

**GEOTECHNICAL EVALUATION
GUSTIN LEVEE EVALUATION
PARCEL NO. 45344.9108
SPOKANE COUNTY, WASHINGTON**

Inland Pacific Engineering Company Project No. 14-037B

July 23, 2015

IPEC

Inland Pacific Engineering Company
Geotechnical Engineering and Consulting

IPEC

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Geotechnical Engineering and Consulting

July 23, 2015
Project No. 14-037B

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

Re: **Geotechnical Evaluation**
Gustin Levee Evaluation
4403 South Dishman-Mica Road
Spokane County, WA

Dear Mr. Walker:

We have completed the geotechnical evaluation for the Gustin Levee at the above-referenced site in Spokane County, Washington. The purpose of evaluation was to evaluate the existing 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

**GEOTECHNICAL EVALUATION
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PARCEL NO. 45344.9108
SPOKANE COUNTY, WASHINGTON**

Inland Pacific Engineering Company Project No. 14-037B

July 23, 2015

Prepared for:

**NAI Black
Spokane, Washington**

IPEC

**Inland Pacific Engineering Company
Geotechnical Engineering and Consulting**

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Gustin Levee Evaluation
Parcel No. 45344.9108
Spokane County, Washington

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1.0 INTRODUCTION

1.1 Project Description

We understand that the proposed Painted Hills 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. In addition, runoff from the drainage east of the site will require a FEMA certified levee. The existing levee is located on the Gustin property off State Highway 27.

1.2 Purpose

The purpose of our services is to evaluate the existing 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 8 penetration test borings at the site to a depth of 15 feet,
- excavate 6 test pits through the existing levee embankment,
- 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 the conformance of the existing levee 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 not dated.

We also performed a preliminary geotechnical evaluation for the golf course 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 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 and test pits were drilled and/or excavated at or near locations selected by us. The boring and test pit locations are shown on the Boring Location Map in Appendix A. The borings

were staked by Whipple Consulting Engineers, Inc. (WCE). The test pits were staked by IPEC. Ground surface elevations at the borings were provided by WCE. Ground surface elevations at the test pits were interpolated from the topographic survey provided by WCE.

2.0 RESULTS

2.1 Logs

Log of Boring and Log of Test Pit 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 or measured from the surface in the test pits. 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 is an open field with no trees and is primarily grass-covered with scattered trees along the fairways and pine trees in the undeveloped area to the northwest. The existing levee extends from the culvert under State Highway 27 on the east side of the property and extends west to the west side of the parcel. The creek side of the levee is typically at a 1.5:1 to 1:1 (H:V) slope. The land side of the levee is typically at a 2.5:1 to 1.5:1 slope. There are two existing crossings where the levee embankment is not present. The crossings consist of embankments with culverts.

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 Hardesty ash silt loam and Urban land-Springdale, disturbed complex. The native soils encountered in the borings and test pits were consistent with the NRCS data.

The borings encountered approximately 1 foot of topsoil at the surface. Below the topsoil, the borings encountered alluvial or glacial silty to clayey sands and/or poorly graded sands to their termination depths. Borings B-1 and B-3 encountered silty clay between the 4 and 9-foot depths.

The test pits were excavated through the existing levee embankment. They encountered existing fill in the upper 4 to 5½ feet. The embankment fill consisted primarily of silty sand. Below the fill, the test pits encountered alluvial or glacial silty to clayey sands and/or gravels to their termination depths.

2.4 Penetration Resistances

Penetration resistances (N-values) in the sands and gravels ranged from 6 to 59 blows per foot (BPF) and averaged 23 BPF indicating that these soils were loose to very dense, but were typically medium dense. Penetration resistances in the clays ranged from 8 to 18 BPF indicating they were medium to very stiff in consistency.

2.5 Groundwater

Groundwater was not encountered in the borings or test pits. Groundwater is believed to currently exist at some depth below the termination depths of the borings and test pits. 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. The tests were performed by IPEC. Attached are data sheets summarizing the tests performed.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Discussion

Based on the results of the borings and test pits, along with topographic data from WCE, the existing levee will need significant modification in order to meet the FEMA standard. At this time, we understand that the existing crossings will be removed. As such, additional freeboard will not be required at these locations. The sideslopes of the levee will need to be sloped flatter to maintain slope stability during flooding. In addition, the crown will need to be widened. It is our opinion that the levee embankment materials are suitable but will need to be re-worked to provide adequate flood protection. In summary, the levee as it exists cannot be certified at this time.

3.2 History

The levee was constructed prior to 1945, when the Gustin family purchased the land. As such, design plans or as-built drawings are not available. However, an as-built survey was completed by WCE in 2015.

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 9 locations starting at the culvert on State Highway 27 and ending

at the proposed triangle stormwater pond north of 40th Avenue west of the Gustin property. The elevations ranged from 2020.02 at State Highway 27 to 2008.85 at the triangle pond. 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. This will require the top of the levee to be at elevation 2024.02 at the State Highway 27 crossing and extending 100 feet west. Since the existing levee is at approximately elevation 2020 in this area, it will need additional fill to meet the minimum freeboard requirements.

3.4 Closures

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

3.5 Embankment Protection

The levee is currently grass-covered for erosion protection. We evaluated the erosion protection for the creek side of the levee using the results of the HEC-RAS analysis by WEST. They provided flow velocities for the 100-year flood event. The flow velocities are shown in the following table.

FEMA FIS Station	100-year Channel Velocity (ft/sec)
1962.72	3.71
2027.72	2.67
2295.08	1.26
2848.82	4.34
2886.75	2.15
2904.75	0.91
2933.32	1.33
3338.84	2.30
3364.84	2.11

As shown in the table, the average flow velocity is typically less than 3 feet per second. At these velocities, it is our opinion that the vegetative erosion protection is adequate for levee slope protection.

3.6 Embankment and Foundation Stability

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 existing 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 1:1 slopes. This configuration is considered to have the lowest factor of safety. 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	1.03
II	0.92
III	0.50

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 not be stable with respect to global slope stability with its current geometry.

We recommend that the levee be improved to have 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.

3.7 Settlement

The average depth of fill is approximately 5 feet. This would result in a loading increase of approximately 625 pounds per square foot (psf) on the bearing soils. Based on the data obtained from the borings, the levee was constructed above medium dense sands. Settlement in these soils would have occurred shortly after construction. Also, given the age of the levee, it is our opinion that significant additional long term settlement will not occur even with addition of 1 to 2 feet in areas requiring additional fill to meet the freeboard requirements.

3.8 Interior Drainage

Interior drainage systems have been designed by WCE. We understand that these systems will include the proposed triangle stormwater pond 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 Excavation and Sampling

The borings were completed on July 13 and 14, 2015 using a truck-mounted drill rig operated by an independent firm working under subcontract to IPEC. After we logged the borings, they were abandoned in accordance with state requirements. The test pits were excavated on July 21, 2015 using a rubber-tired backhoe operated by an independent firm working under subcontract to IPEC. After we logged the test pits, the test pits were backfilled. A geotechnical engineer from our firm continuously observed the borings and test pits and logged the surface and subsurface conditions.

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 and test pits performed at the locations indicated on the Boring and Test Pit 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 and test pits at the times and conditions stated on the boring and test pit 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

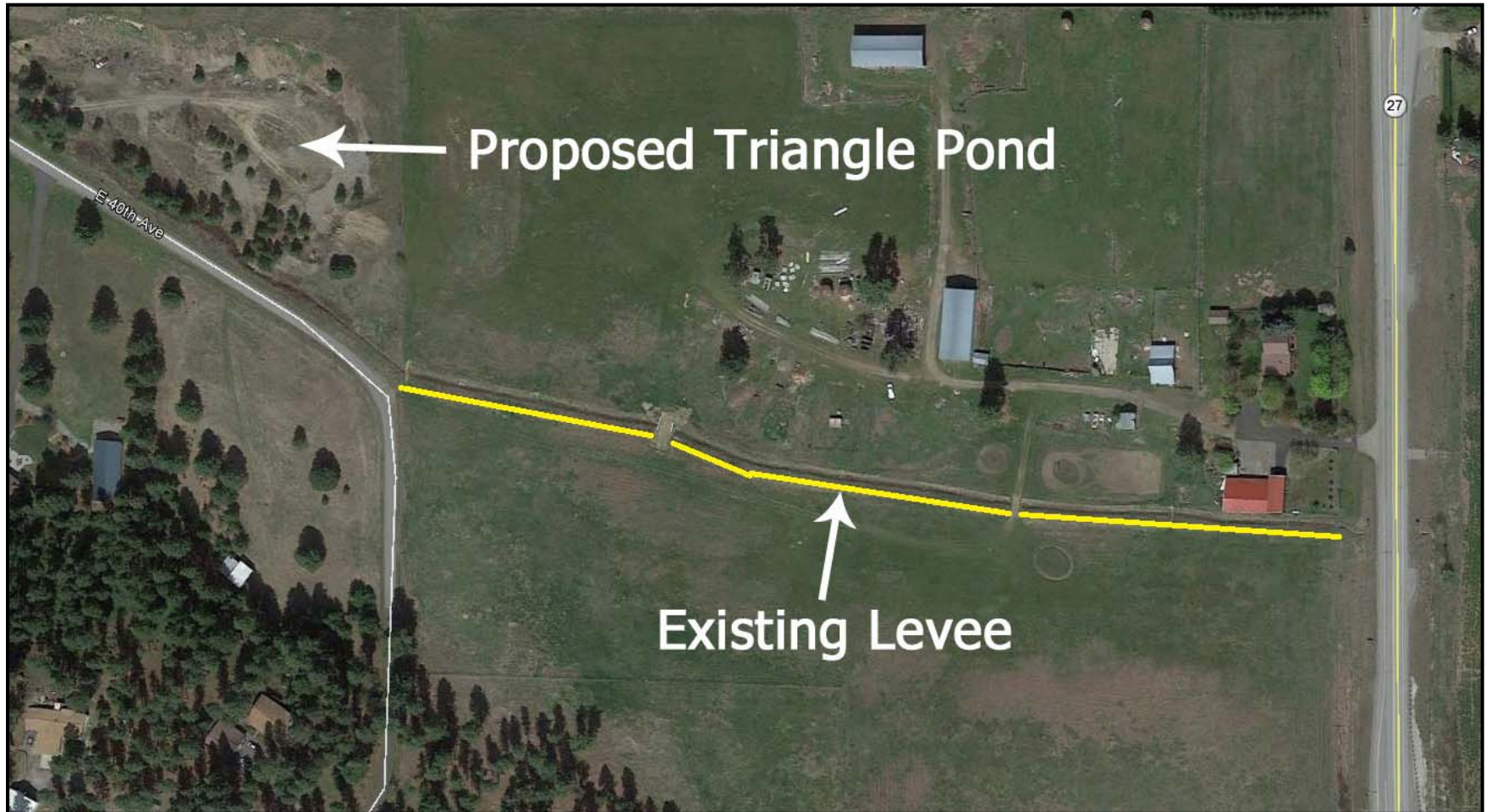


7-23-15

APPENDIX A

SITE LOCATION MAP, NRCS MAP, BORING AND TEST
PIT LOCATION MAP

FIGURE 1




Site Location Map		
 Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 14-037B	July 22, 2015
	Gustin Levee Parcel No. 45344.9108 Spokane County, WA	

FIGURE 2




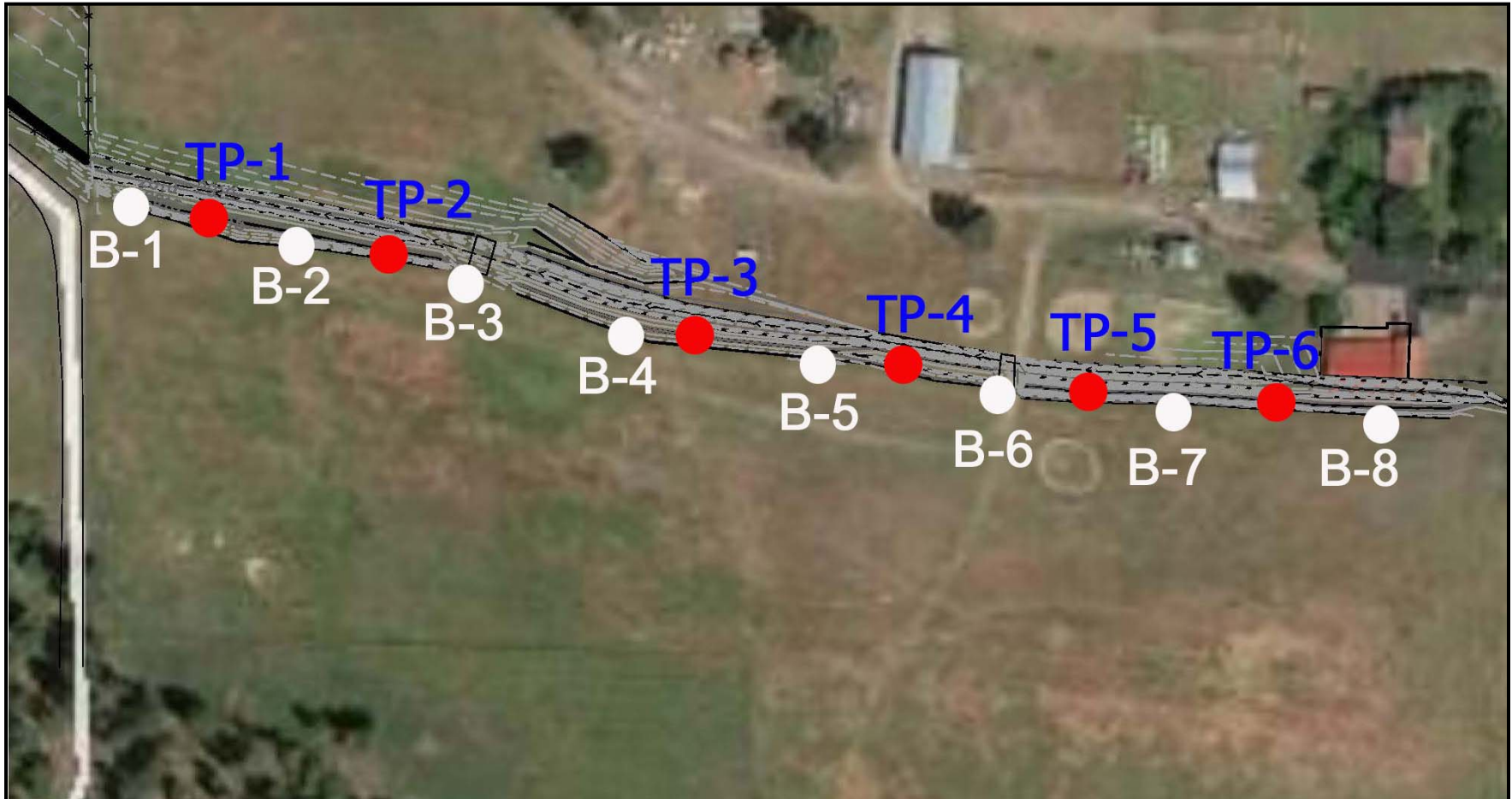

NRCS Map		
 Inland Pacific Engineering Company Geotechnical Engineering and Consulting	Project No. 14-037B	July 22, 2015
	Gustin Levee Parcel No. 45344.9108 Spokane County, WA	

FIGURE 3



Boring Location Map		
	Project No. 14-037B	July 22, 2015
	Gustin Levee Parcel No. 45344.9108 Spokane County, WA	

APPENDIX B

LOGS OF BORINGS, LOGS OF TEST PITS, DESCRIPTIVE TERMINOLOGY



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 NUMBER 14-037B
DATE STARTED 7/13/15 **COMPLETED** 7/13/15
DRILLING CONTRACTOR Johnson Exploration Drilling
DRILLING METHOD Hollow Stem Auger
LOGGED BY DD **CHECKED BY** PTN
NOTES _____

PROJECT NAME Gustin Levee
PROJECT LOCATION Spokane County
GROUND ELEVATION 2010.8 ft **HOLE SIZE** 8 inches
GROUND WATER LEVELS:
AT TIME OF DRILLING --- Not encountered
AT END OF DRILLING --- Not encountered
AFTER DRILLING --- Not encountered

IPEC BORING LOG - GINT STD US LAB.GDT - 7/23/15 15:32 - J.\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEVEE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEVEE.GPJ

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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND, fine to medium grained, brown, moist, loose. (Alluvium)	X SS		5-4 (9)							
5		(CL-ML) SANDY SILTY CLAY, brown, moist to wet, medium to stiff. (Alluvium)	X SS		4-4 (8)			21	24	20	4	77
			X SS		6-8 (14)							
10		(SM) SILTY SAND, fine to medium grained, a trace of Gravel, brown, moist, medium dense. (Alluvium)	X SS		12-13 (25)							
		(SM) SILTY SAND with GRAVEL, medium to coarse grained, brown, moist to wet, medium dense. (Glacial Outwash)										
15			X SS		14-15 (29)							

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.



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 Fax: 509-290-5734

BORING NUMBER B-2

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/13/15 COMPLETED 7/13/15
 DRILLING CONTRACTOR Johnson Exploration Drilling
 DRILLING METHOD Hollow Stem Auger
 LOGGED BY DD CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2010.7 ft HOLE SIZE 8 inches
 GROUND WATER LEVELS:
 AT TIME OF DRILLING --- Not encountered
 AT END OF DRILLING --- Not encountered
 AFTER DRILLING --- Not encountered

IPEC BORING LOG - GINT STD US LAB.GDT - 7/23/15 15:32 - J.\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEEVE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEEVE.GPJ

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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND, fine to medium grained, brown, moist, loose to medium dense. (Alluvium)	X SS		3-3 (6)							
5			X SS		7-8 (15)							
			X SS		6-8 (14)							
10			X SS		5-8 (13)							
		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, medium dense. (Glacial Outwash)										
15			X SS		15-11 (26)							6

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.



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BORING NUMBER B-3

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/13/15 COMPLETED 7/13/15
 DRILLING CONTRACTOR Johnson Exploration Drilling
 DRILLING METHOD Hollow Stem Auger
 LOGGED BY DD CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2012.4 ft HOLE SIZE 8 inches
 GROUND WATER LEVELS:
 AT TIME OF DRILLING --- Not encountered
 AT END OF DRILLING --- Not encountered
 AFTER DRILLING --- Not encountered

IPEC BORING LOG - GINT STD US LAB.GDT - 7/23/15 15:32 - J.\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEEVE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEEVE.GPJ

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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND, very fine to fine grained, brown, moist, loose. (Alluvium)	X SS		3-3 (6)							
5		(CL-ML) SANDY SILTY CLAY, brown, moist to wet, very stiff. (Alluvium)	X SS		8-10 (18)			17	23	19	4	62
		(SP-SM) POORLY GRADED SAND with SILT, medium to coarse grained, a trace of Gravel, brown, moist, medium dense. (Glacial Outwash)	X SS		7-6 (13)							
10			X SS		7-9 (16)							8
15			X SS		9-9 (18)							

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.



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BORING NUMBER B-4

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/13/15 COMPLETED 7/13/15
 DRILLING CONTRACTOR Johnson Exploration Drilling
 DRILLING METHOD Hollow Stem Auger
 LOGGED BY DD CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2013 ft HOLE SIZE 8 inches
 GROUND WATER LEVELS:
 AT TIME OF DRILLING --- Not encountered
 AT END OF DRILLING --- Not encountered
 AFTER DRILLING --- Not encountered

IPEC BORING LOG - GINT STD US LAB.GDT - 7/23/15 15:32 - J.\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEVEE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEVEE.GPJ

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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND, fine to medium grained, brown, moist, loose. (Alluvium)	X SS		4-4 (8)							36
5		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, medium dense to dense. (Glacial Outwash)	X SS		10-9 (19)							
			X SS		6-7 (13)							
10			X SS		20-21 (41)							
15			X SS		13-13 (26)							4

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.



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BORING NUMBER B-5

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/14/15 COMPLETED 7/14/15
 DRILLING CONTRACTOR Johnson Exploration Drilling
 DRILLING METHOD Hollow Stem Auger
 LOGGED BY SLN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2013.9 ft HOLE SIZE 8 inches
 GROUND WATER LEVELS:
 AT TIME OF DRILLING --- Not encountered
 AT END OF DRILLING --- Not encountered
 AFTER DRILLING --- Not encountered

IPEC BORING LOG - GINT STD US LAB.GDT - 7/23/15 15:32 - J:\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEEVE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEEVE.GPJ

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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND with GRAVEL, fine to medium grained, brown, moist, medium dense. (Glacial Outwash)	X SS		11-10 (21)							
5		(SP-SM) POORLY GRADED SAND with SILT and GRAVEL, medium to coarse grained, brown, moist, medium dense. (Glacial Outwash)	X SS		15-10 (25)							
		(SP-SM) POORLY GRADED SAND with SILT and GRAVEL, medium to coarse grained, brown, moist, medium dense. (Glacial Outwash)	X SS		5-6 (11)							
10		(SP-SM) POORLY GRADED SAND with SILT and GRAVEL, medium to coarse grained, brown, moist, medium dense. (Glacial Outwash)	X SS		6-9 (15)							
15		(SP-SM) POORLY GRADED SAND with SILT and GRAVEL, medium to coarse grained, brown, moist, medium dense. (Glacial Outwash)	X SS		13-17 (30)							

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.

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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-6

CLIENT NAI Black
PROJECT NUMBER 14-037B
DATE STARTED 7/14/15 **COMPLETED** 7/14/15
DRILLING CONTRACTOR Johnson Exploration Drilling
DRILLING METHOD Hollow Stem Auger
LOGGED BY SLN **CHECKED BY** PTN
NOTES _____

PROJECT NAME Gustin Levee
PROJECT LOCATION Spokane County
GROUND ELEVATION 2015.1 ft **HOLE SIZE** 8 inches
GROUND WATER LEVELS:
AT TIME OF DRILLING --- Not encountered
AT END OF DRILLING --- Not encountered
AFTER DRILLING --- Not encountered

IPEC BORING LOG - GINT STD US LAB.GDT - 7/23/15 15:33 - J. IPEC PROJECTS, 2014 PROJECTS\14-037B GUSTIN LEVEE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEVEE.GPJ

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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND with GRAVEL, fine to coarse grained, brown, moist, dense to medium dense. (Glacial Outwash)	X SS		16-16 (32)							
5		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, very dense to medium dense. (Glacial Outwash)	X SS		7-15 (22)							
		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, very dense to medium dense. (Glacial Outwash)	X SS		43-15 (58)							
10		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, very dense to medium dense. (Glacial Outwash)	X SS		17-16 (33)							
15		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, very dense to medium dense. (Glacial Outwash)	X SS		12-12 (24)							

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.



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BORING NUMBER B-7

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/14/15 COMPLETED 7/14/15
 DRILLING CONTRACTOR Johnson Exploration Drilling
 DRILLING METHOD Hollow Stem Auger
 LOGGED BY SLN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2015.9 ft HOLE SIZE 8 inches
 GROUND WATER LEVELS:
 AT TIME OF DRILLING --- Not encountered
 AT END OF DRILLING --- Not encountered
 AFTER DRILLING --- Not encountered

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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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND with GRAVEL, fine to coarse grained, brown, moist, medium dense. (Glacial Outwash)	X SS		5-13 (18)							
5		(SP) POORLY GRADED SAND with GRAVEL, medium to coarse grained, brown, moist, dense to very dense. (Glacial Outwash)	X SS		24-18 (42)							
			X SS		25-16 (41)							
10			X SS		8-15 (23)							
15			X SS		50							

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.



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BORING NUMBER B-8

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/14/15 COMPLETED 7/14/15
 DRILLING CONTRACTOR Johnson Exploration Drilling
 DRILLING METHOD Hollow Stem Auger
 LOGGED BY SLN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2020 ft HOLE SIZE 8 inches
 GROUND WATER LEVELS:
 AT TIME OF DRILLING --- Not encountered
 AT END OF DRILLING --- Not encountered
 AFTER DRILLING --- Not encountered

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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			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SM) SILTY SAND, fine to medium grained, with roots, dark brown, moist. (Topsoil)										
		(SM) SILTY SAND with GRAVEL, fine to coarse grained, brown, moist, medium dense. (Glacial Outwash)	X SS		9-8 (17)							
5			X SS		5-7 (12)							
			X SS		7-7 (14)							
10		(GP-GM) POORLY GRADED GRAVEL with SILT and SAND, fine grained, brown, moist, dense to very dense. (Glacial Outwash)	X SS		20-19 (39)							7
15			X SS		27-32 (59)							

End of boring.
 Groundwater not encountered with 14' of hollow-stem auger in the ground.
 Groundwater not encountered immediately after withdrawal of the auger.
 Bore hole then grouted to the surface.




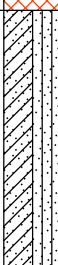
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TEST PIT NUMBER TP-1

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/21/15 COMPLETED 7/21/15
 EXCAVATION CONTRACTOR Alpine Excavating
 EXCAVATION METHOD Backhoe
 LOGGED BY PTN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2016 ft TEST PIT SIZE 30 inches
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION --- Not encountered
 AT END OF EXCAVATION --- Not encountered
 AFTER EXCAVATION --- Not encountered

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 7/23/15 15:54 - J:\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEVEE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEVEE.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
2.5		MC = 16% Fines = 44%	SM		(SM) FILL: Silty Clayey Sand, fine grained, a trace of fibers, brown, moist.
5.0			SC-SM		(SC-SM) SILTY CLAYEY SAND, fine grained, brown, moist. (Alluvium)
7.0					

2011.0

2009.0

End of test pit.
 Groundwater not encountered
 Test pit immediately backfilled.

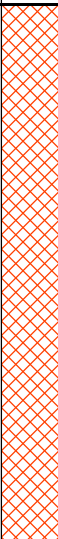



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TEST PIT NUMBER TP-2

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/21/15 COMPLETED 7/21/15
 EXCAVATION CONTRACTOR Alpine Excavating
 EXCAVATION METHOD Backhoe
 LOGGED BY PTN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2016 ft TEST PIT SIZE 30 inches
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION --- Not encountered
 AT END OF EXCAVATION --- Not encountered
 AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0				
2.5		SM		(SM) FILL: Silty Sand, fine to medium grained, brown, moist.
4.0				2012.0
5.0		SM		(SM) SILTY SAND, fine to medium grained, brown, moist. (Alluvium)
7.5				
8.0				2008.0

End of test pit.
 Groundwater not encountered
 Test pit immediately backfilled.

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TEST PIT NUMBER TP-3

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/21/15 COMPLETED 7/21/15
 EXCAVATION CONTRACTOR Alpine Excavating
 EXCAVATION METHOD Backhoe
 LOGGED BY PTN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2015 ft TEST PIT SIZE 30 inches
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION --- Not encountered
 AT END OF EXCAVATION --- Not encountered
 AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
2.5		MC = 6% Fines = 22%	SM		(SM) FILL: Silty Sand with Gravel, fine to medium grained, brown, moist.
5.0					
5.5			SM		(SM) SILTY SAND, fine to coarse grained, a trace of Gravel, brown, moist. (Glacial Outwash)
7.0					

2009.5

2008.0

End of test pit.
 Groundwater not encountered
 Test pit immediately backfilled.

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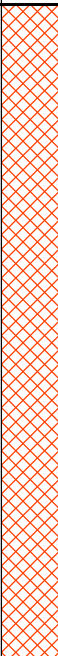



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TEST PIT NUMBER TP-4

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/21/15 COMPLETED 7/21/15
 EXCAVATION CONTRACTOR Alpine Excavating
 EXCAVATION METHOD Backhoe
 LOGGED BY PTN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2017 ft TEST PIT SIZE 30 inches
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION --- Not encountered
 AT END OF EXCAVATION --- Not encountered
 AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0				
2.5		SM		(SM) FILL: Silty Sand with Gravel, fine to coarse grained, brown, moist.
5.0		SM		(SM) SILTY SAND with GRAVEL, fine to coarse grained, brown, moist. (Glacial Outwash)
7.0				

End of test pit.
 Groundwater not encountered
 Test pit immediately backfilled.

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TEST PIT NUMBER TP-5

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/21/15 COMPLETED 7/21/15
 EXCAVATION CONTRACTOR Alpine Excavating
 EXCAVATION METHOD Backhoe
 LOGGED BY PTN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2021 ft TEST PIT SIZE 30 inches
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION --- Not encountered
 AT END OF EXCAVATION --- Not encountered
 AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					(SM) FILL: Silty Sand, fine grained, brown, moist.
2.5		MC = 7% Fines = 48%	SM		
5.0			SM		(SM) SILTY SAND with GRAVEL, fine to coarse grained, brown, moist. (Glacial Outwash)
					2016.0
					2014.0

End of test pit.
 Groundwater not encountered
 Test pit immediately backfilled.

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TEST PIT NUMBER TP-6

CLIENT NAI Black
 PROJECT NUMBER 14-037B
 DATE STARTED 7/21/15 COMPLETED 7/21/15
 EXCAVATION CONTRACTOR Alpine Excavating
 EXCAVATION METHOD Backhoe
 LOGGED BY PTN CHECKED BY PTN
 NOTES _____

PROJECT NAME Gustin Levee
 PROJECT LOCATION Spokane County
 GROUND ELEVATION 2021 ft TEST PIT SIZE 30 inches
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION --- Not encountered
 AT END OF EXCAVATION --- Not encountered
 AFTER EXCAVATION --- Not encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					(SM) FILL: Silty Sand with Gravel, fine to coarse grained, brown, moist.
2.5		Fines = 25%	SM		
5.0			GM		(GM) SILTY GRAVEL with SAND, fine to coarse grained, brown, moist. (Glacial Outwash)
					2016.0
					2014.0

End of test pit.
 Groundwater not encountered
 Test pit immediately backfilled.

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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 <50% passes #200 sieve	Gravel and Gravelly Soils <50% coarse fraction passes #4 sieve	Gravel <small>(with little or no fines)</small>	GW	Well Graded Gravel
		<small>(with >12% fines)</small>	GP	Poorly Graded Gravel
		Gravel <small>(with >12% fines)</small>	GM	Silty Gravel
		<small>(with >12% fines)</small>	GC	Clayey Gravel
	Sandy and Sandy Soils >50% coarse fraction passes #4 sieve	Sand <small>(with little or no fines)</small>	SW	Well Graded Sand
		<small>(with >12% fines)</small>	SP	Poorly Graded Sand
Sand <small>(with >12% fines)</small>		SM	Silty Sand	
		<small>(with >12% fines)</small>	SC	Clayey Sand
Fine-Grained Soils >50% passes #200 sieve	Silt and Clay Liquid Limit < 50		ML	Silt
			CL	Lean Clay
			OL	Organic Silt and Clay (low plasticity)
	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



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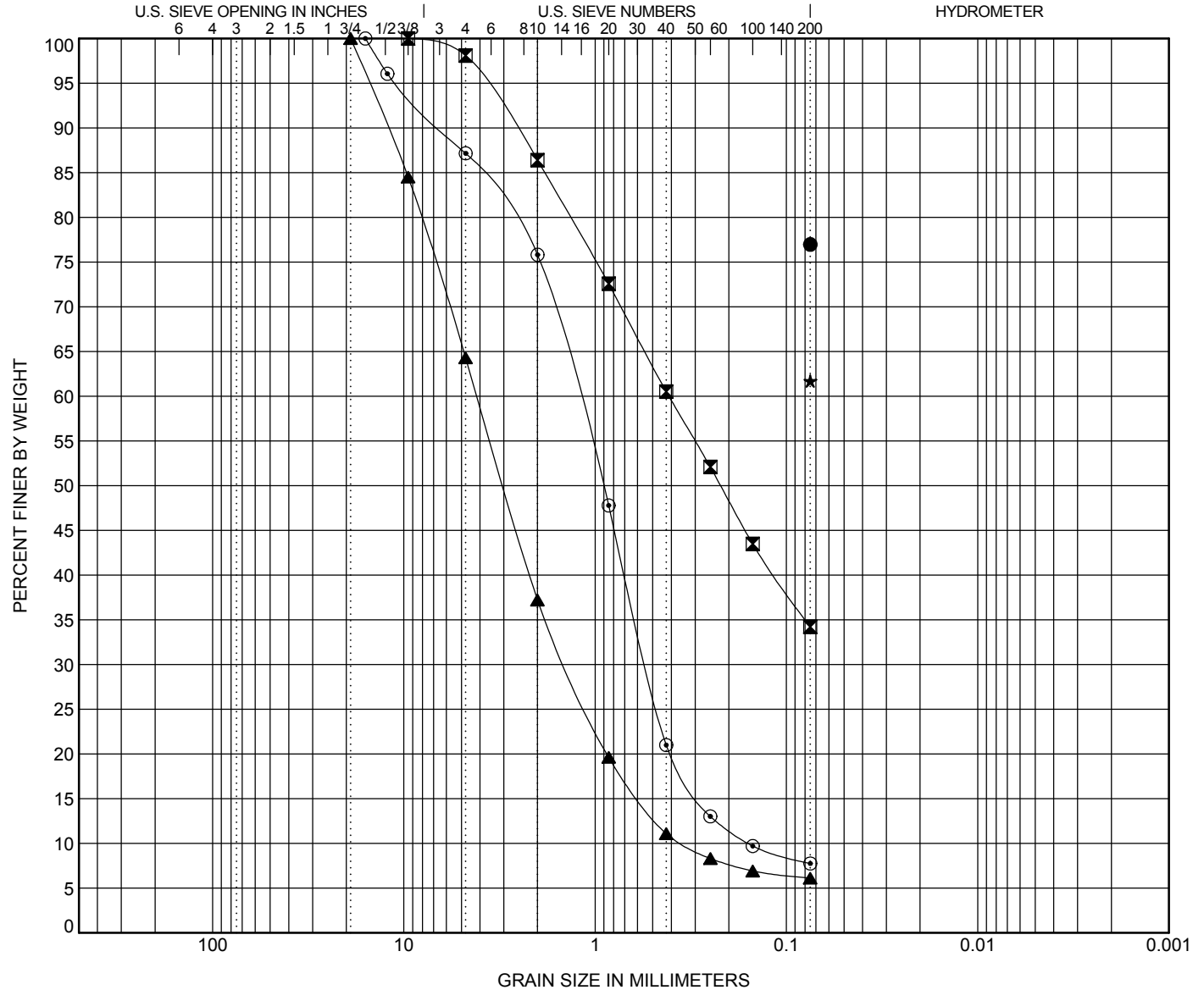
GRAIN SIZE DISTRIBUTION

CLIENT NAI Black

PROJECT NAME Gustin Levee

PROJECT NUMBER 14-037B

PROJECT LOCATION Spokane County



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

GRAIN SIZE - GINT STD US LAB.GDT - 7/23/15 15:31 - J:\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEVEE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEVEE.GPJ

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● B-1	5.0	CL-ML Sandy Silty Clay					24	20	4		
■ B-2	7.5	SM Silty Sand									
▲ B-2	15.0	SP-SM Poorly Graded Sand with Silt and Gravel								1.39	12.01
★ B-3	5.0	CL-ML Sandy Silty Clay					23	19	4		
◎ B-3	10.0	SP-SM Poorly Graded Sand with Silt								1.48	7.85
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
● B-1	5.0	0.075							77.0		
■ B-2	7.5	9.5	0.411			1.9	63.9		34.2		
▲ B-2	15.0	19	4.142	1.408	0.345	35.7	58.2		6.1		
★ B-3	5.0	0.075							61.7		
◎ B-3	10.0	15.9	1.234	0.537	0.157	12.8	79.4		7.8		



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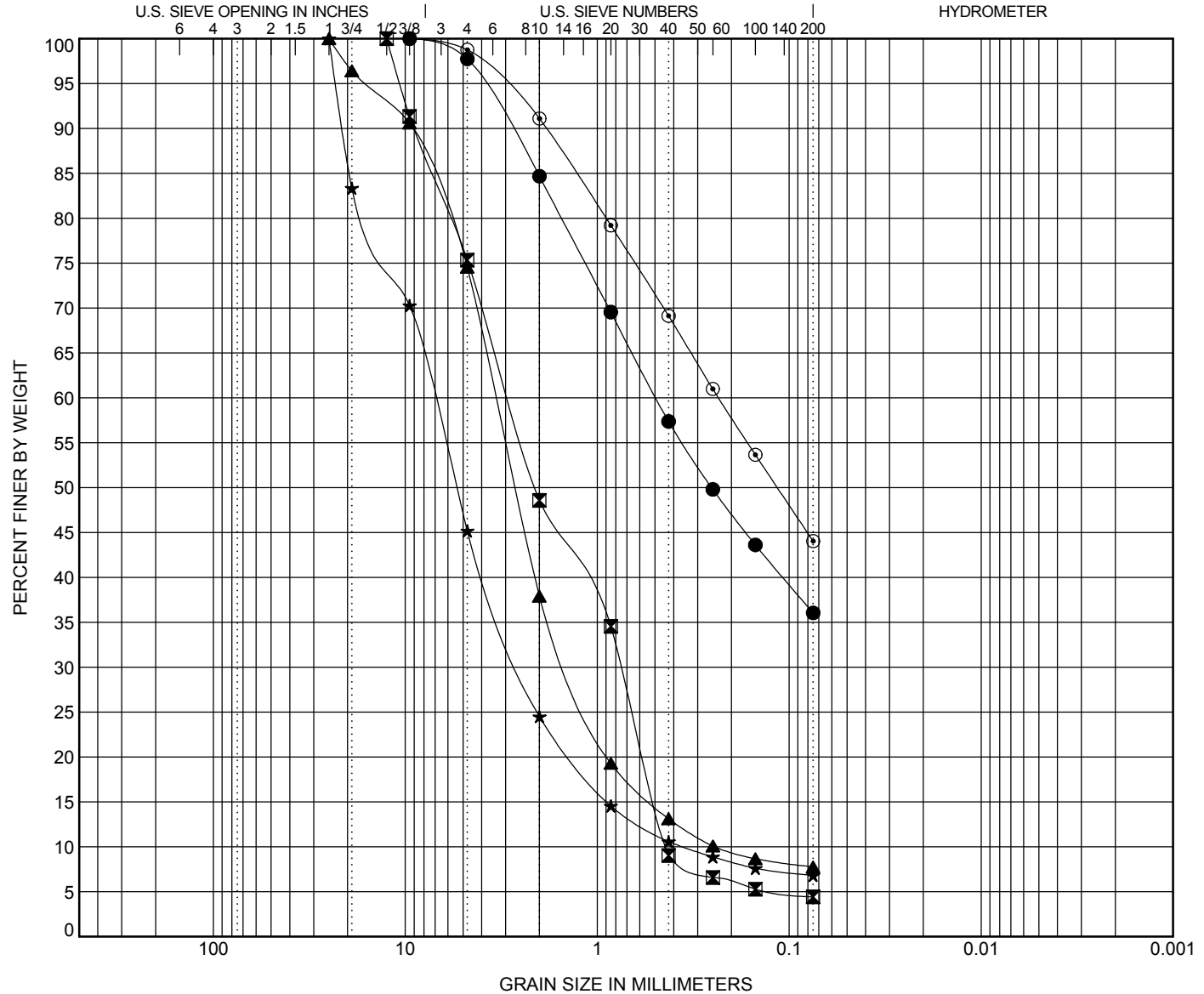
GRAIN SIZE DISTRIBUTION

CLIENT NAI Black

PROJECT NAME Gustin Levee

PROJECT NUMBER 14-037B

PROJECT LOCATION Spokane County



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
● B-4	2.5	SM Silty Sand					
☒ B-4	15.0	SP Poorly Graded Sand with Gravel				0.45	6.63
▲ B-5	10.0	SP-SM Poorly Graded Sand with Silt and Gravel				2.37	13.93
★ B-8	10.0	GP-GM Poorly Graded Gravel with Silt and Sand				2.50	20.18
◎ TP-1	4.0	SM Silty Sand					

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-4	2.5	9.5	0.494			2.3	61.7	36.1	
☒ B-4	15.0	12.5	2.893	0.751	0.436	24.7	70.9	4.4	
▲ B-5	10.0	25	3.369	1.391	0.242	25.5	66.8	7.8	
★ B-8	10.0	25	7.153	2.518	0.354	54.8	38.4	6.8	
◎ TP-1	4.0	9.5	0.233			1.2	54.7	44.0	

GRAIN SIZE - GINT STD US LAB.GDT - 7/23/15 15:31 - J:\IPEC PROJECTS\2014 PROJECTS\14-037B GUSTIN LEVEE FOR PAINTED HILLS\GINT\14-037B GUSTIN LEVEE.GPJ



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