PRCNC20241019

City of Puyallup
Development & Permitting Services
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Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

July 16, 2018
ES-4960.02

Step by Step Family Support Center
c/o Jeff Brown Architecture
12181 C Street South
Tacoma, Washington 98444

Attention: Mr. Jeff Brown

Subject: **Geotechnical Consulting Services**
Winter High Groundwater Evaluation and Infiltration Testing
Germaine Korum Center
13407 – 80th Street East
Puyallup, Washington

Reference: Earth Solutions NW, LLC
Geotechnical Engineering Study
Project No. ES-4960, dated April 12, 2017

Barghausen Consulting Engineers, Inc.
Grading and Storm Drainage Plan
Job No. 17376, dated September 12, 2017

Washington State Department of Ecology
Stormwater Management Manual for Western Washington, December 2014

Dear Mr. Brown:

In accordance with your request, Earth Solutions NW, LLC (ESNW) has prepared this letter with results of our recent infiltration testing and winter groundwater monitoring. With respect to the proposed bioretention cell, an allowable infiltration rate of 0.25 inches per hour (iph) was specified for design. The purpose of our recent investigation was to perform in-situ infiltration testing within the infiltration pond area and provide groundwater monitoring throughout the winter season.

Project Description

ESNW understands the proposed development will be comprised of several one- or two-story structures, two greenhouses, parking areas and drive lanes, a bioretention cell, and related infrastructure improvements. Many of the existing structures will be retained. The determination of the capacity for native soils to accommodate infiltration and seasonal high groundwater monitoring were the primary foci of this evaluation.

Groundwater Monitoring

Our groundwater monitoring program consisted of installing two piezometers at the approximate locations depicted on the attached test pit location plan (TP-101 and TP-102). The installations occurred in February 2018 and readings have been collected on a bi-weekly basis. The following table summarizes the data collected during the groundwater monitoring period.

	TP-101	TP-102
Date	**Groundwater Depth (ft)***	
2/21	2.0	2.5
3/6	2.3	2.7
3/20	2.4	2.8
4/4	2.7	3.1
4/16	1.0	2.7
5/15	5.0	4.8

**Depth measured from existing ground surface*

As anticipated, high groundwater readings corresponded with relatively high rainfall events. The readings completed on April 16, 2018 are indicative of seasonal high groundwater elevations.

Infiltration Evaluation

Our infiltration evaluation was completed in general accordance with the 2014 Surface Water Management Manual for Western Washington (2014 SWMMWW), as adopted by the city of Puyallup.

Native alluvium was encountered in a loose to medium dense condition within the proposed bioretention cell. To determine a long-term design rate for the proposed bioretention cell, we completed small-scale Pilot Infiltration Tests (PITs). In-situ testing was performed at a depth of approximately one to one-and-one-half feet below the ground surface at TP-101 and TP-102, which correlates to the approximate proposed infiltrating surface depth. Following the soak period, the falling head observation was performed and yielded a measured field rate (K_{sat} initial) of 0.75 iph at TP-101 and 1.0 iph at TP-102. The K_{sat} obtained from the PITs must be reduced through the application of correction factors to account for site variability, test methods, and degree of influent control to prevent sedimentation. The following factors were used in design and analysis:

- Site variability (CF_v) 0.8
- Test Method (CF_t) 0.5 (Small-scale PIT)
- Degree of influent control to prevent siltation (CF_m) 0.9

Multiplying our K_{sat} initial with the calculated CF_t, a design infiltration rate of 0.3 iph was determined. Based on the conditions observed during our fieldwork, a design infiltration rate of 0.3 iph is considered applicable to the proposed infiltration location with respect to bioretention applications. We recommend incorporating an overflow provision to the extent practicable.

Discussion

Our infiltration testing was performed to confirm that native soil present at the proposed bottom of the bioretention cell exhibited an infiltration capacity to support the design infiltration rate of 0.25 iph. Native soil at the proposed bottom of the bioretention cell was recognized as a fine-grained alluvial deposit. It is our professional opinion the infiltration capacity of the native soil within the stormwater management pond is adequate to support the design rate of 0.25 iph, provided adequate separation between the facility base and the seasonal high groundwater table is incorporated into final designs.

If the design assumptions outlined in this letter are incorrect or change, or if construction conditions differ from those encountered during our fieldwork, ESNW should be contacted to review the recommendations and conclusions provided in this letter. This letter has been prepared for the exclusive use of the Step by Step Family Support Center and their representatives. A warranty is neither expressed nor implied. The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. Variations in the soil and groundwater conditions encountered at the test pit locations may exist and may not become evident until construction.

We appreciate the opportunity to be of service to you and trust this letter meets your current needs. Should you have questions, or require additional information, please call.

Sincerely,

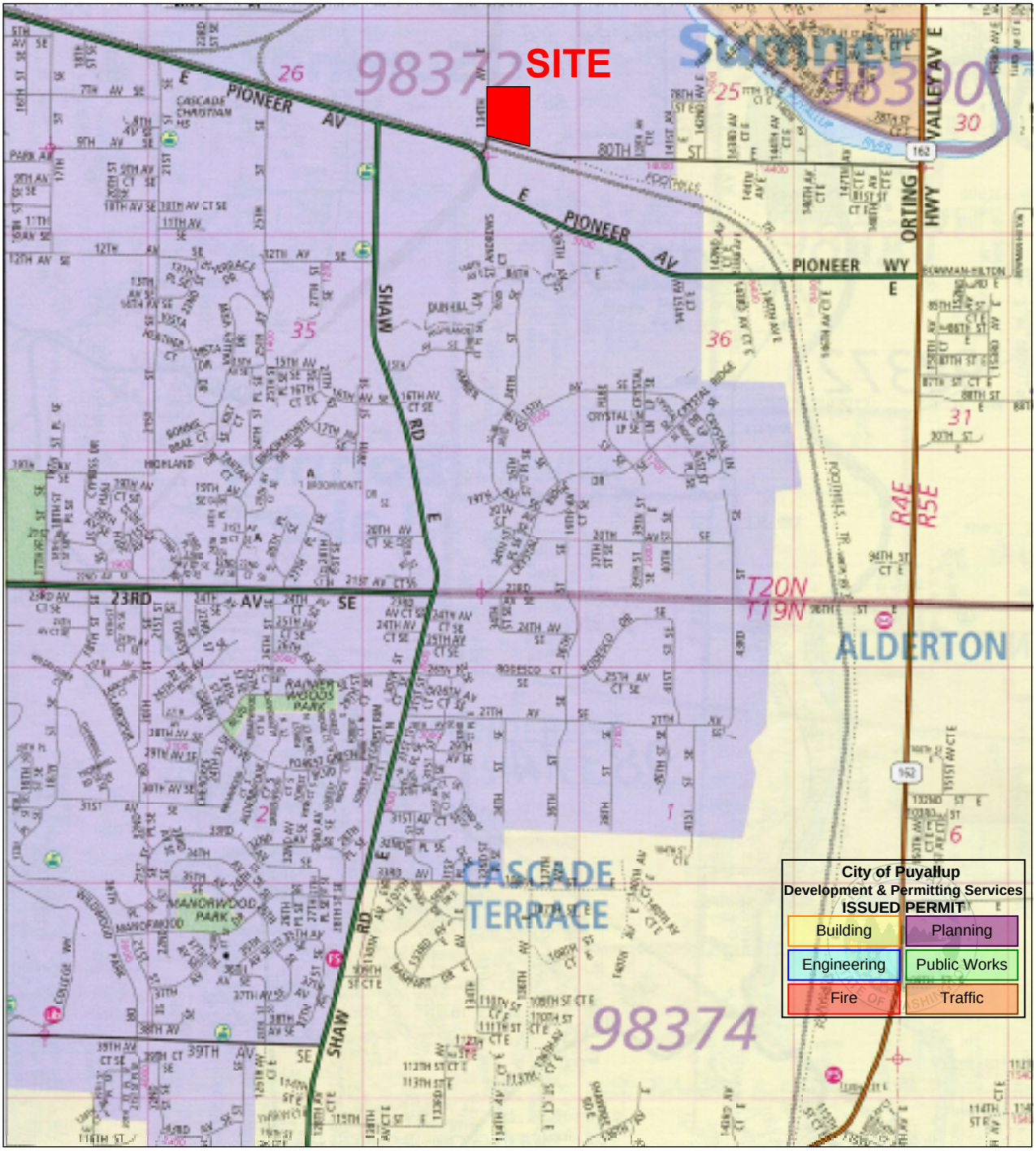
EARTH SOLUTIONS NW, LLC

Adam Z. Shier, G.I.T.
Staff Geologist

Keven D. Hoffmann, P.E.
Senior Project Engineer

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Test Pit Logs
Laboratory Data

cc: Barghausen Consulting Engineers, Inc.
Attention: Mr. Dan Balmelli, P.E. (Email only)



Reference:
Pierce County, Washington
Map 835
By The Thomas Guide
Rand McNally
32nd Edition

NORTH

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

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Germaine Korum Center
Puyallup, Washington

Drwn. CAM	Date 06/07/2018	Proj. No. 4960.02
Checked AZS	Date June 2018	Plate 1

LEGEND

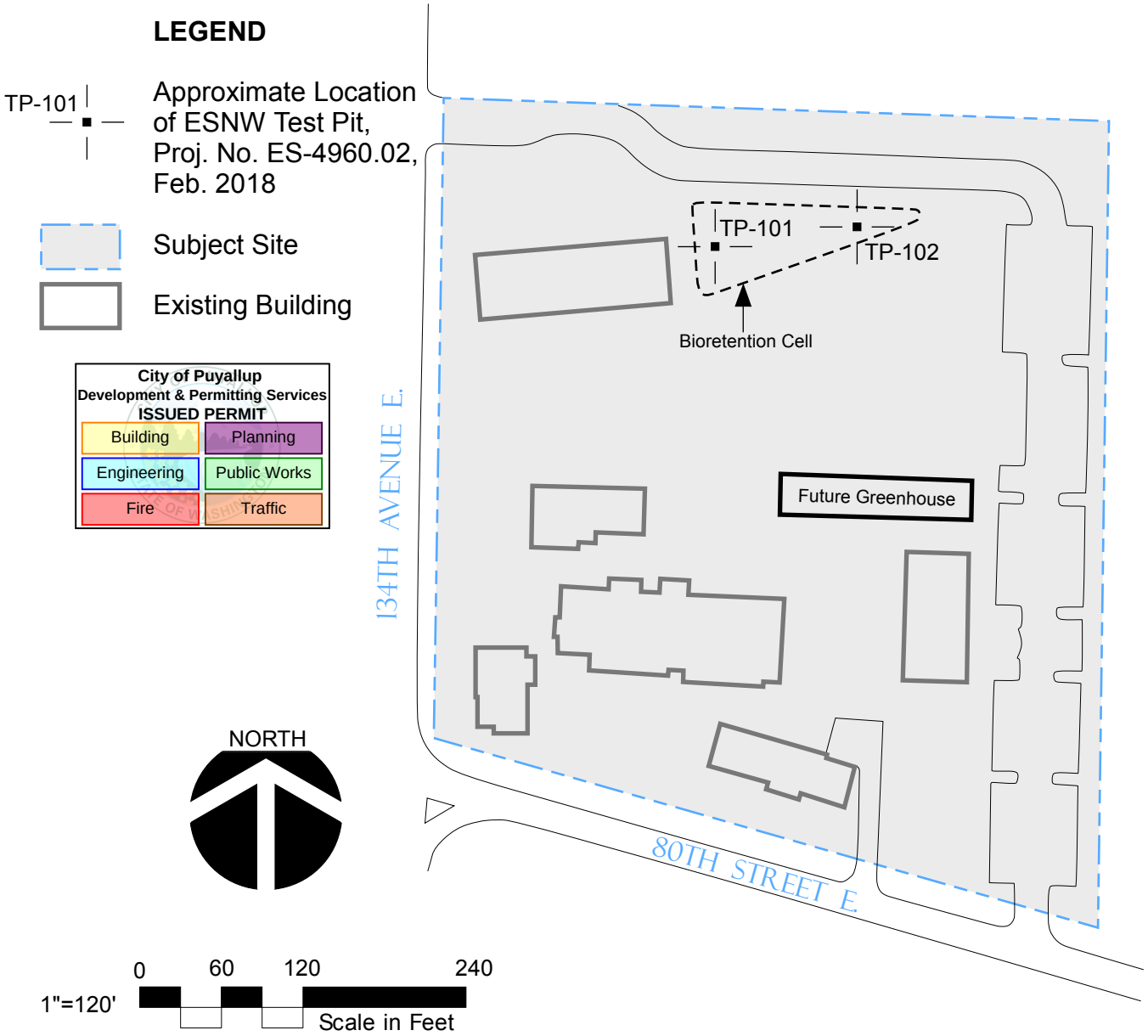
TP-101 — Approximate Location of ESNW Test Pit, Proj. No. ES-4960.02, Feb. 2018

Subject Site

Existing Building

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic



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.

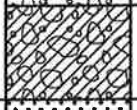
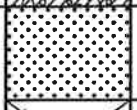
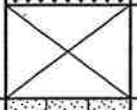
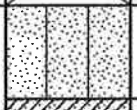
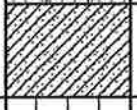
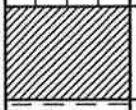
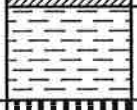
Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Test Pit Location Plan
Germaine Korum Center
Puyallup, Washington

Drwn. CAM	Date 06/07/2018	Proj. No. 4960.02
Checked AZS	Date June 2018	Plate 2

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-101

PROJECT NUMBER ES-4960.02 **PROJECT NAME** Germaine Korum Center

DATE STARTED 2/8/18 **COMPLETED** 2/8/18 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY AZS **CHECKED BY** HTW **AT END OF EXCAVATION** ---

NOTES Surface Conditions: bare soil **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 29.40% Fines = 66.60%	ML		Brown sandy SILT, loose to medium dense, moist to wet [USDA Classification: slightly gravelly LOAM] -iron oxide staining
5		MC = 24.70% MC = 38.00% Fines = 64.20%			-becomes gray -light groundwater seepage at 6' [USDA Classification: LOAM]
10		MC = 41.90%		10.0	Test pit terminated at 10.0 feet below existing grade. Groundwater seepage encountered at 6.0 feet during excavation. No caving observed. Bottom of test pit at 10.0 feet.

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GENERAL BH / TP / WELL 4960-2.GPJ GINT US.GDT 6/7/18

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-102

PROJECT NUMBER ES-4960.02 **PROJECT NAME** Germaine Korum Center

DATE STARTED 2/8/18 **COMPLETED** 2/8/18 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY AZS **CHECKED BY** HTW **AT END OF EXCAVATION** ---

NOTES Surface Conditions: bare soil **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 28.40% Fines = 73.10%	ML		Brown SILT with sand, loose to medium dense, moist to wet [USDA Classification: slightly gravelly LOAM] -iron oxide staining -becomes gray
5		MC = 29.40% MC = 31.30%			-caving from to 9' -light groundwater seepage at 9'
10		MC = 36.50% Fines = 91.60%		10.0	[USDA Classification: LOAM] Test pit terminated at 10.0 feet below existing grade. Groundwater seepage encountered at 9.0 feet during excavation. Caving observed from 6.0 to 9.0 feet. Bottom of test pit at 10.0 feet.

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GENERAL BH / TP / WELL 4960-2.GPJ GINT US.GDT 6/7/18

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1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

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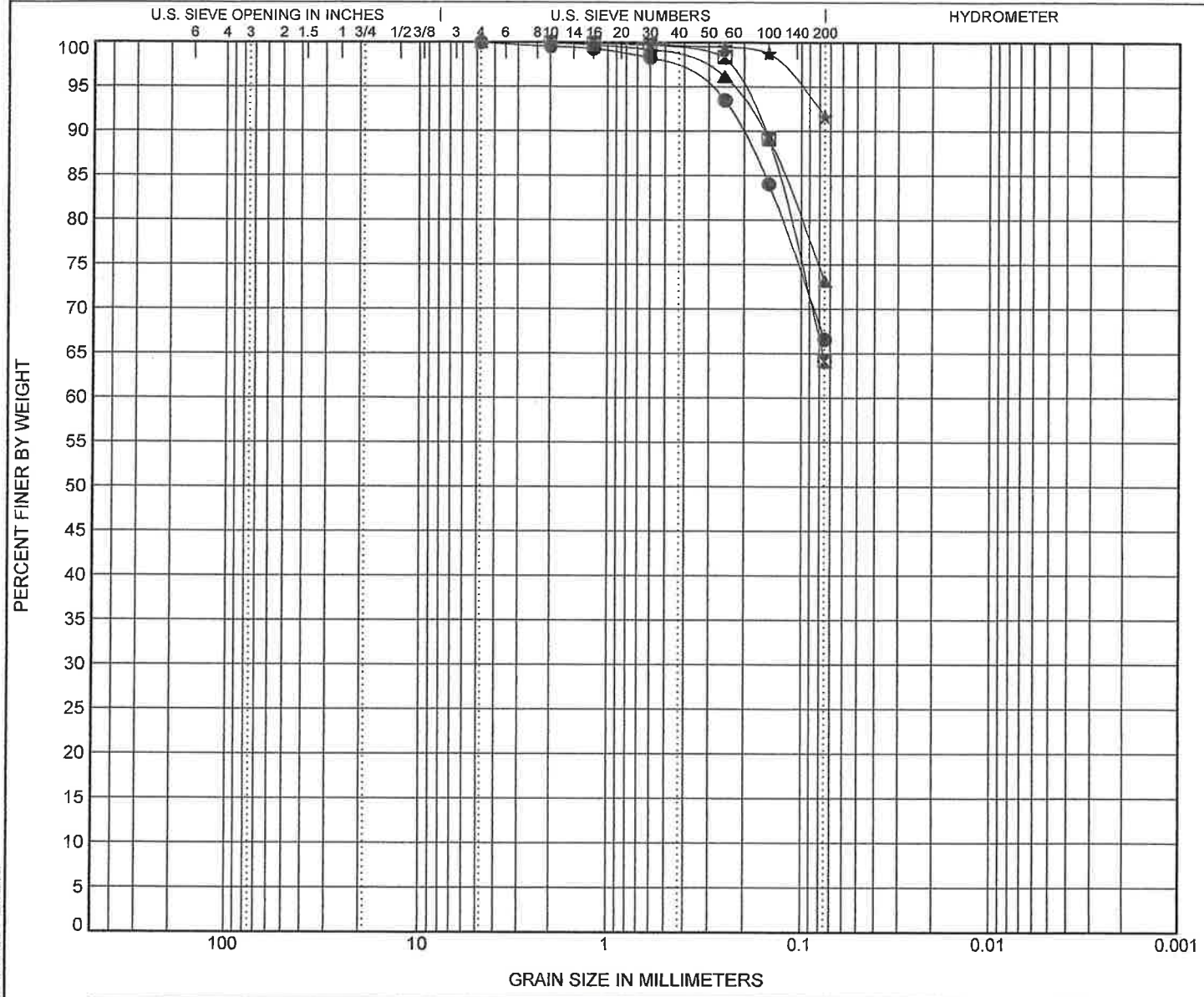
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-4960.02 **PROJECT NAME** Germaine Korum Center



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	Cc	Cu
● TP-101	1.00ft.	USDA: Brown Slightly Gravelly Loam. USCS: Sandy ML.		
⊠ TP-101	6.00ft.	USDA: Gray Loam. USCS: Sandy ML.		
▲ TP-102	1.00ft.	USDA: Brown Slightly Gravelly Loam. USCS: ML with Sand.		
★ TP-102	10.00ft.	USDA: Gray Loam. USCS: ML.		

Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-101	1.0ft.	4.75							66.6	
⊠ TP-101	6.0ft.	2							64.2	
▲ TP-102	1.0ft.	4.75							73.1	
★ TP-102	10.0ft.	2							91.6	