GEOTECHNICAL EVALUATION
PROPOSED LEVEE
4403 SOUTH DISHMAN-MICA ROAD
SPOKANE COUNTY, WASHINGTON

Inland Pacific Engineering Company Project No. 14-037A

July 17, 2015

IPEC

Inland Pacific Engineering Company
Geotechnical Engineering and Consulting

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Geotechnical Engineering and Consulting

July 17, 2015
Project No. 14-037A

NAI Black
c/o Mr. Bryan Walker
107 South Howard
Suite 500
Spokane, WA 99201

Re: **Geotechnical Evaluation**
Proposed Levee
4403 South Dishman-Mica Road
Spokane Valley, WA

Dear Mr. Walker:

We have completed the geotechnical evaluation for the proposed new levee at the above-referenced site in Spokane Valley, Washington. The purpose of evaluation was to provide design recommendations for the proposed levee for conformance to 44 CFR 65.10 of the Code of Federal Regulations for certification by the Federal Emergency Management Agency (FEMA).

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

Paul T. Nelson, P.E.
Principal Engineer

Attachment: Geotechnical Evaluation Report

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

GEOTECHNICAL EVALUATION
PROPOSED LEVEE
4403 SOUTH DISHMAN-MICA ROAD
SPOKANE COUNTY, WASHINGTON

Inland Pacific Engineering Company Project No. 14-037A

July 17, 2015

Prepared for:

NAI Black
Spokane, Washington

IPEC
Inland Pacific Engineering Company
Geotechnical Engineering and Consulting

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4403 South Dishman-Mica Road
Spokane County, Washington

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1.0 INTRODUCTION

1.1 Project Description

We understand that the proposed project may consist of a residential development. The site consists of 91 acres currently developed as a golf course. Stormwater runoff will be treated using drywells and/or gravel galleries for subsurface infiltration. These type of facilities will also be used to manage potential floodwaters, if needed. Because the existing Dishman-Mica roadway embankment is not considered a FEMA certified levee, a new levee will be constructed along the east side of the roadway.

1.2 Purpose

The purpose of our services is to provide design recommendations for the proposed levee for conformance to 44 CFR 65.10 of the Code of Federal Regulations for certification by the Federal Emergency Management Agency (FEMA).

1.3 Scope

Our services were requested by Mr. Bryan Walker of NAI Black. Mr. Walker authorized us to proceed on April 28, 2015. The scope of work agreed upon consisted of the following:

- review of existing geotechnical data and reports for the development, if available
- drill 6 penetration test borings at the site to a depth of 15 feet,
- performing laboratory tests on samples obtained from the test pits,
- classifying the soils and preparing boring logs, and
- submitting a geotechnical report containing logs of the borings, results of our field investigation and laboratory testing, and our analyses, opinions, and recommendations relative to levee design and construction for conformance to FEMA standards.

1.4 Available Information

We were provided a topographic survey for the project site by WCE. This topographic survey showed the existing roadways, existing structures, property lines, and existing ground surface elevation contours. This plan was prepared by WCE and was dated November 7, 2013.

We performed a preliminary geotechnical evaluation for the property in December 2013. The results of that evaluation, along with our opinions and recommendations, are summarized in our Preliminary Geotechnical Evaluation dated December 31, 2013.

In addition, we performed a geotechnical evaluation for the existing levee on the property to evaluate conformance to the FEMA standard. The results of that evaluation are summarized in our Geotechnical Evaluation report dated February 12, 2015.

In conjunction with this evaluation, West Consultants, Inc. (WEST) has been contracted by NAI Black to provide a FEMA Conditional Letter of Map Revision submittal (CLOMR). They have provided Inland Pacific Engineering Company (IPEC) water surface elevations and velocity output from their revised RAS model to assist us in our evaluation.

1.5 Locations and Elevations

The borings were drilled at or near locations selected by us. The boring locations are shown on the Boring Location Map in Appendix A. The borings were staked by Whipple Consulting Engineers, Inc. (WCE). Ground surface elevations at the borings were provided by WCE.

2.0 RESULTS

2.1 Logs

Log of Boring sheets indicating the vertical sequence of soils and materials encountered and groundwater observations are included in Appendix B. The strata changes were inferred from the changes in the penetration test samples and auger cuttings brought to the surface. 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 borings. 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 was used as a golf course prior to our evaluation. The site is relatively level with some elevated golf greens and excavated areas for water hazards. The site is primarily grass-covered with scattered trees along the fairways and pine trees in the undeveloped area to the northwest. The clubhouse building is present at the southwest corner. The existing levee is on the east side of Chester Creek between Thorpe Road and Dishman-Mica Road. The new levee will extend from the north end of the existing levee north and west along Dishman-Mica Road.

2.3 Soils

Geologic maps indicate the soils in this area consist primarily of alluvial and/or glacially deposited silts, clays, sands, and gravels. According to the Soil Survey of Spokane County, the site soils are classified by the Natural Resource Conservation Service (NRCS) as Narcisse silt loam and Endoaquolls and Fluvaquents. The native soils encountered in the borings were consistent with the NRCS data.

Boring B-2 encountered existing fill in the upper 6 feet. The fill consisted of silty clay over silty sand. The remaining borings encountered 6 inches to 4 feet of topsoil at the surface. Below the topsoil or existing fill, the borings generally encountered water-deposited silty to clayey sands and/or poorly graded sands to their termination depths. Boring B-5 encountered alluvial lean clay between the 9 and 12-foot depth. Boring B-6 encountered lean below the 7-foot depth.

2.4 Penetration Resistances

Penetration resistances (N-values) in the existing fill were 12 and 13 blows per foot (BPF). Penetration resistances in the silts and sands ranged from 7 to 37 BPF and averaged 19 BPF, indicating that these soils were loose to dense, but were typically medium dense. Penetration

resistances in the clays ranged from 10 to 40 BPF indicating that these soils were rather stiff to hard in consistency.

2.5 Groundwater

Groundwater was not encountered in any boring during or immediately after drilling. Groundwater is believed to currently exist at some depth below the termination depths of the borings. Based on our experience in the vicinity of the site, along with numerous test pits excavated previously on the site along with borings performed on the existing levee, it is our opinion that the portion of the creek along the existing levee is the beginning of the recharge section as evidenced by the typical lack of water in the creek further downstream. Also, the test pits previously excavated at the site east of the levee did not encounter groundwater. Well log data in the vicinity of the site indicate that groundwater is typically 50 to 80 feet below the surface.

2.6 Laboratory Testing

We obtained soil samples from the borings during our site investigation. The tests performed included the following:

1. ASTM D 6913, Sieve Analysis
2. ASTM D 4318, Atterberg Limits'

These tests were used to aid in classifying the soils and in the engineering analyses and formulation of engineering opinions and recommendations. Attached are data sheets summarizing the tests performed.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Discussion

Based on the data obtained from the recent and previous borings and/or test pits, it is our opinion that a new levee can be constructed adjacent to the Dishman-Mica Road that conforms to the FEMA standard. The following sections provide recommendations for construction of a levee that meets the standard based on EM 1110-2-1913, "Design and Construction of Levees, by the US Corps of Engineers dated April 30, 2000. Certification of the levee can be completed after construction has been completed.

3.2 Site Preparation

We recommend that any existing topsoil, root zone, and existing fill be excavated and removed from the levee footprint area. After these soils have been removed, we recommend surface compacting the exposed soils prior to placing structural fill for the embankment. 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 92 percent of the maximum dry density determined in accordance with ASTM D 1557 (modified Proctor).

In areas where structural fill is placed on the existing Dishman-Mica Road embankment, we recommend that the fill be benched into the slope. We recommend a maximum bench height of 4 feet and a minimum bench width equal to twice the bench height. At this time, we recommend a maximum slope angle of 3:1 (H:V) for permanent slopes excavated in the native soils or embankment fills using the native soils as structural fill.

The site soils which will be reused as backfill or fill are likely to be dry of optimum moisture content. These soils may require wetting 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.

We recommend in-place density tests be performed on all embankment fill placed. We recommend at least one test for every 100 cubic yards of fill placed in the levee embankment with at least one test for every 2 feet of fill placed.

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 should be placed on soils which have frozen or contain frozen material. Frozen soils should not be used as backfill or fill.

3.3 Freeboard

We were provided 100-year flood elevations by WEST. They provided us a plan view of the levee with flood elevations at 6 locations starting at the existing levee at the bridge on Dishman-Mica Road and ending at the northwest corner of the property near Wilbur Road. The elevations ranged from 2010.4 at the existing levee to 2008.1 at the north end. Please refer to the WEST report for a complete summary of the floodplain analysis.

According to 44 CFR Section 65.10(b)(1), an additional 1 foot of freeboard is required within 100 feet of bridge structures. The freeboard requirement for the Dishman-Mica Road bridge is adequate.

3.4 Closures

There are no penetrations of the levee proposed so closure devices are not required.

3.5 Embankment Protection

The levee will tie in to the Dishman-Mica Road embankment along its entire length which will provide creekside erosion protection to the top of the roadway embankment. For those portions of the levee above this elevation (if needed), it is our opinion that vegetative cover (grasses) would be suitable based on the flow velocities provided by WEST.

3.6 Embankment and Foundation Stability

We recommend that the new levee be constructed with maximum 3:1 (H:V) slopes for stability. We recommend a minimum crown width of 8 feet. We recommend that the levee embankment materials consist of a granular soil having 10 to 30 percent by weight passing a 200 sieve to reduce the permeability and limit seepage. We have assumed that on-site soils will be used as borrow to construct the embankment.

We evaluated the embankment and foundation stability for conditions described in EM 1110-2-1913, "Design and Construction of Levees, by the US Corps of Engineers dated April 30, 2000, Chapter 6. We analyzed the levee embankment for the following cases:

1. CASE I, End of construction.
2. CASE II: Sudden drawdown.
3. CASE III: Steady state seepage from full flood stage.

We performed slope stability analyses for each case. We analyzed the levee embankment with 3:1 slopes. For our analyses, we used XSTABL software which is based on a software program developed at Purdue University.

For these cases, we calculated the minimum factors of safety as shown in the following table.

CASE	Minimum Factor of Safety
I	2.45
II	1.86
III	2.15

For stability, a minimum factor of safety of 1.5 is generally considered acceptable. Based on this analysis, it is our opinion that the levee will be stable with respect to global slope stability provided the recommendations of this report are followed.

3.7 Settlement

The average depth of fill will be approximately 5 to 6 feet. This would result in a loading increase of approximately 750 pounds per square foot (psf) on the bearing soils. Based on the data obtained from the borings, the levee will be constructed above loose to medium dense sands or sandy silts. Settlement in these soils will generally occur shortly after construction.

Given the stiff condition of the clays at depth, we do not anticipate any significant settlement in these layers. We did analyze the lean clay layer encountered in Boring B-5 with a 6-foot raise in grade to maintain minimum freeboard. For our analysis, we used a unit weight of 125 pounds per cubic foot (pcf) for the embankment fill soils and a compression index of 0.06 for the lean clay and assumed total saturation of the clay layer. Based on these parameters, we estimated the settlement to be less than 0.5 inches.

3.8 Interior Drainage
Interior drainage systems have been designed by WCE. We understand that these systems will include detention ponds with multiple drywells to control flood waters and infiltrate them into the ground. Please refer to the WCE report for a comprehensive description of the interior drainage system.

3.9 Operation Plans
The Operation Plan will be prepared as part of the final levee certification.

3.10 Maintenance Plan
The Maintenance Plan will be prepared as part of the final levee certification.

4.0 PROCEDURES

4.1 Drilling and Sampling
The borings were completed on May 21, 2015 using a truck-mounted drill rig operated by an independent firm working under subcontract to IPEC. A geotechnical engineer from our firm continuously observed the borings and logged the surface and subsurface conditions. After we logged the borings, they were abandoned in accordance with state requirements.

4.2 Soil Classification
The soils encountered in the borings 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)".

5.0 GENERAL RECOMMENDATIONS

5.1 Basis of Recommendations
The analyses and recommendations submitted in this report are based on the data obtained from the borings performed at the locations indicated on the Boring 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.

5.2 Groundwater Fluctuations
We made water level observations in the borings at the times and conditions stated on the boring 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.

5.3 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.

5.4 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.

5.5 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

7-17-15

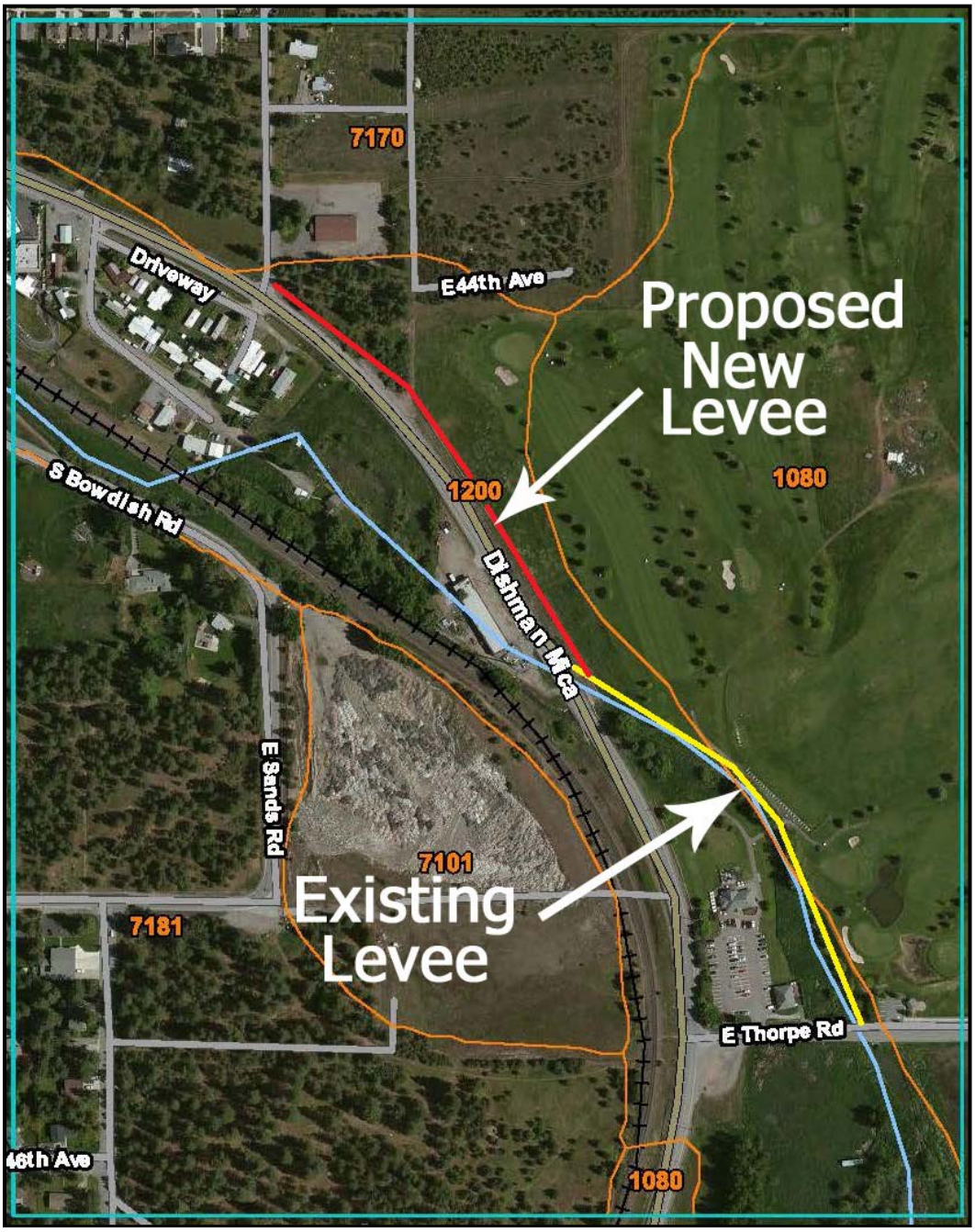
APPENDIX A

SITE LOCATION MAP, NRCS MAP, BORING LOCATION MAP

FIGURE 1

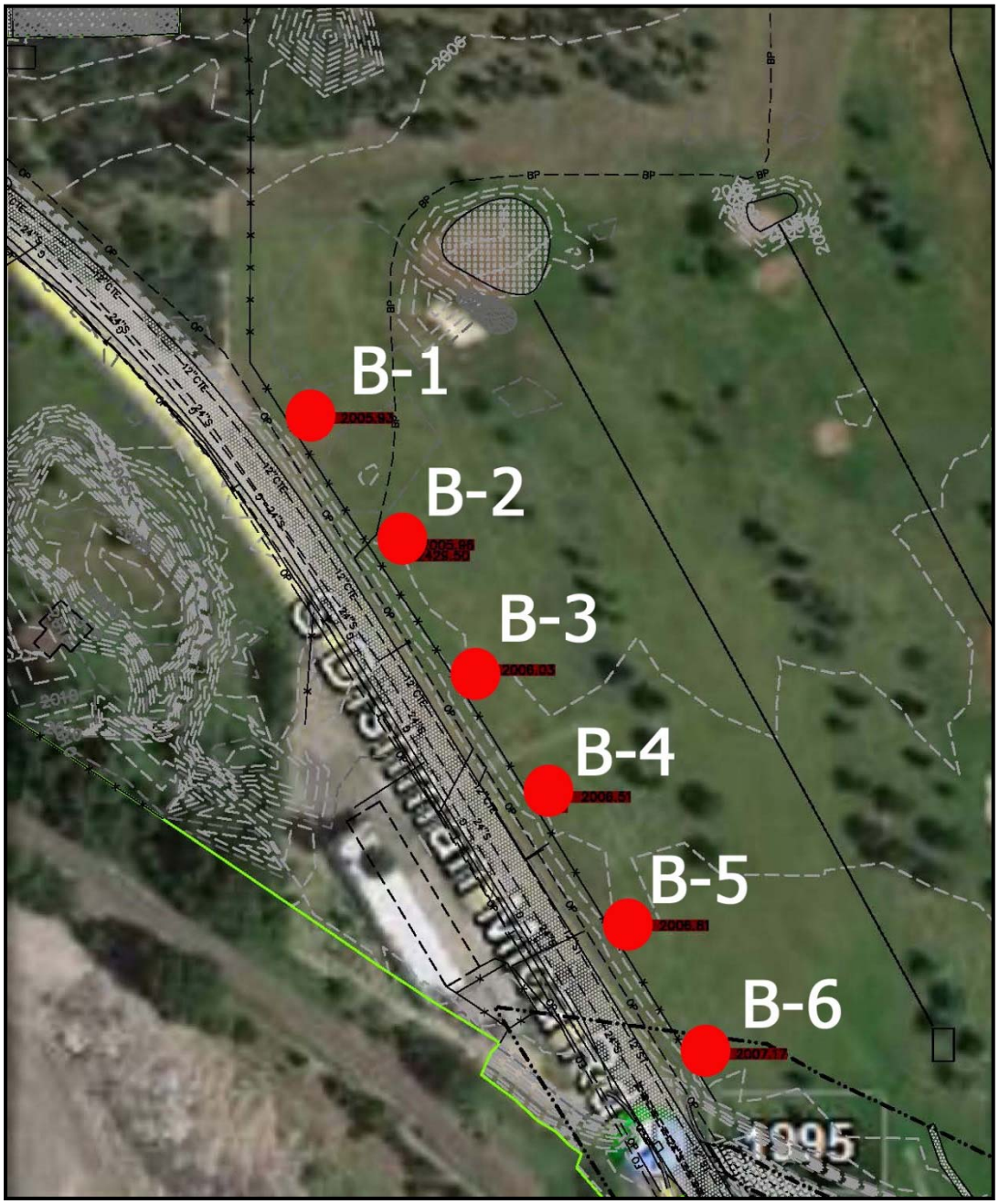
Site Location Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 14-037A Proposed Levee 4403 South Dishman-Mica Road Spokane Valley, WA	July 17, 2015

FIGURE 2



NRCS Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 14-037A Proposed Levee 4403 South Dishman-Mica Road Spokane Valley, WA	July 17, 2015

FIGURE 3



Boring Location Map		
IPEC Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 14-037A	July 17, 2015
	Proposed Levee 4403 South Dishman-Mica Road Spokane Valley, WA	

APPENDIX B

LOGS OF BORINGS, 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

BORING NUMBER B-1

CLIENT NAI Black
PROJECT NAME Painted Hills New Levee
PROJECT NUMBER 14-037A
PROJECT LOCATION 4403 South Dishman-Mica Road
DATE STARTED 5/21/15 **COMPLETED** 5/21/15
GROUND ELEVATION 2005.9 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Johnson Exploration Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- Not encountered
LOGGED BY SLN **CHECKED BY** PTN
AT END OF DRILLING --- Not encountered
NOTES
AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND, fine grained, with roots, dark gray, moist to wet. (Topsoil)										
			SS		8-10 (18)							
		(SC) CLAYEY SAND, fine grained, brown, moist to wet, medium dense. (Alluvium)										
5			SS		3-10 (13)							
		(SP-SM) POORLY GRADED SAND with SILT, medium to coarse grained, with seams of Clayey Sand, brown, moist, medium dense to dense. (Alluvium)										
			SS		10-15 (25)							
10			SS		17-18 (35)							
		(SP-SM) POORLY GRADED SAND with SILT, medium to coarse grained, a trace of Gravel, brown, moist, medium dense. (Glacial Outwash)										
15			SS		14-8 (22)			11				7

End of boring.

Groundwater not encountered with 14 feet of hollow-stem auger in the ground.

Groundwater not encountered immediately after withdrawal.

Bore hole then grouted.

IPEC

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

BORING NUMBER B-2

CLIENT NAI Black
PROJECT NAME Painted Hills New Levee
PROJECT NUMBER 14-037A
PROJECT LOCATION 4403 South Dishman-Mica Road
DATE STARTED 5/21/15 **COMPLETED** 5/21/15
GROUND ELEVATION 2006 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Johnson Exploration Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- Not encountered
LOGGED BY SLN **CHECKED BY** PTN
AT END OF DRILLING --- Not encountered
NOTES
AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(CL-ML) FILL: Sandy Silty Clay, with roots, dark brown, moist to wet.	SS		6-6 (12)							
5		(SM) FILL: Silty Sand, fine to medium grained, a trace of Gravel, brown mixed with dark brown, moist.	SS		7-6 (13)							
		(SP-SM) POORLY GRADED SAND with SILT and GRAVEL, fince to coarse grained, brown, moist, medium dense to dense. (Glacial Outwash)	SS		8-9 (17)			9				7
10			SS		11-14 (25)							
15			SS		15-22 (37)							

End of boring.

Groundwater not encountered with 14 feet of hollow-stem auger in the ground.

Groundwater not encountered immediately after withdrawal.

Bore hole then grouted.

IPEC

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Spokane Valley, WA 99216
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BORING NUMBER B-3

CLIENT NAI Black
PROJECT NAME Painted Hills New Levee
PROJECT NUMBER 14-037A
PROJECT LOCATION 4403 South Dishman-Mica Road
DATE STARTED 5/21/15 **COMPLETED** 5/21/15
GROUND ELEVATION 2006 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Johnson Exploration Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- Not encountered
LOGGED BY SLN **CHECKED BY** PTN
AT END OF DRILLING --- Not encountered
NOTES
AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(ML) SANDY SILT, with roots, dark brown, moist. (Topsoil)										
			SS		5-6 (11)							
		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, medium dense. (Glacial Outwash)										
5			SS		9-17 (26)							
			SS		11-12 (23)			7				7
10			SS		7-9 (16)			7				5
15			SS		11-8 (19)							

End of boring.

Groundwater not encountered with 14 feet of hollow-stem auger in the ground.

Groundwater not encountered immediately after withdrawal.

Bore hole then grouted.

IPEC
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BORING NUMBER B-4

CLIENT NAI Black
PROJECT NAME Painted Hills New Levee
PROJECT NUMBER 14-037A
PROJECT LOCATION 4403 South Dishman-Mica Road
DATE STARTED 5/21/15 **COMPLETED** 5/21/15
GROUND ELEVATION 2006.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Johnson Exploration Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- Not encountered
LOGGED BY SLN **CHECKED BY** PTN
AT END OF DRILLING --- Not encountered
NOTES
AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND, very fine to fine grained, with roots, dark brown, moist to wet. (Topsoil)	SS		4-5 (9)							
5		(ML) SANDY SILT, brown, moist to wet, loose. (Alluvium)	SS		3-4 (7)			39	45	36	9	74
		(SP-SM) POORLY GRADED SAND with SILT, medium to coarse grained, with seams of Sandy Lean Clay, brown, moist to wet, loose. (Alluvium)	SS		5-3 (8)							
10		(SC) CLAYEY SAND, fine grained, with seams of Poorly Graded Sand, brown, moist to wet, medium dense. (Alluvium)	SS		15-11 (26)							
		(SP-SM) POORLY GRADED SAND with SILT and GRAVEL, medium to coarse grained, moist, medium dense. (Glacial Outwash)										
15			SS		7-8 (15)			6				6

End of boring.

Groundwater not encountered with 14 feet of hollow-stem auger in the ground.

Groundwater not encountered immediately after withdrawal.

Bore hole then grouted.

IPEC

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

BORING NUMBER B-5

CLIENT NAI Black
PROJECT NAME Painted Hills New Levee
PROJECT NUMBER 14-037A
PROJECT LOCATION 4403 South Dishman-Mica Road
DATE STARTED 5/21/15 **COMPLETED** 5/21/15
GROUND ELEVATION 2006.8 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Johnson Exploration Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- Not encountered
LOGGED BY SLN **CHECKED BY** PTN
AT END OF DRILLING --- Not encountered
NOTES
AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SC) CLAYEY SAND, fine grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND, very fine to fine grained, brown to dark brown, moist, loose. (Alluvium)	SS		3-3 (6)							
		(SC-SM) SILTY CLAYEY SAND, fine grained, brown, moist to wet, medium dense. (Alluvium)	SS		6-7 (13)							
5		(SC) CLAYEY SAND, fine grained, brown, wet, loose. (Alluvium)	SS		4-6 (10)							
		(CL) LEAN CLAY. brown, wet, very stiff. (Alluvium)	SS		5-6 (11)			22	31	17	14	
10		(SM) SILTY SAND, fine grained, with seams of Poorly Graded Sand, brown, wet, medium dense. (Alluvium)										
15			SS		10-11 (21)							

End of boring.

Groundwater not encountered with 14 feet of hollow-stem auger in the ground.

Groundwater not encountered immediately after withdrawal.

Bore hole then grouted.

IPEC

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BORING NUMBER B-6

CLIENT NAI Black
PROJECT NAME Painted Hills New Levee
PROJECT NUMBER 14-037A
PROJECT LOCATION 4403 South Dishman-Mica Road
DATE STARTED 5/21/15 **COMPLETED** 5/21/15
GROUND ELEVATION 2007.2 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Johnson Exploration Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- Not encountered
LOGGED BY SLN **CHECKED BY** PTN
AT END OF DRILLING --- Not encountered
NOTES
AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)										
			SS		7-7 (14)							
		(SP) POORLY GRADED SAND, medium grained, brown, moist, loose. (Alluvium)										
5			SS		3-6 (9)							
		(CL) LEAN CLAY with SAND, brown, wet, rather stiff to hard. (Alluvium)	SS		5-11 (16)			19	26	18	8	76
10			SS		5-5 (10)							
15			SS		21-19 (40)							

End of boring.

Groundwater not encountered with 14 feet of hollow-stem auger in the ground.

Groundwater not encountered immediately after withdrawal.

Bore hole then grouted.

IPEC

Inland Pacific Engineering Company
Geotechnical Engineering and Consulting

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	4 - 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

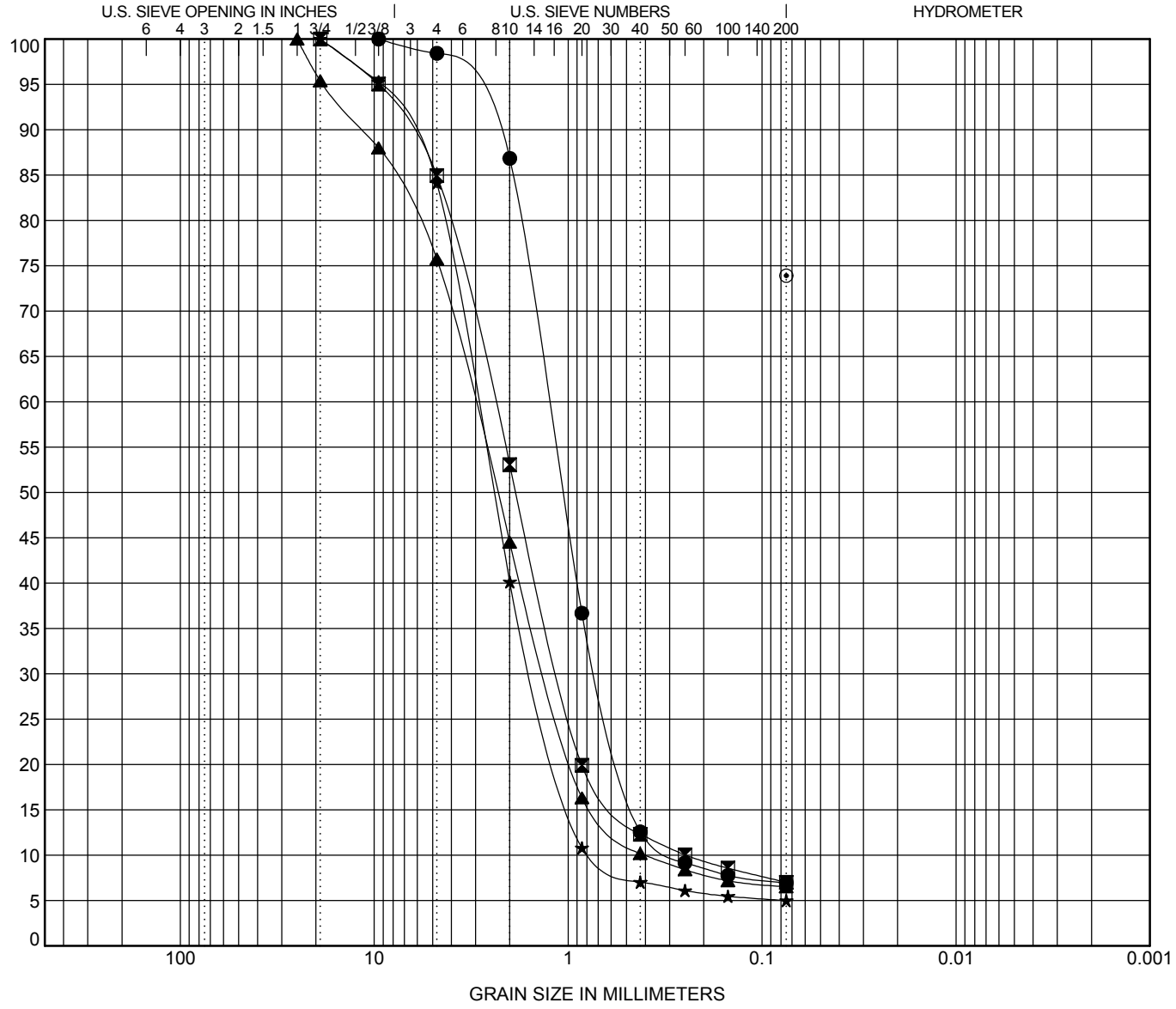
LABORATORY TEST RESULTS

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

GRAIN SIZE DISTRIBUTION

CLIENT NAI Black **PROJECT NAME** Painted Hills New Levee

PROJECT NUMBER 14-037A **PROJECT LOCATION** 4403 South Dishman-Mica Road



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-1	15.0	SP-SM Poorly Graded Sand with Silt				1.36	4.44
⊠	B-2	7.5	SP-SM Poorly Graded Sand with Silt and Gravel				2.05	9.80
▲	B-3	7.5	SP-SM Poorly Graded Sand with Silt and Gravel				1.34	7.63
★	B-3	10.0	SP Poorly Graded Sand with Gravel				1.02	4.03
⊙	B-4	5.0	ML Silt	45	36	9		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	15.0	9.5	1.265	0.701	0.285	1.6	91.5	7.0	
⊠	B-2	7.5	19	2.414	1.103	0.246	15.1	77.9	7.0	
▲	B-3	7.5	25	3.072	1.288	0.403	24.3	69.2	6.5	
★	B-3	10.0	19	2.956	1.488	0.734	15.9	79.1	5.0	
⊙	B-4	5.0	0.075						73.9	

GRAIN SIZE DISTRIBUTION

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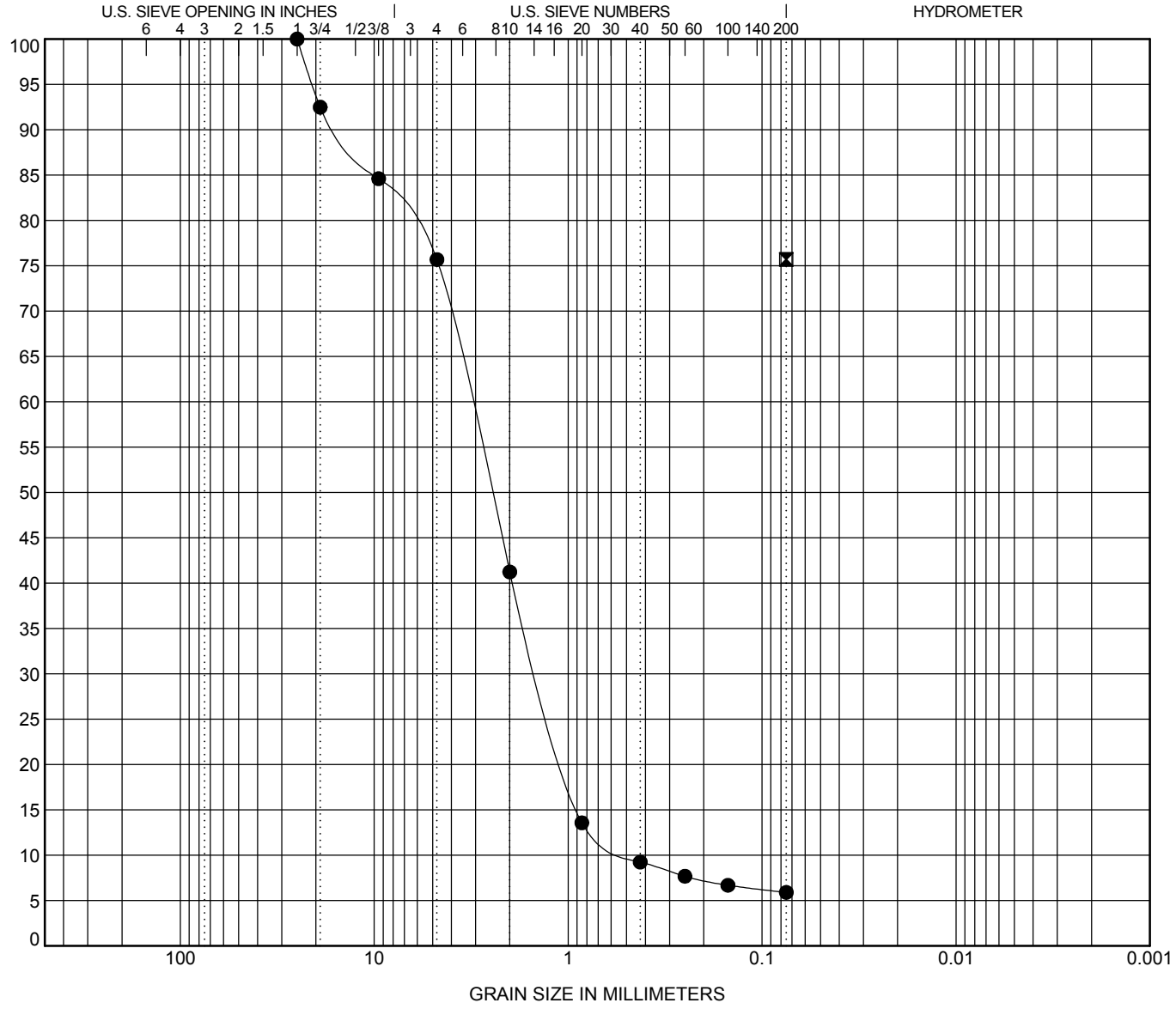
PROJECT NUMBER 14-037A **PROJECT LOCATION** 4403 South Dishman-Mica Road



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	B-4	15.0	SP-SM Poorly Graded Sand with Silt and Gravel				1.30	6.67
⊠	B-6	7.5	CL Lean Clay with Sand	26	18	8		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4	15.0	25	3.204	1.413	0.48	24.3	69.8	5.9	
⊠	B-6	7.5	0.075						75.7	

ATTERBERG LIMITS' RESULTS

IPEC
Inland Pacific Engineering Company
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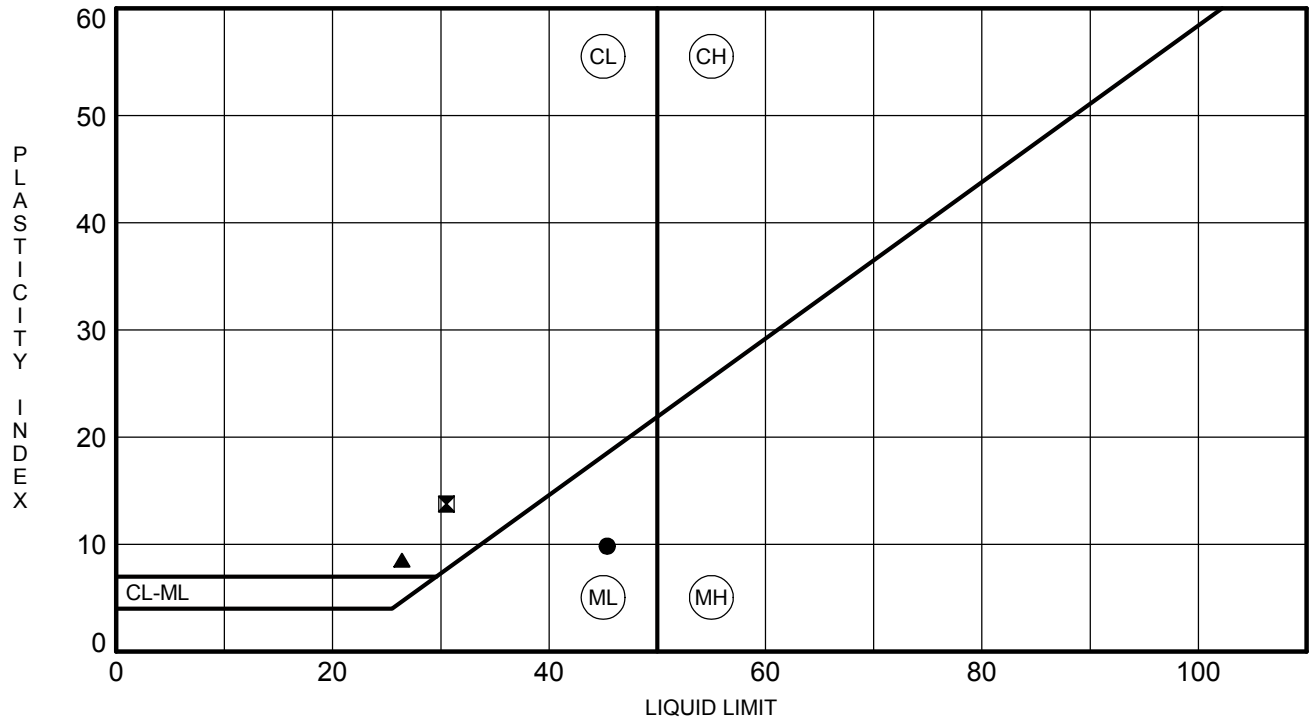
PROJECT NUMBER 14-037A **PROJECT LOCATION** 4403 South Dishman-Mica Road



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B-4**	**5.0**	**45**	**36**	**9**	**74**	**ML Silt**
⊠	**B-5**	**10.0**	**31**	**17**	**14**		**CL Lean Clay**
▲	**B-6**	**7.5**	**26**	**18**	**8**	**76**	**CL Lean Clay with Sand**