegetated or provided with other physical means to guard against erosion. Final grades at the top of the slope must promote surface drainage away from the slope crest. Water must not be allowed to flow in an uncontrolled fashion over the slope face. If it is necessary to direct surface runoff towards the slope, it should be controlled at the top of the slope, piped in a closed conduit installed on the slope face, and taken to an appropriate point of discharge beyond the toe.

All fill used for slope and embankment construction should meet the structural fill requirements described in the Site Preparation and Grading section of this report. In addition, if new fills will be placed over existing slopes of 20 percent or greater, the structural fill should be keyed and benched into competent slope soils.

5.9 Site Drainage

Surface,

Final exterior grades should promote free and positive drainage away from the building area. All ground surfaces, pavements, and sidewalks should be sloped away from the structure. We recommend providing a gradient of at least three percent for a minimum distance of ten feet from the building perimeter, except in paved locations. In paved locations, a minimum gradient of one percent should be provided, unless provisions are included for collection and disposal of surface water adjacent to the structure.

Subsurface,

We recommend installing a continuous drain along the lower outside edge of the perimeter building foundation. The foundation drain should be tightlined to an approved point of controlled discharge. The roof drain should not be connected to the footing drains unless a backflow device will be installed, or an adequate gradient will prevent backflow into the footing drains.

Subsurface drains must be laid with a gradient sufficient to promote positive flow to the point of discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once every year.

6.0 ADDITIONAL SERVICES

Ages Engineering should review the final project designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design. If changes are made in the loads, grades, locations, configurations or types of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as necessary.

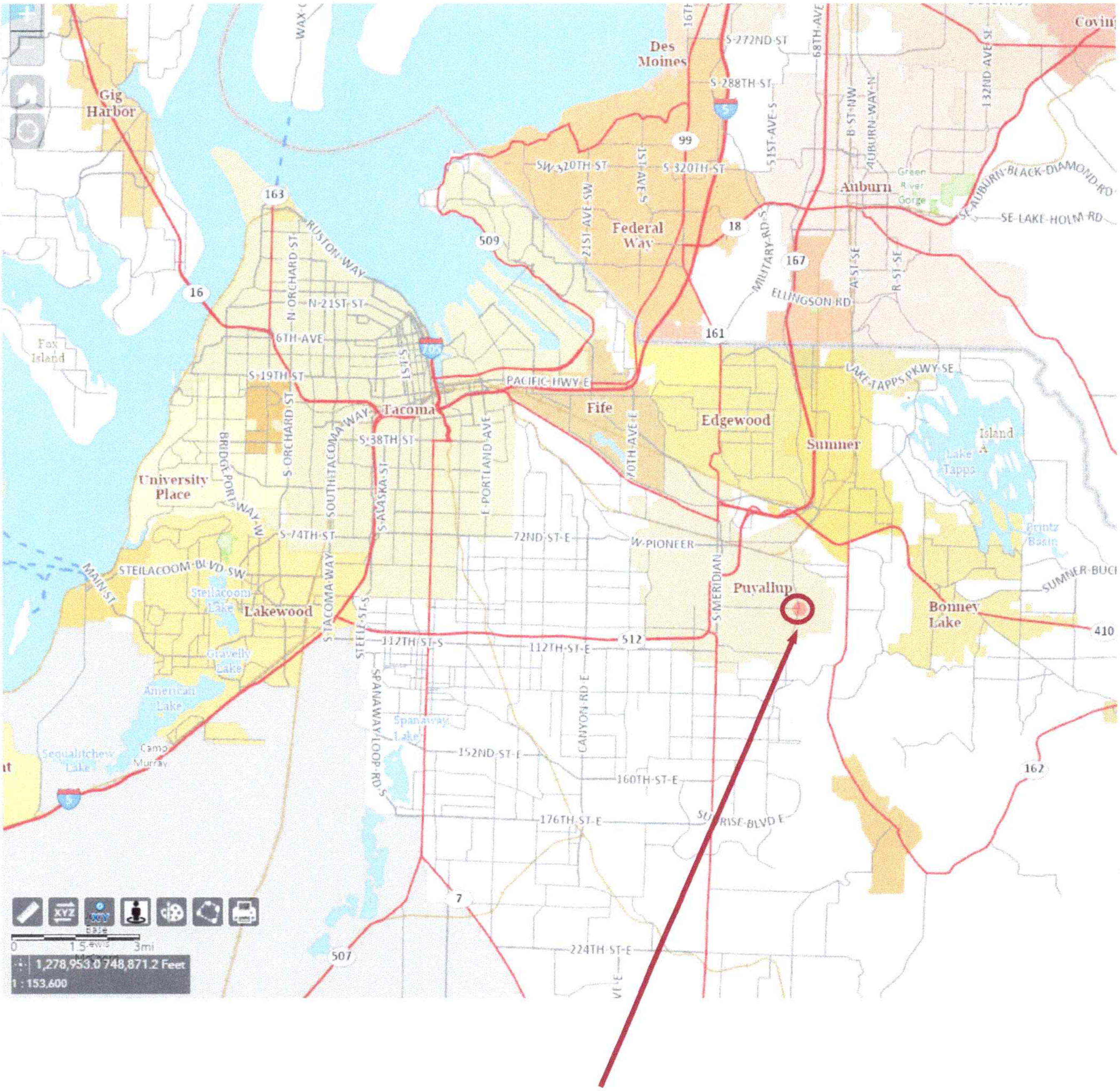
We should also provide geotechnical services during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for expedient design changes if subsurface conditions differ from those anticipated prior to the start of construction.

7.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Ages Engineering and is intended for the exclusive use of Mr. Mingqi Shao, and their authorized representatives for use in the design, permitting, and construction portions of this project.

The analysis and recommendations presented in this report are based on data obtained from others and our site explorations and should not be construed as a warranty of the subsurface conditions. Variations in subsurface conditions are possible. The nature and extent of which may not become evident until the time of construction. If variations appear evident, Ages Engineering should be requested to reevaluate the recommendations in this report prior to proceeding with construction. A contingency for unanticipated subsurface conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated during our exploration, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.



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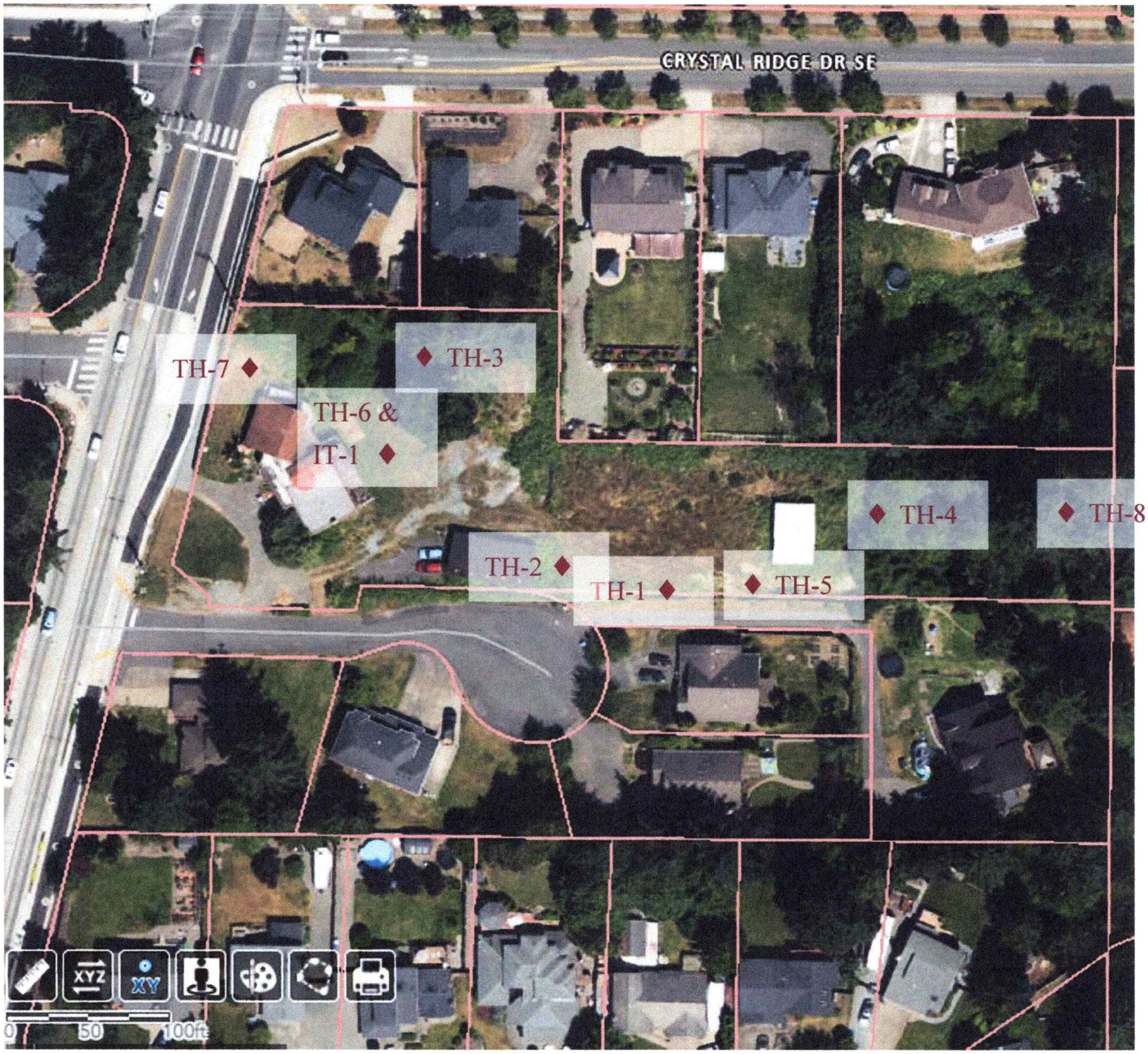
Site Vicinity Map
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

Project No.: A-1692	August 2024	**Figure 1**



KEY:

APPROXIMATE LOCATION OF TEST HOLE	TH-1 ◆
APPROXIMATE LOCATION OF INFILTRATION TEST	IT-1 ◆

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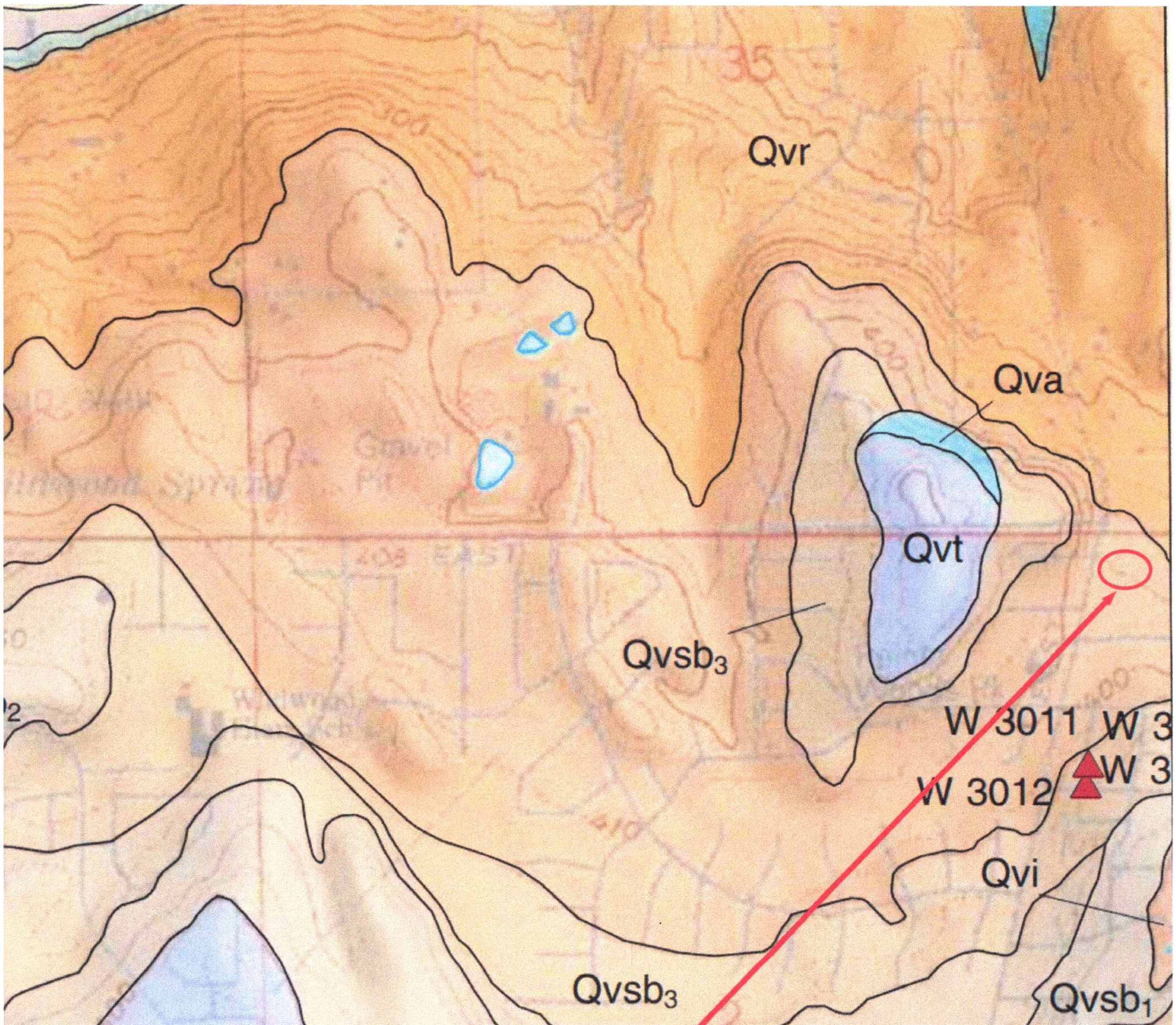
Exploration Location Plan
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

Project No.: A-1692	August 2024	**Figure 2**



Approximate Site Location

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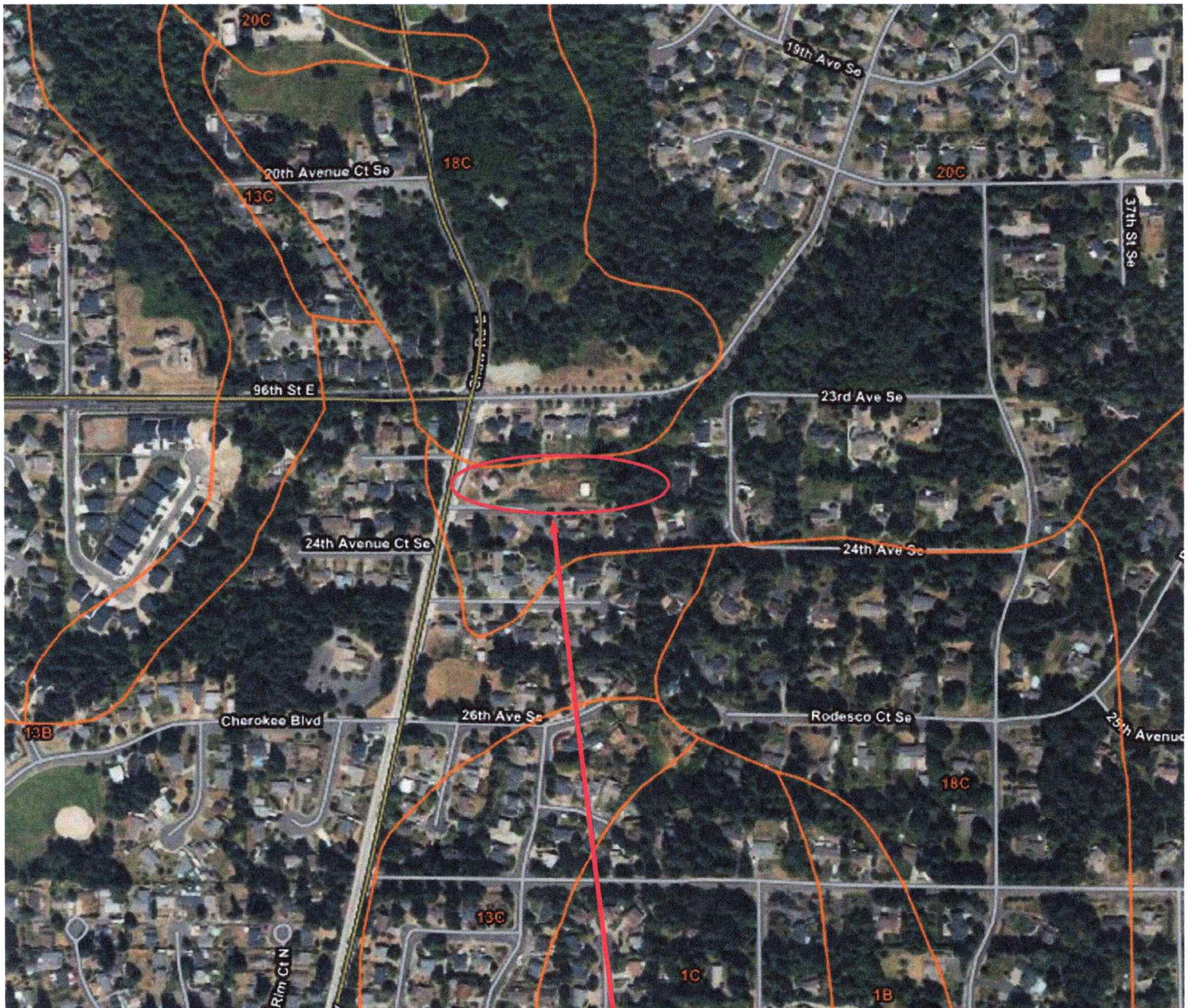
Geologic Map
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

Project No.: A-1692	August 2024	**Figure 3**



Approximate Site Location

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USDA NRCS Map
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

Project No.: A-1692	August 2024	**Figure 4**

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

Shaw Road Residential
Puyallup, Washington

On February 1, 2024 we explored subsurface conditions at the site by excavating one hand-augured test holes to a maximum depth of 3.0 feet below surface grades. We returned to the site on February 13, 2024 we explored subsurface conditions at the site by excavating seven additional machine-excavated test pits to a maximum depth of 7.0 feet below surface grades. The approximate location of the site is shown on the Site Vicinity map provided in Figure 1. The approximate test hole locations are shown on the Exploration Location Plan provided in Figure 2.

A geotechnical engineering representative from our office conducted the field exploration, maintained a log of each test hole and classified the soils encountered, collected representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1. The test hole logs are presented on Figures A-2 through A-4.

Representative soil samples obtained from the test holes were placed in sealed containers and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the test hole logs.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More than 50% Retained on No. 200 Sieve	GRAVEL More than 50% Of Coarse Fraction Retained on No. 4 Sieve	GRAVEL WITH < 5 % FINES	GW	Well-Graded GRAVEL
			GP	Poorly-Graded GRAVEL
		GRAVEL WITH BETWEEN 5 AND 15 % FINES	GW-GM	Well-Graded GRAVEL with silt
			GW-GC	Well-Graded GRAVEL with clay
			GP-GM	Poorly-Graded GRAVEL with silt
			GP-GC	Poorly-Graded GRAVEL with clay
		GRAVEL WITH > 15 % FINES	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	SAND More than 50% Of Coarse Fraction Passes No. 4 Sieve	SAND WITH < 5 % FINES	SW	Well-Graded SAND
			SP	Poorly-Graded SAND
		SAND WITH BETWEEN 5 AND 15 % FINES	SW-SM	Well-Graded SAND with silt
			SW-SC	Well-Graded SAND with clay
			SP-SM	Poorly-Graded SAND with silt
			SP-SC	Poorly-Graded SAND with clay
		SAND WITH > 15 % FINES	SM	Silty SAND
			SC	Clayey SAND
FINE GRAINED SOILS More than 50% Passes No. 200 Sieve	SILT AND CLAY	Liquid Limit Less than 50	ML	Inorganic SILT with low plasticity
			CL	Lean inorganic CLAY with low plasticity
			OL	Organic SILT with low plasticity
		Liquid Limit 50 or more	MH	Elastic inorganic SILT with moderate to high plasticity
			CH	Fat inorganic CLAY with moderate to high plasticity
			OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

(1) Soil descriptions are based on visual field and laboratory observations using the classification methods described in ASTM D-2488. Where laboratory data are available, classifications are in accordance with ASTM D-2487.

(2) Solid lines between soil descriptions indicate a change in the interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

(3) Fines are material passing the U.S. No. 200 Sieve.

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Unified Soil Classification System (USCS)
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

Project No.: A-1692	August 2024	**Figure A-1**

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Test Hole TH-1

DATE: February 1, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	6 inches **TOPSOIL**		
	FILL: Brown silty sand with gravel , cobbles to 8 inches.		
	FILL: Tan, reddish-brown and gray silty sand with gravel, moderate cementation, medium dense, moist. (SM) (Weathered Glacial Till)		
	Test Hole terminated at a depth of 3.0 feet below surface grades.		
	No groundwater seepage encountered.		
5			

Test Hole TH-2

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	**FILL:** Tan, gray and brown silty sand with gravel, cobbles to 10 inches, loose, moist. (SM)		
	TOPSOIL		
	Reddish-orange silty **SAND** with gravel, slight cementation, medium dense, moist. (SM)		
5	Test Hole terminated at a depth of 5.0 feet below surface grades.		
	No groundwater seepage encountered.		

Test Hole TH-3

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	6 inches **TOPSOIL**		
	FILL: Brown and reddish-orange silty sand with gravel , cobbles to 8 inches, medium dense, moist.		
	FILL: Gray and reddish-orange silty sand with gravel , cobbles to 8 inches, medium dense, moist.		
	6 inches **TOPSOIL**		
5	Tan and gray mottled reddish-orange silty SAND with gravel, medium dense, moist. (SM) (Glacial Till)		
	Test Hole terminated at a depth of 7.0 feet below surface grades.		
	No groundwater seepage encountered.		

Figure A-2

Project No.: A-1692

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Test Hole TH-4

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	**FILL:** Tan, gray and brown silty sand with gravel, cobbles to 10 inches, loose, moist.		
	FILL: Brown silty sand with gravel and topsoil, cobbles to 8 inches, loose, moist.		
5	Large Boulder at 5.5 feet.		

Test Hole terminated at a depth of 6.5 feet below surface grades.

No groundwater seepage encountered.

Test Hole TH-5

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	**FILL:** Tan, gray and brown silty sand with gravel, cobbles to 10 inches, loose, moist. (SM)		
	TOPSOIL, with cobbles.		
5	Gray silty **SAND** with gravel, medium dense, moist. (SM) (Glacial Till)		

Test Hole terminated at a depth of 5.5 feet below surface grades.

No groundwater seepage encountered.

Test Hole TH-6

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	**FILL:** Tan, gray and brown silty sand with gravel, cobbles to 10 inches, loose, moist. (SM)		
	TOPSOIL, with cobbles.		
5	Gray silty **SAND** with gravel, medium dense, moist. (SM) (Glacial Till)		

Test Hole terminated at a depth of 6.0 feet below surface grades.

No groundwater seepage encountered.

Figure A-3

Project No.: A-1692

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Office (253) 845-7000

Test Hole TH-7

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	Tan SAND, trace silt, medium dense, moist. (SP) (Recessional Outwash)		
5	Gary SAND with silt, medium dense, moist. (SP/SM) (Recessional Outwash)		
	Gray silty **SAND** with gravel, medium dense, moist. (SM) (Glacial Till)		
	Test Hole terminated at a depth of 6.5 feet below surface grades.		
	No groundwater seepage encountered.		

Test Hole TH-8

DATE: February 13, 2024 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	Reddish-orange silty **SAND** with gravel, medium dense, moist. (SM)		
	Tan **SAND**, trace silt, medium dense, moist. (SP) (Recessional Outwash)		
	Test Hole terminated at a depth of 3.0 feet below surface grades.		
	No groundwater seepage encountered.		
5			

Figure A-4

APPENDIX B

SMALL PILOT INFILTRATION TEST

Shaw Road Residential
Puyallup, Washington

Project No. A-1692

Small Pilot Infiltration Test (Small PIT)

Excavation:

Test Pit Surface Dimensions	4	5	feet
Test Pit Bottom Dimensions	3	4	feet
Test Pit Bottom Area	12		square feet
Test Pit Depth	8		feet

Pre-Soak Period:

Time (hh:mm)	Depth of Water (inches)
10:00	16
11:00	18
12:00	17
13:00	18
14:00	18
15:00	18
16:00	18

Steady-State Period:

Time of Measurement (hh:mm)	Depth of Water (inches)	Cumulative Volume (gallons)	Flow Rate (gpm)	Infiltration Rate (inches/hour)
16:00	18			0.3
16:15	18			0.4
16:30	18			0.4
16:45	18			0.4
17:00	18			0.4

Falling Head Period:

Time of Measurement 15-min intervals	Depth of Water (inches)	Infiltration Rate (inches/hour)
17:00	18	0
17:15	17.5	2
17:30	17	2
17:45	16.5	2
18:00	16	2

Rate Determination:

Steady State		0.4	(inches/hour)
Falling Head		2	(inches/hour)
Selected Rate:		0.4	(inches/hour)
Correction Factor:	A	1	
	B	0.5	
	C	0.9	

Design Rate: **0.18** **(inches/hour)**

Ages Engineering

A Geotechnical Engineering Services Company

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www.agesengineering.com

December 23, 2024
Project No. A-1692

Mingqi Shao
12319 NE 68th Place
Kirkland, WA 98033

Subject: Infiltration Testing
Shaw Road Residential
2317 Shaw Road
Puyallup, Washington

Reference: Geotechnical Report, Shaw Road Residential, prepared by Ages Engineering, dated August 6, 2024

Dear Mr. Shao,

As requested, we have completed the on-site infiltration testing on Lot 4 for the subject site located at 2317 Shaw Road in Puyallup, Washington. We discussed the project with you and were previously provided with a Site Plan showing the lot locations.

Based on the information provided to us, we understand the project will consist of dividing the site into 4 residential. The existing residence on the south end of the site will remain. The north end of the site will be divided into three additional residential lots. The development storm water for each lot will discharge to infiltration facilities on each lot. The driveways and sidewalks will be constructed using permeable pavement. We previously performed infiltration testing on the site and currently have been requested to perform an additional infiltration test on the north end of Lot 4 adjacent to our previous TH-8 location.

CONCLUSIONS AND RECOMMENDATIONS

We visited the site to perform one Small PIT in the approximate center of the north end of Lot 4 on the subject site. The infiltration test was performed in accordance with the City of Puyallup specifications.

To prepare the infiltration test area, we excavated the surface area around the test location to 5.0 feet by 4.0 feet. The test area was then excavated to a depth of 4.0 feet below surface grades and the size of the bottom of the test hole was 4.0 feet by 3.0 feet equating to a top surface area of 20 square feet. The side slopes were laid back at an approximate 0.75:1 inclination to avoid caving during the testing procedure. The bottom of the infiltration test pit measured approximately 4.0 feet by 3.0 feet equating to a surface area of 12.0 square feet. The test was performed in medium dense native sand with silt and gravel consistent with Advance Outwash.

A vertical measuring rod was placed in the infiltration test hole to allow accurate measuring of the infiltration rate during testing. We utilized a ¾ inch diameter flexible hose to convey water from a house spigot into a barrel adjacent the the test hole. The water was discharged from the barrel onto a splash block placed in the center of the infiltration test hole. The infiltration test hole was filled with 12 to 13 inches of water and allowed to soak for 6 hours. During the pre-soak period, the water flow through the hose was slightly altered to try and match the infiltration rate. After the 6-hour soak period, the Steady State period was performed. Water was added to the test hole at a rate that maintained a depth of 12 inches of water in the hole for 1 hour. Every 15 minutes during that hour, we estimated the cumulative volume and instantaneous flow rate (in gallons per minute) necessary to maintain 12 inches of water in the test hole. The hose did not have any devices that were able to accurately measure the cumulative volume and instantaneous flow rate. Therefor we had to calculate these values by periodically placing a one-gallon container between the hose and the pit. After the 1-hour Steady State period, the water was turned off and the infiltration rate was measured every 15 minutes for 1 hour. The measured rate in PIT 1 was 9.3 inches per hour, and the maximum falling head rate was 9.5 inches per hour. We utilized the measured rate of 9.3 for our design. The correction factors are 1.0 for Uniformity of Site Conditions, 0.5 for the small PIT, and 0.9 for Potential Siltation. After the correction factors have been applied, the long-term design infiltration rate for the site is 4.2 inches per hour.

We performed the infiltration testing on the site during a period of wet weather in the first month of the wet season. After the testing was complete, the test hole was excavated further but due to light rainfall and dark conditions due to heavy tree canopy coverage, it was nearly impossible to determine how deep the wet soils extended to. We obtained a soil sample during our site exploration and delivered it to an outside testing laboratory for determination of the cation exchange capacity (CEC) of the soil.

Based on our infiltration testing on the site, it is our opinion that the infiltration of the development storm water is feasible. Based on the results of our Small PIT, and the specifications provided by the City of Puyallup, we recommend the infiltration system be sized using a long-term design infiltration rate of 4.2 inches per hour.

◆ ◆ ◆

We trust this information is sufficient for your current needs. If you have any questions, or require additional information, please call.

Respectfully Submitted,
Ages Engineering

BERNARD P. KNOLL II
STATE OF WASHINGTON
38917
REGISTERED PROFESSIONAL ENGINEER

12-23-2024

Bernard P. Knoll, II, P.E.
Principal

BPK:bpk
Project No.: A-1591

Small Pilot Infiltration Test (Small PIT)

Project Name: Shaw Road Residential
Project Number: A-1692
Date: December 18, 2024
Field Representative BK

Excavation:

Test Pit Surface Dimensions	3.0	5.0	feet
Test Pit Bottom Dimensions	3.0	4.0	feet
Test Pit Bottom Area	12.0		square feet
Test Pit Depth	4.0		feet

Pre-Soak Period:

Time (hh:mm)	Depth of Water (inches)
9:00	8.5
9:30	10.5
10:00	11.0
10:30	12.0
11:00	12.0
11:30	13.5
12:00	12.0
12:30	13.0
1:00	12.0
2:30	12.0

Steady-State Period:

On-Site Rate Test:	Container	1	Gallon Jug	
	Volume	0.13368	ft^3	
		0.00	in^3	
	Time	0:52:00	0.87	min
		0:52:00	0.87	min
		0:52:00	0.87	min

Time of Measurement (hh:mm)	Depth of Water (inches)	Cumulative Volume (gallons)	Flow Rate (gpm)	Infiltration Rate (inches/hour)
1:30	14.0	0		
1:45	14.0	17.31	1.15	9.3
2:00	14.0	17.31	1.15	9.3
2:15	14.0	17.31	1.15	9.3

Falling Head Period:

Time of Measurement 15-min intervals	Depth of Water (inches)	Infiltration Rate (inches/hour)
4:30	12.0	
4:45	6.5	9.5
5:00	1.0	9.5
5:15	0.0	5.0
5:30	0.0	4.0

Rate Determination:

Steady State		9.3	(inches/hour)
Falling Head		9.5	(inches/hour)
Selected Rate:		9.3	(inches/hour)
Correction Factor:	A	1	
	B	0.5	
	C	0.9	
Design Rate:		**4.2**	**(inches/hour)**