GEOTECHNICAL EVALUATION
SONNELAND PROPERTY
SW OF EAST 29TH AVENUE AND SOUTH SOUTHEAST BOULEVARD
SPOKANE, WASHINGTON

Inland Pacific Engineering Company Project No. 17-574

December 4, 2017

IPEC

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Geotechnical Engineering and Consulting

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Geotechnical Engineering and Consulting

December 4, 2017
Project No. 17-574

Mr. Doug Desmond
Greenstone Corporation
1421 North Meadowwood Lane, Suite 200
Liberty Lake, WA 99019

Re: **Geotechnical Evaluation**
Sonneland Properties
SW of East 29th Avenue and South Southeast Boulevard
Spokane, WA

Dear Mr. Desmond:

We have completed the geotechnical evaluation for the proposed improvements located at the above-referenced site in Spokane, Washington. The purpose of evaluation was to assess subsurface soil and groundwater conditions to assist in design and construction of foundations, slabs, pavement, and stormwater management facilities and in preparation of plans and specifications.

We appreciate the opportunity to provide our services to you on this project. If you have any questions or need additional information, please do not hesitate to call me at (509) 209-6262 at your convenience.

Sincerely,
Inland Pacific Engineering Company

Gregory J. Voigt, P.E.
Project Engineer

Paul T. Nelson, P.E.
Principal Engineer

Attachment: Geotechnical Evaluation Report

GEOTECHNICAL EVALUATION
SONNELAND PROPERTY
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Inland Pacific Engineering Company Project No. 17-574

December 4, 2017

Prepared for:

Greenstone Corporation
Liberty Lake, WA

IPEC
Inland Pacific Engineering Company
Geotechnical Engineering and Consulting

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Spokane, Washington

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1.0 INTRODUCTION

1.1 Project Description

We understand that the project will consist of the construction of apartment buildings and residential houses along with associated roadways, parking areas, and stormwater management facilities. We have assumed that the apartment buildings will be two to three-story, slab-on grade structures. For our purposes, we have assumed that apartment wall loads will be less than 2 to 4 kips per lineal foot and that column loads will be 100 kips or less. We have assumed that the residential houses will be one to two-story, slab-on-grade structures. We have assumed that house wall loads will be less than 1 to 2 kips per lineal foot and that column loads will be less than 50 kips. We have also assumed that traffic loads will consist primarily of light automobiles with occasional truck traffic. We have assumed that stormwater runoff will be managed using infiltration swales with gravel galleries or drywells.

1.2 Purpose

The purpose of the evaluation is to assess subsurface soil and groundwater conditions to assist in design and construction of foundations, slabs, pavements, and stormwater management facilities and in preparation of plans and specifications for construction.

1.3 Scope

Our services were requested by Mr. Doug Desmond of Greenstone. Mr. Desmond authorized us to proceed on October 27, 2017. The scope of work agreed upon consisted of the following:

- review of existing geotechnical data and reports for the development, if available
- observe the excavation of 12 test pits at the site to depths ranging from 5 to 15 feet,
- performing 3 test pit permeability tests,
- performing laboratory tests on samples obtained from the test pits, if necessary,
- classifying the soils and preparing test pit logs, and
- submitting a geotechnical report containing logs of the test pits, results of our field investigation, our analyses and our recommendations for design and construction.

1.4 Available Information

We were provided a proposed site plan for the project. The site plan showed the proposed locations of the buildings, parking and drive areas, existing roadways, and property lines. The plan was titled “PUD Multi-Family” prepared by Greenstone Corporation and was dated October 17, 2017.

1.5 Locations and Elevations

The test pits were excavated at or near locations selected by us and staked by RFK Land Surveying, Inc. (RFK). The test pit locations are shown on the Test Pit Location Map in Appendix A. The test pits were excavated by an excavator working under subcontract to Greenstone. Ground surface elevations at the test pits were provided by RFK.

2.0 RESULTS

2.1 Logs

Log of Test Pit sheets indicating the vertical sequence of soils and materials encountered and groundwater observations are included in Appendix B. The strata changes were measured during excavation of the test pits. Please note that the depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of changes vary between the test pits. Geologic origins for each stratum are based on the soil type, available geologic maps, previous geotechnical reports for this and adjacent sites, and available common knowledge of the depositional history of the site.

2.2 Site Conditions

The site is located southeast of the intersection of East 29th Avenue and South Southeast Boulevard in Spokane, Washington. The location of the site is shown on the Site Location Map in Appendix A. The site is currently undeveloped with young to mature pine trees with open, grassy areas. Tree-covered slopes are present on the north and west and eastern sides of the site. Basalt bedrock outcrops are present in these areas.

2.3 Soils

Geologic maps indicate the soils in this area consist primarily of loess over loess over residuum derived from basalt. According to the Natural Resources Conservation Service (NRCS) Soil Survey of Spokane County, Washington, the site soils are classified as Northstar-Rock outcrop-Rockly complex (3117). The native soils encountered in the test pits were generally consistent with the NRCS data.

At the surface, Test Pits TP-1 and TP- 4 encountered fill or “possible fill” (it was considered possible fill because it did not appear to be native soil but no indicator, such as debris, etc. was found to confirm our opinion). Below the possible fill in Test Pit TP-1, the test pit encountered glacially deposited silty gravel over weathered basalt to its refusal depth. Test Pit TP-4 encountered fill to its refusal depth. The remaining test pits encountered topsoil consisting of silt or silty sand to depths ranging from 1 to 2 feet. Below the topsoil, these test pits generally encountered ash or loess overlying alluvial silty to poorly graded sands to their termination or refusal depths.

Refusal was encountered in 9 test pits at depths ranging from 4 to 11 feet. Refusal is defined as the depth at which the excavation could not be advanced further. Refusal can be caused by boulders, bedrock, very dense soils, or obstructions. Because weathered bedrock was encountered above the refusal depths in the test pits, it is our opinion that refusal was caused by dense weathered bedrock. Coring would be required to confirm our opinion.

2.4 Groundwater

Groundwater was encountered in 7 test pits (TP-2A and TP-7 through TP-12) at depths ranging from 8 to 10 feet. Groundwater was not encountered in the remaining test pits. Well log data in the vicinity of the site indicate that groundwater depths are extremely variable depending on elevation and depth to bedrock.

2.5 Field Infiltration Testing

Test pit permeability tests were performed adjacent to Test Pits TP-2A, TP-7, and TP-12 on November 15, 2017. The infiltration tests were performed in accordance with the Spokane Regional Stormwater Manual (SRSM) Appendix 4C procedures.

The following table summarizes the results of the tests performed.

Test Location	Depth (feet)	USCS Classification	Percent Fines	Infiltration Rate (cfs/ft^2)
P-1 (TP-2A)	4 – 6	SP	3.9	2.93×10^{-5}
P-2 (TP-7)	4 – 6	SP-SM	10.2	1.42×10^{-4}
P-3 (TP-12)	2.5 – 4.5	SP-SM	9.2	2.71×10^{-5}

Data sheets summarizing the tests performed is attached in Appendix D. The above results do not include a safety factor.

2.6 Laboratory Testing

Grain size analysis test was performed in accordance with ASTM D6913 on a samples obtained from Test Pits TP-2A, TP-7, TP-8, and TP-12. The results of the tests performed can be found in Appendix C.

3.0 DESIGN DATA

We understand that the project will consist of the construction of apartment buildings and residential houses along with associated roadways, parking areas, and stormwater management facilities. We have assumed that the apartment buildings will be two to three-story, slab-on grade structures. For our purposes, we have assumed that apartment wall loads will be less than 2 to 4 kips per lineal foot and that column loads will be 100 kips or less. We have assumed that the residential houses will be one to two-story, slab-on-grade structures. We have assumed that house wall loads will be less than 1 to 2 kips per lineal foot and that column loads will be less than 50 kips. We have also assumed that traffic loads will consist primarily of light automobiles with occasional truck traffic. We have assumed that stormwater runoff will be managed using infiltration swales with gravel galleries or drywells.

If design loads or elevations change, we should be contacted. Additional analyses may be necessary.

4.0 ANALYSIS AND RECOMMENDATIONS

4.1 Discussion

The test pits indicate that existing fill is present at the northeast corner of the site. The existing fill encountered in the test pit (TP-4) appears to be uncontrolled fill. Because of the variability in the relative density of the existing fill, it is our opinion that the fill is not suitable for support of foundations, slabs, or pavements in its current condition. We recommend that the existing fill soils be excavated from the proposed building and pavement areas and replaced with a compacted structural fill. It may be possible to re-use the existing fill as structural fill provided large particles and organic or deleterious particles are removed.

Based on the data obtained from the test pits, it is our opinion that the proposed buildings can be supported on conventional spread footings bearing on the native soils or on compacted structural fill placed over the native soils. However, the ash encountered in the test pits has very low strength and a high settlement potential and is not considered suitable for support of foundations. We recommend that the ash be removed and replaced below the proposed building areas, if encountered. A map showing the approximate limits of the ash deposits is included in Appendix A.

The floor slabs can be placed over the native soils below the existing fill and ash topsoil or on compacted structural fill placed over the native soils below these deposits. In the parking and drive areas, the native soils below the fill or ash should provide adequate support for the anticipated traffic loads.

As an alternative in parking lots and pavements, it may be possible to leave a portion of the ash in place by using geotextiles to increase strength in the subgrade. This option, however, would require traffic loading data and resilient modulus testing. A second option would be to cement treat the subgrade soils.

Based on the data obtained from the test pits and the laboratory test performed, it is our opinion that swales with gravel galleries would be suitable for infiltration of stormwater.

4.2 Site Preparation

We recommend that the topsoil, ash, and any existing fill, if present, be excavated and removed from the building, parking, and drive areas. After these soils have been removed, we recommend surface compacting the exposed soils prior to placing structural fill or forms for footings.

Structural fill should be placed in 6- to 8-inch-thick loose lifts at or near optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density determined in accordance with ASTM D 1557 (modified Proctor). Non-structural fill should be placed in twelve-inch-thick, loose lifts and compacted to at least 85 percent of the modified Proctor maximum dry density.

4.3 Foundations

We recommend that continuous foundations be placed at least 24 inches below the exposed ground surface for frost protection or as required by local building codes. Interior footings can be placed immediately below the slab. For unheated footings, we recommend that they be placed a minimum of 36 inches below the exposed ground surface.

We recommend that subgrades be evaluated by a geotechnical engineer for support of the proposed construction. Soils judged to be unsuitable should be subexcavated and replaced with compacted structural fill.

Based on the data obtained from the test pits, we anticipate that bedrock may be encountered at foundation elevations in some areas. In order to reduce the potential for abrupt differential settlement, we recommend subexcavating the bedrock a minimum of 12 inches below bottom-of-footing elevation and replacing with a compacted structural fill. Alternatively, the subgrade could transition from soil to bedrock at a 10:1 (H:V) taper in the upper 12 inches or all footings could be lowered to bear directly on bedrock.

We recommend that any subexcavations be oversized (widened) 1 foot horizontally from the edges of the footings for each foot of excavation below bottom-of-footing grade (1:1 oversizing). All foundation bearing surfaces should be free of loose soil and debris. If the foundation bearing soils are disturbed by excavation, the exposed soil should be re-compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

It is our opinion that the native soils encountered at the site would be suitable for support of isolated or continuous footings designed for a net allowable bearing pressure of 2,000 pounds per square foot (psf). Fill or backfill placed and compacted as previously recommended would be suitable for support of isolated or continuous footings designed for a net allowable bearing pressure of 2,000 pounds per square foot (psf). This recommended bearing capacity includes a safety factor of at least 3.0 against shear failure. The maximum net allowable bearing pressure values may be increased up to 30 percent to account for transient loads such as wind and seismic.

If the previous recommendations are implemented, it is our opinion that total settlement will be less than 1 inch. It is also our opinion that differential settlement will be less than ½ inch across a distance of 40 feet.

We recommend that all backfill placed on the exterior sides of the foundation walls be compacted to a minimum of 90 percent of the modified Proctor maximum dry density. Beneath slabs, steps, and pavements, it should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density. Backfill should be brought up uniformly on both sides of the foundation walls to minimize displacement of the foundation walls.

4.4 Floor Slabs

After the construction of the building pads have been completed, slab subgrades will likely consist of clayey and silty to poorly graded sand, silty to poorly graded gravel, or structural fill consisting of these soils. Interior footing and mechanical trenches should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

We recommend placing a minimum of 6 inches of crushed aggregate having less than 5 percent by weight passing a 200 sieve immediately below the slabs. This aggregate cushion will reduce moisture transmission to the floor slabs from the subgrade soils by creating a capillary break. The aggregate cushion should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

We recommend using a subgrade modulus of 200 pounds per cubic inch per inch of deflection (pci) to design the slabs. If a minimum of 6 inches of crushed gravel road base is placed above the subgrade and below the aggregate cushion, a modulus of 250 pci could be used for design.

If moisture-sensitive floor coverings or coatings will be used, a vapor retarder beneath the slabs should be considered. The designer of the buildings is best suited to make the decision regarding use of a vapor retarder, placement, and location relative to the slab base. We would be available to discuss the methods available.

4.5 Exterior Slabs

The silts and silty sands at the site are considered to be moderately to highly frost-susceptible. If these soils become saturated and freeze, up to 1 inch of heave may occur. This heave may become a nuisance for slabs or steps in front of doors or at other critical grade areas adjacent to the buildings. One way to reduce this heave is to remove the frost-susceptible soils down to bottom-of-footing grade and replace them with non-frost-susceptible sand or sandy gravel. Sand or sandy gravel having less than 5 percent of the particles by weight passing a 200 sieve is considered to be non-frost-susceptible.

4.6 Friction Coefficients

For mass concrete placed over the native gravels or granular structural fill, we recommend using a coefficient of friction against sliding of 0.45. For mass concrete placed over the native fine grained sands, we recommend using a coefficient of friction against sliding of 0.40. For mass concrete placed on a vapor retarder over the native soils, we recommend using a coefficient of friction against sliding of 0.35.

4.7 Lateral Earth Pressures

Any below-grade or retaining walls will retain low to significant amounts of soil. To reduce the potential for hydrostatic pressures to develop against the walls, we recommend using a free draining granular material with less than 5 percent passing a 200 sieve as backfill. The backfill material should consist of a sand or sandy gravel having 100 percent by weight passing a 1½ inch sieve and less than 5 percent passing a 200 sieve.

The equivalent fluid pressure used to design the walls will depend on the soil type used as backfill and whether the walls are designed to be flexible (allowed to move) or rigid (not allowed to move).

Assuming a sand or sandy gravel backfill with an internal friction angle of 34 degrees and a unit weight of 125 pound per cubic foot (pcf), we recommend using the following values for design:

A. Flexible Walls

Active Earth Pressure Coefficient, K_a:	0.28
Equivalent Fluid Pressure, pcf:	35

B. Rigid Walls

At-rest Earth Pressure Coefficient, K_0:	0.44
Equivalent Fluid Pressure, pcf:	55

For passive pressures, we recommend using a passive earth pressure coefficient K_P of 3.54 and an equivalent fluid pressure of 440 pcf for design.

4.8 Seismic Conditions

An S_S coefficient of 0.332g should be used for the project site per Figure 1613.3.1(1) in the 2015 edition of the International Building Code. An S_1 coefficient of 0.115g should be used for the project site per Figure 1613.3.1(2). The seismic coefficients should be modified for a soil site class D per Table 1613.3.5(1) of the International Building Code.

4.9 Utilities

Support soils for utilities will consist primarily of silty to poorly graded sands. It is our opinion that the native soils will provide adequate support for utilities. Unsuitable soils (e.g., loose, soft, organic, etc.), if encountered, should be removed and replaced with structural fill. For trench sidewall support, the site soils are considered Type C soils according to Occupational Safety and Health Administration (OSHA) guidelines.

Backfill placed over the utilities should consist of a debris-free mineral soil. Soils from the trench excavation can be used as backfill above the pipe. Backfill should be placed and compacted to a minimum of 95 percent of the modified Proctor maximum dry density. Compaction to 85 percent would be suitable in landscape areas.

4.10 Site Grading and Drainage

We recommend that the site be graded to provide positive runoff away from the proposed structures. We recommend that landscape areas be sloped a minimum of 6 inches within 10 feet of structures and that slabs be sloped a minimum of 2 percent.

4.11 Stormwater Recommendations

Based on the data obtained from the test pits, field infiltration tests, and laboratory tests performed, it is our opinion that swales with gravel galleries would be suitable for infiltration of stormwater. Due to the shallow bedrock at the site, it is our opinion that drywells are not feasible. For design, we recommend using the following infiltration rate for the design of gravel galleries.

1. Test P-1 (TP-2A): 2.66×10^{-5} cfs/ft^2
2. Test P-2 (TP-7): 5.68×10^{-5} cfs/ft^2
3. Test P-3 (TP-12): 1.29×10^{-5} cfs/ft^2

These recommended design infiltration rates include safety factors of 1.1, 2.1, or 2.5 as recommended by the SRSM. Infiltration would be through the sides and bottoms of the gallery trenches. We recommend that the gallery excavations expose the sands below the surficial ash or silt.

5.0 PAVEMENTS

5.1 Subgrade Preparation

After stripping the topsoil, ash, and any existing fill, if present, we recommend that the upper 8 inches of the resulting subgrade be scarified, moistened or dried to within 3 percent of optimum moisture, and compacted to a minimum of 95 percent of the modified Proctor maximum dry density determined in accordance with ASTM D 1557. Where fill is required, we recommend that it be similarly moisture conditioned and compacted. If there are areas that cannot be compacted, we recommend that the unstable soils be removed and replaced with soils similar to the surrounding subgrade soils.

We recommend that the subgrade surface be shaped to provide for positive drainage to minimize the potential for water to pond in the subgrade. Because the site soils are low to moderately frost-susceptible, it will be important to avoid creating “bathtubs” in the subgrade where water can pond and freeze, which could heave the pavement.

After preparing the subgrade, we anticipate that the subgrade will consist primarily of silty to poorly graded sands, silty to poorly graded gravels, or structural fill consisting of these soils. The fine grained sands are moderately sensitive to disturbance, especially when wet. If these soils are wet, we recommend that construction traffic be minimized where these soils are exposed. If these soils become unstable, other measures, such as excavation and replacement or geotextile fabric may be necessary.

5.2 Test Rolling

Prior to placing the aggregate base, we recommend that all subgrade areas be proof-rolled with a loaded dump truck. This precautionary measure would assist in detecting any localized soft areas. Any soft areas discovered during the proof-rolling operation should be excavated and replaced with a suitable structural fill material. The structural fill should be similar to the

existing subgrade soil type to provide a uniform subgrade. We recommend that the proof-rolling process be observed by an experienced geotechnical engineer to make the final evaluation of the subgrade.

5.3 Pavement Section Design

Based on the data from the test pits and laboratory testing, we recommend a pavement section consisting of a minimum of 2 inches of asphalt over 6 inches of crushed gravel base for parking and drive areas. If significant truck traffic is anticipated, we recommend that the asphalt thickness be increased to 3 inches in the truck drive areas. For streets classified as local access streets, we recommend the City of Spokane standard section of 3 inches of asphalt over 4 inches of crushed surfacing base course. If anticipated traffic data becomes available, we should be notified so we can review our pavement recommendations and provide revisions if necessary.

5.4 Materials and Compaction

We recommend specifying crushed gravel base meeting the requirements of the Washington Department of Transportation (WSDOT) Standard Specification 9-03.9(3) for crushed gravel surfacing (base course and/or top course). We recommend that the asphalt concrete pavement meet the requirements of WSDOT Standard Specification for Class ½ inch HMA asphalt concrete pavements. We recommend that the crushed gravel surfacing be compacted to a minimum of 95 percent of the modified Proctor maximum dry density. We recommend that the asphaltic concrete surface be compacted to minimum of 92 percent of the Rice density.

6.0 CONSTRUCTION

6.1 Excavation

Based on our observations of the test pit excavations, it is our opinion that some of the on-site soils can be excavated with standard soil excavation equipment. The bedrock may require mechanical splitting. We recommend excavations greater than four feet deep be sloped no steeper than 1.5:1 (horizontal to vertical), or that deeper excavations be shored or braced in accordance with OSHA specifications and local codes. The soils present at the site are considered to be Type C soils by OSHA.

6.2 Observations

We recommend that a geotechnical engineer observe all subgrades prior to placing fill or forms for footings to evaluate if the soils are suitable for support of the proposed structure and to evaluate whether the subsurface conditions are consistent with the test pits.

6.3 Backfills and Fills

The site soils which will be reused as backfill or fill are likely to be near to wet of optimum moisture content. These soils may require drying to achieve adequate compaction. Backfills and fills should be placed in thin lifts not exceeding 6 to 8 inches. Most of the on-site native soils and much of the existing fill can be used as structural fill provided particles larger than six inches and all debris are removed.

6.4 Testing

We recommend in-place density tests be performed on all fill placed. We recommend at least one test for every 2,500 square feet in the building areas for each foot of fill placed. We recommend at least one test for every 100 cubic yards of fill placed in the parking and drive areas with at least one test for every 2 feet of fill placed. At least one density test should be taken for every 100 feet of trench at vertical intervals not exceeding 2 feet.

6.5 Cold Weather

If site grading and construction are anticipated during cold weather, we recommend that good winter construction practices be observed. All snow and ice should be removed from excavated and fill areas prior to additional earthwork or construction. No fill, footings, or slabs should be placed on soils which have frozen or contain frozen material. Frozen soils should not be used as backfill or fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed upon frozen soils or soils which contain frozen material. Concrete should be protected from freezing until the necessary strength is achieved. Frost should not be permitted to penetrate below footings bearing on frost-susceptible soils since such freezing could heave and crack the footings and/or foundation walls.

6.6 Wet Weather

The fine grained sands and silts encountered at the site are moderately to highly sensitive to disturbance when wet. If these soils become wet and unstable, we recommend that construction traffic be minimized where these soils are exposed. Low ground pressure (tracked) equipment should be used to minimize disturbance. For high traffic areas, such as access or haul roads, we recommend placing a woven, water-permeable geotextile fabric (e.g., Mirafi 500X or 600X) and 12 to18 inches of crushed gravel to reduce disturbance. Specific options should be evaluated during construction in order to select the most cost-effective option.

7.0 PROCEDURES

7.1 Excavation and Sampling

The test pits were excavated on November 14, 2017 using a tracked backhoe operated by an independent firm working under subcontract to others. A geotechnical engineer from our firm continuously observed the test pit excavations and logged the surface and subsurface conditions. After we logged the test pits, the test pits were backfilled.

7.2 Soil Classification

The soils encountered in the test pits were visually and manually classified in the field by our field personnel in accordance with ASTM D 2488, “Description and Identification of Soils (Visual-Manual Procedures)”.

8.0 GENERAL RECOMMENDATIONS

8.1 Basis of Recommendations

The analyses and recommendations submitted in this report are based on the data obtained from the test pits excavated at the locations indicated on the Test Pit Location Map in Appendix A. It should be recognized that the explorations performed for this evaluation reveal subsurface conditions only at discreet locations across the project site and that actual conditions in other areas could vary. Furthermore, the nature and extent of any such variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed at that time, we may need to modify our conclusions and recommendations contained in this report to reflect the actual site conditions.

8.2 Groundwater Fluctuations

We made water level observations in the test pits at the times and conditions stated on the test pit logs. These data were interpreted in the text of this report. The period of observation was relatively short and fluctuation in the groundwater level may occur due to rainfall, flooding, irrigation, spring thaw and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations.

8.3 Use of Report

This report is for the exclusive use of the addressee and the copied parties to use in design of the proposed project and to prepare construction documents. In the absence of our written approval, we make no representations and assume no responsibility to other parties regarding this report. The data, analyses, and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

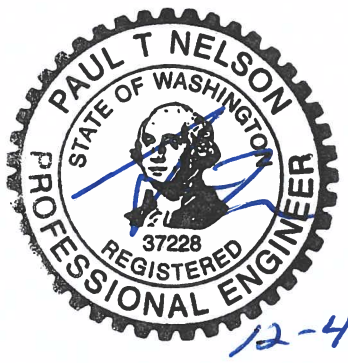
8.4 Level of Care

Services performed by the geotechnical engineers for this project have been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is intended or made.

8.5 Professional Certification

This report was prepared by me or under my direct supervision and I am a duly registered engineer under the laws of the State of Washington.

Paul T. Nelson, P.E.
Principal Engineer



12-4-17

APPENDIX A

SITE LOCATION MAP, NRCS MAP, TEST PIT LOCATION MAP, APPROXIMATE LIMITS OF ASH DEPOSITS

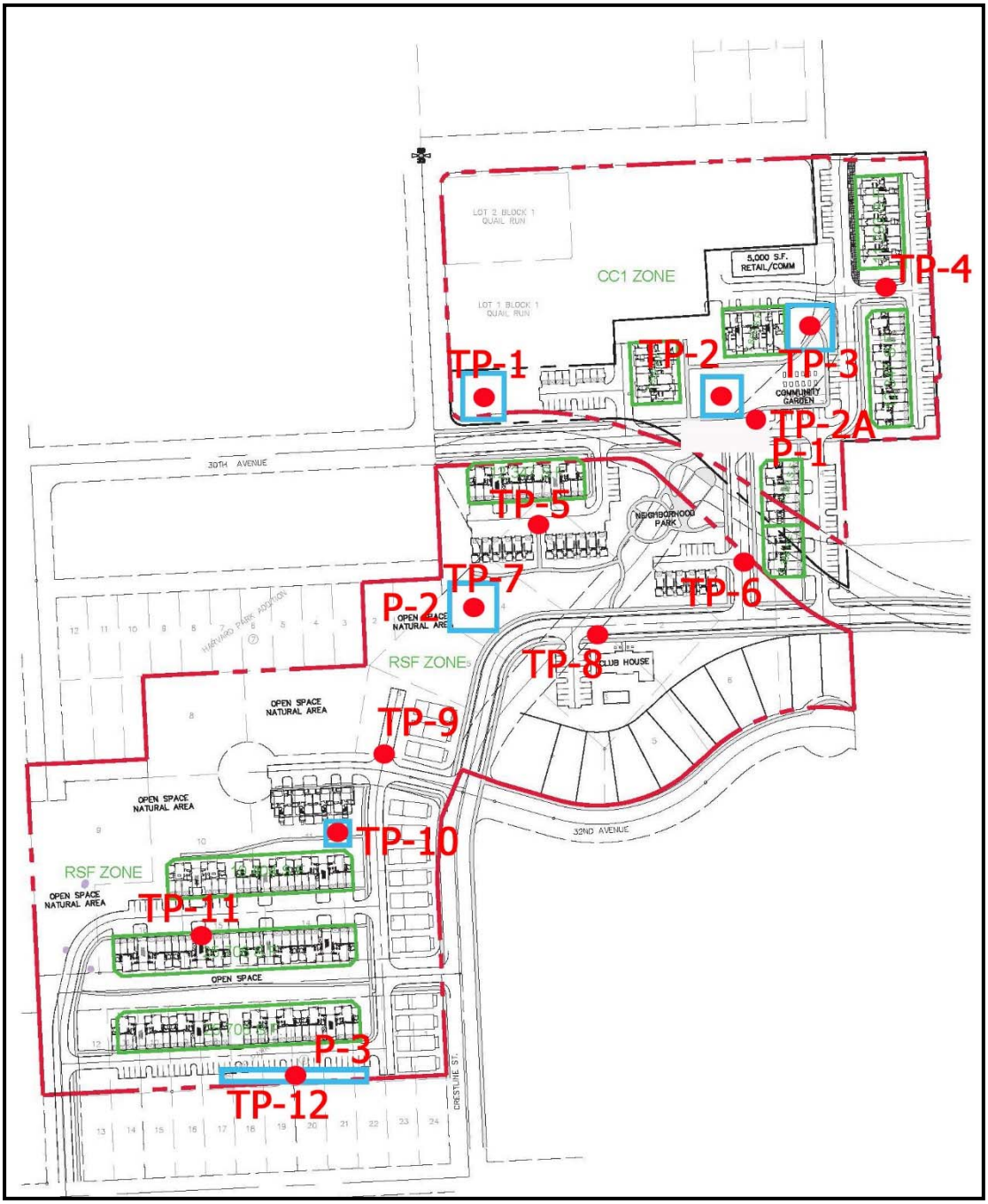
FIGURE 1

Site Location Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 17-574	December 4, 2017
	Sonneland Property SW of East 29th Ave. and South Southeast Boulevard Spokane, WA	

FIGURE 2

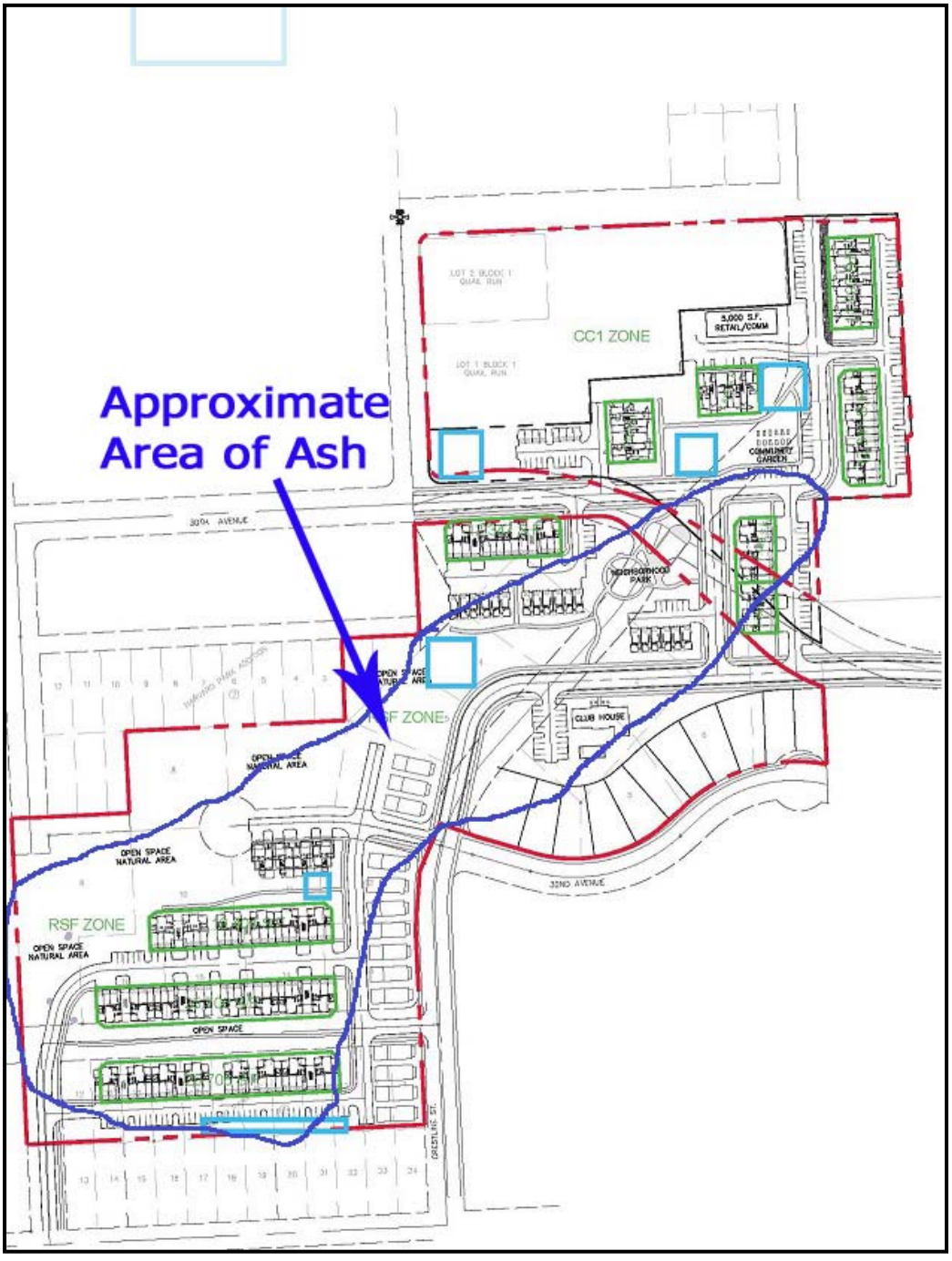
NRCS Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 17-574	December 4, 2017
	Sonneland Property SW of East 29th Ave. and South Southeast Boulevard Spokane, WA	

FIGURE 3



Test Pit Location Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 17-574 Sonneland Property SW of East 29th Ave. and South Southeast Boulevard Spokane, WA	December 4, 2017

FIGURE 4



Approximate Limits of Ash Deposits		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 17-574 Sonneland Property SW of E. 29th Ave. and S. SE Boulevard Spokane, WA	December 4, 2017

APPENDIX B

LOGS OF TEST PITS, DECRIPTIVE TERMINOLOGY

IPEC
Inland Pacific Engineering Company
3012 North Sullivan Road, Suite C
Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-1

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2342.2 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		SM		(SM) Silty Sand, fine to coarse grained, with roots, dark brown, moist. (Possible Fill)	
					2340.2
2.5		GM		(GM) SILTY GRAVEL with SAND, fine to coarse grained, a trace of Cobbles, brown, moist. (Glacial Outwash)	
					2338.2
5.0		GM		(GM) SILTY GRAVEL, fine to coarse grained, dark gray, moist. (Weathered Basalt)	
					2336.2

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

IPEC
Inland Pacific Engineering Company
3012 North Sullivan Road, Suite C
Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-2

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2332.2 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		SM		(SM) SILTY SAND, fine to coarse grained, with roots, dark brown, moist. (Topsoil)	
					2330.2
2.5		SM		(SM) SILTY SAND, fine grained, light brown, moist. (Loess)	
					2329.2
		GM		(GM) SILTY GRAVEL, fine to coarse grained, dark gray, moist. (Weathered Basalt)	
					2328.2

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

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Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-2A

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2329.9 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION 8.00 ft / Elev 2321.90 ft
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION 8.00 ft / Elev 2321.90 ft
NOTES
AFTER EXCAVATION 8.00 ft / Elev 2321.90 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0			OL		(OL) ORGANIC SILT, with roots, black, moist to wet. (Topsoil)	
						2328.4
2.5			ML		(ML) SILT, gray, moist. (Ash)	
						2325.9
5.0		Fines = 4%	SP		(SP) POORLY GRADED SAND, fine to medium grained, olive-brown, iron-stained, moist to 8' then water-bearing. (Alluvium)	
7.5						
10.0						
						2319.4

End of test pit.

Groundwater encountered at 8'.

Test pit immediately backfilled.

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Fax: 509-290-5734

TEST PIT NUMBER TP-3

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2330.2 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		GM		(GM) SILTY GRAVEL with SAND, fine to coarse grained, with roots, dark brown, moist. (Topsoil)	
					2328.7
1.5		ML		(ML) SANDY SILT, gray, moist. (Loess)	
2.5					
					2326.2
4.0		SM		(SM) SILTY SAND, fine to medium grained, brown, moist. (Alluvium)	
5.0					
6.5					2323.7

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

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Fax: 509-290-5734

TEST PIT NUMBER TP-4

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2336.7 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		SM		(SM) FILL: Silty Sand with Gravel, fine to medium grained, with Cobbles and Boulders, organic.	
2.0					2334.7
2.5		GM		(GM) FILL: Silty Gravel with Sand, fine to coarse grained, mixed with concrete, brick, plastic, wood, etc., dark brown to brown, moist.	
5.0					2331.7

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

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Inland Pacific Engineering Company
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Spokane Valley, WA 99216
Telephone: 509-209-6262
Fax: 509-290-5734

TEST PIT NUMBER TP-5

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2330.7 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		ML		(ML) SILT, with roots, black, moist to wet. (Topsoil)	
					2329.7
		ML		(ML) SILT, gray, moist. (Ash)	
2.5					
					2327.2
		SM		(SM) SILTY SAND, fine grained, olive-brown, moist. (Alluvium)	
5.0					
					2324.7
		GM		(GM) SILTY GRAVEL, fine to coarse grained, dark gray, moist. (Weathered Basalt)	
					2324.2

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

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3012 North Sullivan Road, Suite C
Spokane Valley, WA 99216
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TEST PIT NUMBER TP-6

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2331.6 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		ML		(ML) SILT, with roots, dark brown, moist. (Topsoil)	
1.5					2330.1
2.5		ML		(ML) SILT, light tan to buff, moist. (Loess)	
4.0					2327.6

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

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TEST PIT NUMBER TP-7

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2329 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION --- Not encountered
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION --- Not encountered
NOTES Offset 50' east of staked location.
AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0			ML		(ML) SILT, with roots, dark brown, moist. (Topsoil)	
					1.5	2327.5
2.5			ML		(ML) SILT, gray, moist. (Ash)	
					3.0	2326.0
5.0		Fines = 10%	SP-SM		(SP-SM) POORLY GRADED SAND with SILT, fine grained, olive-gray, moist to wet. (Alluvium)	
7.5						
10.0						
					10.5	2318.5

Refusal.

Groundwater not encountered.

Test pit immediately backfilled.

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Spokane Valley, WA 99216
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TEST PIT NUMBER TP-8

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2328.9 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION 8.50 ft / Elev 2320.40 ft
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION 8.50 ft / Elev 2320.40 ft
NOTES
AFTER EXCAVATION 8.50 ft / Elev 2320.40 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0			ML		(ML) SILT, with roots, dark brown, moist. (Topsoil)	
						1.5 / 2327.4
2.5			ML		(ML) SILT, gray, moist. (Ash)	
						4.5 / 2324.4
5.0		Fines = 6%	SP-SM		(SP-SM) POORLY GRADED SAND with SILT, fine grained, olive-brown, moist to 8.5' then water-bearing. (Alluvium)	
7.5						9.0 / 2319.9

End of test pit.

Groundwater encountered at 8 1/2'.

Test pit immediately backfilled.

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TEST PIT NUMBER TP-9

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2332.7 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION 9.50 ft / Elev 2323.20 ft
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION 9.50 ft / Elev 2323.20 ft
NOTES
AFTER EXCAVATION 9.50 ft / Elev 2323.20 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		ML		(ML) SILT, with roots, dark brown, moist. (Topsoil)	
					1.0 / 2331.7
		ML		(ML) SILT, gray, moist. (Ash)	
					2.0 / 2330.7
2.5		SM		(SM) SILTY SAND, fine to medium grained, brown, moist. (Alluvium)	
5.0					
					6.5 / 2326.2
7.5		SP-SM		(SP-SM) POORLY GRADED SAND with SILT, fine to medium grained, brown, moist to 9.5' then water-bearing. (Alluvium)	
10.0					10.0 / 2322.7

Refusal.

Groundwater encountered at 9 1/2'.

Test pit immediately backfilled.

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TEST PIT NUMBER TP-10

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2332.3 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION 9.50 ft / Elev 2322.80 ft
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION 9.50 ft / Elev 2322.80 ft
NOTES
AFTER EXCAVATION 9.50 ft / Elev 2322.80 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		ML		(ML) SILT, with roots, dark brown to black, moist to wet. (Topsoil)	
					2330.3
2.5		ML		(ML) SILT, gray, moist. (Ash)	
					2327.8
5.0		SM		(SM) SILTY SAND, fine to medium grained, olive-gray to reddish-brown, moist to 9.5' then water-bearing. (Alluvium)	
7.5					
10.0					2322.3

End of test pit.

Groundwater encountered at 9 1/2'.

Test pit immediately backfilled.

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TEST PIT NUMBER TP-11

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2335.5 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION 9.00 ft / Elev 2326.50 ft
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION 9.00 ft / Elev 2326.50 ft
NOTES
AFTER EXCAVATION 9.00 ft / Elev 2326.50 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0		ML		(ML) SILT, with roots, dark brown, moist. (Topsoil)	
					2334.5
		ML		(ML) SILT, gray, moist. (Ash)	
2.5					
					2332.5
		SP-SM		(SP-SM) POORLY GRADED SAND with SILT, fine to medium grained, olive-gray, moist to 9' then water-bearing. (Alluvium)	
5.0					
7.5					
					2326.0

Refusal.

Groundwater encountered at 9'.

Test pit immediately backfilled.

IPEC
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TEST PIT NUMBER TP-12

CLIENT Greenstone Corporation
PROJECT NAME Sonneland Properties
PROJECT NUMBER 17-574
PROJECT LOCATION Spokane, WA
DATE STARTED 11/14/17 **COMPLETED** 11/14/17
GROUND ELEVATION 2334.9 ft **TEST PIT SIZE** 36 inches
EXCAVATION CONTRACTOR Continental Contractors
GROUND WATER LEVELS:
EXCAVATION METHOD Trackhoe
AT TIME OF EXCAVATION 10.00 ft / Elev 2324.90 ft
LOGGED BY PTN **CHECKED BY** PTN
AT END OF EXCAVATION 10.00 ft / Elev 2324.90 ft
NOTES
AFTER EXCAVATION 10.00 ft / Elev 2324.90 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0			ML		(ML) SILT, with roots, dark brown, moist. (Topsoil)	
						1.0 / 2333.9
			ML		(ML) SILT, gray, moist. (Ash)	
2.5						2.5 / 2332.4
			SP-SM		(SP-SM) POORLY GRADED SAND with SILT, fine to medium grained, olive-gray, moist to 10' then water-bearing. (Alluvium)	
5.0		Fines = 9%				
7.5						
10.0					▼	
						11.0 / 2323.9

Refusal.

Groundwater encountered at 10'.

Test pit immediately backfilled.

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RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALVE			
COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
DENSITY	N(BLOWS/FT)	CONSISTENCY	N(BLOWS/FT)
Very Loose	0 - 4	Very Soft	0 - 1
Loose	5 - 10	Soft	2 - 3
Medium-Dense	11 - 30	Rather Soft	4 - 5
		Medium	6 - 8
Dense	31 - 50	Rather Stiff	9 - 12
		Stiff	13 - 16
Very Dense	> 50	Very Stiff	17 - 30
		Hard	> 30

USCS SOIL CLASSIFICATION					
MAJOR DIVISIONS			GROUP DESCRIPTIONS		
Coarse-Grained Soils	Gravel and Gravelly Soils <50% coarse fraction passes #4 sieve	Gravel (with little or no fines)	GW	Well Graded Gravel	
			GP	Poorly Graded Gravel	
		Gravel (with >12% fines)	GM	Silty Gravel	
			GC	Clayey Gravel	
<50% passes #200 sieve	Sandy and Sandy Soils >50% coarse fraction passes #4 sieve	Sand (with little or no fines)	SW	Well Graded Sand	
			SP	Poorly Graded Sand	
		Sand (with >12% fines)	SM	Silty Sand	
			SC	Clayey Sand	
Fine-Grained Soils	Silt and Clay Liquid Limit < 50		ML	Silt	
			CL	Lean Clay	
			OL	Organic Silt and Clay (low plasticity)	
>50% passes #200 sieve	Salt and Clay Liquid Limit > 50		MH	Inorganic Silt	
			CH	Fat Clay	
			OH	Organic Clay and Silt (med to high plasticity)	
Highly Organic Soils			PT	Peat	Muck

MODIFIERS	
DESCRIPTION	RANGE
Occasional	<5%
Trace	5% - 12%
With	>12%

MOISTURE CONTENT	
DESCRIPTION	FIELD OBSERVATION
Dry	Absence of moisture, dusty, dry to the touch
Moist	Dry of optimum moisture content
Wet	Wet of optimum moisture content

MAJOR DIVISIONS WITH GRAIN SIZE							
SIEVE SIZE							
12"	3"	3/4"	4	10	40	200	
GRAIN SIZE (INCHES)							
12	3	0.75	0.19	0.079	0.0171	0.0029	
Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

APPENDIX C

LABORATORY TEST RESULTS

GRAIN SIZE DISTRIBUTION

IPEC
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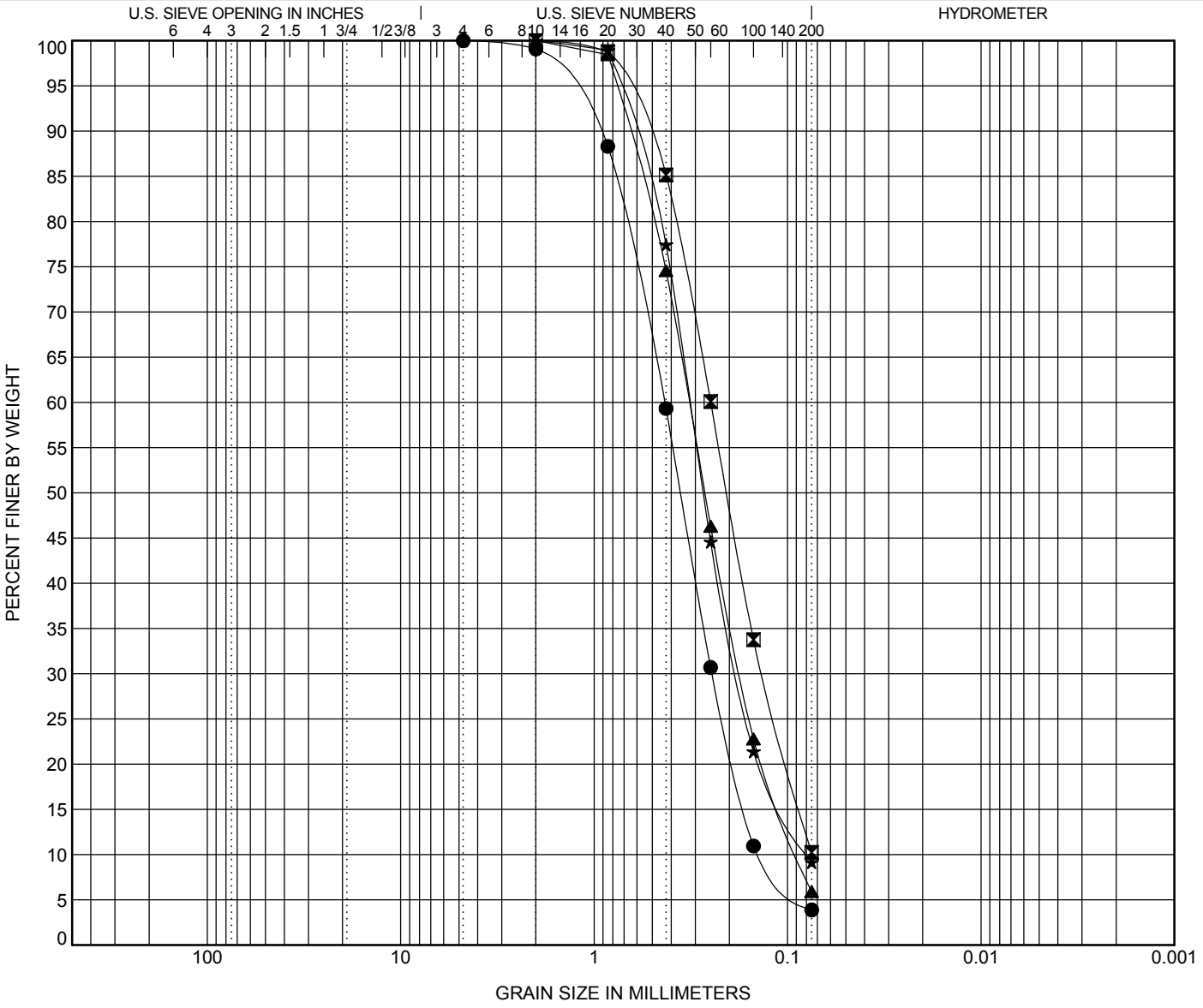
Fax: 509-290-5734

CLIENT Greenstone Corporation **PROJECT NAME** Sonneland Properties

PROJECT NUMBER 17-574 **PROJECT LOCATION** Spokane, WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	TP-2A	5.0	SP Poorly Graded Sand				1.02	3.16
⊠	TP-7	5.0	SP-SM Poorly Graded Sand with Silt				0.97	3.35
▲	TP-8	5.0	SP-SM Poorly Graded Sand with Silt				1.07	3.64
★	TP-12	5.0	SP-SM Poorly Graded Sand with Silt				1.30	4.08

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-2A	5.0	4.75	0.432	0.246	0.137	0.0	96.1	3.9	
⊠	TP-7	5.0	2	0.25	0.134		0.0	89.8	10.2	
▲	TP-8	5.0	2	0.323	0.175	0.089	0.0	94.1	5.9	
★	TP-12	5.0	4.75	0.321	0.181	0.079	0.0	90.8	9.2	

APPENDIX D

FIELD PERMEABILITY TEST RESULTS

IPEC
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Test Pit Infiltration Test Results

Project Name: Sonneland Propoerty Test Date: 11/15/2017

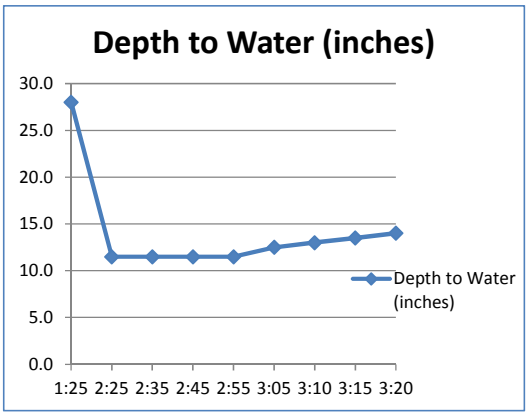
Project Number: 17-574 Test Location: P-1 (TP-2A)

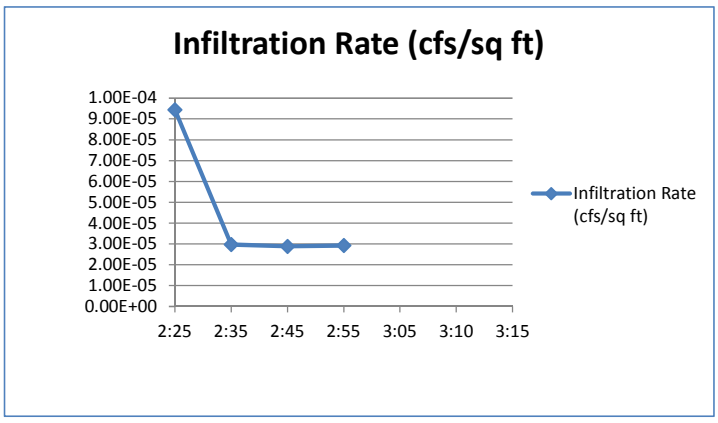
Client: Greenstone Corporation Depth: 4'-6'

Average Test Pit Dimensions: Length (ft): 5.00 Width (ft): 3.00 Depth (ft): 2

Time	Elapsed Time (seconds)	Depth to Water (inches)	Flow Meter Reading (ft^3)	Volume of Water (ft^3)	Flow Rate (cfs)	Infiltration Rate (cfs/ft^2)
1:25	0	28.0	1327.37			
2:25	3600	11.5	1339.95	12.58	3.49E-03	9.44E-05
2:35	600	11.5	1340.61	0.66	1.10E-03	2.97E-05
2:45	600	11.5	1341.25	0.64	1.07E-03	2.88E-05
2:55	600	11.5	1341.90	0.65	1.08E-03	2.93E-05
3:05	600	12.5				
3:10	300	13.0				
3:15	300	13.5				
3:20	300	14.0				
3:25	300	14.5				

Average Infiltration Rate: 2.93E-05





P.O. Box 1566, Veradale, WA 99037
Phone 509-209-6262

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Test Pit Infiltration Test Results

Project Name: Sonneland Propoerty Test Date: 11/15/2017

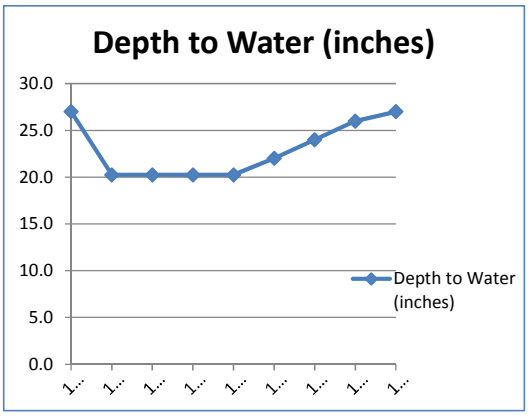
Project Number: 17-574 Test Location: P-2 (TP-7)

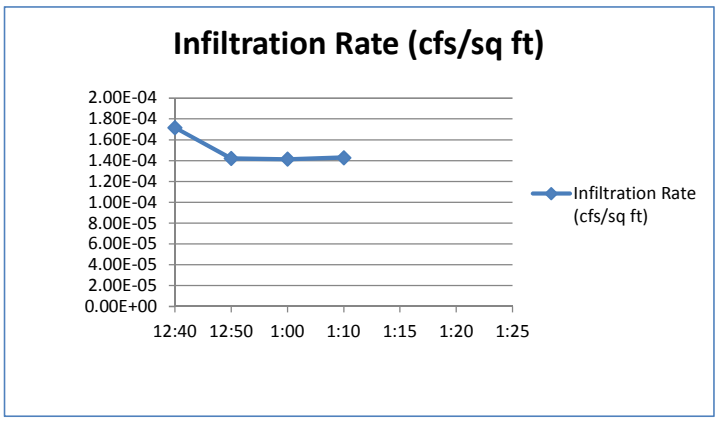
Client: Greenstone Corporation Depth: 4'-6'

Average Test Pit Dimensions: Length (ft): 4.50 Width (ft): 3.00 Depth (ft): 2

Time	Elapsed Time (seconds)	Depth to Water (inches)	Flow Meter Reading (ft^3)	Volume of Water (ft^3)	Flow Rate (cfs)	Infiltration Rate (cfs/ft^2)
11:40	0	27.0	1308.16			
12:40	3600	20.3	1321.72	13.56	3.77E-03	1.72E-04
12:50	600	20.3	1323.59	1.87	3.12E-03	1.42E-04
1:00	600	20.3	1325.45	1.86	3.10E-03	1.41E-04
1:10	600	20.3	1327.33	1.88	3.13E-03	1.43E-04
1:15	300	22.0				
1:20	300	24.0				
1:25	300	26.0				
1:30	300	27.0				

Average Infiltration Rate: 1.42E-04





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Test Pit Infiltration Test Results

Project Name: Sonneland Propoerty Test Date: 11/15/2017

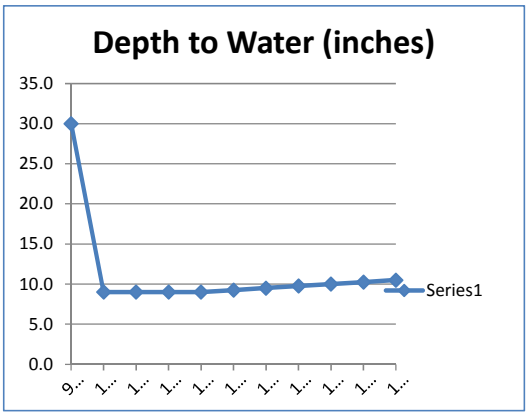
Project Number: 17-574 Test Location: P-3 (TP-12)

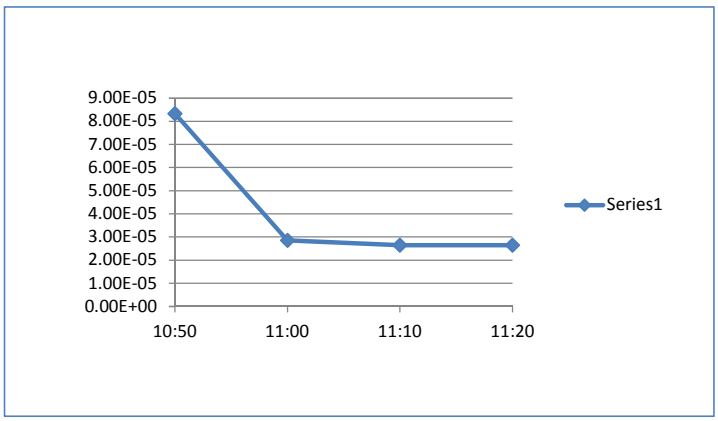
Client: Greenstone Corporation Depth: 2.5'-4.5'

Average Test Pit Dimensions: Length (ft): 5.50 Width (ft): 3.25 Depth (ft): 2

Time	Elapsed Time (seconds)	Depth to Water (inches)	Flow Meter Reading (ft^3)	Volume of Water (ft^3)	Flow Rate (cfs)	Infiltration Rate (cfs/ft^2)
9:50	0	30.0	1291.20			
10:50	3600	9.0	1305.75	14.55	4.04E-03	8.33E-05
11:00	600	9.0	1306.58	0.83	1.38E-03	2.85E-05
11:10	600	9.0	1307.35	0.77	1.28E-03	2.65E-05
11:20	600	9.0	1308.12	0.77	1.28E-03	2.65E-05
11:25	300	9.3				
11:30	300	9.5				
11:35	300	9.8				
11:40	300	10.0				
11:45	300	10.3				
11:50	300	10.5				

Average Infiltration Rate: 2.71E-05





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