



## MEMORANDUM

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**Date:** February 3, 2021

**To:** City of Seattle  
Department of Construction and Inspections

**From:** Anna Nguyen, P.E.

**Subject:** Subsurface Report & Infiltration Checklist  
Project Address: 11730 Pinehurst Wy NE



### ***Geologic Setting***

The Geologic Map of Seattle - A Progress Report, by Kathy Goetz Troost, Derek B. Booth, Aaron P. Wisher and Scott A. Shimel, published in October 2006, was referenced for the geologic and soil conditions of the project site. According to this publication, the surficial soil unit at the project site and its immediate vicinity is mapped as outwash (Qva).

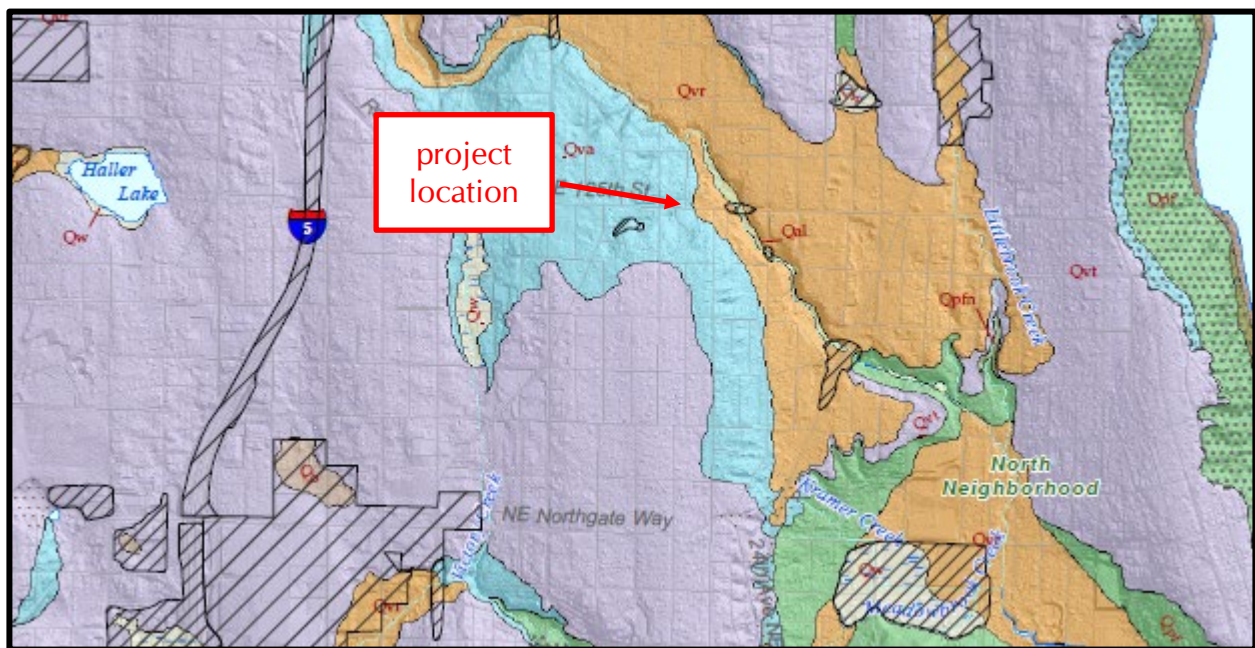


Figure 1 – The Geologic Map of Seattle (Not-to-Scale)

### ***Small Scale Pilot Infiltration Test***

On January 24, 2021, we performed a field infiltration test. The test pit location is shown in Figure 2. The infiltration test was conducted in general accordance with the procedure for the City of Seattle's Small-Scale Pilot Infiltration test methodology, outlined in Appendix D, Section 3.3 of the 2016 City of Seattle Stormwater Manual.

One Small Pilot Infiltration Test (PIT) was performed to determine a field infiltration rate for the onsite soils. Infiltration test yielded a measured rate of 2.0 inches per hour. Refer to the attached Pilot Infiltration Checklist for specific test methodology and field data.

### ***Subsurface Soil Data***

A representative soil sample was collected near the grade of the proposed BMP bottom layer which was analyzed by Northwest Agricultural Consultants, Inc. on January 27, 2021. The soil characteristics are summarized in the attached lab results and Figure 3.

### ***Groundwater/ Hydraulic Restrictive Layer***

This test was conducted during the wet-season. The test pit was excavated to a total depth of 7 FT. The subsurface exploration encountered groundwater at 6 ft 2 in.



Figure 2 - Soils Test Pit Location (Not-to-Scale)

Depth (FT)	Sample	USCS	Graphic	Description
0.0	1			top soil
0.5				
1.0	2	SP		compacted brown soil with some gravel
1.5				
2.0				
2.5				
3.0				
3.5	3	SM		compacted gray silty sand, water seepage at 6' 2"
4.0				
4.5				
5.0				
5.5				
6.0				
6.5				
7.0				

Figure 3 - Soils Log (Not-to-Scale)

**Limitations**

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test pits are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary.

Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples in test pits. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project.

This report has been prepared for the exclusive use of property owners and its representatives for specific application to this project and site. Our recommendations and conclusions are based on observed site materials and engineering analyses. Our conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the scope of our services and within budget and time constraints.

No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and 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 stormwater design.

## APPENDIX

Lab Results

Infiltration Checklist



**Northwest Agricultural  
Consultants**

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PAP-Accredited



The Concept Group  
4701 SW Admiral Way STE 353  
Seattle, WA 98116

**Report:** 53895-1-1  
**Date:** January 27, 2021  
**Project No:**  
**Project Name:** 11730 Pinehurst Way NE

Sample ID	Moisture	Organic Matter	Cation Exchange Capacity
1	15.68% by weight	3.04%	7.9 meq/100g
	Gravimetric	ASTM D2974	EPA 9081

Sample ID	Sand	Silt	Clay	Texture Class
1	72.0%	22.0%	6.0%	Sandy Loam



City of Seattle  
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# City of Seattle

## Pilot Infiltration Test (PIT) Checklist

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### Call before you dig – Utility Locates 811

Project Address: 11730 Pinehurst Way NE Date: 1/24/2021

Permit Number: \_\_\_\_\_

Other Project Information: \_\_\_\_\_

This Infiltration Test was performed by:

Company Name: The Concept Group Primary Contact Name: Anna Nguyen, P.E.

Phone Number: (206) 446 - 1291 Email Address: anna@ConceptBusinessGroup.com

☒ Include site map or drainage control plan, with test locations clearly marked.

The intent of this checklist is to provide a summary of stormwater BMP infiltration testing requirements associated with the Pilot Infiltration Test (PIT). All projects and associated plans are also subject to the minimum requirements outlined in the City of Seattle Stormwater Manual and SMC Chapters 22.800 – 22.808, as well as the specific subsurface investigation and infiltration testing requirements outlined in Volume 3, Chapter 3 and Appendix D of the 2016 City of Seattle Stormwater Manual. See also Appendix C for site constraints that preclude infiltration facility feasibility (such as site slope > 8%).

This checklist does not preclude the use of professional judgment to evaluate and manage risk associated with design, construction, and operation of infiltration BMPs. Justification for testing procedures that deviate from the minimum investigation requirements specified in Appendix D shall be documented in a stamped and signed letter from a State of Washington licensed professional (licensed professional engineer, engineering geologist, geologist, or hydrogeologist) who has experience in infiltration and groundwater testing and infiltration facility design.

Before you start call Utility Locates 811 to request locates of utilities at your site.

#### **SMALL PILOT INFILTRATION TEST (SMALL PIT) AND LARGE PILOT INFILTRATION TEST (LARGE PIT):**

Note: The test methods outlined below may be modified due to site conditions if recommended by the licensed professional and the reasoning is documented in the testing report.

1. Indicate type of test:

☒ Small PIT

☐ Large PIT

2. Date and time of tests: 1/24/2021 @ 8:00 am

3. Is the infiltration test within the footprint of the proposed infiltration facility? (Yes/ No)

4. If "no," is testing being conducted within 50 feet of the proposed infiltration facility? (Yes) No)

Explain why: \_\_\_\_\_



5. What is the total proposed impervious area (does not include permeable pavement surfaces) to be infiltrated on the site? TBD ft<sup>2</sup>  
(Note: acceptance testing is required if testing was performed greater than 50 feet from the proposed infiltration facility, and greater than 5,000 ft<sup>2</sup> infiltrated on the site [see City of Seattle Stormwater Manual, Volume 3, Section 3.2].)
6. ☒ Dig an infiltration test pit
7. Test pit excavated to bottom elevation of the proposed infiltration facility (Yes) No)  
(See City of Seattle Stormwater Manual, Appendix D for additional details.)
8. Test pit surface dimensions (ft): Length: 3' 8" Width: 4' 2" Depth: 4' 0"
9. Test pit bottom dimensions (ft): Length: 3' 0" Width: 4' 0"
10. Test pit bottom area (ft<sup>2</sup>): 12.0
11. Small PIT only: Is the surface area of the test pit bottom at least 12 ft<sup>2</sup>? (Yes) No)
12. Large PIT only: Is the surface area of the test pit bottom at least at least 32 ft<sup>2</sup>? (Yes / No)  
a. If "no," indicate why: \_\_\_\_\_
13. Large PIT only: The test pit bottom area should be as close to the bottom area of the proposed infiltration facility as is feasible.  
a. Bottom area of proposed infiltration facility: \_\_\_\_\_ ft<sup>2</sup>  
b. Bottom area of test pit: \_\_\_\_\_ ft<sup>2</sup>
14. Identify device used to measure water level in test pit:  
☐ Pressure transducer (recommended for areas with slow draining soils), or  
☒ Vertical rod (min 5 ft long, 1/2-inch increments, placed in center of pit)
15. Identify method of delivering water to the bottom of the test pit (e.g., rigid pipe with a splash plate):  
rigid pipe with splash plate  
(The method of delivery must reduce erosion in the test pit that could cause clogging of the infiltration receptor)

16. **Testing Procedure:**

- a. **Pre-soak period:** Add water to maintain water level at least 12 inches above the bottom of the test pit for at least 6 hours. Record the time and depth of water hourly in the table below.

Time of Measurement (hh:mm)	Depth of Water (inches)
8:00 am	12
9:00 am	12
10:00 am	12
11:00 am	12
noon	12
1:00 pm	12
2:00 pm	12

- b. **Steady-state period:** The steady-state data is used to establish the measured infiltration rate (see step 17)
- Add water to the test pit at a rate that will maintain a depth of 12 inches above the bottom of the test pit for 1 full hour. During this hour, record the time, depth of water, cumulative volume, and instantaneous flow rate every 15-minutes in the table below.
  - Calculate the infiltration rate for each 15-minute interval. First convert the flow rate to in<sup>3</sup>/hr and the test pit bottom area (recorded in step 10) into in<sup>2</sup>. Divide the flow rate by the bottom area and record the result in the table below.

Time of Measurement (hh:mm)	Depth of Water (inches)	Cumulative Volume (gallons)	Flow Rate (gpm)	Infiltration Rate (in/hr)
2:00 pm	12	---	---	---
2:15 pm	12	4.6	0.31	2.5
2:30 pm	12	9.4	0.31	2.5
2:45 pm	12	13.2	0.29	2.4
3:00 pm	12	17.0	0.28	2.3

<sup>1</sup> gallon = 231 in<sup>3</sup>, 1 ft<sup>2</sup> = 144 in<sup>2</sup>

- c. **Falling head period:** The falling head data is used to confirm the measured infiltration rate calculated from the steady- state data.
- At the end of the steady-state period, turn off the water and immediately record the time and depth of water in the table below. Record the time and depth of water every 15-minutes for a minimum of 1 hour, or until the pit is empty. (Note: in areas with slow draining soils, a pressure transducer is recommended to improve the accuracy of change in depth readings. In addition, users are encouraged to extend the testing period and use longer intervals to improve accuracy.)
  - Calculate the infiltration rate for each 15-minute interval (change in depth at each interval x 4) and record the results in the table below. Alternatively, users may also record the total time for fixed intervals of changes in depth, and use those values to compute the infiltration rates.

Time of Measurement (15-minute minimum intervals)	Depth of Water (inches)	Infiltration Rate (in/hr)
3:00 pm	12	---
3:15 pm	11.50	2.0
3:30 pm	11.00	2.0
3:45 pm	10.50	2.0
4:00 pm	10.00	2.0

- d. **Check for high groundwater / immediate groundwater mounding:**
- ☒ Within 24 hours after the falling head period, excavate the bottom of the pit  
(Minimum excavation depths are provided in the City of Seattle Stormwater Manual, Appendix D, Section D-3.3 Step 9, and Section D-2.)
  - Is standing water or seepage visible in the excavation hole? (Yes) No
  - If "yes," record depth: 6' 2"
- Note: Additional Groundwater Monitoring requirements may apply. See Table 3.1 and Table 3.2 in Volume 3, Section 3.2 of the City of Seattle Stormwater Manual.

## 17. Data Analysis/"Measured Infiltration Rate" Selection (use the falling head data to confirm the measured



*infiltration rate calculated from the steady-state data):*

- a. Steady-state measured infiltration rate: Provide the lowest infiltration rate from steady-state table above: 2.3 in/hr
- b. Selected "Measured Infiltration Rate" 2.0 in/hr  
(Include an explanation if the selected rate deviates from the steady-state rate in step 16a.)
- c. If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP, that BMP cannot be used.
- d. If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs (see Table 1 in the Reference Tables at the end of this document), no further investigation is required.

**18. Calculate "Design Infiltration Rate":** The design infiltration rate shall be calculated by applying the appropriate correction factor to the above measured infiltration rate (see the *City of Seattle Stormwater Manual, Appendix D, Section D-4*).

- a. Select a correction factor.
- b. Calculate the Design Infiltration Rate below.

<input checked="" type="checkbox"/> Design infiltration rate = <u>2.0</u> x <u>0.50</u> = <u>1.0</u> in/hr
Measured infiltration rate (in/hr) Correction Factor*

\*A Correction Factor of 0.5 must be used for all projects unless a lower value is warranted by site conditions, as recommended and documented by a licensed professional, and shall not be less than 0.2. See Appendix D, Section D-4.2.

**19. Supporting Documents and Additional Analysis Required:**

- a. Include a report for the Small and Large PIT that includes documentation of the testing procedure (including this checklist and any supporting documentation), analysis, and results to assess infiltration feasibility, and an explanation of the correction factor used to determine the design infiltration rate. In addition, include the following information.
- b. One or more of the following analysis/reports will be required. See Table 3.1 and Table 3.2 in Volume 3, Section 3.2 of the *City of Seattle Stormwater Manual*. Indicate which analysis/reports are required below and include them in the report.
  - ☒ **Standard Subsurface Investigation Report** (Appendix D, Section D-2.4)
  - ☐ **Comprehensive Subsurface Investigation Report** (Appendix D, Section D-2.5)
  - ☐ **Groundwater Monitoring Report** (Appendix D, Section D-5)
  - ☐ **Characterization of Infiltration Receptor** (Appendix D, Section D-6)
  - ☐ **Groundwater Mounding and Seepage Analysis** (Appendix D, Section D-7)

## SIGNATURES ARE REQUIRED

The Small and Large PIT report shall be prepared by a licensed professional.

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP infiltration rate.

**Infiltration Test performed by:**

Print Name Anna Nguyen, P.E.

Signature  Date 1/24/2021

Professional Stamp:



## REFERENCE TABLES

**Table 1. Minimum Measured Infiltration Rates** (Taken from the 2016 City of Seattle Stormwater Manual, Vol. 3, Section 3.2 – Table 3.3)

<b>Infiltration BMP</b>	<b>Minimum Measured Infiltration Rate for On-site List Approach (in/hr)</b>	<b>Minimum Allowed Measured Infiltration Rate for Meeting Flow Control, Water Quality Treatment, and On-site Performance Standards (in/hr)</b>
Infiltration Trenches	5	5
Drywells	5	5
Infiltrating Bioretention without underdrain	0.6	0.6
Infiltrating Bioretention with underdrain	0.3	No minimum
Rain Gardens	0.3	Not applicable (only for On-site List Approach)
Permeable Pavement Facility	0.3	0.3b
Permeable Pavement Surface	0.3a	No minimum
Perforated Stub-out Connections	0.3	Not applicable (only for On-site List Approach)
Infiltration Basins	Not applicable	0.6
Infiltration Chambers	Not applicable	0.6

<sup>a</sup> Infiltration testing not required, only necessary to prove infeasibility.

<sup>b</sup> No minimum infiltration rate if underdrain is installed.