East Town Crossing - 22S075 - Field Report: Geotechnical consulting: Report #F279450

CLIENT	Dan Lloyd	**DATE**	04/13/2022
PROJECT LOCATION	Intersection of Shaw Road East and East Pioneer Puyallup WA 98372	**PERMIT #**	

Inspection Information:

Inspection Date: 04/13/2022 **Time Onsite:** N/A **Weather Conditions:** N/A

Inspection Performed: Geotechnical consulting

Comments:

Infiltration Testing Report with Corrected Infiltration Rates - REVISED on 04/18/2022.

On April 1, 2022, MTC Staff Geologist visited the site to perform limited shallow infiltration testing in accordance with the Falling Head Percolation Test Procedure (US EPA 1980), as requested by the contractor, in order to demonstrate that the selected import soil, Des Moines Pit Run w/ Glass (33%), generally conforms with design infiltration rates of 2.0 in/hr.

At the time of testing, the Contractor had prepared and compacted four (4) testing pads, approximately 12 to 18 inches thick and 5' L x 5' W, prior to MTC's arrival. MTC conducted a total of three (3) falling head infiltration tests between two (2) locations on each pad. Testing locations were free of standing water at the time of our visit. Holes were prepared in accordance with EPA standards. The prescribed soaking period was determined to be unnecessary based on the sandy/gravelly nature of the soils. Testing locations were continuously observed to measure cumulative head fall. A field report containing the initial, uncorrected infiltration rates of all four (4) of the tested soils was completed previously (MTC Report #F278686).

The infiltration rates of the Selected Import Soil (Des Moines Pit Run w/ Glass) can be found below:

Des Moines Pit Run w/ Glass (33%) - Field test results of this soil yielded average uncorrected field infiltration rate of:

- 164.1 in/hr.

All field test results are to be further reduced by correction factors by the Geotechnical Engineer of Record as stipulated in the locally-accepted stormwater manual. Utilizing the average uncorrected value(s) and applying the correction factors of $CF_v = 0.33$, $CF_t = 0.40$, $CF_m = 0.90$ for the selected soil yields **corrected field infiltration rate** of:

- 19.50 in/hr

Which meets/exceeds the project design infiltration rate of 2.0 in/hr.

NOTES:

1) MTC assumes the project civil engineer will review to confirm these findings and evaluate final correction factors, if necessary. MTC also assumes these results to be preliminary, for permit approval only. Final infiltration testing should be conducted on the compacted soils after placement.

2) MTC's assessment did not include: evaluation of underlying soil consistency or variability, mounding analysis, verification of depth to a static water level, or depth to impermeable soil units. Falling Head tests are limited but typically considered suitable for confirmation of infiltration potential is reasonably consistent soil conditions with no confining soils or shallow water table. If greater confidence or accuracy is required, further testing may be necessary.

3) Refer to MTC Report No. F287686 for pictures of the testing.

REPORTED BY: Marcus Van Valen REVIEWED BY: Medhanie Tecle, Project Manager

Service Disabled Veteran Owned Small Business

Correction Factor For Infiltration Testing

Total Correction Factor Determination using 2019 Stormwater Management Manual for Western Washington Volume V - Chapter 5 - Page 736 - Table V-5.1.

Site Variability: CF_V = 0.33 (Uncertain Risk is Very Low)

Testing Method:
Falling Head: CF_t = 0.40

Degree of Influent Control: CF_M = 0.9

Total Correction Factor Equation: $CF_T = CF_V \times CF_t \times CF_M$

$$0.1188 = 0.33 \times 0.40 \times 0.90$$

Des Moines Soil Testing: **Des Moines Pit Run w/ Glass (33%)**

K_{sat} : 112.5 in/hr
174.2 in/hr
207.7 in/hr

*Average: 164.13 in/hr

Correction Factor Equation

K_{sat} design = K_{sat} x CF_T

Test #1: 13.37 in/hr = 112.5 x 0.1188
Test #2: 20.69 in/hr = 174.2 x 0.1188
Test #3: 24.44 in/hr = 205.7 x 0.1188

Average: 19.50 in/hr = 164.13 x 0.1188

Projected Infiltration Design Rate
Based on Table V.5.1

Table V-5.1: Correction Factors to be Used With In-Situ Saturated Hydraulic Conductivity Measurements to Estimate Design Rates

Issue	Partial Correction Factor
Site variability and number of locations tested	CF_V = 0.33 to 1.0
Test Method	
• Large-scale PIT • Small-scale PIT • Other small-scale (e.g. Double ring, falling head) • Grain Size Method	• CF_t = 0.75 • = 0.50 • = 0.40 • = 0.40
Degree of influent control to prevent siltation and bio-buildup	CF_m = 0.9

Total Correction Factor, $CF_T = CF_V \times CF_t \times CF_m$

- The design infiltration rate (K_{sat}design) is calculated by multiplying the initial K_{sat} by the total correction factor:

$$K_{sat}\ design = K_{sat}\ initial \times CF_T$$

2019 Stormwater Management Manual for Western Washington
Volume V - Chapter 5 - Page 736

Materials Testing & Consulting, Inc.
Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Des Moines Pit Run w/ Glass (33%)

Client:	Dan Lloyd	**Date:**	April 14, 2022
Address:	Intersection Of Shaw Road East	**Project:**	East Town Crossing
		Project #:	22S075
Attn:	Dan Lloyd	**Sample #:**	S22-0107
		Date Sampled:	April 12, 2014

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
X	Sieve	See Test Report		Sulfate Soundness	
X	Proctor	137.9 @ 7.5 % R.C.		Bulk Density & Voids	
	Sand Equivalent			WSDOT Degradation	
	Fracture Count			CEC	
	Moisture Content			Organic Content	
	Specific Gravity, Coarse				
	Specific Gravity, Fine				
	Hydrometer Analysis				
	Atterberg Limits				
	Asphalt Extraction/Gradation				
	Rice Density				

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,

Mark Peterson

Mark Peterson
Laboratory Manager
WAQTC # 60203

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Sieve Report

Project: East Town Crossing
Project #: 22S075
Client: Dan Lloyd
Source: On Site Stockpile
Sample#: S22-0107

DateSampled: April 12, 2022
Date Received: April 12, 2022
Sampled By: Client
Date Tested: April 13, 2022
Tested By: Madison Miller

ASTM D-2487 Unified Soils Classification System
SW-SM, Well-graded Sand with Silt and Gravel, Crushed
Sample Color:
Gray / Tan

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

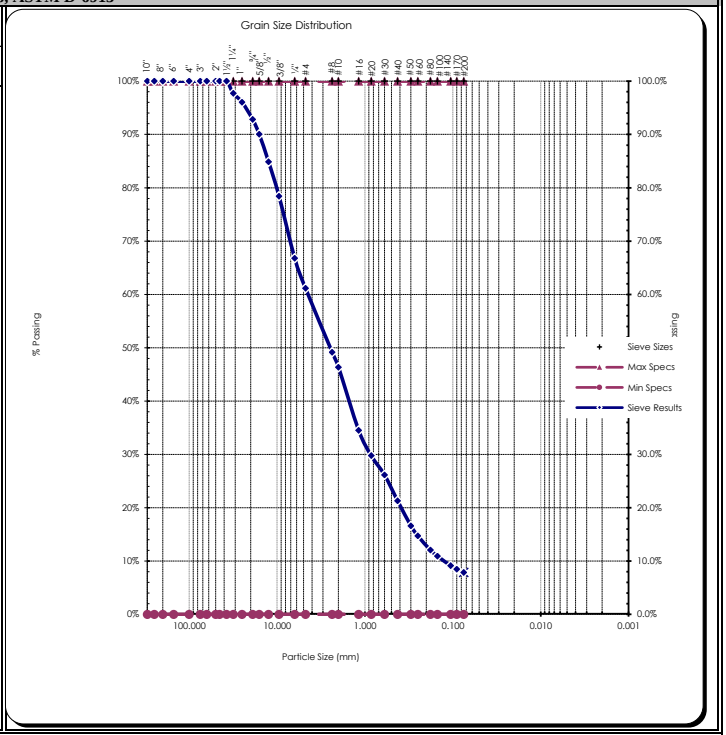
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ =	0.048	mm	% Gravel =	38.8%	Coeff. of Curvature, C_C = 1.30
See Report	0.127	mm	% Sand =	53.3%	Coeff. of Uniformity, C_U = 35.50
	0.258	mm	% Silt & Clay =	7.9%	Fineness Modulus = 4.30
	0.866	mm	Liquid Limit =	0.0%	Plastic Limit = 0.0%
	2.526	mm	Plasticity Index =	0.0%	Moisture %, as sampled = n/a
$D_{(60)}$ =	4.518	mm	Sand Equivalent =	n/a	Req'd Sand Equivalent =
$D_{(90)}$ =	15.949	mm	Fracture %, 1 Face =	0.0%	Req'd Fracture %, 1 Face = 75 Min. %
Dust Ratio =	7/19		Fracture %, 2+ Faces =	n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50	100%	100%	100.0%	0.0%
1.25"	31.50	98%	98%	100.0%	0.0%
1.00"	25.00	96%	96%	100.0%	0.0%
3/4"	19.00	93%	93%	100.0%	0.0%
5/8"	16.00	90%	90%	100.0%	0.0%
1/2"	12.50	85%	85%	100.0%	0.0%
3/8"	9.50	78%	78%	100.0%	0.0%
1/4"	6.30		67%	100.0%	0.0%
#4	4.75	61%	61%	100.0%	0.0%
#8	2.36	49%	49%	100.0%	0.0%
#10	2.00	46%	46%	100.0%	0.0%
#16	1.18		35%	100.0%	0.0%
#20	0.850		30%	100.0%	0.0%
#30	0.600	26%	26%	100.0%	0.0%
#40	0.425	21%	21%	100.0%	0.0%
#50	0.300		17%	100.0%	0.0%
#60	0.250		15%	100.0%	0.0%
#80	0.180		12%	100.0%	0.0%
#100	0.150	11%	11%	100.0%	0.0%
#140	0.106		9%	100.0%	0.0%
#170	0.090		8%	100.0%	0.0%
#200	0.075	7.9%	7.9%	100.0%	0.0%



Comments:

Reviewed by: Mark Peterson

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Proctor Report

Project: East Town Crossing
Project #: 22S075
Client: Dan Lloyd
Source: On Site Stockpile
Sample#: S22-0107

Date Received: April 12, 2022
Date Sampled: April 12, 2022
Sampled By: Client
Date Tested: April 13, 2022
Tested By: Mark Peterson

Unified Soils Classification System, ASTM D-2487
SW-SM, Well-graded Sand with Silt and Gravel, Crushed
Sample Color
Gray / Tan

Sample Prepared: Moist: X; Dry:
Test Standard: ASTM D698:; ASTM D 1557: X
Manual:; Mechanical: X
AASHTO T 99:; AASHTO T 180:
Method: C

Assumed Sp. Gr. 2.78

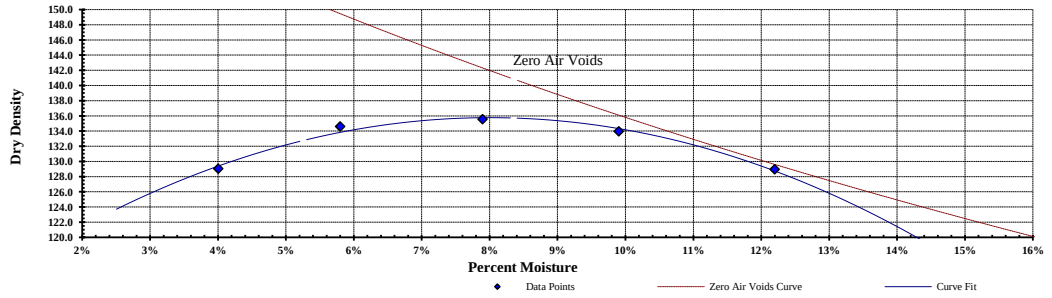
Point Number	Percent Moisture	Dry Density
1	4.0 %	129.0
2	5.8 %	134.6
3	7.9 %	135.5
4	9.9 %	133.9
5	12.2 %	129.0

Uncorrected Proctor Value
Max. Dry Density: **135.8 lbs/ft³** Optimum Moist.: **8.0 %**

Value w/ Oversize Correction Applied
Max. Dry Density: **137.9 lbs/ft³** Optimum Moist.: **7.5%**

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

Moisture Density Relationship



ASTM C-136

Sieve US	Size mm	Percent Passing	Specifications Max	Specifications Min
12.00"	300.0		100.0 %	0.0 %
10.00"	250.0		100.0 %	0.0 %
8.00"	200.0		100.0 %	0.0 %
6.00"	150.0		100.0 %	0.0 %
4.00"	100.0		100.0 %	0.0 %
3.00"	75.0		100.0 %	0.0 %
2.50"	63.0		100.0 %	0.0 %
2.00"	50.0		100.0 %	0.0 %
1.75"	45.0		100.0 %	0.0 %
1.50"	37.5	100 %	100.0 %	0.0 %
1.25"	31.5	98 %	100.0 %	0.0 %
1.00"	25.0	96 %	100.0 %	0.0 %
3/4"	19.0	93 %	100.0 %	0.0 %
5/8"	16.0	90 %	100.0 %	0.0 %
1/2"	12.5	85 %	100.0 %	0.0 %
3/8"	9.5	78 %	100.0 %	0.0 %
1/4"	6.3		100.0 %	0.0 %
#4	4.750	61 %	100.0 %	0.0 %
#8	2.36	49 %	100.0 %	0.0 %
#10	2	46 %	100.0 %	0.0 %
#16	1.18		100.0 %	0.0 %
#20	0.85		100.0 %	0.0 %
#30	0.6	26 %	100.0 %	0.0 %
#40	0.425	21 %	100.0 %	0.0 %
#50	0.3		100.0 %	0.0 %
#60	0.25		100.0 %	0.0 %
#80	0.18		100.0 %	0.0 %
#100	0.15	11 %	100.0 %	0.0 %
#140	0.106		100.0 %	0.0 %
#170	0.09		100.0 %	0.0 %
#200	0.075	7.9 %	100.0 %	0.0 %

ASTM D-4718, Misc. Oversize Correction Values
% Oversize Mat'l: 7%

% Oversize Retained	Corrected Density	Optimum Moisture
5%	137.3	7.6%
10%	138.8	7.3%
15%	140.3	6.9%
20%	141.9	6.5%
25%	143.6	6.1%
30%	145.2	5.8%

Specs: No Specs **Meets Specs? N/A**

% Gravel: 38.8% C_C: 1.30 $D_{(10)}$: 0.127
% Sand: 53.3% C_U: 35.50 $D_{(30)}$: 0.866
% Silt&Clay: 7.9% FM: 4.30 $D_{(60)}$: 4.518

LL: 0.0% PL: 0.0% PI: 0.0%

Sand Equivalent: n/a Req'd Sand Equivalent:

Fracture %, 1 Face: 0.0% Req'd Fracture %, 1 Face: 75 Min. %
Fracture %, 2+ Faces: n/a Req'd Fracture %, 2+ Faces:

Comments:

Reviewed by: Mark Peterson

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East Town Crossing - 22S075 - Field Report: Geotechnical consulting: Report #F278686

CLIENT	Dan Lloyd	**DATE**	04/01/2022
PROJECT LOCATION	Intersection of Shaw Road East and East Pioneer Puyallup WA 98372	**PERMIT #**	

Inspection Information:

Inspection Date: 04/01/2022

Time Onsite: 1100

Weather Conditions: 50F, Partly Cloudy

Inspection Performed: Geotechnical consulting

Comments:

Report of Infiltration Test – Infiltration

MTC Staff Geologist visited the site to perform limited shallow infiltration testing in accordance with the Falling Head Percolation Test Procedure (US EPA 1980), as requested by the contractor, in order to demonstate that the import soils generally conform with design infiltration rates.

Contractor had prepared and compacted four (4) testing pads, approximately 12 to 18 inches thick and 5'L x 5'W, prior to MTC's arrival. MTC conducted a total of three (3) falling head infiltration tests between two (2) locations on each pad. Testing locations were free of standing water at the time of our visit. Holes were prepared in accordance with EPA standards. The prescribed soaking period was determined to be unncessary based on the sandy/gravelly nature of the soils. Testing locations were continuously observed to measure cumulative head fall.

Des Moines Pit Run w/ Glass (33%) - These observed import soils appeared to be moderately-well draining, Well-Graded Sand with moderate amounts of gravel and cobbles, some fines content, and a significant amount of glass shards.

- Field test results of this soil yielded **uncorrected** field infiltration rates of:
  - 205.7 in/hr
  - 112.5 in/hr
  - 174.2 in/hr

SOILS TO BE USED AS ENGINEERED FILL

Miles Pit Run - Gravel Borrow - These observed import soils appeared to be moderately-well draining, Poorly-Graded gravel with a moderate amount of sand and few fines.

- Field test results of this soil yielded **uncorrected** field infiltration rates of:
  - 480.0 in/hr
  - 240.0 in/hr
  - 348.4 in/hr

Miles Pit Run - Gravel Borrow w/ Glass - These observed import soils appeared to be moderately-well draining, Poorly-Graded gravel with a moderate amount of sand, few fines and some glass shards.

- Field test results of this soil yielded **uncorrected** field infiltration rates of:
  - 981.8 in/hr
  - 617.1 in/hr
  - 674.5 in/hr

Corliss/Miles Gravel Borrow Mix - These observed import soils appeared to be moderately-well draining, Poorly-Graded Sand with Gravel and few fines.

- Field test results of this soil yielded **uncorrected** field infiltration rates of:
  - 106.4 in/hr
  - 322.4 in/hr
  - 225.0 in/hr

All field test results are to be further reduced by correction factors by the Geotechnical Engineer of Record as stipulated in the locally-accepted stormwater manual, utilizing a minimum safety factor of 0.5.

Uncorrected field test results indicate the maximum design infiltration rate of **30** in/hr may be used for each of the import soils.

MTC's assessment did not include: evaluation of underlying soil consistency or variability, mounding analysis, verification of depth to a static water level, or depth to impermeable soil units. Falling Head tests are limited but typically considered suitable for confirmation of infiltration potential is reasonably consistent soil conditions with no confining soils or shallow water table. If greater confidence or accuracy is required, further testing may be necessary.

MTC assumes the geotechnical engineer of record, and project civil engineer will review to confirm these findings and evaluate final correction factors if necessary.

Images:

UPLOADED: 04/04/2022 14:05:26 Des Moines Pit Run w/ Glass (33%

UPLOADED: 04/04/2022 14:07:45 Miles Pit Run - Gravel Borrow

UPLOADED: 04/04/2022 14:09:55 Miles Pit Run - Gravel Borrow w/ Glass

UPLOADED: 04/04/2022 14:13:01 Corliss/Miles Gravel Borrow Mix

REPORTED BY: Marcus Van Valen REVIEWED BY: Medhanie Tecle, Project Manager