



July 15, 2022
ES-5718.13

Earth Solutions NW LLC

Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

Pulte Group
3535 Factoria Blvd SE, Ste 600
Bellevue, WA 98006

Attention: Mr. Ryan Kohlmann

**Subject: Infiltration Evaluation and
Winter Groundwater Monitoring
Montesa Plat
2703 - 156th St NE
Marysville, Washington**

Reference: 2012 SWMMWW
(with 2014 Updates)

City of Marysville
Chapter 4
Engineering Standards

Dear Mr. Kohlmann:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter summarizing the results of infiltration testing and winter groundwater monitoring. Project plans include development of a residential community and related infrastructure improvements. At this time, site grading and related structural fill placement throughout the site is ongoing. Consistent with subsurface investigations completed on nearby and adjacent residential projects, the subject property is underlain by the Marysville Sand Member. In general, stormwater infiltration into the Marysville sand can be successfully achieved through implementation of stormwater galleries or ponds that penetrate through the site fills and interface with the native sands. With respect to the Montesa project, civil designs will incorporate the use of a stormwater infiltration pond positioned near the southwest corner of property. To support the pond design, ESNW staff completed in-situ infiltration testing and winter groundwater monitoring within the future footprint area of the pond.

Groundwater Monitoring

ESNW completed a seasonal groundwater monitoring program utilizing two monitoring wells that were installed in November 2021 at test pit locations TP-102 and TP-103. The attached Plate 1 depicts the approximate locations of the test pits and corresponding monitoring wells.

An ESNW representative recorded groundwater levels at the monitoring well locations between the time of installation (November 2021) and through the end of April 2022. Based on the collected monitoring data, a seasonal high (or near seasonal) high level occurred several times during the monitoring period. In any case, there is good agreement from the data establishing a “reliable” seasonal high level suitable for design. The following table provides pertinent data for each of the two monitoring wells.

Monitoring Well Location	Ground Surface Elevation (ft.)	Measured Depth (At Peak) Below Ground Surface Elevation (ft)	Measured Seasonal High Elevation (ft.)	Seasonal High Level Recommended For Design (ft.)
TP-102	109.81	4.50	105.31	105.50
TP-103	109.53	4.25	105.28	105.50

As indicated above, the seasonal high groundwater level recommended for design is elevation 105.50 feet. In our experience, and based on the seasonal high level derived from our winter monitoring program, the recommended seasonal high groundwater level specified above is generally in good agreement with our findings on adjacent and nearby sites.

Design Infiltration Rate

A constant and falling head small-scale pit test (PIT) was completed at test pit TP-102 at the time of our November 2021 investigation. The PIT was completed at a depth of roughly 2.5 feet below the existing ground surface elevation. The photo below depicts the general soil characteristic exposed at the test site (also see attached sieve data).



Marysville Sand Exposed At Test Location (Future Pond Area)

It should be noted that given our experience with infiltration design on adjacent and nearby sites, the small-scale PIT used for determining the initial saturated hydraulic conductivity of the soil for design was considered to be appropriate for the project. The general uniformity of the Marysville Sand identified across the site was the primary basis for this decision. Results of the small-scale infiltration testing yielded a field measured rate of roughly 10 inches per hour. The measured field rate and identified soil characteristics (Marysville Sand) are generally consistent with our findings on adjacent and nearby projects. On this basis, generally good certainty with respect to soil infiltration capacity at the site was confirmed as a result of the testing and related investigation. Design infiltration rates on the order of 1 to 2 inches per hour are generally considered typical (and acceptable) for the Marysville Sand. As such, and based on our findings and experience in the area, the following design infiltration rate is recommended:

- **Design Infiltration Rate (Marysville Sand) 1.5 in./hr.**

At the time of construction and related excavation activities for the proposed infiltration pond facility, the engineer (or his representative) should observe the pond excavation to confirm that Marysville Sand soils suitable for the design infiltration rate will be exposed throughout the entirety of the completed pond bottom. As necessary, supplement recommendations may be provided by the engineer to ensure the design rate is satisfied.

We trust this letter meets your current needs. Should you have questions regarding the content herein, or require additional information, please call.

Sincerely,

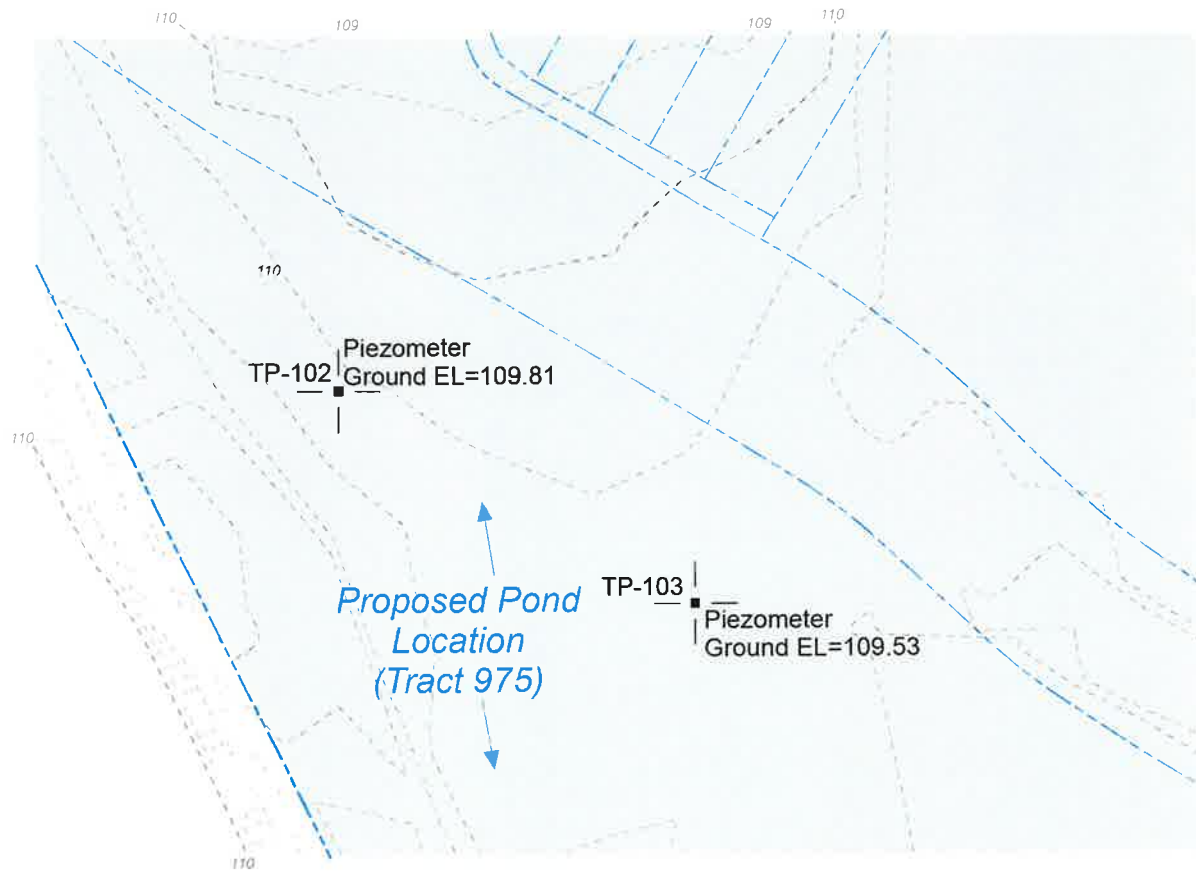
EARTH SOLUTIONS NW, LLC





Raymond A. Cogias, P.E.
Principal Engineer

Attachments: Plate 1 – Piezometer Location Plan
Test Pit Logs
Laboratory Data

Cc: LDC, Inc.
Attn. Mr. Jesse Jarrell (email only)



LEGEND

- 
 TP-102 | Approximate Location of ESNW Test Pit, Proj. No. ES-5718.13, Nov. 2021
- 
 Subject Site



NOT - TO - SCALE

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

	Earth Solutions NW LLC <small>Geotechnical Engineering, Construction Observation/Testing and Environmental Services</small>	
	Piezometer Location Plan Montesa Marysville, Washington	
Drwn. MRS	Date 07/14/2022	Proj. No. 5718.13
Checked RAC	Date July 2022	Plate 1






Earth Solutions NW, LLC
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TEST PIT NUMBER TP-102

PAGE 1 OF 1

PROJECT NUMBER ES-5718.13 PROJECT NAME Montesa
 DATE STARTED 11/30/21 COMPLETED 11/30/21 GROUND ELEVATION 109.81 ft
 EXCAVATION CONTRACTOR NW Excavating LATITUDE 48.14034 LONGITUDE -122.19612
 LOGGED BY KTK CHECKED BY RAC GROUND WATER LEVEL:
 NOTES Surface Conditions: exposed soil ∇ AT TIME OF EXCAVATION 4.5 ft
 SURFACE CONDITIONS _____ AFTER EXCAVATION _____

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
		MC = 25.7% Fines = 13.0%	SM		0.5 Gray silty SAND with gravel, loose, wet (Fill)	109.3
			SM		Dark brown silty SAND, loose, moist -organic rich -becomes wet -moderate caving to BOH -infiltration test at 2.5' [USDA Classification: gravelly loamy coarse SAND]	105.8
5			SP		∇ Gray poorly graded SAND, loose, wet -groundwater table at 4.5'	102.8
		MC = 14.9%			7.0	

Test pit terminated at 7.0 feet below existing grade. Groundwater table encountered at 4.5 feet during excavation. Caving observed from 2.0 feet to BOH.



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TEST PIT NUMBER TP-103

PROJECT NUMBER ES-5718.13 PROJECT NAME Montesa
 DATE STARTED 11/30/21 COMPLETED 11/30/21 GROUND ELEVATION 109.53 ft
 EXCAVATION CONTRACTOR NW Excavating LATITUDE 48.13941 LONGITUDE -122.19602
 LOGGED BY KTK CHECKED BY RAC GROUND WATER LEVEL:
 NOTES Surface Conditions: exposed soil ∇ AT TIME OF EXCAVATION 4.25 ft
 SURFACE CONDITIONS _____ AFTER EXCAVATION _____

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
			SM		Gray silty SAND with gravel, medium dense, moist (Fill)	108.5
		MC = 27.5% Fines = 20.2%	SM		Dark brown silty SAND, loose, moist -fine organics -becomes gray, wet -severe caving to BOH -infiltration test at 3' [USDA Classification: slightly gravelly loamy coarse SAND] ∇ -increased gravel content, groundwater at 4.25'	104.5
5		MC = 24.8%				
			SP		Gray poorly graded SAND with gravel, loose, wet	102.0
		MC = 6.5%				

Test pit terminated at 7.5 feet below existing grade. Groundwater table encountered at 4.25 feet during excavation. Caving observed from 2.5 feet to BOH.

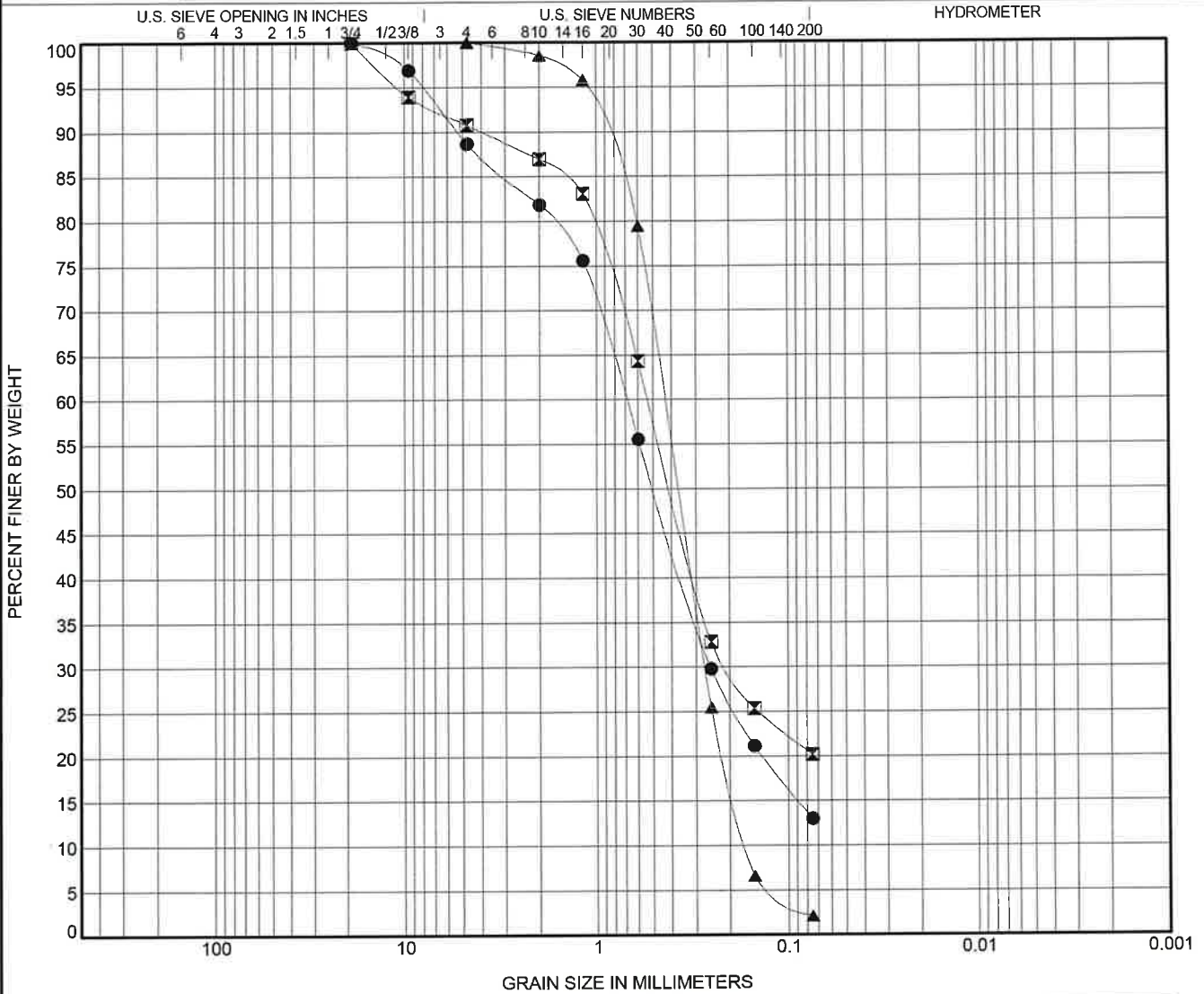


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GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-5718.13

PROJECT NAME Montesa



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification							Cc	Cu
● TP-102 2.50ft.	USDA: Brown Gravelly Loamy Coarse Sand. USCS: SM.								
☒ TP-103 3.00ft.	USDA: Gray Slightly Gravelly Loamy Coarse Sand. USCS: SM.								
▲ TP-104 2.50ft.	USDA: Brown Slightly Gravelly Sand. USCS: SP.							1.00	2.66
Specimen Identification	D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-102 2.5ft.	19	0.697	0.252					13.0	
☒ TP-103 3.0ft.	19	0.532	0.206					20.2	
▲ TP-104 2.5ft.	4.75	0.438	0.269	0.165				2.1	

GRAIN SIZE USDA ES-5718.13 MONTESA.GPJ GINT US LAB.GDT 12/10/21