


# GEOTECHNICAL REPORT
**for**
# USFWS FISH PASSAGE IMPROVEMENTS
# COPPER RIVER HIGHWAY
# CORDOVA, ALASKA

**Prepared for:**
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**Prepared by:**
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NGE-TFT Project # 5138-18

November 19, 2018 *BCE # 1684.18*

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*RE: Geotechnical Recommendations for the Proposed Fish Passage Improvements Project in Cordova, Alaska*

Dear Heather,

Bratslavsky Consulting Engineers, Inc. (BCE) and its subconsultant, Northern Geotechnical Engineering, Inc. (NGE) have completed the geotechnical engineering assessment of the eleven (11) sites on the above referenced project. Our assessment suggests that most of the sites are suitable for the proposed improvements provided that our engineering recommendations are incorporated into the design.

In the following report we provide a summary of our field and laboratory programs, our conclusions and recommendations regarding the suitability of the project site to support the proposed improvements, and our recommendations for the design and construction of the proposed site improvements.

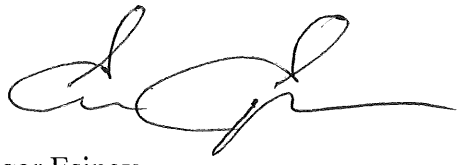
In the process of the field investigation, unsuitable materials were observed at four of the sites: COP 25, COP 33, COP 45, and CAB 2.

**CAB 2 -** The unsuitable materials encountered at CAB 2 are at the anticipated footing depth and we expect that they will have to be removed during the excavation for the proposed improvements.

**COP 25, COP 33, COP 45 -** Excavation of the unsuitable materials at these three sites is not feasible nor is it cost effective. Therefore, it is recommended that screw anchors (or piling) be installed under the culvert foundation to transfer the loads into more competent soils.

We appreciate the opportunity to provide professional services for this USFWS Program in Cordova. Please contact us with any questions or comments you may have regarding the information presented in this report.

Sincerely,



Egor Esipov
Project Manager

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# 1.0 INTRODUCTION

In this report, we (Northern Geotechnical Engineering, Inc. *d.b.a.* Terra Firma Testing) present the results of a geotechnical assessment that we conducted for the proposed U.S. Fish and Wildlife Service (USFWS) fish passage improvements along the Copper River Highway in Cordova, Alaska; hereafter referred to as "the project site". We provided our professional service in accordance with our service fee proposal #18-159 which we submitted to Bratslavsky Consulting Engineers, Inc. (BCE) on August 10, 2018. BCE authorized our proposed scope of service on October 4, 2018 by signed agreement contract.

BCE subcontracted us to perform subsurface explorations and geotechnical engineering analysis and provide design recommendations to replace eleven existing culverts along the Copper River Highway and Cabin Lake Road in Cordova, Alaska. The purpose of this project is to improve fish habitat and migration across the Copper River Highway. In this report, we present the results of our geotechnical assessment conducted for the proposed U.S. Fish and Wildlife Service (USFWS) fish passage improvements.

# 2.0 PROJECT OVERVIEW

This project lies within a geographic area that has been identified to be affected by the Exxon Valdez Oil Spill (EVOS). The EVOS Trustee Council (EVOSTC) has made the restoration of this area a priority, as it has affected a wide range of wildlife. This project is aimed to support the previous restoration efforts by the EVOSTC.

The restoration effort consists of ten proposed fish passage sites along the Alaska State Highway 10, also known as the Copper River Highway and one site along Cabin Lake Road near Cordova, Alaska. The fish passage sites are shown on the attached Figure 1. The Copper River Highway is a 50-mile, two-lane gravel surface road that was previously used as the Copper River and Northwestern Railway. The 73 culverts along the highway were not properly designed and, as such, the highway functions similarly to a dike. The culvert design has reduced the ecological functions in the area and causes expensive road repair following major high-water events.

To improve the drainage and increase fish habitat within the Copper River Watershed and Delta, the USFWS is proposing to replace/install fish passages at the eleven sites deemed highest priority.

# 3.0 CURRENT PROJECT SITE ACTIVITIES

## 3.1 Subsurface Exploration

We coordinated and directed a subsurface exploration program at the project site to help characterize the subsurface conditions of the project site as they currently exist. We subcontracted Discovery Drilling, Inc. (DDI) to provide the necessary geotechnical exploration services. A qualified representative from our office was present on-site during the entire exploration program





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to select the exploration locations, direct the exploration activities, log the geology of each exploration, and collect representative samples for further identification and laboratory analysis. Under our direction DDI advanced two soil borings, one upstream and one downstream, at each site for a total of 22 soil borings on October 12, 2018 through October 15, 2018 to depths of approximately 21.5 feet below the existing ground surface (bgs). General boring locations for each site are shown in Figures 2 through 12.

Under our direction, DDI performed a Modified Penetration Test (MPT) at regular intervals during the drilling of each borehole. An MPT can be used to assess the consistency of a soil interval and to collect representative soil samples. An MPT is performed by driving a 2.0-inch O.D. or 3.0-inch O.D. split-spoon sampler at least 18 inches past the bottom of the advancing augers with blows from a 340-lb drop-hammer, free-falling 30 inches onto an anvil attached to the top of the drill rod stem. Our field representative recorded the hammer blows required to drive the modified split-spoon sampler the entire length of each sample interval, or until sampler refusal was encountered. We have provided the field blow count data for each sample interval (in six-inch increments) on the graphical borehole logs contained in Appendix A of this report.

During the course of our subsurface exploration program, we encountered a physical phenomenon common to hollow-stem auger drilling known as "sand-heave" below the groundwater level. Sand-heave typically occurs when sampling saturated sand deposits with hollow stem augers/split-spoon samplers, as the increased hydrostatic pressure outside of the hollow-stem augers forces a sand slurry up into the hollow auger flights when the drill stem is removed (to allow for split-spoon sampling). At times, sand-heave can be significant; filling the inside of the hollow-stem auger flights with several feet of densely-packed sand. As a result, sand-heaving forces disturb the in-situ density of the sand deposit at the tip of the advancing augers and can lead to the collection of unrepresentative blow count data (i.e., soil resistance measurements) and a disturbed split-spoon sample.

Sand-heave can typically be controlled by filling the inside of the augers with an appropriate drilling fluid (e.g., water, drill mud, etc.) which equalizes the hydrostatic pressures inside and outside of the augers. In order to prevent sand heave, once below the water table, DDI primed the augers with water for each sample. We have noted on our borehole logs when efforts by DDI were ineffective in preventing the sand heave.

We corrected the field blow count data for all 22 boreholes for standard confining pressure, drill rod length, and drop-hammer operation procedure to estimate a standard $(N_1)_{60}$ value for each sample interval. $(N_1)_{60}$ values are a measure of the relative density (compactness) and consistency (stiffness) of cohesionless or cohesive soils, respectively. Our estimate of the $(N_1)_{60}$ values is based on the drop-hammer blows required to drive the spilt-spoon sampler the final 12-inches of an 18-inch MPT. We have provided our estimated $(N_1)_{60}$ values for each sample interval on the graphical borehole logs contained in Appendix A of this report. The automatic drop-hammer that DDI used for this project is not standard, so we applied a correction factor of 1.1 to the $(N_1)_{60}$ values to





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account for the efficiency of the automatic drop-hammer used. We have provided a graphical plot of the field blow count corrections that we used to correct for confining pressure and drill rod length in Figure 13 of this report.

Our field representative photographed each split-spoon sample that they collected during our exploration program and we have included these photographs in Appendix A of this report. Our field representative sealed each sample that they collected during our subsurface exploration program inside of an air-tight bag and/or container, to help preserve the moisture content of each sample, and then submitted each sample to our laboratory for further identification and analysis.

Once the exploration activities were complete, we directed DDI to backfill the annulus of each exploration with its respective drill cuttings.

### 3.2 Survey

BCE and the U.S. Fish and Wildlife Service met on site on October 10, 2018. A surveyor, contracted by BCE, was also on site and placed stakes at each of the proposed culvert crossing improvements.

## 4.0 LABORATORY TESTING

We collected a total of 154 soil samples from the 22 geotechnical borings that DDI advanced at the project site and submitted all of the soil samples to our laboratory for further identification and geotechnical analysis. We tested select soil samples in accordance with the respective ASTM standard test methods including:

- moisture content analysis (ASTM D-2216);
- determination of fines content (a.k.a. P200 – ASTM D-1140);
- grain size sieve and hydrometer analysis (ASTM D-6913 & D-422); and
- organic content (ASTM D2974);

It is important to note that ASTM test method D-6913 requires that any soil sample specimen which is to be submitted for gradational analysis (by ASTM D-422 or other methods) must satisfy a minimum mass requirement based on the maximum particle size of the sample specimen. Split-spoon sampling techniques (standard or modified), as well as other small-diameter soil sampling techniques (e.g., macro-core, etc.), typically recover anywhere from approximately 1 to 10 pounds of sample specimen. The amount of sample specimen recovered can be influenced by (amongst other variables) the soil gradation, soil density, sample interval, sampler tooling, and soil moisture content. As a result, samples of coarse-grained soils (with individual soil particles greater than approximately 0.75 inches in diameter) collected with small-diameter sampling methods (e.g., split-spoons, macro-core, etc.) may not meet the minimum mass requirement specified by Table 2 of ASTM D-6913. This may result in inaccurate gradational and frost classification results. The use of small-diameter sampling devices in coarse-grained soils (e.g., sand and gravel) can result in





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the collection of unrepresentative samples due to: the exclusion of oversized particles (larger than the opening of the sampler) from the sample; and the mechanical breakdown/degradation of coarse-grained particles by the sampling process (producing an unrepresentative increase in smaller-diameter particles in the sample). Both of these sampling biases can skew laboratory test results towards the fine-grained end of the gradational spectrum.

The laboratory test results, along with the observations we made during our subsurface exploration efforts, aid in our evaluation of the subsurface conditions at the project site and help us to assess the suitability of the subsurface materials located at the project site to support the proposed improvements. We have included the results of our geotechnical laboratory analyses on the graphical exploration logs contained in Appendix A of this report and on the laboratory data sheets contained in Appendix B of this report.

# 5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

We compiled our field observations with the results from our laboratory analyses to produce graphical logs of each subsurface exploration (Appendix A). The graphical exploration logs depict the subsurface conditions that we identified at each exploration location and help us to interpret/extrapolate the subsurface conditions for areas adjacent to, and immediately surrounding, each exploration location across the project site

## 5.1 General Subsurface Profile

Each site exploration was advanced through the road section at the locations where culverts are proposed to be installed/replaced. The road section generally consists of well-graded gravel with silt and sand to well-graded sand with silt and gravel and ranged between 4 and 10 feet in thickness. Differentiation between the road and the underlying native soils was not consistently apparent. Underlying the road section, the soils are consistent with streambed deposits, consisting of sands and gravels with varying amounts of silt. We provide more detailed subsurface profiles for each site in Section 7.0.



# 6.0 ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

## 6.1 General Site Conclusions

Based on the findings of our field efforts and laboratory testing, it is our conclusion that the sand and gravel soils which we observed across at each project site are generally suitable to support the proposed improvements; provided that our concerns and recommendations that we present in this report are addressed by the design and construction processes.

Based on the example figures in the request for proposal submitted by the USFWS, we anticipate that the most likely culvert will be an open-channel, box culvert design (as shown in Figure 14). We have based our recommendation and conclusions to accommodate this design. If the design is significantly different, we will revise our recommendations accordingly.



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### 6.2 Earthworks

Our recommendations assume that any shallow foundations (i.e., poured-concrete footings) will be founded either directly onto the undisturbed sand and gravel soils or compacted structural fill pads constructed directly above the undisturbed silty sand and gravel soils. Any structural fill materials used on-site should be compacted to a minimum of 95 percent of the modified Proctor density.

Any material removed during the initial site grading and excavation activities, which does not contain any organic/deleterious material, and has relatively low silt content (less than 15 percent passing the #200 sieve), can be re-used on-site as structural fill. Proper placement and compaction techniques need to be applied during the backfill. Additional laboratory testing may be required to verify the frost susceptibility of any excavated soil for use in shallow fill applications.

All earthworks should be completed with quality control inspection, including: bottom-of-hole inspections; fill gradation classification; and in-situ compacting testing. A bottom-of-hole inspection should be conducted by a qualified geotechnical engineer, geologist, or special inspector following site excavation activities (and before any foundation construction begins) in order to visually confirm the findings of this report and provide recommendations for any non-conforming conditions encountered during the excavation activities.

Any and all fill material used should be placed at 95 percent of the modified Proctor density as determined by ASTM D-1557, unless specifically stated otherwise in other sections of this report. The thickness of individual lifts will be determined based on the equipment used, the soil type, and existing soil moisture content. Typically, fill material will need to be placed in lifts of less than one-foot in thickness. All earthworks should be completed with quality control inspection.

In our professional experience, structural fill should have less than approximately 10 to 15 percent passing the #200 sieve for ease of placement. Soils with higher silt contents can be used within the foundation footprint. However, the effort required to achieve proper compaction of silt-rich soils may be more expensive than purchasing better grade materials. The time of year, existing moisture content, rainfall, air temperature, and fill temperature can all have an impact on the effort required to adequately compact silt-rich material.

Any excavated fill or native sand and gravel soils (which are free of organic material and have relatively low silt contents) which are stockpiled on-site (for later use as structural backfill) should be protected from additional moisture inputs (precipitation, etc.) through the use of plastic tarps, etc. Additional moisture inputs can have detrimental effects on the effort needed to achieve proper compaction rates.





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### 6.3 Shallow Foundations

Care should be taken during foundation excavation activities to limit the disturbance of the bottom of any foundation excavations. The bottom of any foundation excavation should be moisture conditioned and proof-rolled as necessary to return the exposed soils to their original in-situ density.

#### 6.3.1.1 Strip Footings

Strip footings can be founded directly onto the undisturbed sand and gravel. The minimum horizontal dimension for the strip footings should be 16 inches. The footings should be placed a minimum of 24 inches below the finished streambed elevation to achieve the recommended allowable soil bearing capacity and help resist any lateral forces.

### 6.4 Settlements

Settlements for shallow foundations should be within tolerable limits, provided that they are placed directly onto the undisturbed sand and gravel or structural. We anticipate a total settlement for shallow concrete foundations placed on either the undisturbed describe the foundation soils and/or or structural fill placed above the undisturbed describe the foundation soils to be less than three-quarters (3/4) of an inch, with differential settlements comprising about one-half (1/2) of the total anticipated settlement. Settlement amounts could increase substantially if the structural fill material used to bring any foundation pads to grade is not properly compacted. Most of the settlements should occur as the building loads are applied, such that additional long-term settlements should be relatively small and within tolerable limits.

### 6.5 Seismic Design Parameters

The seismic site classification for the project site is D based on the $(N_1)_{60}$ values that we calculated for the sand and gravel soils that occur at the project site. We utilized the United States Geological Survey (USGS) Seismic Design Maps tool for the project site in Cordova, AK as shown at the website (http://earthquake.usgs.gov/designmaps/us/application.php) to calculate the seismic design parameters for the project site, which are $F_a$ = 1.000 ($S_s$ = 1.630 g) and $F_v$ = 1.500 ($S_1$ = 0.823 g). A copy of the USGS Design Maps report for the project site is contained in Appendix C of this report.

During our field explorations, we encountered soils which have the potential to liquefy under a strong-motion seismic event. In the event liquefaction occurs, the soils under both the road and the culvert will be impacted equally. As such, measures to mitigate liquefaction of the soils are unlikely to cost effective.

The potential for earthquake-induced lateral spreading and pressure ridges is unlikely.





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### 6.6 Winter Construction

It is imperative that shallow foundations remain in a thawed state for the entire construction period; even when dealing with soils that have little to no frost susceptibility. Foundation soils that are allowed to freeze during the initial construction may be compromised by the development of ice lenses. Upon thawing, which may take several weeks or months, potential differential settlements could distort the structure resulting in damaged foundations. If construction extends into the winter months, temporary enclosures should be constructed which completely enclose foundations and heat should be applied to the enclosure to prevent freezing of the soils located beneath any foundation.

Proper placement and compaction of structural fill is not possible when fill material is frozen, and as such, frozen fill material should never be used for structural support unless it has been subsequently thawed and compacted to 95 percent of the modified Proctor density (throughout its vertical extent). Furthermore, subgrade soils (fill or native) need to be completely thawed prior to the placement and compaction of additional lifts of thawed fill material. In our professional experience, ambient soil temperatures need to be above 37 °F in order to achieve efficient compaction. It is extremely difficult to achieve compaction levels equal to 95 percent of the modified Proctor density in fill material that is between 32 °F to 37 °F.

## 7.0 DESIGN RECOMMENDATIONS

For the culvert foundations we assumed a strip foundation on each side of the culvert. The assumed foundation is a minimum of 16 inches wide and two feet in depth as shown in Figure 15. The forces on the foundation are also shown in Figure 15. Soil pressure on the culvert arch can be calculated assuming a soil density of 135 pcf. Traffic loads will be a function of the cover depth and wheel loads. We have not provided these loads because we have not received the final design.

### 7.1 SITE COP 1

#### 7.1.1 Subsurface Profile

The soils at this site are comprised of approximately five feet of well graded gravel with silt and sand. The gravel is underlain by approximately four feet of well graded sand with silt and gravel to well graded sand with gravel on the upstream side and two feet of silty sand overlaying well graded sand with silt and gravel on the downstream side. There is a thin (<2’) layer of stiff silt underlying the sand on the downstream side. The sand and silt are underlain by approximately ten feet of poorly graded sand with silt and gravel overlaying stiff silt.

We encountered groundwater at this site at approximately six to seven feet below the road surface.





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### 7.1.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 1,800 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 2,300 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.2 SITE COP 9

### 7.2.1 Subsurface Profile

Upstream, the soils consist of approximately 5 feet of poorly graded gravel with sand overlaying approximately 5 feet of poorly graded sand with silt and gravel and approximately 2 feet of well graded gravel with silt and sand. Downstream, the soils consist of approximately 12 feet of well graded gravel with silt and sand. Underlying the gravel, the soils consist of silty sand to sandy silt to the extents of our exploration.

We encountered groundwater at this site at approximately seven to nine feet below the road surface.

### 7.2.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed silty sand may be designed for an allowable soil bearing capacity of 2,200 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 2,500 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.3 SITE COP 20

### 7.3.1 Subsurface Profile

The upstream soils consist of approximately seven feet of poorly graded to well graded gravel and sand with varying amounts of silt overlaying approximately two feet of well graded sand. Underlying the sand, the soils consist of well graded gravel with sand. We encountered sand heaving in the auger during our exploration at approximately 20 feet below the road surface.

The downstream soils consist of approximately 10 feet of well graded to poorly graded sand with silt. Underlying the sand, the soils consist of approximately 5 feet of well graded gravel with sand overlaying well graded sand with silt and gravel.

We encountered groundwater at this site approximately five to six feet below the road surface.





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### 7.3.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 1,800 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 1,800 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.4 SITE COP 22

### 7.4.1 Subsurface Profile

In our upstream exploration, we encountered approximately seven feet of medium dense to loose, well graded sand with silt and gravel overlaying medium dense, well graded gravel with sand and varying amounts of silt.

In our downstream exploration, we encountered approximately five feet of medium dense, well graded gravel with silt and sand overlaying approximately five feet of loose to medium dense, well graded sand with silt and gravel. Underlaying the sand is approximately two feet of medium dense, well graded sand with gravel overlaying dense to loose, poorly graded sand with gravel.

We encountered groundwater at this site at approximately six to seven feet below the road surface.

### 7.4.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 1,500 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 2,500 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.5 SITE COP 25

### 7.5.1 Subsurface Profile

Upstream, the soils consist of approximately five feet of loose, well graded gravel overlaying approximately five feet of very loose to loose, well graded sand with gravel and varying amounts of silt. The soils underlaying the sand are approximately five feet of medium dense well graded gravel with sand overlaying medium dense sand to sand with silt and gravel.

Downstream, the soils consist of approximately 15 feet of medium dense to very loose sand with gravel and varying amounts of silt. Underlying the sand is approximately two to three feet of highly organic soil/peat underlain by loose sand with silt.

We encountered groundwater at this site at approximately five to seven feet below the road surface.





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### 7.5.2 Soil Bearing Capacity

The highly organic soil/peat we encountered at approximately 15 feet below the road surface is not suitable for foundation support. Excavation of the peat is not feasible given the distance below the groundwater table. We recommend using 2-inch diameter screw anchors with a 10-inch diameter flight (as shown in Figure 16) to transfer the load through the peat to the underlying sandy soils. The screw anchor at 20 feet below the road surface can be designed for an allowable bearing capacity of 4,000 pounds. The culvert foundation may be designed for an allowable lateral resistance of 2,000 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.6 SITE COP 33

### 7.6.1 Subsurface Profile

The soils we encountered in the upstream exploration consisted of approximately 12 feet of loose to very loose, well graded gravel with sand overlying approximately three feet of very loose, silty sand and approximately three feet of very loose sand with silt and gravel. We encountered a thin (<1') layer of decomposing wood debris at approximately 16 feet below the road surface overlaying soft silt and loose silty sand.

In the downstream exploration, we encountered loose, poorly graded gravel and loose silty sand to approximately eight feet below the road surface. Underlying the silty sand is approximately five feet of loose, poorly graded gravel with silt and sand overlaying medium dense, poorly graded sand with silt and gravel to loose silty sand and silty gravel.

We encountered groundwater at this site at approximately seven feet below the road surface.

### 7.6.2 Soil Bearing Capacity

The decomposing wood debris we encountered at approximately 17 feet below the road surface is not suitable for foundation support. Excavation of the debris is not feasible given the distance below the groundwater table. We recommend using 2-inch diameter screw anchors with a 10-inch diameter flight (as shown in Figure 16) to transfer the load through the peat to the underlying sandy soils. The screw anchor at 20 feet below the road surface can be designed for an allowable bearing capacity of 4,000 pounds. The culvert foundation may be designed for an allowable lateral resistance of 2,800 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.





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## 7.7 SITE COP 43

### 7.7.1 Subsurface Profile

Upstream, we encountered approximately seven feet of medium dense to loose, well graded sand with silt and gravel overlaying loose to medium dense silty sand and gravel.

Downstream, we encountered approximately five feet of medium dense, well graded gravel with silt and sand overlaying approximately two feet of medium dense, well graded sand with gravel and approximately 15 feet of loose to very loose silty sand to medium dense, poorly graded sand with silt and gravel.

We encountered groundwater at this site at approximately three feet below the road surface.

### 7.7.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 1,400 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 1,200 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.8 SITE COP 44

### 7.8.1 Subsurface Profile

The soils upstream consist of approximately 10 feet of dense to medium dense, well graded gravel with sand overlaying approximately 3 feet of loose, sand with silt and gravel. Underlying the loose sand is very soft to medium stiff sandy silt to the bottom of the exploration.

The soils downstream consist of approximately 10 feet of very dense to medium dense well graded gravel and sand overlaying approximately 5 feet of loose sand with gravel. Underlying the loose sand is very loose to loose, silty sand to the bottom of the exploration.

We encountered groundwater at this site at approximately 2.5 feet below the road surface.

### 7.8.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 2,300 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 1,200 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.





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## 7.9 SITE COP 45

### 7.9.1 Subsurface Profile

In our upstream exploration, we encountered approximately five feet of well graded sand with gravel overlaying very loose silty sand to ten feet below the road surface. Underlying the silty sand is approximately 10 feet of medium dense sand and gravel.

Downstream, the soils consist of approximately 10 feet of medium dense, well graded to poorly graded gravel and sand with silt. Underlying the sand and gravel is approximately three feet of very loose, silty sand overlaying medium dense gravel with silt and sand.

We encountered groundwater at this site at approximately three feet below the road surface.

### 7.9.2 Soil Bearing Capacity

The very loose silty sand we encountered at approximately seven to ten feet below the road surface is not suitable for foundation support. Excavation of the loose soil is not feasible given the distance below the groundwater table. We recommend using 2-inch diameter screw anchors with a 10-inch diameter flight (as shown in Figure 16) to transfer the load through the very loose soil strata to the underlying dense sand and gravel soils. The screw anchor at 20 feet below the road surface can be designed for an allowable bearing capacity of 3,500 pounds. The culvert foundation may be designed for an allowable lateral resistance of 1,100 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.10 SITE CAB 2

### 7.10.1 Subsurface Profile

Due to utility conflicts at the site, both borings were advanced on the downstream side of the road on either side of the culvert. In the northern boring, we encountered approximately seven feet of medium dense, well graded gravel with silt and sand overlaying approximately eight feet of loose, well graded sand with silt and gravel. Underlying the sand is loose to medium dense silty sand.

The soils in the southern boring consisted of approximately three feet of gravel with silt and sand overlaying medium stiff silt with sand to approximately five feet below the road surface. Underlying the silt is approximately one foot of silty sand. We encountered solid wood debris at approximately six feet below the road surface overlaying approximately eight feet of medium dense, well graded gravel with silt and sand. Underlying the gravel is silt with sand to silty sand to the depth of the exploration.

We encountered groundwater at this site at approximately 4.5 below the road surface.





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### 7.10.2 Soil Bearing Capacity

The wood debris encountered at approximately six feet below the road surface will need to be completely removed from the footprint of the proposed culvert.

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 1,500 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 1,500 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

## 7.11 SITE SHER 1

### 7.11.1 Subsurface Profile

This site contained two culvert crossings. One crossing was immediately adjacent to the Copper River Highway. This culvert was smaller in diameter and we observed it to be completely submerged. The second culvert was approximately 500 feet from the highway and was in very poor condition. The culvert was large, contained no water around the entrance or exit, and appeared to have collapsed in the center of the road. Conversations with the design engineer led us to understand that the new culver crossing would be placed between the two existing culverts. The road at the site was very narrow, so our borings were placed adjacent to the existing culverts.

In the northern boring, we encountered approximately seven feet of poorly graded gravel with sand overlying medium dense to loose, well graded to poorly graded sand with silt and varying amounts of gravel.

In the southern boring, the soils consisted primarily of medium dense to loose sand and silty sand with varying amounts of gravel.

We encountered groundwater at this site at approximately six below the road surface.

### 7.11.2 Soil Bearing Capacity

Concrete foundations placed on the undisturbed sand and gravel may be designed for an allowable soil bearing capacity of 1,700 pounds per square foot (psf). The culvert foundation may be designed for an allowable lateral resistance of 2,000 psf. Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

# 8.0 THE OBSERVATIONAL METHOD

A comprehensive geoprofessional service (e.g., geotechnical, geological, civil, and/or environmental engineering, etc.) should consist of an interdependent, two-part process comprised of:





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Part I - pre-construction site assessment, engineering, and design; and

Part II - continuous construction oversight and design support.

This process, commonly referred to in the geoprofessional industry as "The Observational Method", was developed to reduce the costs required to complete a construction project, while simultaneously reducing the overall risk associated with the design and construction of the project.

In geotechnical engineering, Part I of the Observational Method (OM) begins with a geotechnical assessment of the site, which typically consists of some combination of literature research, site reconnaissance, subsurface exploration, laboratory testing, and geotechnical engineering. These efforts are usually documented in a formal report (e.g., such as this report) that summarizes the findings of the geotechnical assessment, and presents provisional geotechnical engineering recommendations for design and construction. Geotechnical assessment reports (and the findings and recommendations contained within) are considered provisional due to the fact that their contents are typically based primarily on limited subsurface information for a site. Most conventional geotechnical exploration programs only physically characterize a very small percentage of a given site, as it is typically cost prohibitive to conduct extensive (i.e. high density/frequency) exploration programs. As an alternative, geoprofessionals use the subsurface information available for a site to extrapolate subsurface conditions between exploration locations and develop appropriate provisional recommendations based on the inferred site conditions. As a result, the geoprofessional of record cannot be certain that the provisional recommendations will be wholly applicable to the site, as subsurface conditions other than those identified during the geotechnical assessment may exist at the site which could present obstacles and/or increased risk to the proposed design and construction.

Part II of the OM is employed by geoprofessionals to help reduce the risk associated with unidentified and/or unexpected subsurface conditions. Geoprofessionals accomplish Part II of the OM by providing construction oversight (e.g., construction observation, inspection, and testing). Part II of the OM is a valuable service, as the geoprofessional of record is available if unexpected conditions are encountered during the construction process (e.g., during excavation, fill placement, etc.) to make timely assessments of the unexpected conditions and modify their design and construction recommendations accordingly; thus reducing considerable cost resulting from potential construction delays and reducing the risk of future problems resulting from inappropriate design and construction practices.

Oftentimes, a client may be persuaded to use an alternative geoprofessional firm to conduct Part II of the OM for a given project; as some geoprofessional firms offer the same services at discounted prices in order to help them obtain the overall construction materials engineering and testing (CoMET) commission. The geoprofessional industry as a whole recommends against this practice. An alternative geoprofessional firm cannot provide the same level of service as the geoprofessional of record. The geoprofessional of record has (amongst other things) a unique





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familiarity with the project including; an intimate understanding of the subsurface conditions, the proposed design, and the client's unique concerns and needs, as well as other factors that could impact the successful completion of a construction project. An alternative geoprofessional firm is not aware of the inferences made and the judgment applied by the geoprofessional of record in developing the provisional recommendations, and may overlook opportunities to provide extra value during Part II of the geoprofessional service.

Clients that prevent the geoprofessional of record from performing a complete service can be held solely liable for any complications stemming from engineering omissions as a result of unidentified conditions. The geoprofessional of record may not be liable for any resulting complications that occur, as the geoprofessional of record was not able to complete their services. Furthermore, the replacement geoprofessional firm may also be found to have no liability for the same reasons.

We are available at any time to discuss the OM in more detail, or to provide you with an estimate for any additional construction observation and testing services required.

## 9.0 CLOSURE

We (Northern Geotechnical Engineering, Inc. d.b.a. Terra Firma Testing) prepared this report exclusively for the use BCE and their consultants. for use in the design and construction of the proposed improvements. We should be notified if significant changes are to occur in the nature, design, or location of the proposed improvements in order that we may review our conclusions and recommendations that we present in this report and, if necessary, modify them to satisfy the proposed changes.

This report should always be read and/or distributed in its entirety (including all figures, exploration logs, appendices, etc.) so that all of the pertinent information contained within is effectively disseminated. Otherwise, an incomplete or misinterpreted understanding of the site conditions and/or our engineering recommendations may occur. Our recommended best practice is to make this report accessible, in its entirety, to any design professional and/or contractor working on the project. Any part of this report (e.g., exploration logs, calculations, material values, etc.) which is presented in the design/construction plans and/or specifications for the project should have an adequate reference which clearly identifies where the report can be obtained for further review.

Due to the natural variability of earth materials, variations in the subsurface conditions across the project site may exist other than those we identified during the course of our geotechnical assessment. Therefore, a qualified geotechnical engineer, geologist, and/or special inspector be on-site during construction activities to provide corrective recommendations for any unexpected conditions revealed during construction (see our discussion of the Observational Method in Section 8.0 of this report for more detail). Furthermore, the construction budget should allow for any unanticipated conditions that may be encountered during construction activities.





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We conducted this evaluation following the standard of care expected of professionals undertaking similar work in the State of Alaska under similar conditions. No warranty, expressed or implied, is made.





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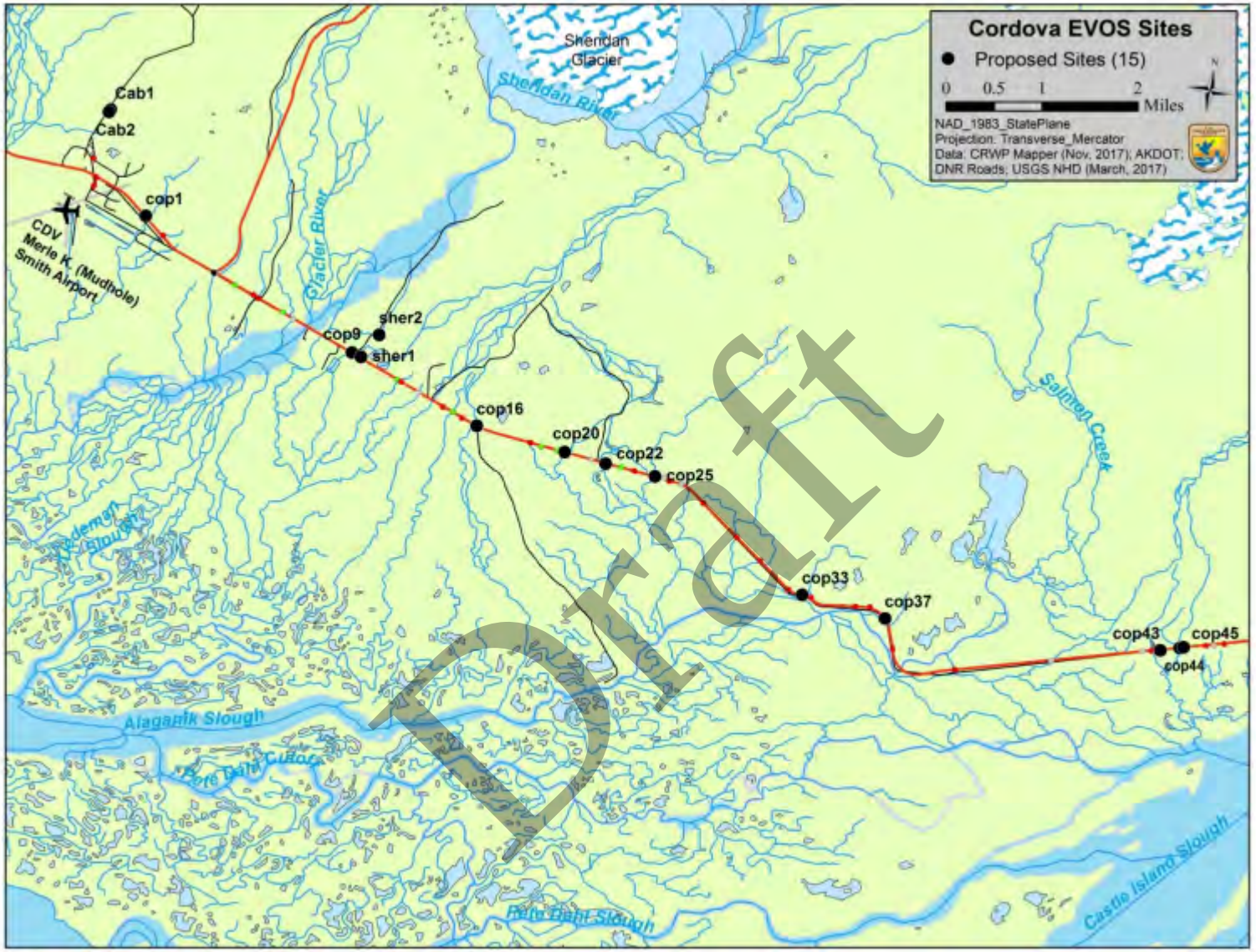
# REPORT
# FIGURES

Location Map Copper River Watershed and Delta






NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | |
|---|---|
| FIGURE TITLE: SITE OVERVIEW | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 1 |


SITE COP 1:
N60.49168, W145.45538
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | |
|---|---|
| FIGURE TITLE: SITE COP 1 | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 2 |




SITE COP 9:
N60.4743, W145.3881
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | | |
|---|---|---|
| FIGURE TITLE: SITE COP 9 | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | | FIGURE NUMBER: 3 |


SITE COP 20:
N60.4630, W145.3207
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

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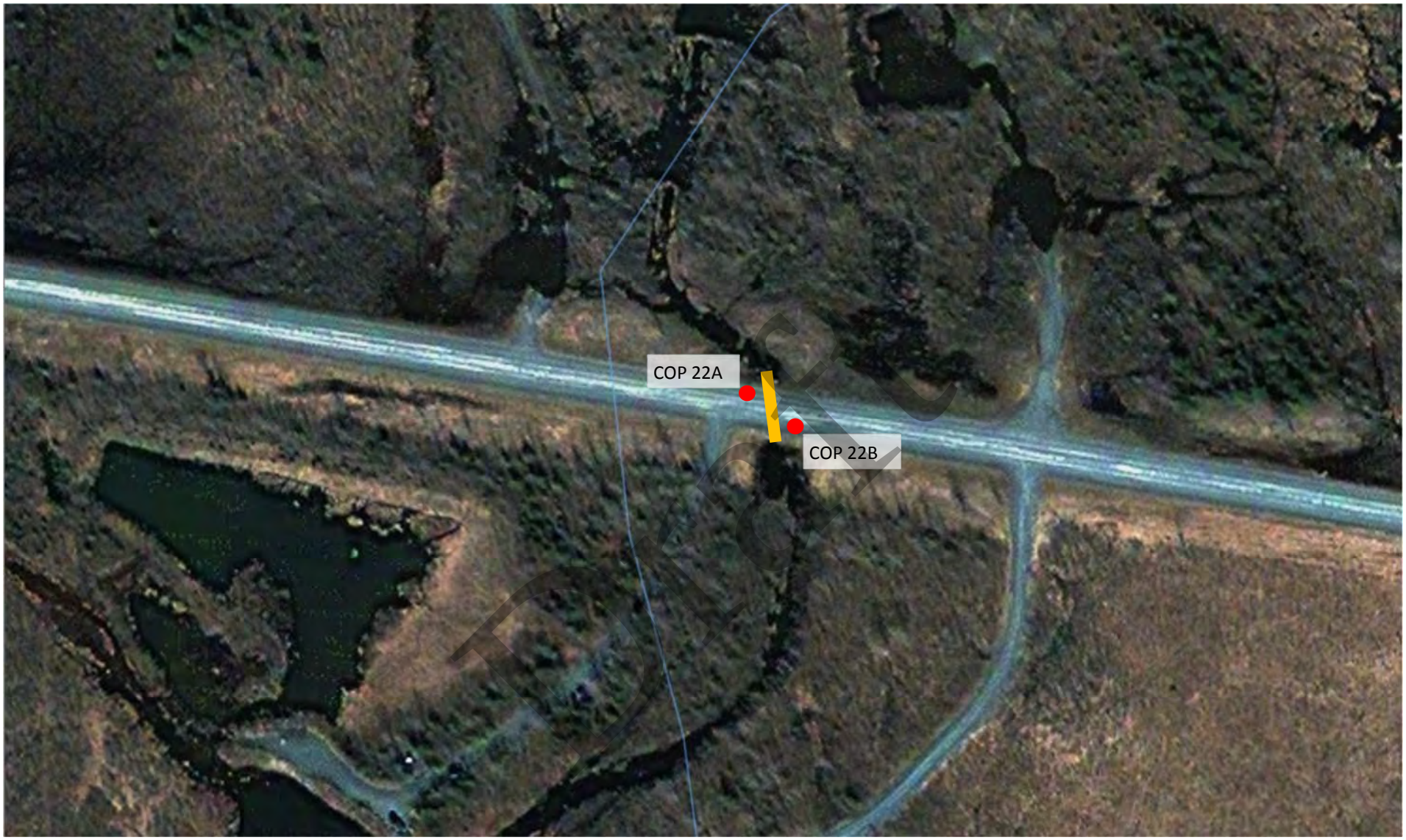
| | |
|---|---|
| FIGURE TITLE: SITE COP 20 | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 4 |




SITE COP 22:
N60.4620, W145.3081
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | | |
|---|---|---|
| FIGURE TITLE: SITE COP 22 | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | | FIGURE NUMBER: 5 |




SITE COP 25:
N60.46078, W145.2444
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | | |
|---|---|---|
| FIGURE TITLE: SITE COP 25 | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | | FIGURE NUMBER: 6 |


SITE COP 33:
N60.4453, W145.2444
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | |
|---|---|
| FIGURE TITLE: SITE COP 33 | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 7 |


SITE COP 43:
N60.4425, W145.1342
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | |
|---|---|
| FIGURE TITLE: SITE COP 43 | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 8 |


SITE COP 44:
N60.443, W145.1285
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | |
|---|---|
| FIGURE TITLE: SITE COP 44 | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 9 |


SITE COP 45:
N60.44318, W145.12714
BORING IN ROAD SHOULDER
OWNED BY: ADOT

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | | |
|---|---|---|
| FIGURE TITLE: SITE COP 45 | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | | FIGURE NUMBER: 10 |


SITE SHER 1:
N60.47399, W145.38571
BORING IN ROAD SHOULDER
OWNED BY: USFS?/ADOT?

= Approx. Culvert Location

= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
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| | | |
|---|---|---|
| FIGURE TITLE: SITE SHER 1 | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | | FIGURE NUMBER: 11 |


SITE CAB 2:
N60.50665, W145.46990
BORING IN ROAD SHOULDER
OWNED BY: USFS?/ CORDOVA?

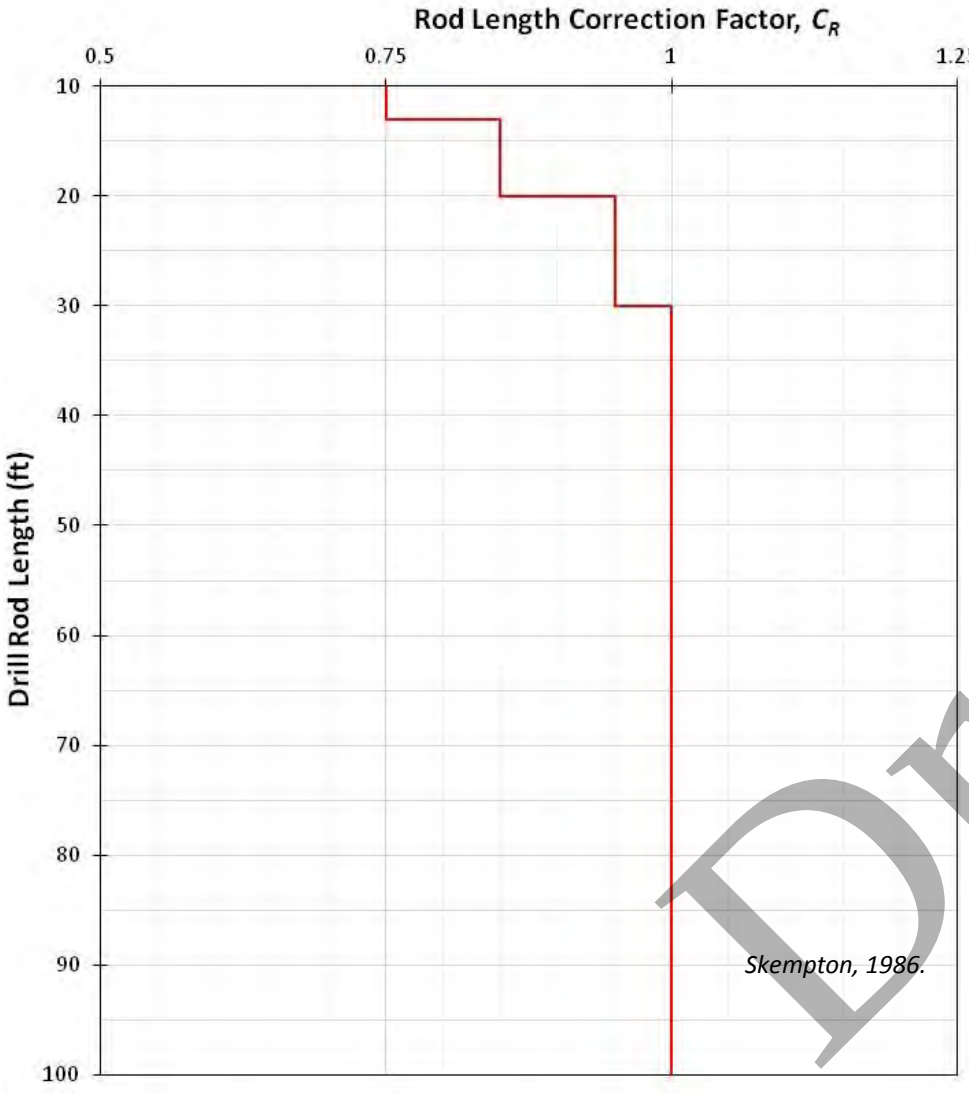
= Approx. Culvert Location

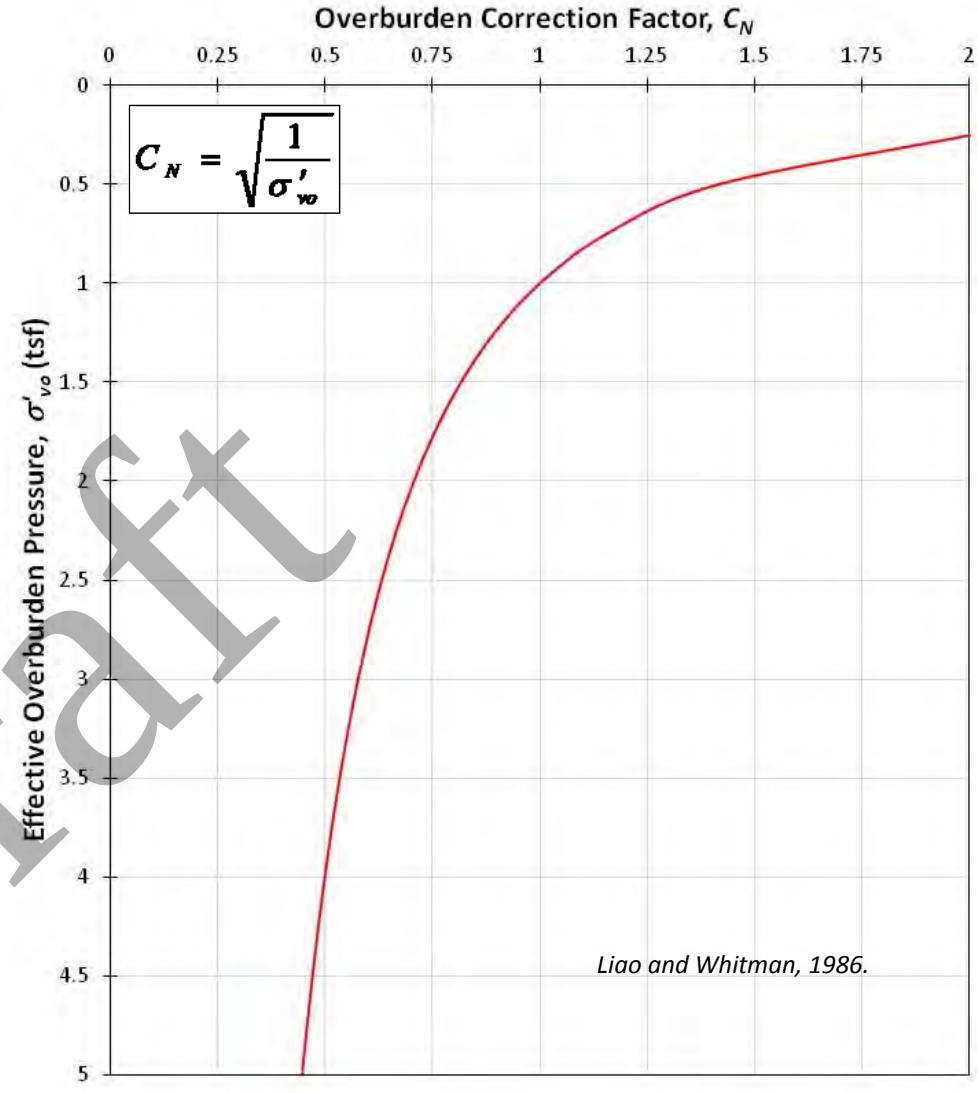
= Approx. Borehole Location

N

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | |
|---|---|
| FIGURE TITLE: SITE CAB 2 | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5638-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 12 |



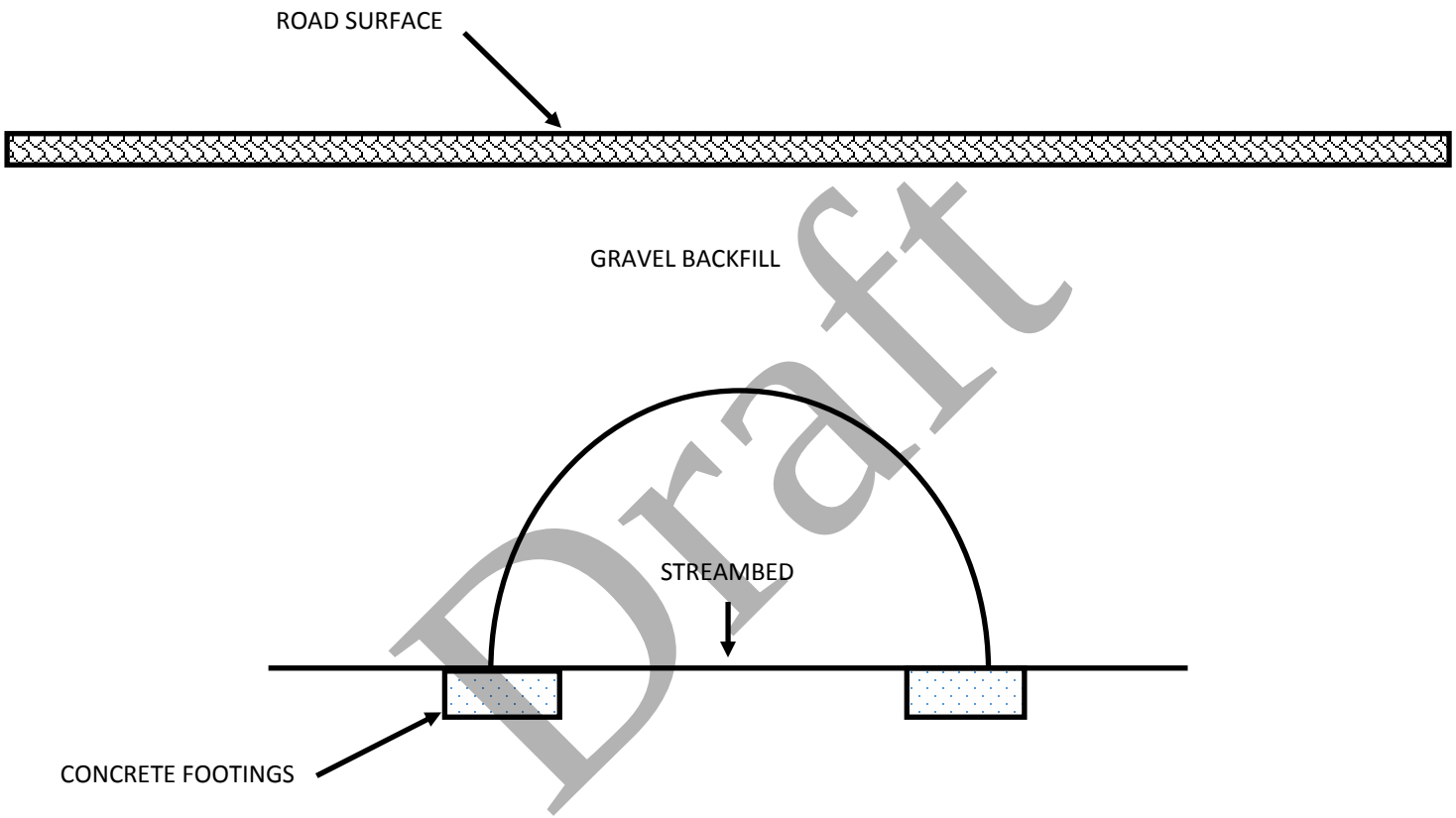



**Notes:**

- Overburden correction factor is used only for cohesionless soils
- $C_N$ is the ratio of the measured blow count to what the blow count would be at an overburden pressure of 1 ton/ft$^2$
- $\sigma'_{vo}$ is the effective overburden pressure at the point of measurement (ton/ft$^2$)

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

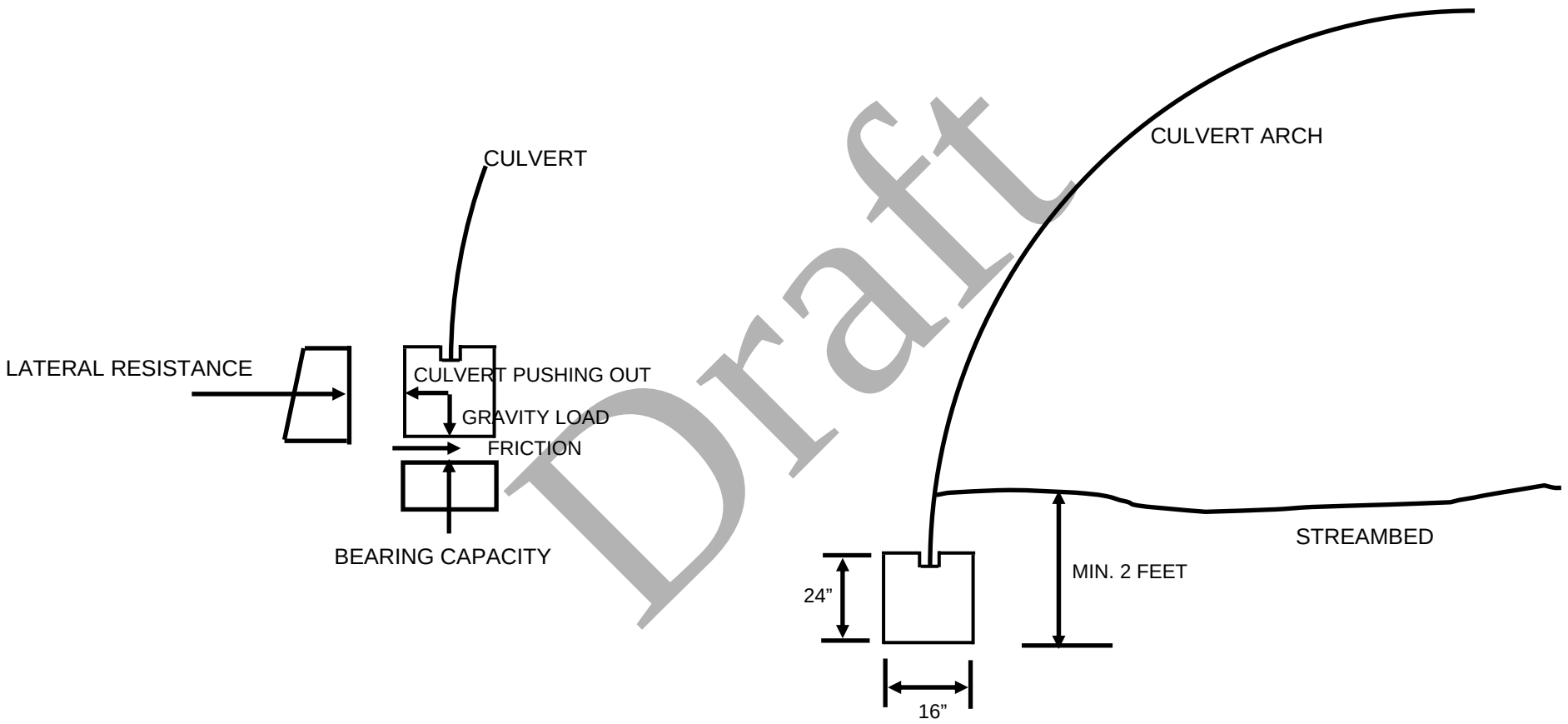
| | |
|---|---|
| FIGURE TITLE: BLOW COUNT CORRECTIONS | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | PROJECT ID: 5138-18 |
| PROJECT LOCATION: CORDOVA, ALASKA | FIGURE NUMBER: 13 |






NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

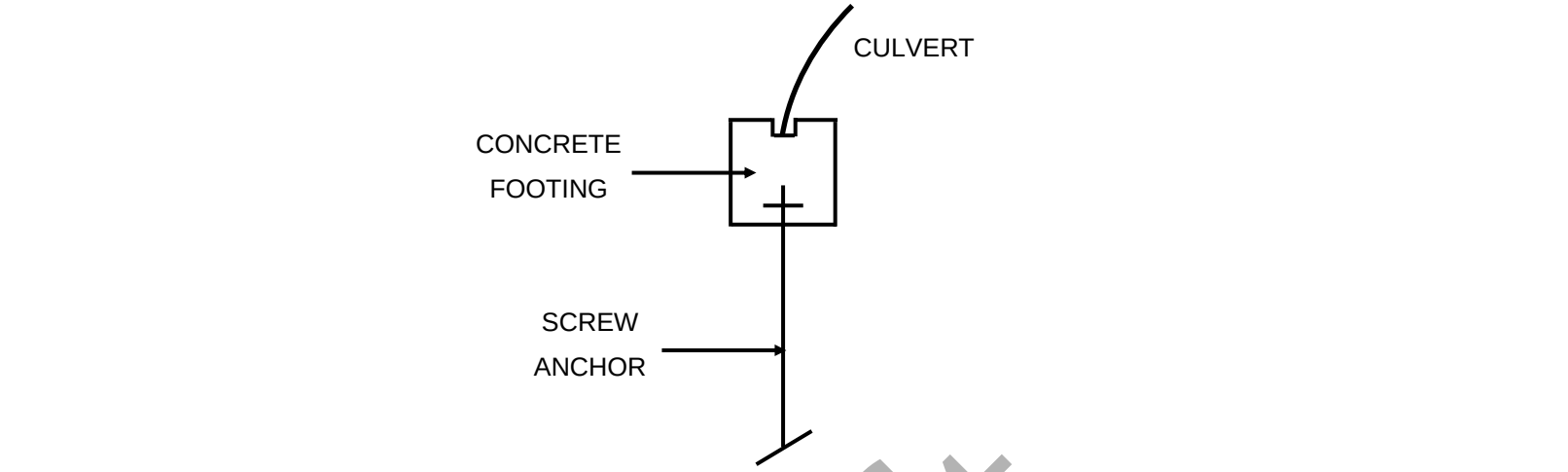
| | | |
|---|---|---|
| FIGURE TITLE: CONCEPTUAL CULVERT DESIGN - BOX CULVERTS | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5138-18 |
| PROJECT LOCATION: COPPER RIVER HWY, CORDOVA, ALASKA | | FIGURE NUMBER: 14 |



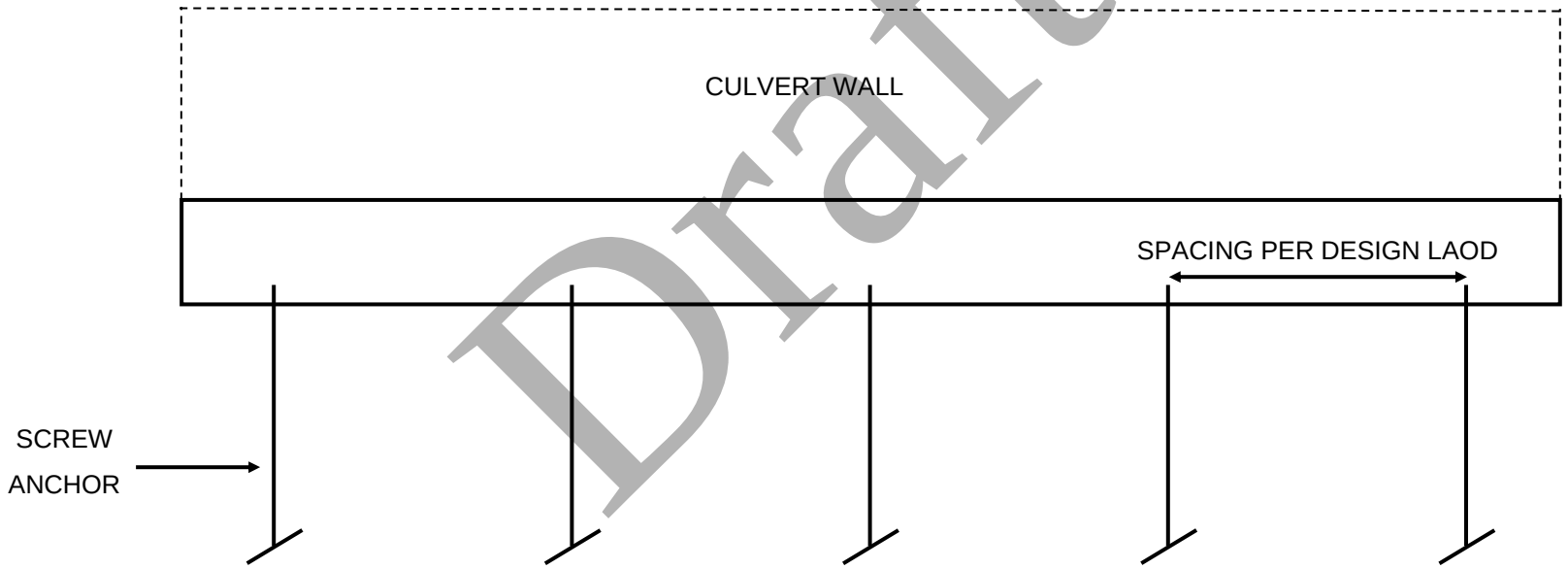



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | | |
|---|---|---|
| FIGURE TITLE: FOOTING DETAIL | | |
| PROJECT NAME: USFWS FISH PAGGAGE IMPROVEMENTS | | PROJECT ID: 5138-18 |
| PROJECT LOCATION: COPPER RIVER HWY, CORDOVA, ALASKA | | FIGURE NUMBER: 15 |




END VIEW




SIDE VIEW



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

| | | |
|---|---|---|
| FIGURE TITLE: PROPOSED SCREW ANCHOR FOUNDATION SUPPORT | | |
| PROJECT NAME: USFWS FISH PASSAGE IMPROVEMENTS | | PROJECT ID: 5138-18 |
| PROJECT LOCATION: COPPER RIVER HWY, CORDOVA, ALASKA | | FIGURE NUMBER: 16 |

# APPENDIX A

# GRAPHICAL BOREHOLE LOGS

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Anchorage, AK 99515
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Fax: 907-344-5993

# EXPLORATION COP 1A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 2
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 6.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 50°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), medium dense, brown - gray, moist to wet | | | | | | | | | |
| | | | | | S1 | 7 | 5<br>4<br>5 | 15 | | S1 | S1<br>MC = 2.5%<br>49.3% gravel,<br>45.4% sand,<br>5.3% silt | Rock in sampler. |
| 5 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), loose, brown - gray, moist to wet ▽ | | S2 | 8 | 4<br>3<br>1 | 5 | | S2 | S2<br>MC = 6.0%<br>46.3% gravel,<br>48.3% sand,<br>5.4% silt | |
| | | | **WELL GRADED SAND WITH GRAVEL** (SW), loose, brown - gray, moist to wet | | S3 | 6 | 10<br>5<br>4 | 10 | | S3 | S3<br>MC = 8.5%<br>37.0% gravel,<br>58.6% sand,<br>4.4% silt<br>P0.02 = 2.3%<br>FC = NFS | Some fines washed out. |
| 10 | | | **POORLY GRADED SAND WITH SILT** (SP-SM), trace organics, medium dense to loose, dark gray, some fine sand lenses | | S4 | 9 | 6<br>6<br>6 | 13 | | S4 | S4<br>MC = 12.0%<br>OC = 2.0% | |
| | | | Less silt | | S5 | 5 | 10<br>5<br>3 | 9 | | S5 | S5<br>MC = 12.5% | |
| 15 | | | Less silt | | S6 | 6 | 6<br>4<br>4 | 9 | | S6 | S6<br>MC = 11.1% | |
| 20 | | | **SILT** (ML), trace organics, stiff, gray, wet | | S7 | 10 | 11<br>5<br>5 | 11 | | S7 | S7<br>MC = 24.9%<br>P200 = 73.2% | |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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Fax: 907-344-5993

# PHOTO LOG
## EXPLORATION COP 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1A Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration COP 1A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1A Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 1A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1A Sample S5
Sample Interval 12.5 - 14.0 ft bgs


Exploration COP 1A Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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Anchorage, AK 99515
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# PHOTO LOG
## EXPLORATION COP 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1A Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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d.b.a. Terra Firma Testing
11301 Olive Lane
Anchorage, AK 99515
Telephone: 907-344-5934
Fax: 907-344-5993

# EXPLORATION COP 1B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 2
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 7.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 50°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), dense, brown - gray, damp to wet | | | | | | | | |
| | | | | | S1 | 5 | 6<br>7<br>9 | 26 | | S1 | S1<br>MC = 8.5%<br>46.8% gravel,<br>43.9% sand,<br>9.3% silt |
| 5 | | | **SILTY SAND WITH GRAVEL** (SM), medium dense, brown - gray, damp to wet | | S2 | 6 | 15<br>7<br>6 | 17 | | S2 | S2<br>MC = 4.1%<br>21.5% gravel,<br>63.4% sand,<br>15.1% silt |
| | | | ▽ **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), loose, gray, wet | | S3 | 12 | 11<br>4<br>5 | 10 | | S3 | S3<br>MC = 9.3%<br>38.2% gravel,<br>52.7% sand,<br>9.1% silt<br>P0.02 = 6.3%<br>FC = F2 |
| 10 | | | **SANDY SILT** (ML), trace organics, stiff, gray, wet | | S4 | 12 | 6<br>5<br>4 | 10 | | S4 | S4<br>MC = 25.3%<br>0.8% gravel,<br>36.0% sand,<br>63.2% silt<br>P0.02 = 24.8%<br>FC = F4 |
| | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), loose to medium dense, dark gray, wet | | S5 | 5 | 3<br>2<br>5 | 8 | | S5 | S5<br>MC = 12.5% |
| 15 | | | Trace organics | | S6 | 9 | 5<br>7<br>5 | 13 | | S6 | S6<br>MC = 11.4% |
| 20 | | | **SILT** (ML), stiff, gray, wet | | S7 | 9 | 9<br>5<br>6 | 13 | | S7 | S7<br>MC = 29.1%<br>P200 = 87.2% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1B Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 1B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1B Sample S3
Sample Interval 7.5 - 9.0 ft bgs

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Exploration COP 1B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1B Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration COP 1B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 1B Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 9A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 5
**GROUND ELEVATION:** Not Known
**GROUNDWATER (ATD):** Approx. 7.0 ft bgs
**GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **POORLY GRADED GRAVEL WITH SAND** (GP), dense, gray - brown, moist to wet | | | | | | | | |
| | | | | | S1 | 12 | 5<br>10<br>10 | 33 | | S1 | S1<br>MC = 7.7%<br>50.4% gravel,<br>45.2% sand,<br>4.4% silt |
| 5 | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), medium dense, gray - brown, moist to wet | | | | | | | | |
| | | | ▽ | | S2 | 11 | 13<br>8<br>6 | 18 | | S2 | S2<br>MC = 3.8%<br>39.4% gravel,<br>53.2% sand,<br>7.4% silt |
| | | | | | S3 | 10 | 4<br>5<br>6 | 13 | | S3 | S3<br>MC = 6.0% |
| 10 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), medium dense, gray - brown, moist to wet | | | | | | | | |
| | | | | | S4 | 9 | 7<br>8<br>15 | 25 | | S4 | S4<br>MC = 6.8%<br>50.1% gravel,<br>44.3% sand,<br>5.6% silt |
| | | | **POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, dark gray, wet | | S5 | 6 | 10<br>10<br>6 | 18 | | S5 | P0.02 = 4.1%<br>FC = S1<br>S5<br>MC = 7.0% |
| 15 | | | **SANDY SILT** (ML), trace organics, medium stiff to soft, gray, wet | | | | | | | | |
| | | | | | S6 | 7 | 3<br>2<br>3 | 5 | | S6 | S6<br>MC = 30.7%<br>P200 = 57.5% |
| 20 | | | | | S7 | 9 | 2<br>1<br>2 | 3 | | S7 | S7<br>MC = 32.4% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 9A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9A Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration COP 9A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 9A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9A Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 9A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 9A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9A Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration COP 9A Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 9A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9A Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 9B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 5
**GROUND ELEVATION:** Not Known
**GROUNDWATER (ATD):** Approx. 9.0 ft bgs
**GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), dense to medium dense, brown - gray, moist to wet | | | | | | | | | |
| | | | | | S1 | 14 | 7<br>12<br>12 | 40 | | S1 | S1<br>MC = 2.5%<br>48.6% gravel,<br>45.3% sand,<br>6.1% silt | |
| 5 | | | | | S2 | 6 | 10<br>8<br>8 | 21 | | S2 | S2<br>MC = 3.8%<br>56.4% gravel,<br>35.5% sand,<br>8.1% silt | Rock in sampler. |
| | | | | | S3 | 11 | 19<br>8<br>6 | 15 | | S3 | S3<br>MC = 3.7% | |
| 10 | | | | | S4 | 13 | 13<br>19<br>20 | 39 | | S4 | S4<br>MC = 6.4%<br>50.5% gravel,<br>42.8% sand,<br>6.7% silt<br>P0.02 = 4.5%<br>FC = S1 | |
| | | | **SILTY SAND** (SM), medium dense to loose, gray, wet, fine to medium grained | | S5 | 13 | 16<br>8<br>9 | 17 | | S5 | S5<br>MC = 24.3% | |
| 15 | | | | | S6 | 12 | 6<br>3<br>4 | 7 | | S6 | S6<br>MC = 19.3% | |
| 20 | | | Tan/brown organic lens | | S7 | 10 | 3<br>2<br>1 | 3 | | S7 | S7<br>MC = 38.3% | |

Bottom of borehole at 21.5 ft bgs.



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# PHOTO LOG
## EXPLORATION COP 9B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9B Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration COP 9B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 9B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9B Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 9B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 9B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9B Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration COP 9B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 9B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 9B Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 20A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 6
**GROUND ELEVATION:** Not Known
▽ **GROUNDWATER (ATD):** Approx. 5.0 ft bgs
▼ **GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **POORLY GRADED GRAVEL WITH SAND** (GP), medium dense, brown - gray, moist | | | | | | | | | |
| | | | | | S1 | 11 | 5<br>5<br>5 | 17 | | S1 | S1<br>MC = 2.4%<br>71.0% gravel,<br>24.9% sand,<br>4.1% silt | |
| 5 | | | ▽ **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), medium dense, brown - gray, moist | | S2 | 8 | 6<br>8<br>8 | 21 | | S2 | S2<br>MC = 6.4%<br>49.8% gravel,<br>43.5% sand,<br>6.7% silt | |
| | | | **WELL GRADED SAND WITH GRAVEL** (SW), medium dense, dark gray - brown, wet | | S3 | 7 | 8<br>5<br>4 | 11 | | S3 | S3<br>MC = 8.2%<br>34.0% gravel,<br>61.1% sand,<br>4.9% silt<br>P0.02 = 3.1%<br>FC = S2 | |
| 10 | | | **WELL GRADED GRAVEL WITH SAND** (GW), loose, dark gray, wet | | S4 | 6 | 11<br>3<br>2 | 6 | | S4 | | |
| | | | | ○ | S5 | 0 | 6<br>2<br>1 | N/A | | S5 | S4<br>MC = 5.9%<br>69.2% gravel,<br>29.8% sand,<br>1.0% silt | |
| 15 | | | | | S6 | 4 | 2<br>0<br>1 | 1 | | S6 | S6<br>MC = 10.1% | |
| 20 | | | Bottom of borehole at 20.0 ft bgs. | | | | | | | | | Approx. 2' of sand heave. Sampler stuck in auger, no sample attempted. |



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 20A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20A Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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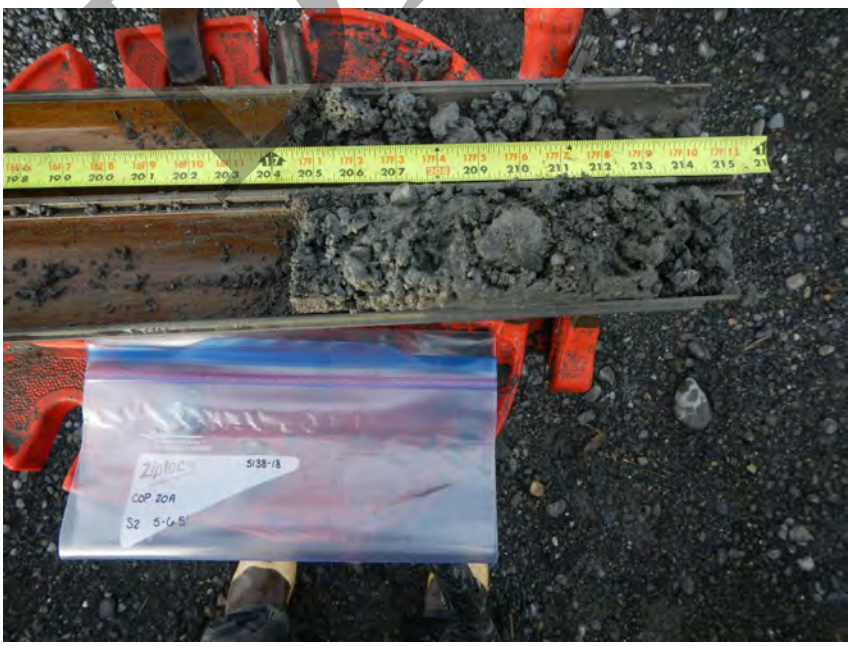


Exploration COP 20A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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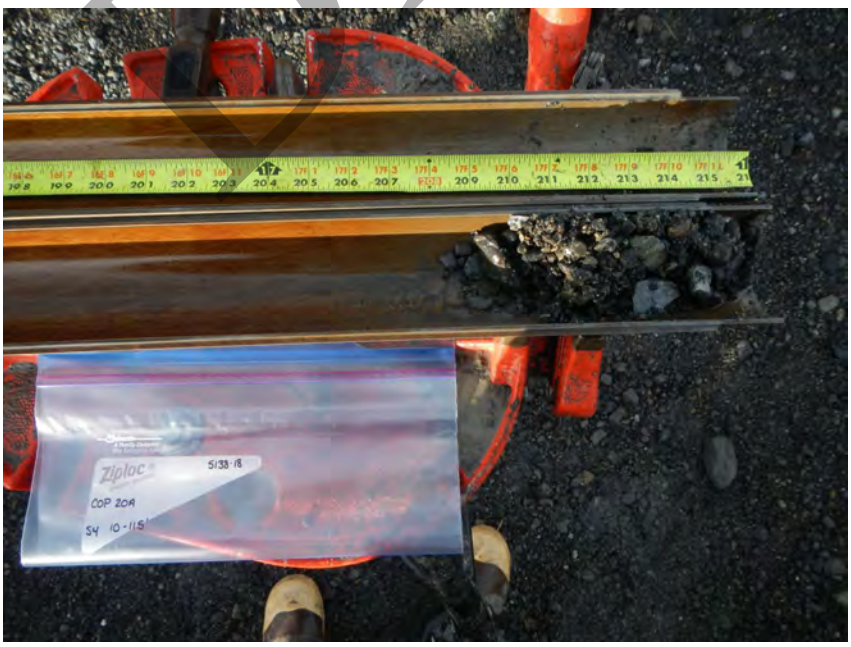
# PHOTO LOG
## EXPLORATION COP 20A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20A Sample S3
Sample Interval 7.5 - 9.0 ft bgs




Exploration COP 20A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 20A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20A Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# EXPLORATION COP 20B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 6
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 6.3 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), medium dense to loose, gray - brown, moist | | | | | | | | |
| | | | | | S1 | 12 | 4<br>4<br>3 | 12 | | S1 | S1<br>MC = 3.3% |
| 5 | | | | | | | | | | | |
| | | | ▽ | | S2 | 10 | 8<br>4<br>3 | 9 | | S2 | S2<br>MC = 5.7%<br>39.6% gravel,<br>51.5% sand,<br>8.9% silt |
| | | | **POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, dark gray, wet | | S3 | 9 | 10<br>6<br>5 | 13 | | S3 | S3<br>MC = 9.1%<br>40.0% gravel,<br>55.3% sand,<br>4.7% silt<br>P0.02 = 2.6%<br>FC = NFS |
| 10 | | | **WELL GRADED GRAVEL WITH SAND** (GW), loose to medium dense, dark gray, wet, rounded gravel | | S4 | 8 | 13<br>5<br>4 | 10 | | S4 | S4<br>MC = 7.0%<br>55.1% gravel,<br>42.1% sand,<br>2.8% silt<br>P0.02 = 1.7%<br>FC = PFS |
| | | | | | S5 | 9 | 4<br>5<br>5 | 11 | | S5 | S5<br>MC = 9.5% |
| 15 | | | **WELL GRADED SAND WITH GRAVEL** (SW), loose to very loose, dark gray, wet, organic lens | | S6 | 8 | 5<br>3<br>6 | 9 | | S6 | S6<br>MC = 11.8%<br>34.8% gravel,<br>60.4% sand,<br>4.8% silt |
| 20 | | | | | S7 | 8 | 8<br>2<br>2 | 4 | | S7 | S7<br>MC = 14.5% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 20B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20B Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 20B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 20B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20B Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 20B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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11301 Olive Lane
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# PHOTO LOG
## EXPLORATION COP 20B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20B Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration COP 20B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 20B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 20B Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 22A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/13/2018
**DATE COMPLETED:** 10/13/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 7
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 7.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), medium dense to loose, gray - brown, moist | | | | | | | | | |
| | | | | | S1 | 7 | 16<br>4<br>5 | 15 | | S1 | S1<br>MC = 4.1% | |
| 5 | | | | | S2 | 9 | 5<br>3<br>2 | 7 | | S2 | S2<br>MC = 4.0%<br>44.7% gravel,<br>49.5% sand,<br>5.8% silt | |
| | | | ▽ **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), medium dense, grayish brown to brown, wet to saturated | | S3 | 12 | 12<br>7<br>9 | 18 | | S3 | S3<br>MC = 5.8%<br>56.0% gravel,<br>38.0% sand,<br>6.0% silt | |
| 10 | | | | | S4 | 10 | 18<br>10<br>7 | 18 | | S4 | S4<br>MC = 6.6%<br>51.1% gravel,<br>43.4% sand,<br>5.5% silt<br>P0.02 = 3.2%<br>FC = S1 | |
| | | | **WELL GRADED GRAVEL WITH SAND** (GW), medium dense, dark gray, wet | | S5 | 8 | 18<br>9<br>9 | 20 | | S5 | S5<br>MC = 5.1% | |
| 15 | | | | | S6 | 9 | 20<br>8<br>9 | 17 | | S6 | S6<br>MC = 4.1%<br>51.8% gravel,<br>47.2% sand,<br>1.0% silt | |
| 20 | | | Bottom of borehole at 20.0 ft bgs. | | | | | | | | | Approx. 5' of sand heave, no sample collected. |



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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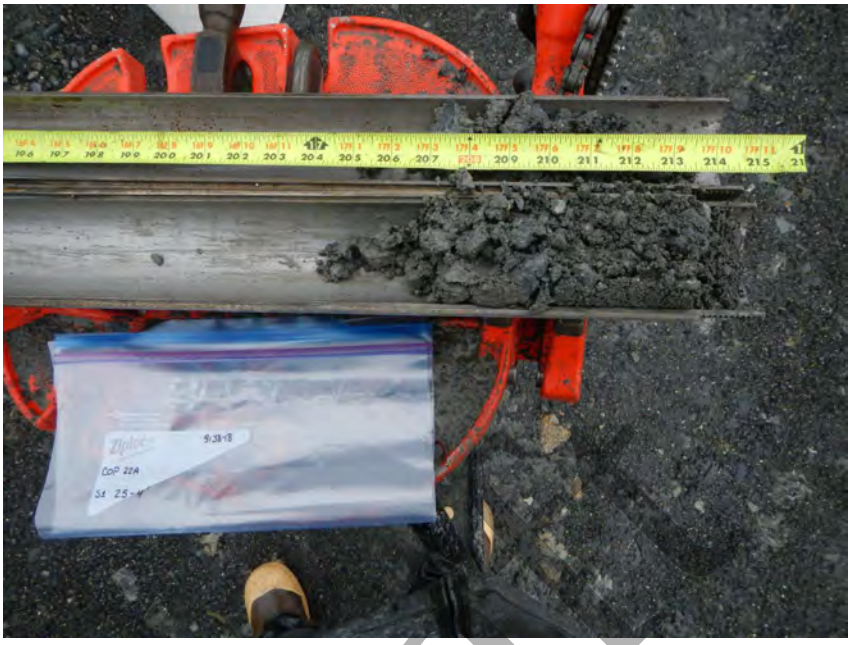
# PHOTO LOG
## EXPLORATION COP 22A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK




Exploration COP 22A Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration COP 22A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 22A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 22A Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 22A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 22A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 22A Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration COP 22A Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# EXPLORATION COP 22B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/14/2018
**DATE COMPLETED:** 10/14/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 7
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 6.5 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Clear, 40°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), medium dense, gray - brown, moist to wet | | | | | | | | | |
| | | | | | S1 | 8 | 3<br>4<br>3 | 12 | | S1 | S1<br>MC = 7.1%<br>52.7% gravel,<br>41.3% sand,<br>6.0% silt | |
| 5 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), loose to medium dense, moist to wet | | S2 | 8 | 6<br>3<br>3 | 8 | | S2 | S2<br>MC = 8.7%<br>36.3% gravel,<br>54.0% sand,<br>9.7% silt | |
| | | | ▽ | | S3 | 11 | 5<br>6<br>6 | 14 | | S3 | S3<br>MC = 7.0%<br>41.5% gravel,<br>52.2% sand,<br>6.3% silt<br>P0.02 = 4.3%<br>FC = S2 | |
| 10 | | | **WELL GRADED GRAVEL WITH SAND** (GW), medium dense, dark gray, wet | | S4 | 9 | 17<br>6<br>6 | 13 | | S4 | S4<br>MC = 6.4%<br>53.8% gravel,<br>42.2% sand,<br>4.0% silt<br>P0.02 = 2.6%<br>FC = PFS | |
| | | | **POORLY GRADED SAND WITH GRAVEL** (SP), dense to loose, dark gray | | S5 | 6 | 13<br>13<br>11 | 27 | | S5 | S5<br>MC = 10.4% | Fine grains possibly washed out. |
| 15 | | | | | S6 | 6 | 5<br>7<br>2 | 10 | | S6 | S6<br>MC = 9.1% | |
| 20 | | | Fine sand lens | | S7 | 5 | 5<br>4<br>12 | 18 | | S7 | S7<br>MC = 9.1% | |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 22B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK

Exploration COP 22B Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 22B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 22B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 22B Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 22B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 22B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 22B Sample S5
Sample Interval 12.5 - 14.0 ft bgs


Exploration COP 22B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 22B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 22B Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 25A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/13/2018
**DATE COMPLETED:** 10/13/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 8
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 5.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SAND** (GW), loose, brown - gray, damp | | | | | | | | |
| | | | | | S1 | 7 | 7<br>3<br>3 | 10 | | S1 | S1<br>MC = 3.4%<br>53.1% gravel,<br>42.8% sand,<br>4.1% silt |
| 5 | | | ▽ **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), very loose, damp | | | | | | | | |
| | | | | | S2 | 7 | 3<br>1<br>1 | 3 | | S2 | S2<br>MC = 4.7%<br>39.7% gravel,<br>54.8% sand,<br>5.5% silt |
| | | | **WELL GRADED SAND WITH GRAVEL** (SW), loose, gray - brown, wet | | | | | | | | |
| | | | | | S3 | 5 | 6<br>3<br>5 | 10 | | S3 | S3<br>MC = 8.1%<br>44.2% gravel,<br>54.6% sand,<br>1.2% silt<br>P0.02 = 0.9%<br>FC = NFS |
| 10 | | | **WELL GRADED GRAVEL WITH SAND** (GW), medium dense, gray - brown, wet, washed | | | | | | | | |
| | | | | | S4 | 4 | 20<br>8<br>8 | 17 | | S4 | S4<br>MC = 3.7% |
| | | | | | S5 | 6 | 10<br>3<br>4 | 8 | | S5 | S5<br>MC = 6.8%<br>52.2% gravel,<br>46.1% sand,<br>1.7% silt |
| 15 | | | **POORLY GRADED SAND** (SP), some gravel, medium dense, gray, wet, medium to coarse grained | | | | | | | | |
| | | | | | S6 | 9 | 6<br>5<br>5 | 11 | | S6 | S6<br>MC = 13.1% |
| | | | **SAND WITH SILT AND GRAVEL** (SP-SM), medium dense, gray - brown, wet | | | | | | | | |
| 20 | | | | | S7 | 8 | 9<br>5<br>8 | 15 | | S7 | S7<br>MC = 8.8%<br>P200 = 10.6% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 25A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25A Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 25A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 25A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25A Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 25A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 25A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25A Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration COP 25A Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 25A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25A Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 25B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/13/2018
**DATE COMPLETED:** 10/13/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 8
**GROUND ELEVATION:** Not Known
**GROUNDWATER (ATD):** Approx. 7.0 ft bgs
**GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), medium dense to very loose, brown - gray, moist to wet | | | | | | | | |
| | | | | | S1 | 5 | 8<br>5<br>4 | 15 | | S1 | S1<br>MC = 6.8% |
| 5 | | | | | | | | | | | |
| | | | | | S2 | 9 | 5<br>1<br>1 | 3 | | S2 | S2<br>MC = 3.2%<br>38.1% gravel,<br>54.6% sand,<br>7.3% silt |
| | | | ▽ **POORLY GRADED SAND WITH GRAVEL TO WELL GRADED SAND WITH GRAVEL** (SP/SW), very loose to loose, moist to wet | | S3 | 7 | 2<br>1<br>2 | 3 | | S3 | S3<br>MC = 8.5%<br>39.8% gravel,<br>56.9% sand,<br>3.3% silt |
| 10 | | | | | S4 | 7 | 4<br>2<br>4 | 6 | | S4 | S4<br>MC = 8.1%<br>41.1% gravel,<br>56.8% sand,<br>2.1% silt<br>P0.02 = 1.7%<br>FC = NFS |
| | | | | | S5 | 6 | 8<br>4<br>4 | 9 | | S5 | S5<br>MC = 8.1% |
| 15 | | | **POORLY GRADED SAND WITH SILT** (SP-SM), gray, wet | | | | | | | | |
| | | | **PEAT** (PT), red - brown, fibrous, wet | | S6 | 12 | 2<br>3<br>2 | 5 | | S6 | S6<br>MC = 221.6% |
| | | | **POORLY GRADED SAND WITH SILT** (SP-SM), loose, gray, wet | | | | | | | | |
| 20 | | | | | S7 | 9 | 3<br>5<br>4 | 10 | | S7 | S7<br>MC = 11.5% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 25B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK

Exploration COP 25B Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 25B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 25B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25B Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 25B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 25B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25B Sample S5
Sample Interval 12.5 - 14.0 ft bgs


Exploration COP 25B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 25B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 25B Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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d.b.a. Terra Firma Testing
11301 Olive Lane
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# EXPLORATION COP 33A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/13/2018
**DATE COMPLETED:** 10/13/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 9
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 7.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SAND** (GW), very loose, brown - gray, wet, angular gravel | | | | | | | | |
| | | | | ○ | S1 | 0 | 4<br>4<br>3 | N/A | | | |
| | | | ▽ | | | | | | | | |
| 10 | | | | | S2 | 9 | 4<br>2<br>1 | 3 | | S2 | S2<br>MC = 5.2%<br>70.6% gravel,<br>25.6% sand,<br>3.8% silt<br>P0.02 = 2.1%<br>FC = PFS |
| | | | **SILTY SAND** (SM), very loose, brown, wet, red-brown organic lens | | S3 | 6 | 3<br>0<br>1 | 1 | | S3 | S3<br>MC = 71.2%<br>11.2% gravel,<br>40.9% sand,<br>47.9% silt |
| 15 | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), very loose, gray brown, wet | | S4 | 4 | 1<br>1<br>1 | 2 | | S4 | S4<br>MC = 20.7% |
| | | | (WOOD), decomposing wood debris | | | | | | | | |
| | | | **SILT** (ML), very loose, gray, wet | | S5 | 7 | 3<br>3<br>1 | 4 | | S5 | S5<br>MC = 34.0%<br>P200 = 85.2% |
| 20 | | | **SILTY SAND** (SM), loose, gray - brown, wet | | S6 | 4 | 2<br>1<br>4 | 6 | | S6 | S6<br>MC = 24.1% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 33A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 33A Sample S2
Sample Interval 10.0 - 11.5 ft bgs


Exploration COP 33A Sample S3
Sample Interval 12.5 - 14.0 ft bgs

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# PHOTO LOG
## EXPLORATION COP 33A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 33A Sample S4
Sample Interval 15.0 - 16.5 ft bgs


Exploration COP 33A Sample S5
Sample Interval 17.5 - 19.0 ft bgs

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# PHOTO LOG
## EXPLORATION COP 33A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 33A Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 33B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/13/2018
**DATE COMPLETED:** 10/13/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 9
**GROUND ELEVATION:** Not Known
▽ **GROUNDWATER (ATD):** Approx. 7.0 ft bgs
▼ **GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **POORLY GRADED GRAVEL WITH SILT AND SAND** (GP-GM), brown - gray, moist | | | | | | | | | |
| | | | **SILTY SAND WITH GRAVEL** (SM), loose, brown - gray, moist | | | | | | | | | |
| 5 | | | | | S1 | 6 | 6<br>3<br>2 | 7 | | S1 | S1<br>MC = 10.1%<br>42.0% gravel,<br>45.2% sand,<br>12.8% silt | |
| | | | ▽ | | | | | | | | | |
| | | | **GRAVEL WITH SILT AND SAND** (GP-GM), loose, gray - brown, wet, angular gravel | | | | | | | | | |
| 10 | | | | | S2 | 6 | 6<br>3<br>2 | 5 | | S2 | S2<br>MC = 8.6%<br>62.3% gravel,<br>29.9% sand,<br>7.8% silt<br>P0.02 = 5.1%<br>FC = S1 | |
| | | | **POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, gray - brown, wet, subrounded gravel | | S3 | 2 | 8<br>9<br>5 | 16 | | S3 | S3<br>MC = 21.5% | |
| 15 | | | **SILTY SAND** (SM), loose, gray, wet | | S4 | 6 | 4<br>2<br>4 | 6 | | S4A<br>S4B | S4A<br>MC = 24.6%<br>S4B<br>MC = 20.2% | |
| | | | **SILTY GRAVEL** (GM), very loose, gray, wet | | S5 | 5 | 3<br>1<br>2 | 3 | | S5 | S5<br>MC = 26.4%<br>OC = 5.4% | Woody debris in sampler shoe. |
| 20 | | | **POORLY GRADED SAND WITH SILT** (SP-SM), loose, gray, wet, angular gravel | | S6 | 12 | 2<br>3<br>6 | 9 | | S6 | S6<br>MC = 19.2% | |
| | | | **POORLY GRADED GRAVEL WITH SILT** (GP-GM), loose, gray, wet | | | | | | | | | |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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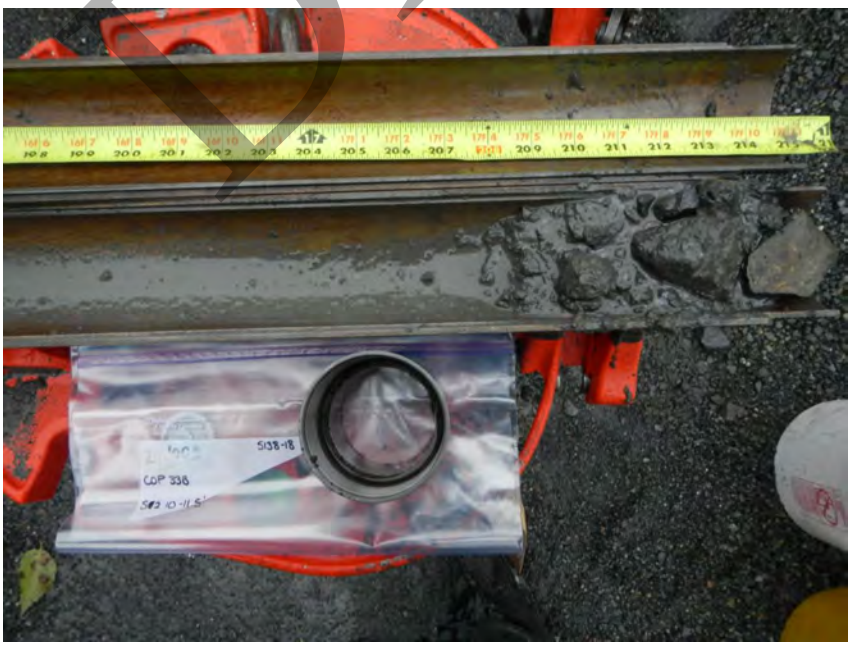
# PHOTO LOG
## EXPLORATION COP 33B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 33B Sample S1
Sample Interval 5.0 - 6.5 ft bgs




Exploration COP 33B Sample S2
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 33B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 33B Sample S3
Sample Interval 12.5 - 14.0 ft bgs


Exploration COP 33B Sample S4
Sample Interval 15.0 - 16.5 ft bgs

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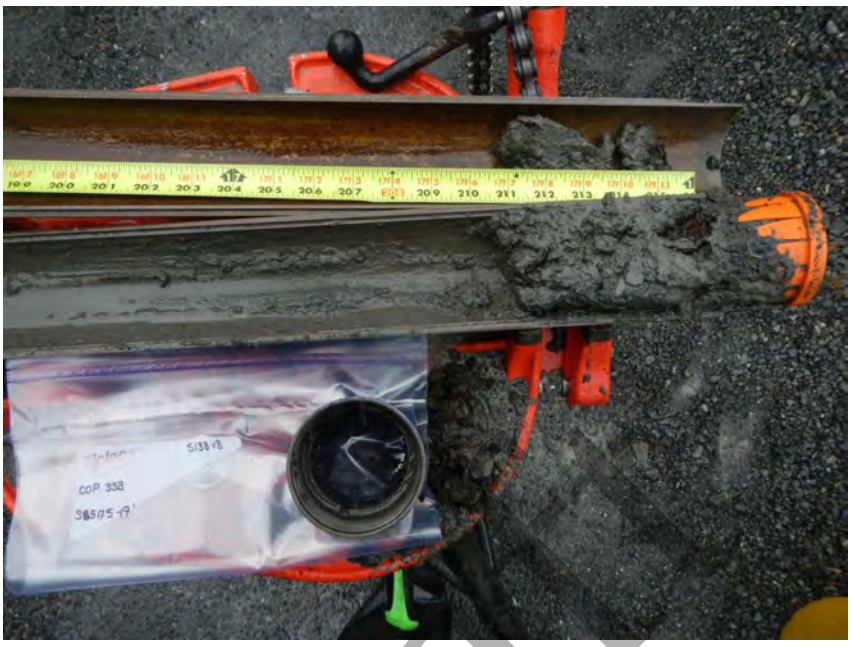
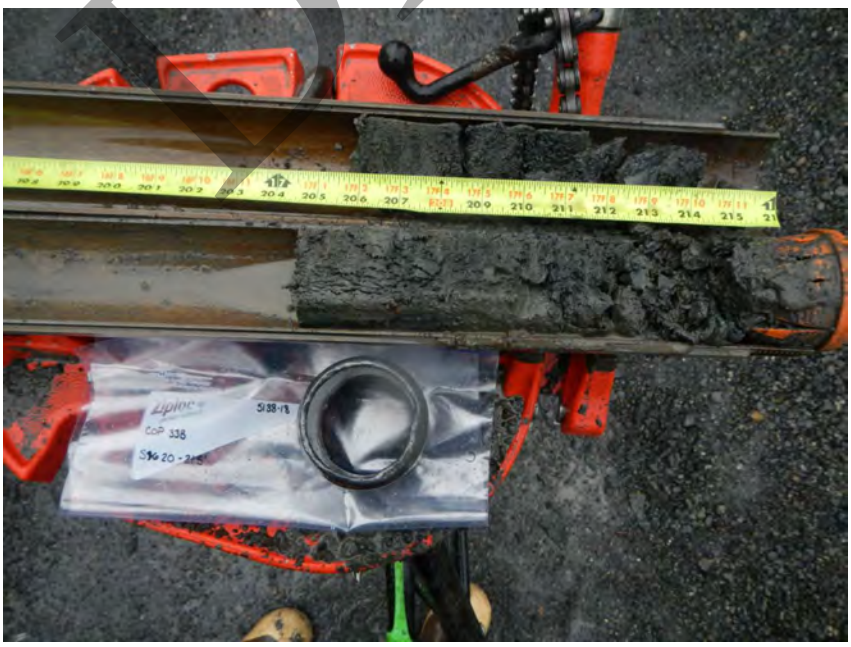
# PHOTO LOG
## EXPLORATION COP 33B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK




Exploration COP 33B Sample S5
Sample Interval 17.5 - 19.0 ft bgs




Exploration COP 33B Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 43A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/12/2018
**DATE COMPLETED:** 10/12/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 10
**GROUND ELEVATION:** Not Known
▽ **GROUNDWATER (ATD):** Approx. 3.0 ft bgs
▼ **GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED SAND WITH GRAVEL** (SW), medium dense to loose, gray - brown, wet | | | | | | | | | |
| | | | ▽ | | S1 | 14 | 7<br>7<br>6 | 21 | | S1 | S1<br>MC = 7.4%<br>41.5% gravel,<br>55.0% sand,<br>3.5% silt | |
| 5 | | | | | S2 | 9 | 6<br>4<br>2 | 9 | | S2 | S2<br>MC = 9.8% | |
| | | | **SILTY SAND** (SM), with organics, loose, gray, wet | | S3 | 6 | 1<br>3<br>4 | 9 | | S3 | S3<br>MC = 17.9%<br>3.2% gravel,<br>80.4% sand,<br>16.4% silt<br>P0.02 = 5.9%<br>FC = F2 | |
| 10 | | | | | S4 | 10 | 3<br>4<br>3 | 9 | | S4 | S4<br>MC = 16.9% | Fine grains possibly washed out. |
| | | | **SILTY GRAVEL** (GM) | | | | | | | | | |
| | | | **SILTY SAND** (SM), loose to medium dense, gray, wet, brown-red lens | | | | | | | | | |
| 15 | | | | | S5 | 9 | 4<br>3<br>4 | 9 | | S5 | S5<br>MC = 26.1%<br>P200 = 24.4% | |
| 20 | | | | | S6 | | 5<br>4<br>5 | 11 | | S6 | S6<br>MC = 20.2%<br>P200 = 23.5% | |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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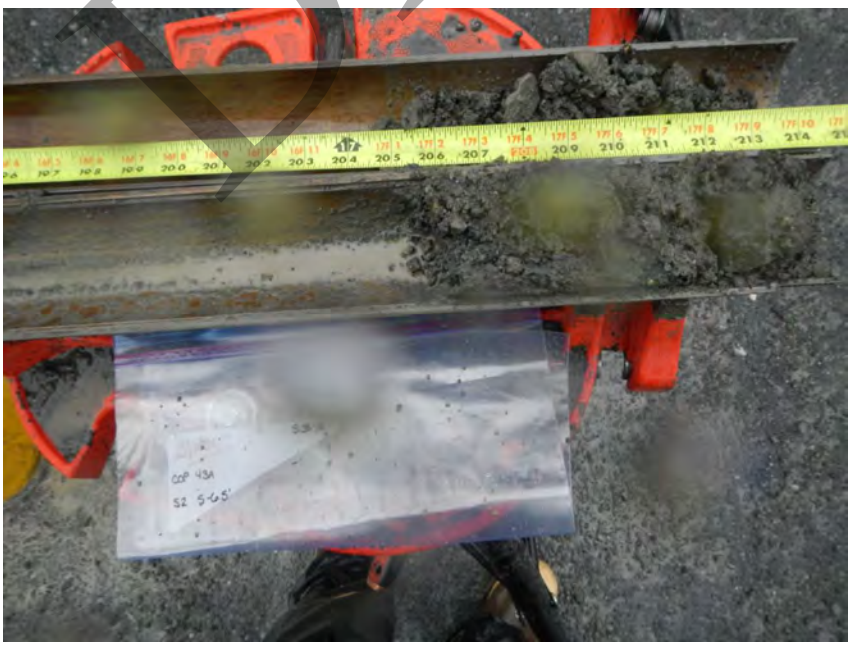
# PHOTO LOG
## EXPLORATION COP 43A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 43A Sample S1
Sample Interval 2.5 - 4.0 ft bgs




Exploration COP 43A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 43A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 43A Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 43A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 43A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK

Exploration COP 43A Sample S5
Sample Interval 15.0 - 16.5 ft bgs

Exploration COP 43A Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 43B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/13/2018
**DATE COMPLETED:** 10/13/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 10
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 3.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Light Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), medium dense, gray, wet | | | | | | | | |
| | | | ▽ | | S1 | 11 | 4<br>6<br>5 | 18 | | S1 | S1<br>MC = 7.3%<br>48.6% gravel,<br>45.8% sand,<br>5.6% silt |
| 5 | | | **WELL GRADED SAND WITH GRAVEL** (SW), medium dense, brown - gray, wet | | S2 | 11 | 7<br>7<br>7 | 22 | | S2 | S2<br>MC = 7.5%<br>42.3% gravel,<br>53.6% sand,<br>4.1% silt<br>P0.02 = 2.6%<br>FC = NFS |
| | | | **SILTY SAND** (SM), loose to very loose, gray, red-brown organic lens | | S3 | 2 | 7<br>2<br>2 | 6 | | S3 | S3<br>MC = 45.8%<br>P200 = 30.9% |
| 10 | | | | | S4 | 9 | 1<br>1<br>2 | 4 | | S4 | S4<br>MC = 46.5%<br>8.5% gravel,<br>74.3% sand,<br>17.2% silt<br>P0.02 = 6.6%<br>FC = F2 |
| 15 | | | | | S5 | 8 | 2<br>2<br>3 | 6 | | S5 | S5<br>MC = 27.4% |
| 20 | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), medium dense, gray - brown, wet | | S6 | 7 | 7<br>6<br>4 | 11 | | S6 | S6<br>MC = 7.3% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 43B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 43B Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration COP 43B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 43B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 43B Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 43B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 43B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK

Exploration COP 43B Sample S5
Sample Interval 15.0 - 16.5 ft bgs

Exploration COP 43B Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 44A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/12/2018
**DATE COMPLETED:** 10/12/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 11
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 2.5 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SAND** (GW), dense to medium dense, gray to brownish gray, wet | | | | | | | | |
| | | | ▽ | | S1 | 12 | 4<br>9<br>8 | 28 | | S1 | S1<br>MC = 5.0%<br>57.6% gravel,<br>38.2% sand,<br>4.2% silt |
| 5 | | | | | S2 | 12 | 7<br>6<br>7 | 20 | | S2 | S2<br>MC = 7.2%<br>47.6% gravel,<br>47.5% sand,<br>4.9% silt<br>P0.02 = 3.2%<br>FC = S1 |
| | | | | | S3 | 6 | 16<br>7<br>6 | 17 | | S3 | S3<br>MC = 6.7%<br>53.3% gravel,<br>43.2% sand,<br>3.5% silt |
| 10 | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), loose, red - brown, wet | | S4 | 7 | 4<br>3<br>2 | 6 | | S4 | S4<br>MC = 8.9% |
| | | | **SANDY SILT** (ML), very soft to medium stiff, gray, wet, organic lens | | | | | | | | |
| 15 | | | | | S5 | 6 | 1<br>0<br>1 | 1 | | S5 | S5<br>MC = 26.9%<br>P200 = 62.7% |
| 20 | | | Organic lens | | S6 | 12 | 1<br>3<br>3 | 8 | | S6 | S6<br>MC = 31.8% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 44A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 44A Sample S1
Sample Interval 2.5 - 5.0 ft bgs

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Exploration COP 44A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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Anchorage, AK 99515
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Fax: 907-344-5993

# PHOTO LOG
## EXPLORATION COP 44A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 44A Sample S3
Sample Interval 7.5 - 9.0 ft bgs

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Exploration COP 44A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 44A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 44A Sample S5
Sample Interval 15.0 - 16.5 ft bgs

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Exploration COP 44A Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 44B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/12/2018
**DATE COMPLETED:** 10/12/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 11
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 2.5 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SAND** (GW), very dense, gray, wet, fractured | | | | | | | | |
| | | | ▽ | | S1 | 12 | 15<br>21<br>11 | 53 | | S1 | S1<br>MC = 8.0%<br>58.9% gravel,<br>36.3% sand,<br>4.8% silt |
| 5 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), medium dense, gray, wet, fractured to subrounded | | S2 | 12 | 7<br>8<br>7 | 22 | | S2 | S2<br>MC = 7.7%<br>47.1% gravel,<br>47.7% sand,<br>5.2% silt<br>P0.02 = 3.6%<br>FC = S2 |
| | | | | | S3 | 9 | 10<br>8<br>8 | 21 | | S3 | |
| 10 | | | **POORLY GRADED SAND WITH GRAVEL** (SP), loose, red - brown | | S4 | 8 | 5<br>4<br>4 | 9 | | S4 | S3<br>MC = 8.6%<br>S4<br>MC = 9.3%<br>43.9% gravel,<br>53.7% sand,<br>2.4% silt |
| 15 | | | **SILTY SAND** (SM), trace gravel, very loose to loose, gray, wet | | S5 | 10 | 1<br>1<br>1 | 2 | | S5 | S5<br>MC = 25.8%<br>P200 = 20.1% |
| 20 | | | No gravel | | S6 | 10 | 4<br>3<br>3 | 8 | | S6 | S6<br>MC = 23.8% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

Northern Geotechnical Engineering, Inc. d.b.a. Terra Firma Testing
11301 Olive Lane
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# PHOTO LOG
## EXPLORATION COP 44B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 44B Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration COP 44B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 44B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK

Exploration COP 44B Sample S3
Sample Interval 7.5 - 9.0 ft bgs

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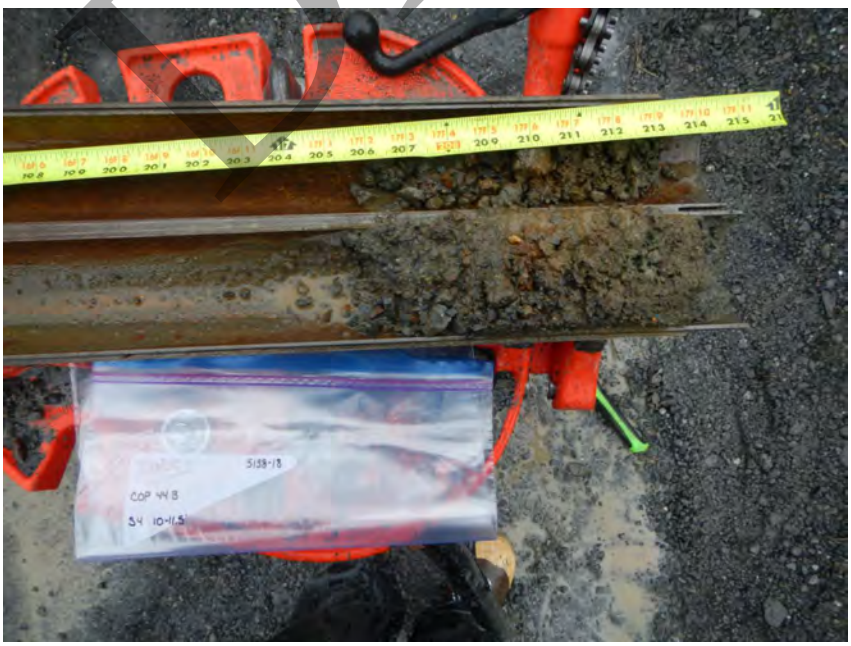

Exploration COP 44B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 44B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 44B Sample S5
Sample Interval 15.0 - 16.5 ft bgs

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Exploration COP 44B Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 45A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/12/2018
**DATE COMPLETED:** 10/12/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 12
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 3.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 40°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), gray - brown | | | | | | | | | |
| | | | ▽ | | S1 | 9 | 16<br>11<br>8 | N/A* | | S1 | S1<br>MC = 7.6%<br>45.3% gravel,<br>47.7% sand,<br>7.0% silt | *Small hammer used, blow counts not representative. |
| 5 | | | **SILTY SAND** (SM), gray, wet | | S2 | 6 | 7<br>5<br>3 | N/A* | | S2 | S2<br>MC = 25.3%<br>2.9% gravel,<br>58.1% sand,<br>39.0% silt<br>P0.02 = 12.0%<br>FC = F2 | *Small hammer used, blow counts not representative. |
| | | | | | S3 | 10 | 0<br>0<br>1 | 1 | | S3 | S3<br>MC = 29.2% | Sampler sank 10" under weight of hammer. |
| 10 | | | **POORLY GRADED SAND** (SP), medium dense to loose, gray, wet | | S4 | 13 | 2<br>5<br>10 | 20 | | S4A<br>S4B | S4A<br>MC = 8.7%<br>S4B<br>MC = 20.4% | |
| | | | **POORLY GRADED GRAVEL WITH SAND** (GP), medium dense, red / brown, wet | | | | | | | | | |
| 15 | | | | | S5 | 10 | 8<br>10<br>9 | 23 | | S5 | S5<br>MC = 7.1%<br>55.9% gravel,<br>42.2% sand,<br>1.9% silt | |
| | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), medium dense, gray, wet, coarse grained | | | | | | | | | |
| 20 | | | | | S6 | 5 | 2<br>6<br>7 | 15 | | S6 | S6<br>MC = 15.5% | Rock in sampler, low recovery. |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 45A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 45A Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 45A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 45A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 45A Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration COP 45A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 45A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 45A Sample S5
Sample Interval 15.0 - 16.5 ft bgs


Exploration COP 45A Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION COP 45B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/12/2018
**DATE COMPLETED:** 10/12/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 12
**GROUND ELEVATION:** Not Known
▽ **GROUNDWATER (ATD):** Approx. 3.0 ft bgs
▼ **GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 40°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SAND** (GW), medium dense, gray - brown, wet | | | | | | | | | |
| | | | ▽ | | S1 | 12 | 5<br>7<br>7 | 23 | | S1 | S1<br>MC = 6.6%<br>54.3% gravel,<br>41.5% sand,<br>4.2% silt | |
| 5 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), medium dense, gray, wet | | S2 | 12 | 20<br>7<br>8 | 22 | | S2 | S2<br>MC = 7.3%<br>44.4% gravel,<br>49.0% sand,<br>6.6% silt<br>P0.02 = 4.7%<br>FC = S2 | |
| | | | **POORLY GRADED SAND** (SP), medium dense, gray - brown, wet, fine to coarse grained | | S3 | 11 | 12<br>5<br>3 | 11 | | S3 | S3<br>MC = 18.5% | |
| 10 | | | **SILTY SAND** (SM), very loose, gray, wet, red to brown organic lenses | | S4 | 9 | 1<br>0<br>1 | 1 | | S4 | S4<br>MC = 42.0%<br>P200 = 34.7% | |
| | | | **POORLY GRADED GRAVEL WITH SILT AND SAND** (GP-GM), medium dense, wet | | | | | | | | | |
| 15 | | | | | S5 | 12 | 11<br>8<br>5 | 15 | | S5 | S5<br>MC = 6.9% | Smaller grain sizes washed out of sampler bottom. |
| 20 | | | | | | | | | | | | Sand heave in auger, no sample attempted. |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION COP 45B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 45B Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration COP 45B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 45B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 45B Sample S3
Sample Interval 7.5 - 9.0 ft bgs

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Exploration COP 45B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION COP 45B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration COP 45B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# EXPLORATION CAB 2A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/15/2018
**DATE COMPLETED:** 10/15/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 4
**GROUND ELEVATION:** Not Known
**GROUNDWATER (ATD):** Approx. 4.5 ft bgs
**GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED GRAVEL WITH SILT AND SAND** (GW-GM), trace organics, medium dense, brown - gray, damp to wet | | | | | | | | |
| | | | | | S1 | 9 | 7<br>5<br>3 | 13 | | S1 | S1<br>MC = 10.5%<br>56.8% gravel,<br>36.1% sand,<br>7.1% silt |
| 5 | | | ▽ | | | | | | | | |
| | | | Grades to gray | | S2 | 10 | 3<br>4<br>4 | 11 | | S2 | S2<br>MC = 10.1% |
| | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), loose, gray brown, wet | | S3 | 7 | 5<br>2<br>3 | 6 | | S3 | S3<br>MC = 12.0%<br>27.9% gravel,<br>64.7% sand,<br>7.4% silt<br>P0.02 = 5.0%<br>FC = S2 |
| 10 | | | | | S4 | 7 | 4<br>3<br>4 | 8 | | S4 | S4<br>MC = 7.6% |
| 15 | | | | | S5 | 10 | 9<br>2<br>2 | 5 | | S5 | S5<br>MC = 26.4%<br>P200 = 67.9% |
| | | | **SANDY SILT** (ML), medium stiff, gray, wet | | | | | | | | |
| | | | **SILTY SAND** (SM), medium dense, gray, wet | | | | | | | | |
| 20 | | | | | S6 | 8 | 10<br>9<br>6 | 19 | | S6 | S6<br>MC = 11.7% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION CAB 2A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration CAB 2A Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration CAB 2A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION CAB 2A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration CAB 2A Sample S3
Sample Interval 7.5 - 9.0 ft bgs

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Exploration CAB 2A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION CAB 2A

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration CAB 2A Sample S5
Sample Interval 15.0 - 16.5 ft bgs


Exploration CAB 2A Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION CAB 2B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/15/2018
**DATE COMPLETED:** 10/15/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 4
**GROUND ELEVATION:** Not Known
**GROUNDWATER (ATD):** Approx. 4.5 ft bgs
**GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **POORLY GRADED GRAVEL WITH SILT AND SAND** (GP-GM), brown - gray, moist | | | | | | | | |
| | | | **SILT WITH SAND** (ML), medium dense, blue - gray, moist | | S1 | 10 | 9<br>4<br>4 | 13 | | S1 | S1<br>MC = 26.4%<br>P200 = 64.2% |
| 5 | | | ▽ **SILTY SAND WITH GRAVEL** (SM), medium dense, brown gray, moist to wet | | S2 | 13 | 3<br>3<br>7 | 16 | | S2 | S2<br>MC = 13.9% |
| | | | Wood | | | | | | | | |
| | | | **WELL GRADED GRAVEL WITH SAND** (GW), medium dense, brown - gray, wet | | S3 | 8 | 4<br>5<br>4 | 13 | | S3 | S3<br>MC = 10.8%<br>48.0% gravel,<br>47.9% sand,<br>4.1% silt<br>P0.02 = 2.4%<br>FC = PFS |
| 10 | | | | | S4 | 8 | 5<br>3<br>4 | 9 | | S4 | S4<br>MC = 11.0% |
| 15 | | | **SANDY SILT** (ML), stiff, gray, wet | | S5 | 10 | 10<br>4<br>4 | 10 | | S5 | S5<br>MC = 26.3%<br>P200 = 60.1% |
| | | | **SILTY SAND** (SM), some gravel, medium dense, brown - gray, wet | | | | | | | | |
| 20 | | | | | S6 | 8 | 6<br>8<br>8 | 20 | | S6 | S6<br>MC = 10.6% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION CAB 2B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration CAB 2B Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration CAB 2B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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Fax: 907-344-5993

# PHOTO LOG
## EXPLORATION CAB 2B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration CAB 2B Sample S3
Sample Interval 7.5 - 9.0 ft bgs


Exploration CAB 2B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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# PHOTO LOG
## EXPLORATION CAB 2B

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration CAB 2B Sample S5
Sample Interval 15.0 - 16.5 ft bgs

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Exploration CAB 2B Sample S6
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION SHER 1A



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/15/2018
**DATE COMPLETED:** 10/15/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 3
**GROUND ELEVATION:** Not Known
**▽ GROUNDWATER (ATD):** Approx. 6.0 ft bgs
**▼ GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS | REMARKS/NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **POORLY GRADED GRAVEL WITH SAND** (GP), medium dense, brown, damp | | | | | | | | | |
| | | | | | S1 | 8 | 3<br>4<br>9 | 21 | | S1 | S1<br>MC = 4.7%<br>52.9% gravel,<br>44.3% sand,<br>2.8% silt | |
| 5 | | | | | S2 | 15 | 5<br>11<br>8 | 25 | | S2 | S2<br>MC = 6.5% | |
| | | | **WELL GRADED SAND WITH SILT** (SW-SM), medium dense, brown to gray, fine to medium grained, silt lens | | S3 | 12 | 12<br>6<br>7 | 16 | | S3 | S3<br>MC = 16.4%<br>5.5% gravel,<br>83.9% sand,<br>10.6% silt<br>P0.02 = 5.1%<br>FC = S2 | |
| 10 | | | | | S4 | 9 | 8<br>6<br>6 | 14 | | S4 | S4<br>MC = 13.6% | Possible sand heave. |
| | | | **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), loose to medium dense, gray, wet, silt lens | | S5 | 6 | 4<br>3<br>4 | 9 | | S5 | S5<br>MC = 10.6%<br>21.1% gravel,<br>68.7% sand,<br>10.2% silt<br>P0.02 = 5.4%<br>FC = S2 | |
| 15 | | | | | S6 | 8 | 6<br>5<br>6 | 12 | | S6 | S6<br>MC = 15.1% | |
| | | | **POORLY GRADED SAND WITH SILT** (SP-SM), loose, wet, fine grained | | | | | | | | | |
| 20 | | | | | S7 | | 3<br>3<br>5 | 9 | | S7 | S7<br>MC = 18.6% | |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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Telephone: 907-344-5934
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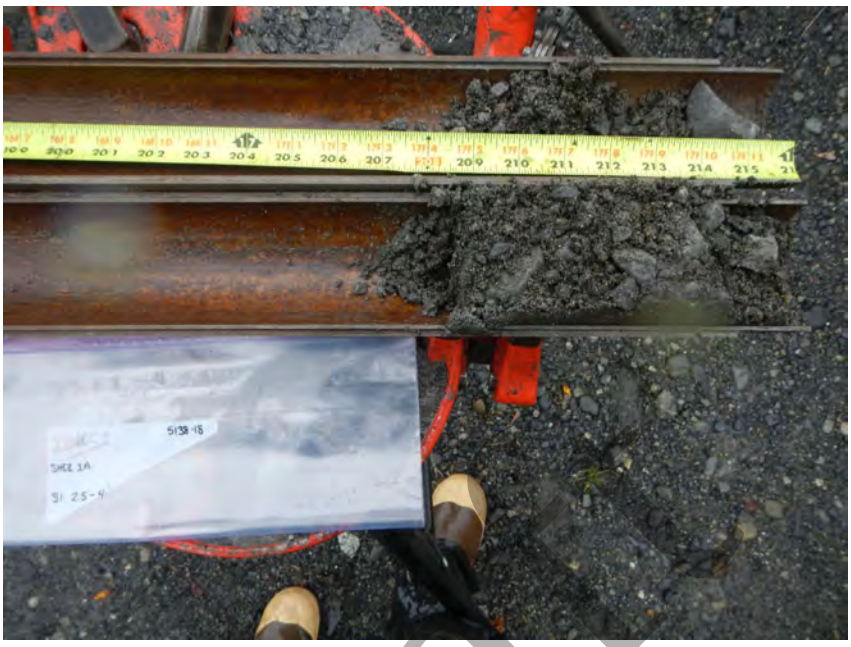
# PHOTO LOG
## EXPLORATION SHER 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK



Exploration SHER 1A Sample S1
Sample Interval 2.5 - 4.0 ft bgs

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Exploration SHER 1A Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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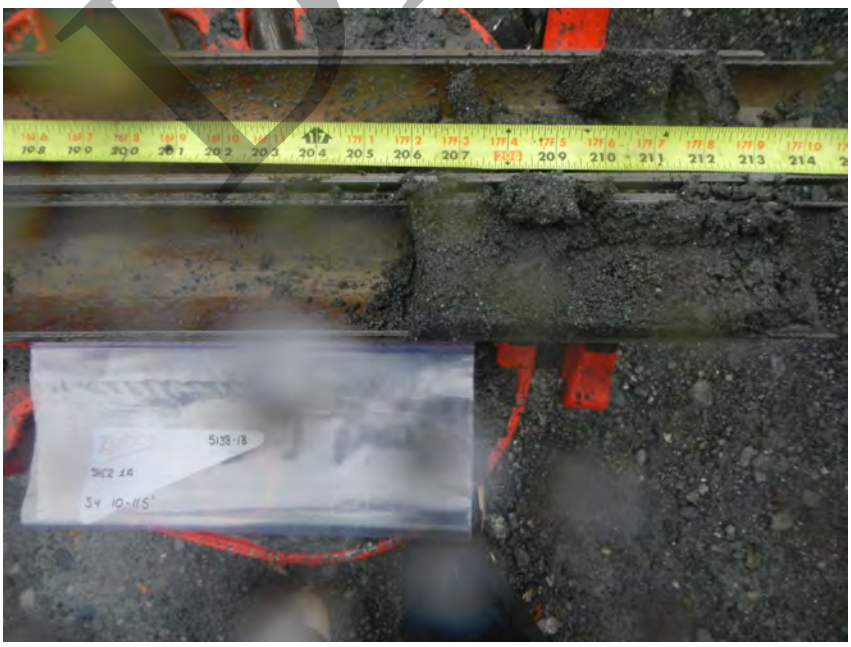
# PHOTO LOG
## EXPLORATION SHER 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration SHER 1A Sample S3
Sample Interval 7.5 - 9.0 ft bgs




Exploration SHER 1A Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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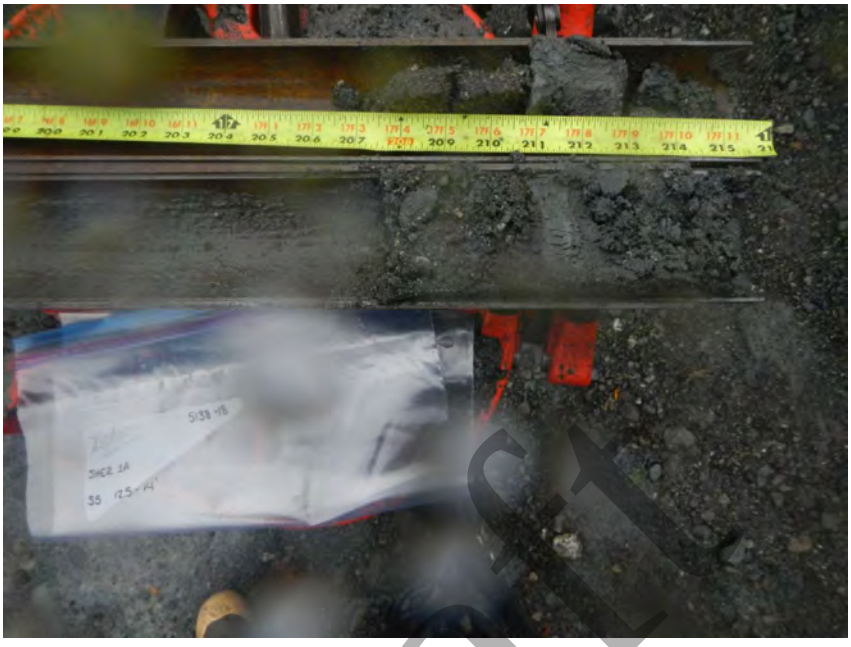
# PHOTO LOG
## EXPLORATION SHER 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK



Exploration SHER 1A Sample S5
Sample Interval 12.5 - 14.0 ft bgs

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Exploration SHER 1A Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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# PHOTO LOG
## EXPLORATION SHER 1A

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration SHER 1A Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION SHER 1B



**NGE-TFT PROJECT NAME:** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER:** 5138-18
**PROJECT LOCATION:** Copper River Hwy, Cordova, AK
**EXPLORATION CONTRACTOR:** Discovery Drilling, Inc.
**EXPLORATION EQUIPMENT:** Truck-mounted CME 75
**EXPLORATION METHOD:** Hollow Stem Auger
**SAMPLING METHOD:** Modified Split-spoon w/ 340lb autohammer
**LOGGED BY:** S. McCoy
**DATE STARTED:** 10/15/2018
**DATE COMPLETED:** 10/15/2018
**EXPLORATION LOCATION:** See report Figure 1 and Figure 3
**GROUND ELEVATION:** Not Known
**GROUNDWATER (ATD):** Approx. 6.5 ft bgs
**GROUNDWATER ():** N/A
**EXPLORATION COMPLETION:** Backfilled with cuttings
**WEATHER CONDITIONS:** Overcast, Rain, 45°F

| DEPTH (ft) | GRAPHIC LOG | FROZEN SOILS | MATERIAL DESCRIPTION | SAMPLE TYPE | FIELD SAMPLE ID | RECOVERY (in) | FIELD BLOWS | $(N_1)_{60}$ | SAMPLE INT. COLLECT | LAB SAMPLE ID | LAB RESULTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | **WELL GRADED SAND WITH SILT AND GRAVEL** (SW-SM), dense to medium dense, brown - gray, moist to wet | | | | | | | | |
| | | | | | S1 | 13 | 19<br>11<br>13 | 40 | | S1 | S1<br>MC = 8.5%<br>44.9% gravel,<br>49.2% sand,<br>5.9% silt |
| 5 | | | | | S2 | 12 | 23<br>8<br>7 | 20 | | S2 | S2<br>MC = 4.7%<br>41.1% gravel,<br>50.5% sand,<br>8.4% silt |
| | | | ▽ **SILTY SAND** (SM), medium dense, gray, wet | | S3 | 5 | 12<br>7<br>6 | 15 | | S3 | S3<br>MC = 7.7%<br>14.5% gravel,<br>69.2% sand,<br>16.3% silt<br>P0.02 = 11.1%<br>FC = F2 |
| 10 | | | **POORLY GRADED SAND WITH GRAVEL** (SP), loose, dark gray, wet, coarse grained | | S4 | 5 | 5<br>4<br>2 | 6 | | S4 | S4<br>MC = 9.6% |
| | | | **SILTY SAND** (SM), loose, gray, wet | | S5 | 7 | 5<br>1<br>4 | 6 | | S5 | S5<br>MC = 20.0%<br>P200 = 40.6% |
| 15 | | | **POORLY GRADED SAND** (SP), loose, dark gray, wet, coarse to medium grained | | S6 | 9 | 9<br>4<br>4 | 9 | | S6 | S6<br>MC = 10.2% |
| 20 | | | Grades to fine grained | | S7 | 5 | 3<br>3<br>4 | 8 | | S7 | S7<br>MC = 11.2% |

Bottom of borehole at 21.5 ft bgs.



*Always refer to our complete geotechnical report for this project for a more detailed explanation of the subsurface conditions at the project site and how they may affect any existing and/or prospective project site development.*

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# PHOTO LOG
## EXPLORATION SHER 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK


Exploration SHER 1B Sample S1
Sample Interval 2.5 - 4.0 ft bgs


Exploration SHER 1B Sample S2
Sample Interval 5.0 - 6.5 ft bgs

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# PHOTO LOG
## EXPLORATION SHER 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK

Exploration SHER 1B Sample S3
Sample Interval 7.5 - 9.0 ft bgs

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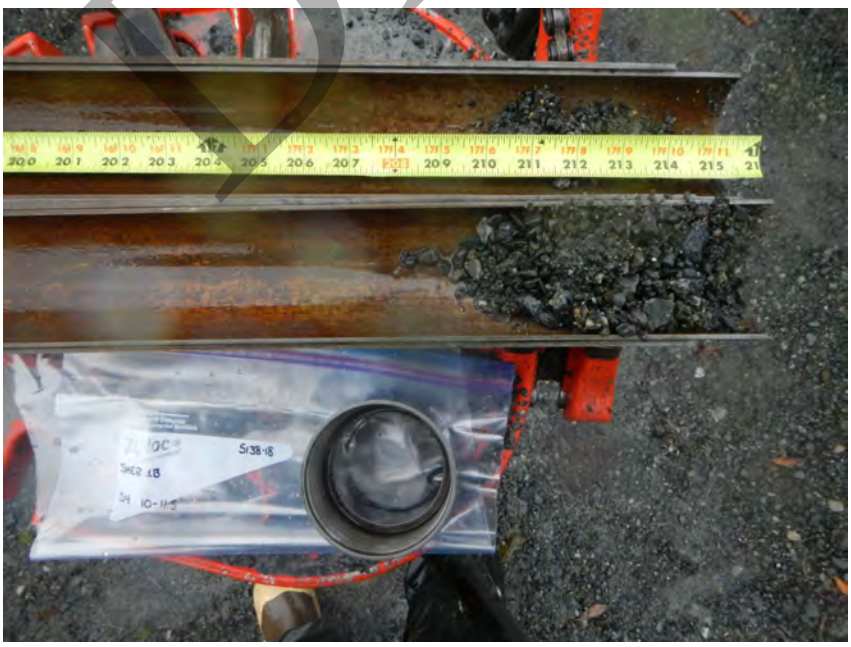

Exploration SHER 1B Sample S4
Sample Interval 10.0 - 11.5 ft bgs

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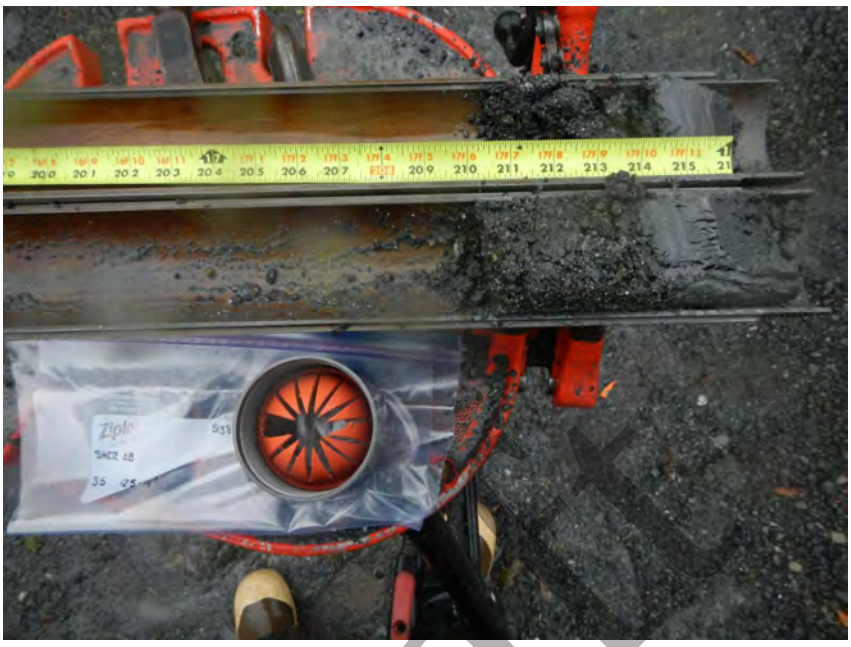
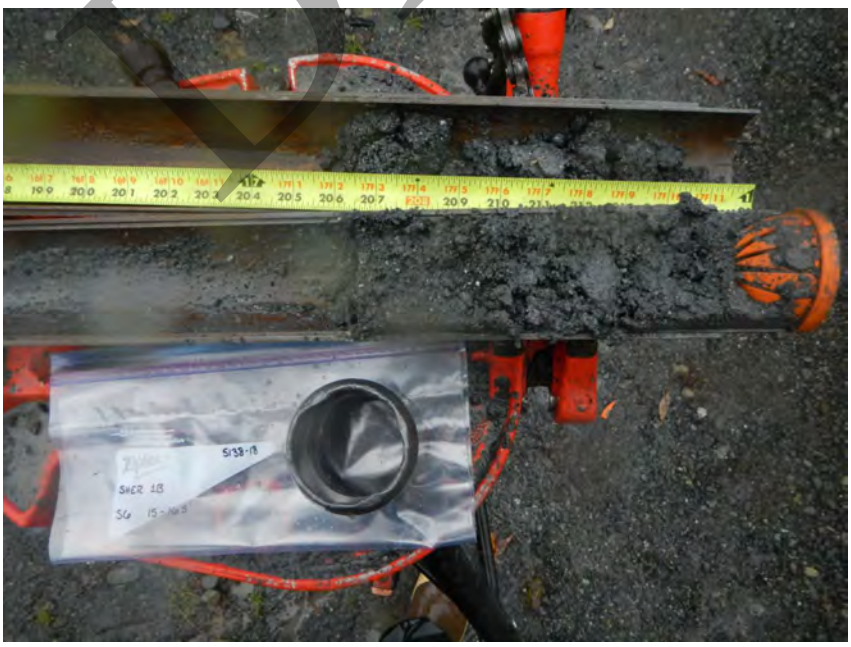
# PHOTO LOG
## EXPLORATION SHER 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK



Exploration SHER 1B Sample S5
Sample Interval 12.5 - 14.0 ft bgs



Exploration SHER 1B Sample S6
Sample Interval 15.0 - 16.5 ft bgs

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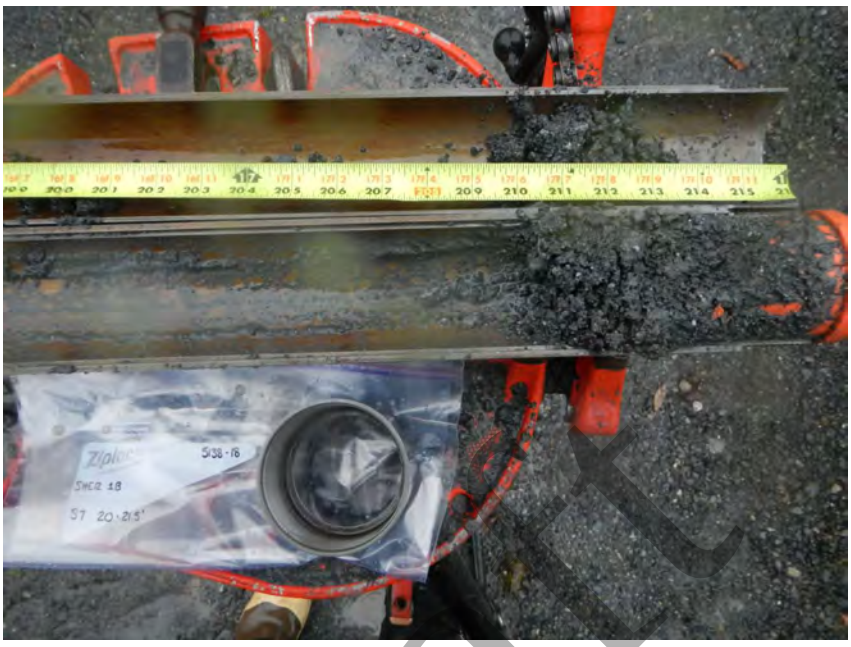
# PHOTO LOG
## EXPLORATION SHER 1B

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK




Exploration SHER 1B Sample S7
Sample Interval 20.0 - 21.5 ft bgs

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# EXPLORATION LEGEND

**CLIENT** Bratslavsky Consulting Engineers, Inc.

**NGE-TFT PROJECT NAME** USFWS Fish Passage Improvements

**NGE-TFT PROJECT NUMBER** 5138-18

**PROJECT LOCATION** Copper River Hwy, Cordova, AK

## LITHOLOGIC SYMBOLS
## (Unified Soil Classification System)


GM: USCS Silty Gravel


GP: USCS Poorly-graded Gravel


GP-GM: USCS Poorly-graded Gravel with Silt


GW: USCS Well-graded Gravel


GW-GM: USCS Well-graded Gravel with Silt


ML: USCS Silt


PT: USCS Peat


SM: USCS Silty Sand


SP: USCS Poorly-graded Sand


SP-SM: USCS Poorly-graded Sand with Silt


SW: USCS Well-graded Sand


SW-SM: USCS Well-graded Sand with Silt


WOOD: Plywood

## SAMPLER SYMBOLS


Modified Penetration Test


No Recovery

## WELL CONSTRUCTION SYMBOLS



## ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
MC - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
P200 - PERCENT PASSING NO. 200 SIEVE
P0.02- PERCENT PASSING 0.02mm SIEVE
PP - POCKET PENETROMETER (tons/ft$^2$)
S/U - CASING STICK-UP

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION
N/E - NOT ENCOUNTERED

▽ Water Level at Time Drilling, or as Shown

▼ Water Level After 24 Hours, or as Shown

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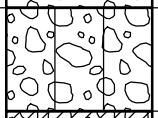
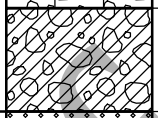
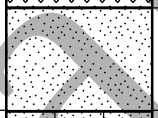
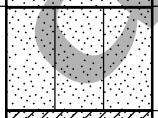
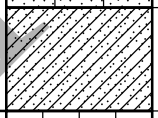
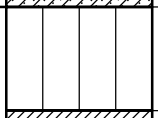
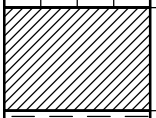
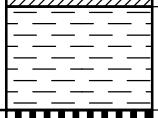
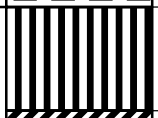
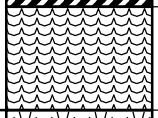
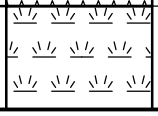
# SOIL CLASSIFICATION CHART

**CLIENT** Bratslavsky Consulting Engineers, Inc.
**PROJECT NAME** USFWS Fish Passage Improvements
**NGE-TFT PROJECT NUMBER** 5138-18
**PROJECT LOCATION** Copper River Hwy, Cordova, AK

| 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 |

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.
DIAGONAL LINES INDICATE UNKNOWN DEPTH OF SOIL TRANSITION.

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# EXPLORATION LOG KEY

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**NGE-TFT PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK

## SAMPLER SYMBOLS

- SPT w/ 140# Hammer 30" Drop and 2.0" O.D. Sampler
- Modified SPT w/ 340# Hammer 30" Drop and 3.0 O.D. Sampler
- Grab Sample
- Shelby Tube Sample
- Rock Core Sample
- Direct Push Sample
- No Recovery
- **N/E** Not Encountered

## WELL SYMBOLS

- 1" Slotted Pipe Backfilled with Silica Sand
- 1" PVC Pipe Backfilled with Auger Cuttings
- 1" PVC Pipe with Bentonite Seal
- Capped Riser

**COMPONENT DEFINITIONS**

| COMPONENT | SIZE RANGE |
|---|---|
| Boulders | Larger than 12 in |
| Cobbles | 3 in to 12 in |
| Gravel | 3 in to No. 4 (4.5mm) |
| Coarse gravel | 3 in to 3/4 in |
| Fine gravel | 3/4 in to No. 4 (4.5 mm) |
| Sand | No. 4 (4.5 mm) to No. 200 |
| Coarse sand | No. 4 (4.5 mm) to No. 10 (2.0 mm) |
| Medium sand | No. 10 (2.0 mm) to No. 40 (0.42 mm) |
| Fine sand | No. 40 (0.42 mm) to No. 200 (0.074 mm) |
| Silt and Clay | Smaller than No. 200 (0.074 mm) |

**COMPONENT PROPORTIONS**

| DESCRIPTIVE TERMS | RANGE OF PROPORTION |
|---|---|
| Trace | 1-5% |
| Few | 5-10% |
| Little | 10-20% |
| Some | 20-35% |
| And | 35-50% |

**MOISTURE CONTENT**

| | |
|---|---|
| DRY | Absence of moisture, dusty, dry to the touch |
| DAMP | Some perceptible moisture; below optimum |
| MOIST | No visible water; near optimum moisture content |
| WET | Visible free water, usually soil is below water table |

**RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE**

| COHESIONLESS SOILS | | | COHESIVE SOILS | | |
|---|---|---|---|---|---|
| DENSITY | N (BLOWS/FT) | APPROXIMATE RELATIVE DENSITY (%) | CONSISTENCY | N (BLOWS/FT) | APPROXIMATE UNDRAINED SHEAR STRENGTH (PSF) |
| VERY LOOSE | 0-4 | 0-15 | VERY SOFT | 0-1 | < 250 |
| LOOSE | 5-10 | 15-35 | SOFT | 2-4 | 250-500 |
| MEDIUM DENSE | 11-25 | 35-65 | MEDIUM STIFF | 5-8 | 500-1000 |
| DENSE | 26-50 | 65-85 | STIFF | 9-15 | 1000-2000 |
| VERY DENSE | > 50 | 85-100 | VERY STIFF | 16-30 | 2000-4000 |
| | | | HARD | > 30 | > 4000 |

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# *EXPLORATION LOG KEY*

**CLIENT** Bratslavsky Consulting Engineers, Inc. **PROJECT NAME** USFWS Fish Passage Improvements

**NGE-TFT PROJECT NUMBER** 5138-18 **PROJECT LOCATION** Copper River Hwy, Cordova, AK

**FROST DESIGN SOIL CLASSIFICATION**

| FROST GROUP (USACOE) | FROST GROUP (M.O.A.) | SOIL TYPE | % FINER THAN 0.02mm BY MASS | TYPICAL SOIL TYPES UNDER UNIFIED SOIL CLASSIFICATION SYSTEM |
|---|---|---|---|---|
| NFS* | NFS* | (A) GRAVELS<br>CRUSHED STONE<br>CRUSHED ROCK<br>(B) SANDS | 0 - 1.5<br><br><br>0 - 3 | GW, GP<br><br><br>SW, SP |
| PFS+ | NFS* | (A) GRAVELS<br>CRUSHED STONE<br>CRUSHED ROCK | 1.5 - 3 | GW, GP |
| | F2 | (B) SANDS | 3 - 10 | SW, SP |
| S1 | F1 | GRAVELLY SOILS | 3 - 6 | GW, GP, GW-GM, GP-GM |
| S2 | F2 | SANDY SOILS | 3 - 6 | SW, SP, SW-SM, SP-SM |
| F1 | F1 | GRAVELLY SOILS | 6 - 10 | GM, GW-GM, GP-GM |
| F2 | F2 | (A) GRAVELLY SOILS<br>(B) SANDS | 10 - 20<br>6 - 15 | GM, GW-GM, GP-GM<br>SM, SW-SM, SP-SM |
| F3 | F3 | (A) GRAVELLY SOILS<br>(B) SANDS, EXCEPT VERY FINE SILTY SANDS<br>(C) CLAYS, PI>12 | Over 20<br>Over 15<br>- - - - - - | GM, GC<br>SM, SC<br>CL, CH |
| F4 | F4 | (A) ALL SILTS<br>(B) VERY FINE SILTY SANDS<br>(C) CLAYS, PI<12<br>(D) VARVED CLAYS AND OTHER FINE GRAINED, BANDED SEDIMENTS | - - - - - -<br>Over 15<br>- - - - - -<br>- - - - - - | ML, MH<br>SM<br>CL, CL-ML<br>CL & ML;<br>CL, ML, & SM;<br>CL, CH, & ML;<br>CL, CH, ML, & SM |

*Non-frost susceptible
+Possibly frost susceptible, but requires lab testing to determine frost design soils classification.



**ICE CLASSIFICATION SYSTEM**

| GROUP | ICE VISIBILITY | DESCRIPTION | | SYMBOL | |
|---|---|---|---|---|---|
| N | SEGREGATED ICE NOT VISIBLE BY EYE | POORLY BONDED OR FRIABLE | | Nf | |
| | | WELL BONDED | NO EXCESS ICE | Nb | Nbn |
| | | | EXCESS MICROSCOPIC ICE | | Nbe |
| V | SEGREGATED ICE IS VISIBLE BY EYE AND IS ONE INCH OR LESS IN THICKNESS | INDIVIDUAL ICE CRYSTALS OR INCLUSIONS | | Vx | |
| | | ICE COATINGS ON PARTICLES | | Vc | |
| | | RANDOM OR IRREGULARY ORIENTED ICE | | Vr | |
| | | STRATIFIED OR DISTINCTLY ORIENTED ICE | | Vs | |
| | | UNIFORMLY DISTRIBUTED ICE | | Vu | |
| ICE | ICE IS GREATER THAN ONE INCH IN THICKNESS | ICE WITH SOILS INCLUSIONS | | ICE + Soil Type | |
| | | ICE WITHOUT SOILS INCLUSIONS | | ICE | |


# APPENDIX B

# LABORATORY TEST RESULTS

# Summary of Laboratory Test Results

## USFWS Fish Passage Improvements

NGE-TFT Project #:5138-18

| Exploration ID | Sample Number | Depth Interval (ft) Top | Depth Interval (ft) Bottom | Moisture Content ASTM D2216 (% By Dry Mass) | Particle Size Analysis ASTM C136/D422/D6913 (% By Mass) Gravel | Sand | Silt/Clay | Passing #200 ASTM D1140 (% By Mass) | Passing 0.02mm ASTM D422 (% By Mass) | Frost Class. | Organic Content (ASTM D2974) (% By Mass) | Unified Soil Classification ASTM D2487 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COP 1A | S1 | 2.5 | 4.0 | 2.5 | 49.3 | 45.4 | 5.3 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 1A | S2 | 5.0 | 6.5 | 6.0 | 46.3 | 48.3 | 5.4 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 1A | S3 | 7.5 | 9.0 | 8.5 | 37.0 | 58.6 | 4.4 | | 2.3 | NFS | | (SW) Well-graded sand w/ gravel |
| COP 1A | S4 | 10.0 | 11.5 | 12.0 | | | | | | | 2.0 | |
| COP 1A | S5 | 12.5 | 14.0 | 12.5 | | | | | | | | |
| COP 1A | S6 | 15.0 | 16.5 | 11.1 | | | | | | | | |
| COP 1A | S7 | 20.0 | 21.5 | 24.9 | | | | 73.2 | | | | |
| | | | | | | | | | | | | |
| COP 1B | S1 | 2.5 | 4.0 | 8.5 | 46.8 | 43.9 | 9.3 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 1B | S2 | 5.0 | 6.5 | 4.1 | 21.5 | 63.4 | 15.1 | | | | | (SM) Silty sand w/ gravel |
| COP 1B | S3 | 7.5 | 9.0 | 9.3 | 38.2 | 52.7 | 9.1 | | 6.3 | F2 | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 1B | S4 | 10.0 | 11.5 | 25.3 | 0.8 | 36.0 | 63.2 | | 24.8 | F4 | | (ML) Sandy silt |
| COP 1B | S5 | 12.5 | 14.0 | 12.5 | | | | | | | | |
| COP 1B | S6 | 15.0 | 16.5 | 11.4 | | | | | | | | |
| COP 1B | S7 | 20.0 | 21.5 | 29.1 | | | | 87.2 | | | | |
| | | | | | | | | | | | | |
| COP 9A | S1 | 2.5 | 4.0 | 7.7 | 50.4 | 45.2 | 4.4 | | | | | (GP) Poorly-graded gravel w/ sand |
| COP 9A | S2 | 5.0 | 6.5 | 3.8 | 39.4 | 53.2 | 7.4 | | | | | (SP-SM) Poorly-graded sand w/ silt and gravel |
| COP 9A | S3 | 7.5 | 9.0 | 6.0 | | | | | | | | |
| COP 9A | S4 | 10.0 | 11.5 | 6.8 | 50.1 | 44.3 | 5.6 | | 4.1 | S1 | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 9A | S5 | 12.5 | 14.0 | 7.0 | | | | | | | | |
| COP 9A | S6 | 15.0 | 16.5 | 30.7 | | | | 57.5 | | | | |
| COP 9A | S7 | 20.0 | 21.5 | 32.4 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 9B | S1 | 2.5 | 4.0 | 2.5 | 48.6 | 45.3 | 6.1 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 9B | S2 | 5.0 | 6.5 | 3.8 | 56.4 | 35.5 | 8.1 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 9B | S3 | 7.5 | 9.0 | 3.7 | | | | | | | | |
| COP 9B | S4 | 10.0 | 11.5 | 6.4 | 50.5 | 42.8 | 6.7 | | 4.5 | S1 | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 9B | S5 | 12.5 | 14.0 | 24.3 | | | | | | | | |
| COP 9B | S6 | 15.0 | 16.5 | 19.3 | | | | | | | | |
| COP 9B | S7 | 20.0 | 21.5 | 38.3 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 20A | S1 | 2.5 | 4.0 | 2.4 | 71.0 | 24.9 | 4.1 | | | | | (GP) Poorly-graded gravel w/ sand |
| COP 20A | S2 | 5.0 | 6.5 | 6.4 | 49.8 | 43.5 | 6.7 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 20A | S3 | 7.5 | 9.0 | 8.2 | 34.0 | 61.1 | 4.9 | | 3.1 | S2 | | (SW) Well-graded sand w/ gravel |
| COP 20A | S4 | 10.0 | 11.5 | 5.9 | 69.2 | 29.8 | 1.0 | | | | | (GW) Well-graded gravel w/ sand |
| COP 20A | S5 | 12.5 | 14.0 | NO SAMPLE | | | | | | | | |
| COP 20A | S6 | 15.0 | 16.5 | 10.1 | | | | | | | | |
| COP 20A | S7 | 20.0 | 21.5 | NO SAMPLE | | | | | | | | |
| | | | | | | | | | | | | |
| COP 20B | S1 | 2.5 | 4.0 | 3.3 | | | | | | | | |

# Summary of Laboratory Test Results

## USFWS Fish Passage Improvements

NGE-TFT Project #:5138-18

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COP 20B | S2 | 5.0 | 6.5 | 5.7 | 39.6 | 51.5 | 8.9 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 20B | S3 | 7.5 | 9.0 | 9.1 | 40.0 | 55.3 | 4.7 | | 2.6 | NFS | | (SP) Poorly-graded sand w/ gravel |
| COP 20B | S4 | 10.0 | 11.5 | 7.0 | 55.1 | 42.1 | 2.8 | | 1.7 | PFS | | (GW) Well-graded gravel w/ sand |
| COP 20B | S5 | 12.5 | 14.0 | 9.5 | | | | | | | | |
| COP 20B | S6 | 15.0 | 16.5 | 11.8 | 34.8 | 60.4 | 4.8 | | | | | (SW) Well-graded sand w/ gravel |
| COP 20B | S7 | 20.0 | 21.5 | 14.5 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 22A | S1 | 2.5 | 4.0 | 4.1 | | | | | | | | |
| COP 22A | S2 | 5.0 | 6.5 | 4.0 | 44.7 | 49.5 | 5.8 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 22A | S3 | 7.5 | 9.0 | 5.8 | 56.0 | 38.0 | 6.0 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 22A | S4 | 10.0 | 11.5 | 6.6 | 51.1 | 43.4 | 5.5 | | 3.2 | S1 | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 22A | S5 | 12.5 | 14.0 | 5.1 | | | | | | | | |
| COP 22A | S6 | 15.0 | 16.5 | 4.1 | 51.8 | 47.2 | 1.0 | | | | | (GW) Well-graded gravel w/ sand |
| COP 22A | S7 | 20.0 | 21.5 | NO SAMPLE | | | | | | | | |
| | | | | | | | | | | | | |
| COP 22B | S1 | 2.5 | 4.0 | 7.1 | 52.7 | 41.3 | 6.0 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 22B | S2 | 5.0 | 6.5 | 8.7 | 36.3 | 54.0 | 9.7 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 22B | S3 | 7.5 | 9.0 | 7.0 | 41.5 | 52.2 | 6.3 | | 4.3 | S2 | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 22B | S4 | 10.0 | 11.5 | 6.4 | 53.8 | 42.2 | 4.0 | | 2.6 | PFS | | (GW) Well-graded gravel w/ sand |
| COP 22B | S5 | 12.5 | 14.0 | 10.4 | | | | | | | | |
| COP 22B | S6 | 15.0 | 16.5 | 9.1 | | | | | | | | |
| COP 22B | S7 | 20.0 | 21.5 | 9.1 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 25A | S1 | 2.5 | 4.0 | 3.4 | 53.1 | 42.8 | 4.1 | | | | | (GW) Well-graded gravel w/ sand |
| COP 25A | S2 | 5.0 | 6.5 | 4.7 | 39.7 | 54.8 | 5.5 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 25A | S3 | 7.5 | 9.0 | 8.1 | 44.2 | 54.6 | 1.2 | | 0.9 | NFS | | (SW) Well-graded sand w/ gravel |
| COP 25A | S4 | 10.0 | 11.5 | 3.7 | | | | | | | | |
| COP 25A | S5 | 12.5 | 14.0 | 6.8 | 52.2 | 46.1 | 1.7 | | | | | (GW) Well-graded gravel w/ sand |
| COP 25A | S6 | 15.0 | 16.5 | 13.1 | | | | | | | | |
| COP 25A | S7 | 20.0 | 21.5 | 8.8 | | | | 10.6 | | | | |
| | | | | | | | | | | | | |
| COP 25B | S1 | 2.5 | 4.0 | 6.8 | | | | | | | | |
| COP 25B | S2 | 5.0 | 6.5 | 3.2 | 38.1 | 54.6 | 7.3 | | | | | (SP-SM) Poorly-graded sand w/ silt and gravel |
| COP 25B | S3 | 7.5 | 9.0 | 8.5 | 39.8 | 56.9 | 3.3 | | | | | (SP) Poorly-graded sand w/ gravel |
| COP 25B | S4 | 10.0 | 11.5 | 8.1 | 41.1 | 56.8 | 2.1 | | 1.7 | NFS | | (SW) Well-graded sand w/ gravel |
| COP 25B | S5 | 12.5 | 14.0 | 8.1 | | | | | | | | |
| COP 25B | S6 | 15.0 | 16.5 | 221.6 | | | | | | | | |
| COP 25B | S7 | 20.0 | 21.5 | 11.5 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 33A | S1 | 5.0 | 6.5 | | | | | | | | | |
| COP 33A | S2 | 10.0 | 11.5 | 5.2 | 70.6 | 25.6 | 3.8 | | 2.1 | PFS | | (GW) Well-graded gravel w/ sand |
| COP 33A | S3 | 12.5 | 14.0 | 71.2 | 11.2 | 40.9 | 47.9 | | | | | (SM) Silty sand |
| COP 33A | S4 | 15.0 | 16.5 | 20.7 | | | | | | | | |
| COP 33A | S5 | 17.5 | 19.0 | 34.0 | | | | 85.2 | | | | |
| COP 33A | S6 | 20.0 | 21.5 | 24.1 | | | | | | | | |
| | | | | | | | | | | | | |

# Summary of Laboratory Test Results

## USFWS Fish Passage Improvements

NGE-TFT Project #:5138-18

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COP 33B | S1 | 5.0 | 6.5 | 10.1 | 42.0 | 45.2 | 12.8 | | | | | (SM) Silty sand w/ gravel |
| COP 33B | S2 | 10.0 | 11.5 | 8.6 | 62.3 | 29.9 | 7.8 | | 5.1 | S1 | | (GP-GM) Poorly-graded gravel w/ silt and sand |
| COP 33B | S3 | 12.5 | 14.0 | 21.5 | | | | | | | | |
| COP 33B | S4A | 15.0 | 16.0 | 24.6 | | | | | | | | |
| COP 33B | S4B | 16.0 | 16.5 | 20.2 | | | | | | | | |
| COP 33B | S5 | 17.5 | 19.0 | 26.4 | | | | | | | 5.4 | |
| COP 33B | S6 | 20.0 | 21.5 | 19.2 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 43A | S1 | 2.5 | 4.0 | 7.4 | 41.5 | 55.0 | 3.5 | | | | | (SW) Well-graded sand w/ gravel |
| COP 43A | S2 | 5.0 | 6.5 | 9.8 | | | | | | | | |
| COP 43A | S3 | 7.5 | 9.0 | 17.9 | 3.2 | 80.4 | 16.4 | | 5.9 | F2 | | (SM) Silty sand |
| COP 43A | S4 | 10.0 | 11.5 | 16.9 | | | | | | | | |
| COP 43A | S5 | 15.0 | 16.5 | 26.1 | | | | 24.4 | | | | |
| COP 43A | S6 | 20.0 | 21.5 | 20.2 | | | | 23.5 | | | | |
| | | | | | | | | | | | | |
| COP 43B | S1 | 2.5 | 4.0 | 7.3 | 48.6 | 45.8 | 5.6 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| COP 43B | S2 | 5.0 | 6.5 | 7.5 | 42.3 | 53.6 | 4.1 | | 2.6 | NFS | | (SW) Well-graded sand w/ gravel |
| COP 43B | S3 | 7.5 | 9.0 | 45.8 | | | | 30.9 | | | | |
| COP 43B | S4 | 10.0 | 11.5 | 46.5 | 8.5 | 74.3 | 17.2 | | 6.6 | F2 | | (SM) Silty sand |
| COP 43B | S5 | 15.0 | 16.5 | 27.4 | | | | | | | | |
| COP 43B | S6 | 20.0 | 21.5 | 7.3 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 44A | S1 | 2.5 | 4.0 | 5.0 | 57.6 | 38.2 | 4.2 | | | | | (GW) Well-graded gravel w/ sand |
| COP 44A | S2 | 5.0 | 6.5 | 7.2 | 47.6 | 47.5 | 4.9 | | 3.2 | S1 | | (GW) Well-graded gravel w/ sand |
| COP 44A | S3 | 7.5 | 9.0 | 6.7 | 53.3 | 43.2 | 3.5 | | | | | (GW) Well-graded gravel w/ sand |
| COP 44A | S4 | 10.0 | 11.5 | 8.9 | | | | | | | | |
| COP 44A | S5 | 15.0 | 16.5 | 26.9 | | | | 62.7 | | | | |
| COP 44A | S6 | 20.0 | 21.5 | 31.8 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 44B | S1 | 2.5 | 4.0 | 8.0 | 58.9 | 36.3 | 4.8 | | | | | (GW) Well-graded gravel w/ sand |
| COP 44B | S2 | 5.0 | 6.5 | 7.7 | 47.1 | 47.7 | 5.2 | | 3.6 | S2 | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 44B | S3 | 7.5 | 9.0 | 8.6 | | | | | | | | |
| COP 44B | S4 | 10.0 | 11.5 | 9.3 | 43.9 | 53.7 | 2.4 | | | | | (SP) Poorly-graded sand w/ gravel |
| COP 44B | S5 | 15.0 | 16.5 | 25.8 | | | | 20.1 | | | | |
| COP 44B | S6 | 20.0 | 21.5 | 23.8 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 45A | S1 | 2.5 | 4.0 | 7.6 | 45.3 | 47.7 | 7.0 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| COP 45A | S2 | 5.0 | 6.5 | 25.3 | 2.9 | 58.1 | 39.0 | | 12.0 | F2 | | (SM) Silty sand |
| COP 45A | S3 | 7.5 | 9.0 | 29.2 | | | | | | | | |
| COP 45A | S4A | 10.0 | 11.0 | 8.7 | | | | | | | | |
| COP 45A | S4B | 11.0 | 11.5 | 20.4 | | | | | | | | |
| COP 45A | S5 | 15.0 | 16.5 | 7.1 | 55.9 | 42.2 | 1.9 | | | | | (GP) Poorly-graded gravel w/ sand |
| COP 45A | S6 | 20.0 | 21.5 | 15.5 | | | | | | | | |
| | | | | | | | | | | | | |
| COP 45B | S1 | 2.5 | 4.0 | 6.6 | 54.3 | 41.5 | 4.2 | | | | | (GW) Well-graded gravel w/ sand |
| COP 45B | S2 | 5.0 | 6.5 | 7.3 | 44.4 | 49.0 | 6.6 | | 4.7 | S2 | | (SW-SM) Well-graded sand w/ silt and gravel |

# Summary of Laboratory Test Results

## USFWS Fish Passage Improvements

NGE-TFT Project #:5138-18

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COP 45B | S3 | 7.5 | 9.0 | 18.5 | | | | | | | | |
| COP 45B | S4 | 10.0 | 11.5 | 42.0 | | | | 34.7 | | | | |
| COP 45B | S5 | 15.0 | 16.5 | 6.9 | | | | | | | | |
| | | | | | | | | | | | | |
| CAB 2A | S1 | 2.5 | 4.0 | 10.5 | 56.8 | 36.1 | 7.1 | | | | | (GW-GM) Well-graded gravel w/ silt and sand |
| CAB 2A | S2 | 5.0 | 6.5 | 10.1 | | | | | | | | |
| CAB 2A | S3 | 7.5 | 9.0 | 12.0 | 27.9 | 64.7 | 7.4 | | 5.0 | S2 | | (SW-SM) Well-graded sand w/ silt and gravel |
| CAB 2A | S4 | 10.0 | 11.5 | 7.6 | | | | | | | | |
| CAB 2A | S5 | 15.0 | 16.5 | 26.4 | | | | 67.9 | | | | |
| CAB 2A | S6 | 20.0 | 21.5 | 11.7 | | | | | | | | |
| | | | | | | | | | | | | |
| CAB 2B | S1 | 2.5 | 4.0 | 26.4 | | | | 64.2 | | | | |
| CAB 2B | S2 | 5.0 | 6.5 | 13.9 | | | | | | | | |
| CAB 2B | S3 | 7.5 | 9.0 | 10.8 | 48.0 | 47.9 | 4.1 | | 2.4 | PFS | | (GW) Well-graded gravel w/ sand |
| CAB 2B | S4 | 10.0 | 11.5 | 11.0 | | | | | | | | |
| CAB 2B | S5 | 15.0 | 16.5 | 26.3 | | | | 60.1 | | | | |
| CAB 2B | S6 | 20.0 | 21.5 | 10.6 | | | | | | | | |
| | | | | | | | | | | | | |
| SHER 1A | S1 | 2.5 | 4.0 | 4.7 | 52.9 | 44.3 | 2.8 | | | | | (GP) Poorly-graded gravel w/ sand |
| SHER 1A | S2 | 5.0 | 6.5 | 6.5 | | | | | | | | |
| SHER 1A | S3 | 7.5 | 9.0 | 16.4 | 5.5 | 83.9 | 10.6 | | 5.1 | S2 | | (SW-SM) Well-graded sand w/ silt |
| SHER 1A | S4 | 10.0 | 11.5 | 13.6 | | | | | | | | |
| SHER 1A | S5 | 12.5 | 14.0 | 10.6 | 21.1 | 68.7 | 10.2 | | 5.4 | S2 | | (SP-SM) Poorly-graded sand w/ silt and gravel |
| SHER 1A | S6 | 15.0 | 16.5 | 15.1 | | | | | | | | |
| SHER 1A | S7 | 20.0 | 21.5 | 18.6 | | | | | | | | |
| | | | | | | | | | | | | |
| SHER 1B | S1 | 2.5 | 4.0 | 8.5 | 44.9 | 49.2 | 5.9 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| SHER 1B | S2 | 5.0 | 6.5 | 4.7 | 41.1 | 50.5 | 8.4 | | | | | (SW-SM) Well-graded sand w/ silt and gravel |
| SHER 1B | S3 | 7.5 | 9.0 | 7.7 | 14.5 | 69.2 | 16.3 | | 11.1 | F2 | | (SM) Silty sand |
| SHER 1B | S4 | 10.0 | 11.5 | 9.6 | | | | | | | | |
| SHER 1B | S5 | 12.5 | 14.0 | 20.0 | | | | 40.6 | | | | |
| SHER 1B | S6 | 15.0 | 16.5 | 10.2 | | | | | | | | |
| SHER 1B | S7 | 20.0 | 21.5 | 11.2 | | | | | | | | |

NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

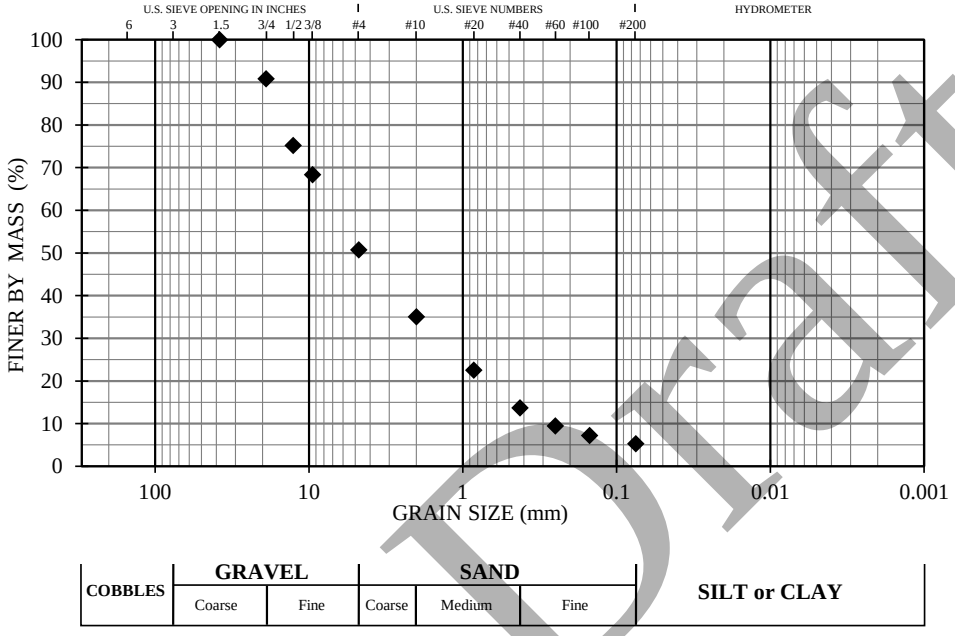
Laboratory Testing · Geotechnical Engineering · Instrumentation · Construction Monitoring Services · Thermal Analysis

| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **CH** |
| REVIEWED BY: | **SAM** |

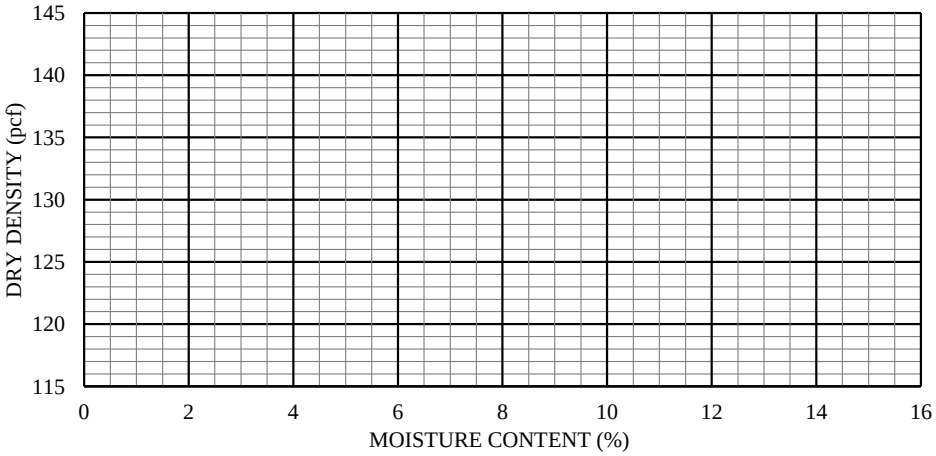
| | | | |
|---|---|---|---|
| % GRAVEL | **49.3** | USCS | **GW-GM** |
| % SAND | **45.4** | USACOE FC | **N/A** |
| % SILT/CLAY | **5.3** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **2.5** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **26.6** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.2** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **91** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **68** | |
| 4.75 | #4 | **51** | |
| 2.00 | #10 | **35** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **14** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **5.3** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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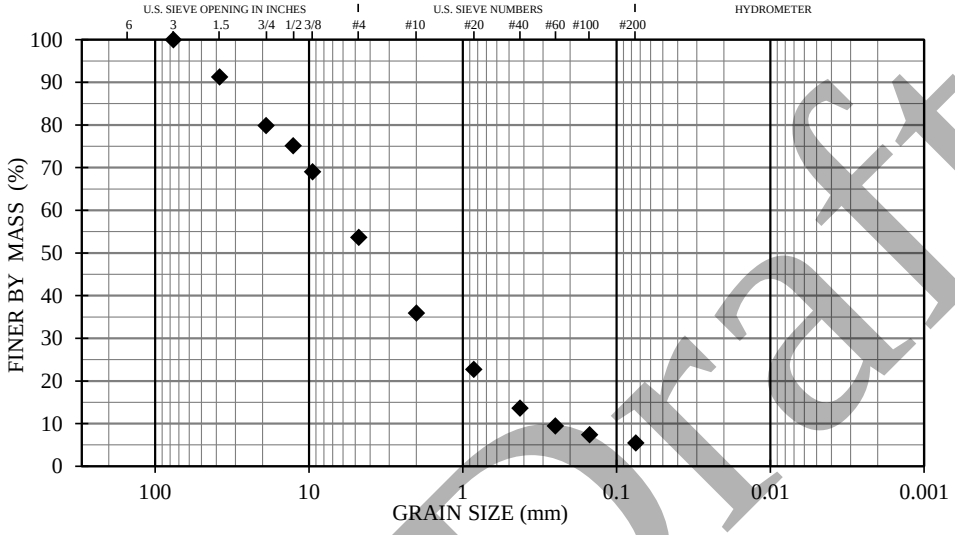
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **CH** |
| REVIEWED BY: | **SAM** |

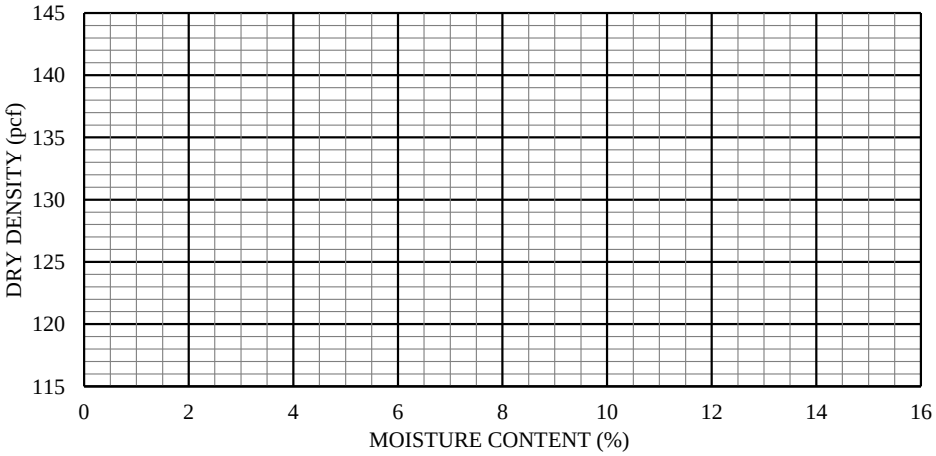
| | | | |
|---|---|---|---|
| % GRAVEL | **46.3** | USCS | **SW-SM** |
| % SAND | **48.3** | USACOE FC | **N/A** |
| % SILT/CLAY | **5.4** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **6.0** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **24.6** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.2** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




| COBBLES | GRAVEL | | SAND | | | SILT or CLAY |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **91** | |
| 19.00 | 3/4" | **80** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **54** | |
| 2.00 | #10 | **36** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **14** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **5.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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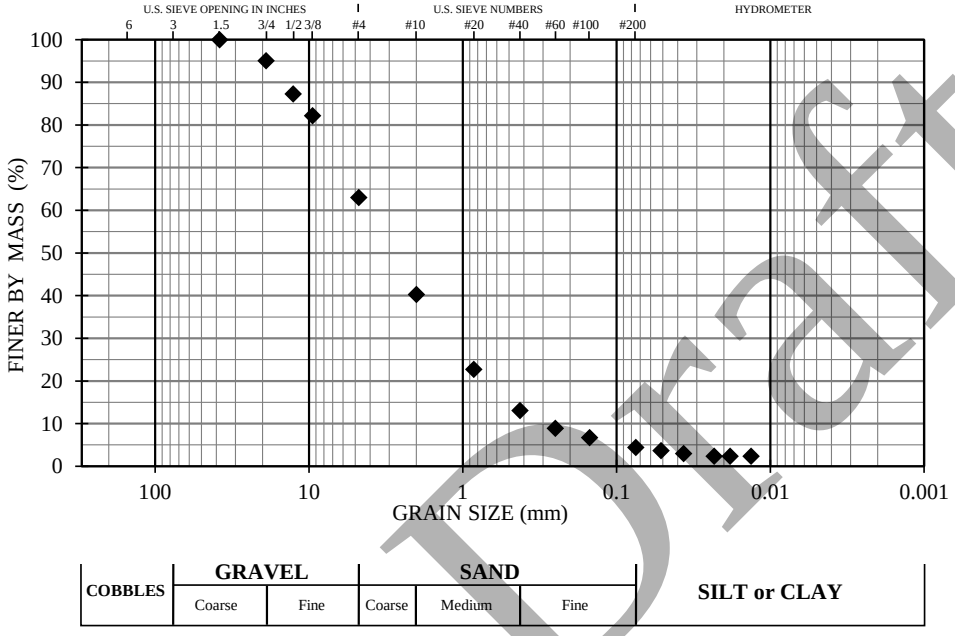
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **37.0** | USCS | **SW** |
| % SAND | **58.6** | USACOE FC | **NFS** |
| % SILT/CLAY | **4.4** | % PASS. 0.02 mm | **2.3** |
| % MOIST. CONTENT | **8.5** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **14.8** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.4** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

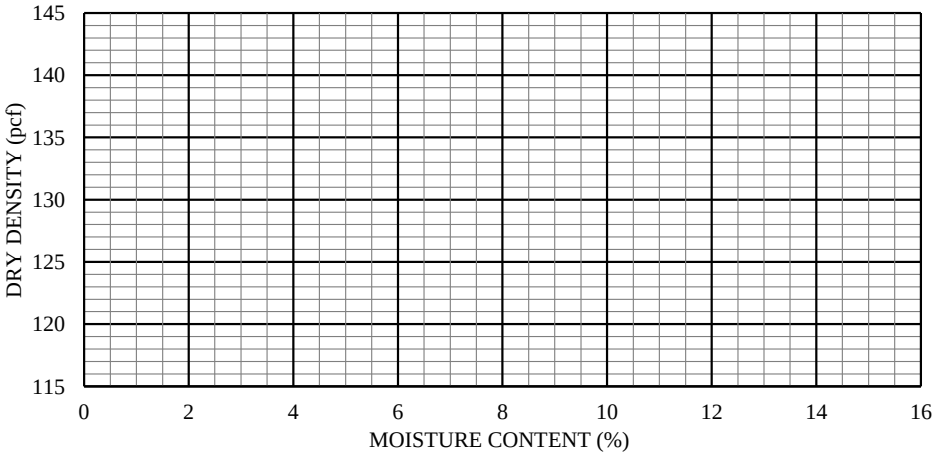
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **95** | |
| 12.70 | 1/2" | **87** | |
| 9.50 | 3/8" | **82** | |
| 4.75 | #4 | **63** | |
| 2.00 | #10 | **40** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **13** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **4.4** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0514 | 3.6 |
| 2 | 0.0366 | 3.0 |
| 5 | 0.0232 | 2.3 |
| 8 | 0.0183 | 2.3 |
| 15 | 0.0134 | 2.3 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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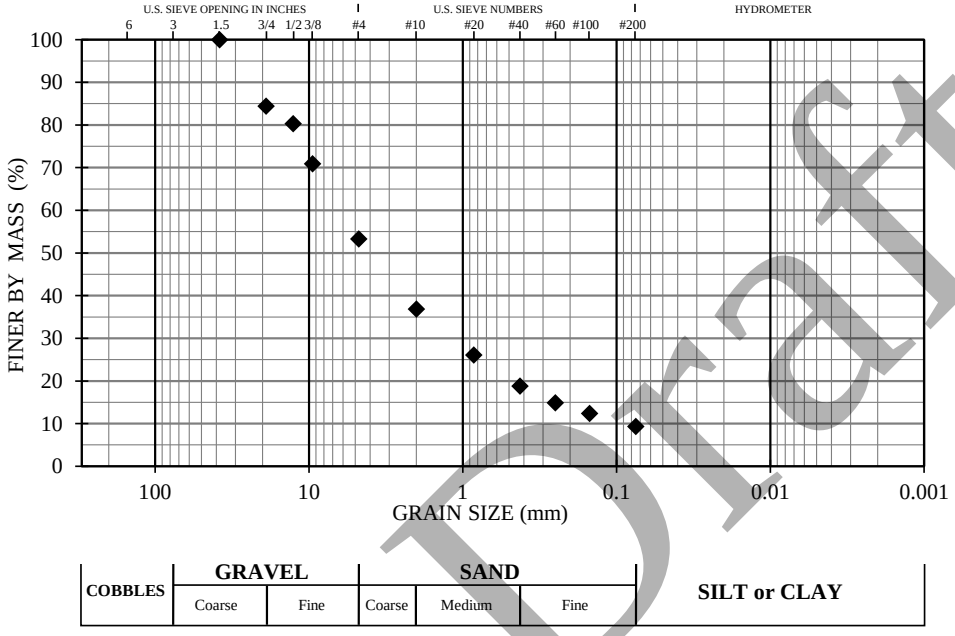
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

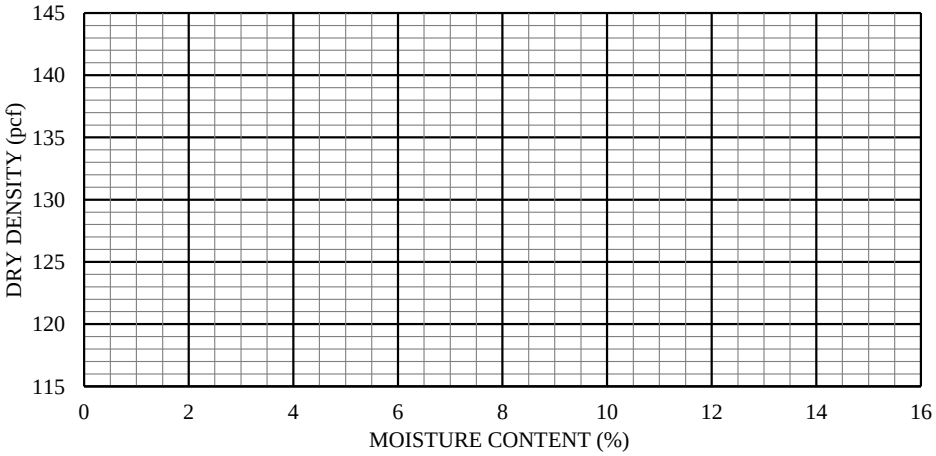
| | | | |
|---|---|---|---|
| % GRAVEL | **46.8** | USCS | **GW-GM** |
| % SAND | **43.9** | USACOE FC | **N/A** |
| % SILT/CLAY | **9.3** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **8.5** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **71.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.7** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **84** | |
| 12.70 | 1/2" | **80** | |
| 9.50 | 3/8" | **71** | |
| 4.75 | #4 | **53** | |
| 2.00 | #10 | **37** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **19** | |
| 0.25 | #60 | **15** | |
| 0.15 | #100 | **12** | |
| 0.075 | #200 | **9.3** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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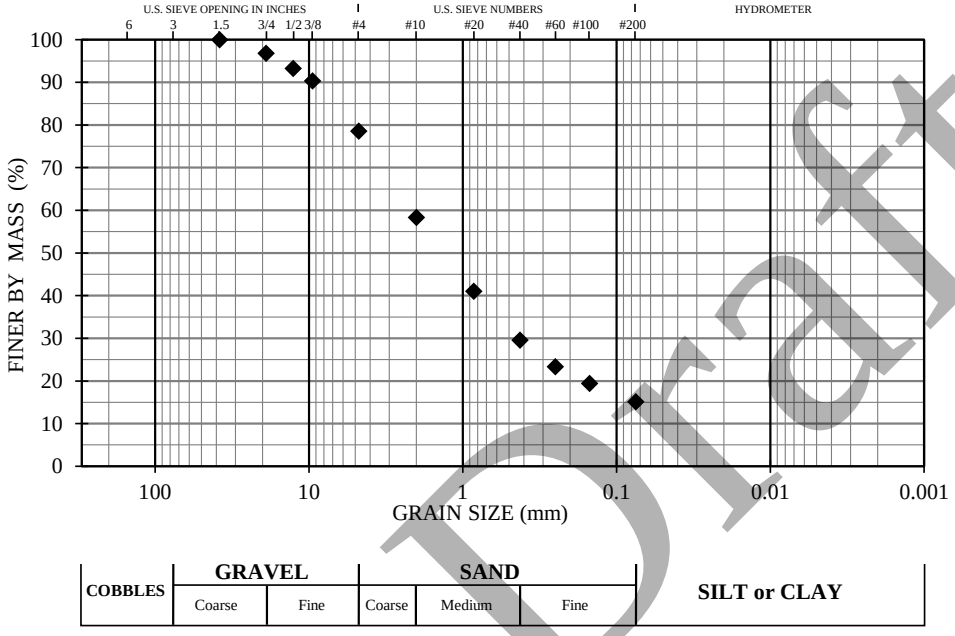
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Silty sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **21.5** | USCS | **SM** |
| % SAND | **63.4** | USACOE FC | **N/A** |
| % SILT/CLAY | **15.1** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **4.1** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | | **UNKNOWN** |
| COEFFICIENT OF GRADATION ($C_c$) | | | **UNKNOWN** |
| ASTM D1557 (uncorrected) | | | **N/A** |
| ASTM D4718 (corrected) | | | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | | | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



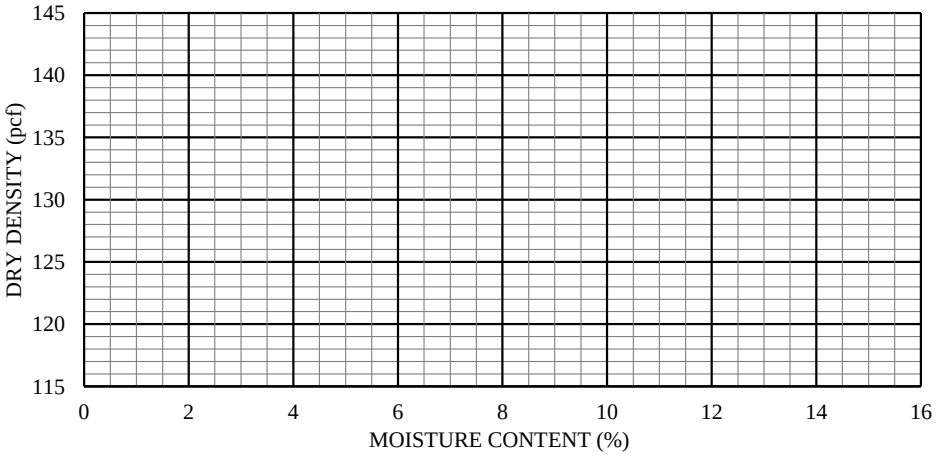

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **97** | |
| 12.70 | 1/2" | **93** | |
| 9.50 | 3/8" | **90** | |
| 4.75 | #4 | **79** | |
| 2.00 | #10 | **58** | |
| 0.85 | #20 | **41** | |
| 0.43 | #40 | **30** | |
| 0.25 | #60 | **23** | |
| 0.15 | #100 | **19** | |
| 0.075 | #200 | **15.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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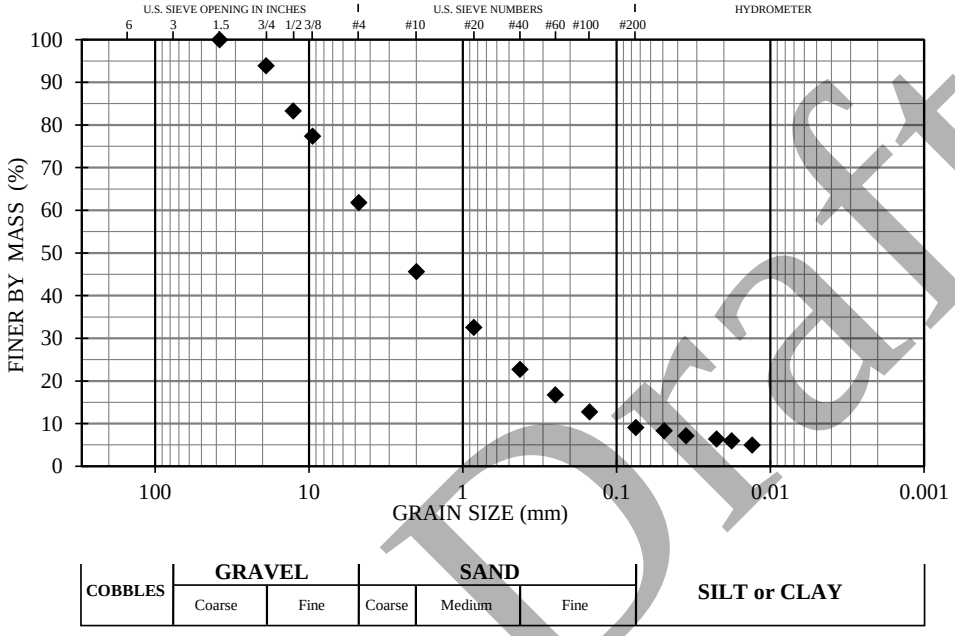
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1B** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

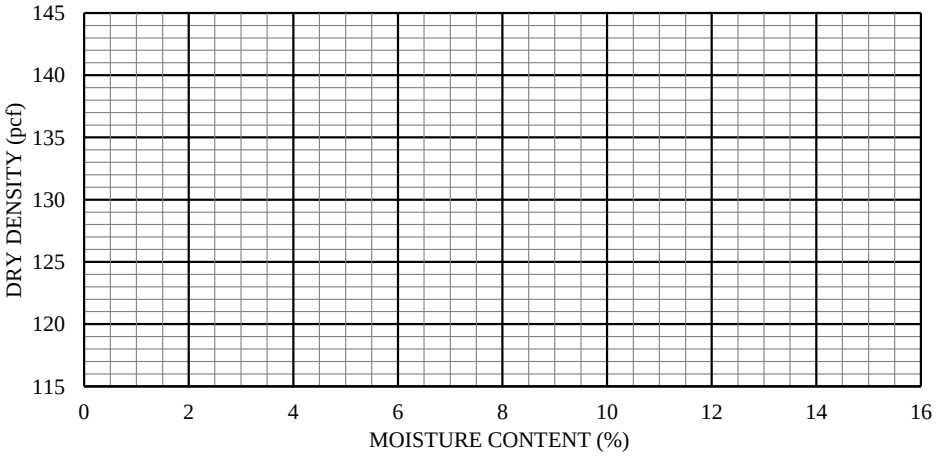
| | | | |
|---|---|---|---|
| % GRAVEL | **38.2** | USCS | **SW-SM** |
| % SAND | **52.7** | USACOE FC | **F2** |
| % SILT/CLAY | **9.1** | % PASS. 0.02 mm | **6.3** |
| % MOIST. CONTENT | **9.3** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **47.4** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.3** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **94** | |
| 12.70 | 1/2" | **83** | |
| 9.50 | 3/8" | **77** | |
| 4.75 | #4 | **62** | |
| 2.00 | #10 | **46** | |
| 0.85 | #20 | **33** | |
| 0.43 | #40 | **23** | |
| 0.25 | #60 | **17** | |
| 0.15 | #100 | **13** | |
| 0.075 | #200 | **9.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0490 | 8.3 |
| 2 | 0.0353 | 7.1 |
| 5 | 0.0223 | 6.4 |
| 8 | 0.0179 | 5.9 |
| 15 | 0.0131 | 5.0 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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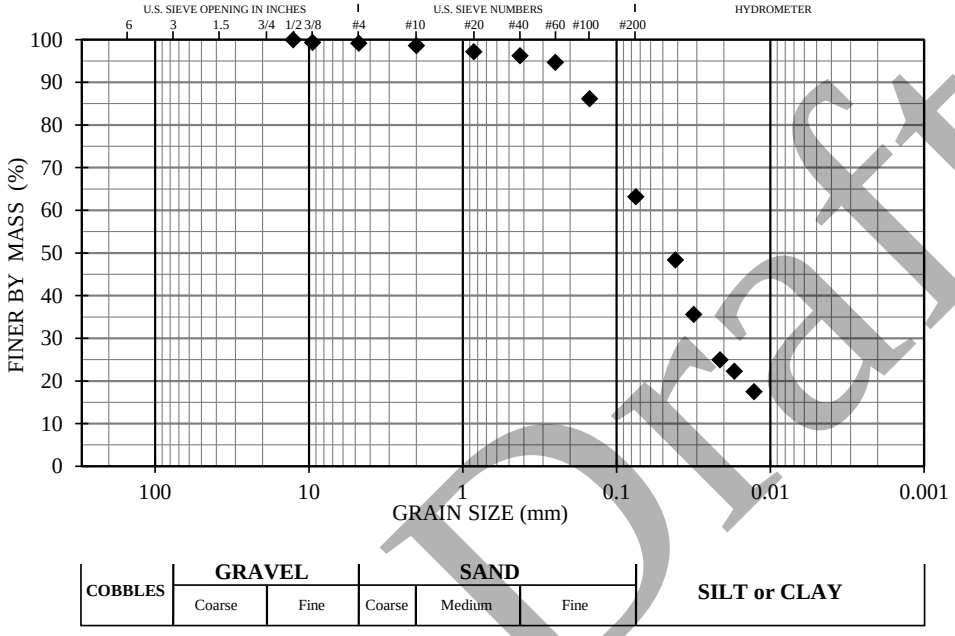
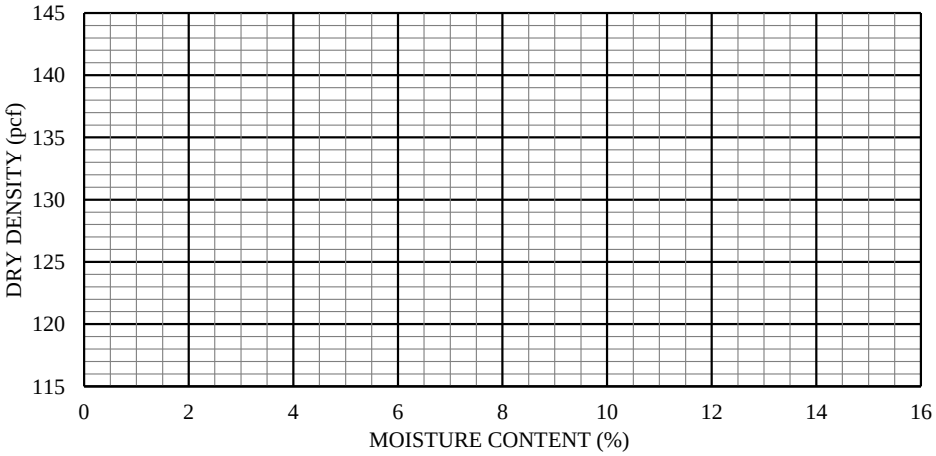
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP1B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Sandy silt** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **0.8** | USCS | **ML** |
| % SAND | **36.0** | USACOE FC | **F4** |
| % SILT/CLAY | **63.2** | % PASS. 0.02 mm | **24.8** |
| % MOIST. CONTENT | **25.3** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | | **UNKNOWN** |
| COEFFICIENT OF GRADATION ($C_c$) | | | **UNKNOWN** |
| ASTM D1557 (uncorrected) | | | **N/A** |
| ASTM D4718 (corrected) | | | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | | | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | | |
| 12.70 | 1/2" | **100** | |
| 9.50 | 3/8" | **99** | |
| 4.75 | #4 | **99** | |
| 2.00 | #10 | **99** | |
| 0.85 | #20 | **97** | |
| 0.43 | #40 | **96** | |
| 0.25 | #60 | **95** | |
| 0.15 | #100 | **86** | |
| 0.075 | #200 | **63.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0414 | 48.3 |
| 2 | 0.0316 | 35.6 |
| 5 | 0.0212 | 24.9 |
| 8 | 0.0171 | 22.3 |
| 15 | 0.0128 | 17.5 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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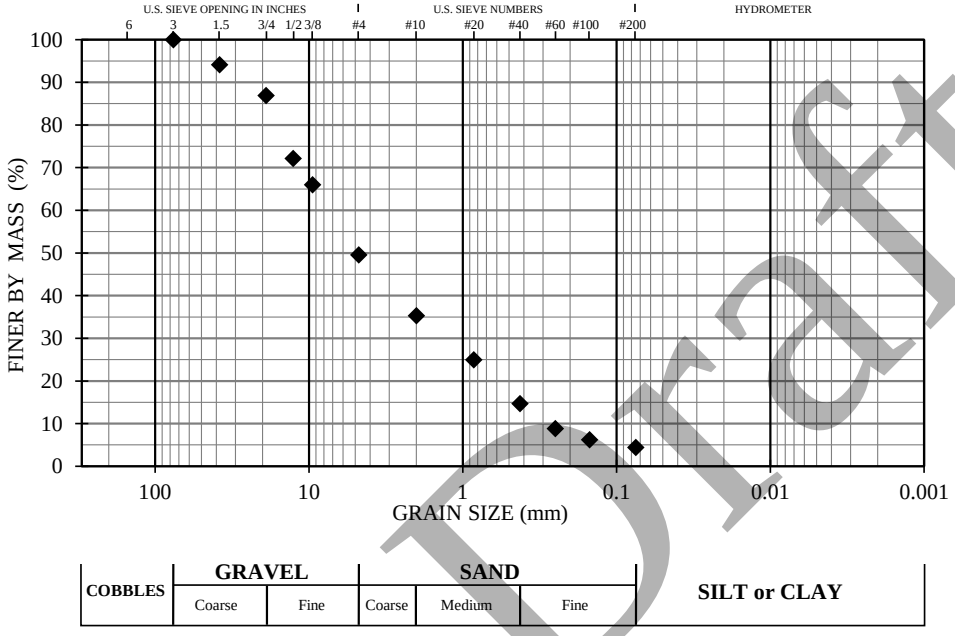
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP9A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Poorly-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **50.4** | USCS | **GP** |
| % SAND | **45.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.4** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **7.7** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **27.2** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



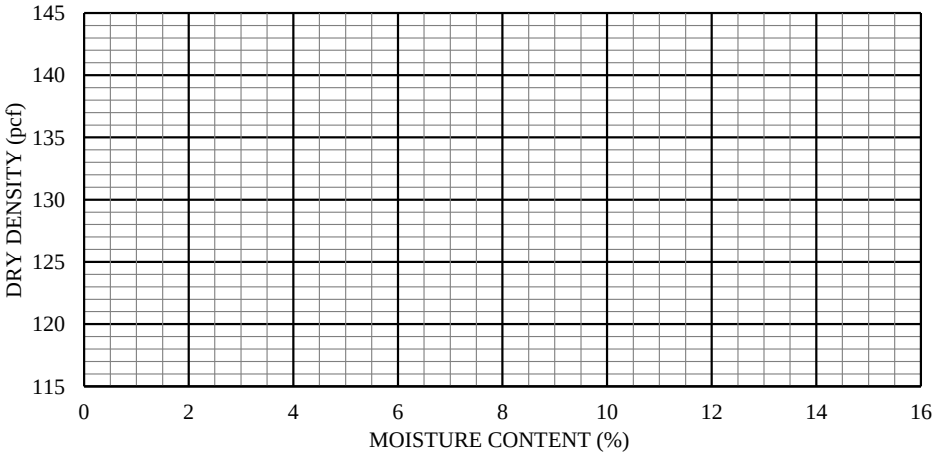

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **94** | |
| 19.00 | 3/4" | **87** | |
| 12.70 | 1/2" | **72** | |
| 9.50 | 3/8" | **66** | |
| 4.75 | #4 | **50** | |
| 2.00 | #10 | **35** | |
| 0.85 | #20 | **25** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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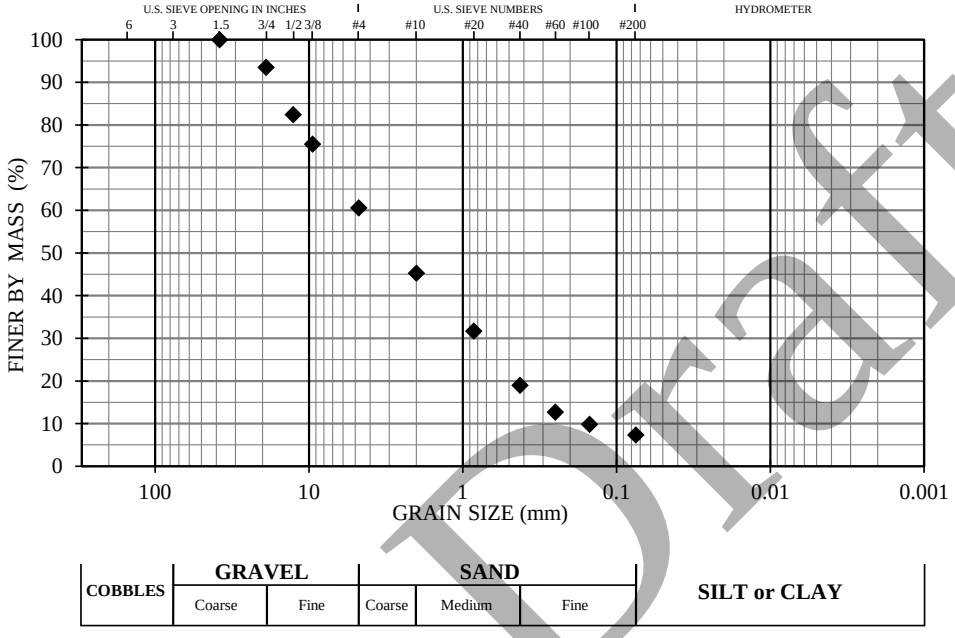
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP9A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Poorly-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **39.4** | USCS | **SP-SM** |
| % SAND | **53.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **7.4** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **3.8** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **29.8** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



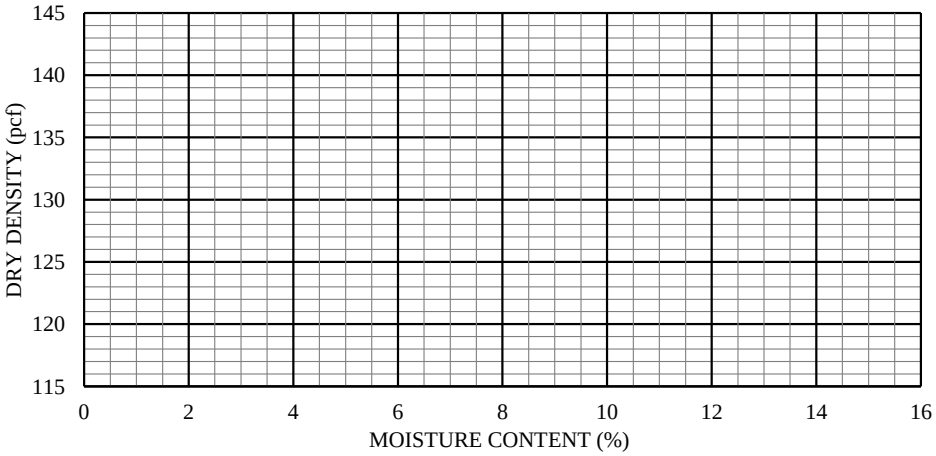

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **93** | |
| 12.70 | 1/2" | **82** | |
| 9.50 | 3/8" | **75** | |
| 4.75 | #4 | **61** | |
| 2.00 | #10 | **45** | |
| 0.85 | #20 | **32** | |
| 0.43 | #40 | **19** | |
| 0.25 | #60 | **13** | |
| 0.15 | #100 | **10** | |
| 0.075 | #200 | **7.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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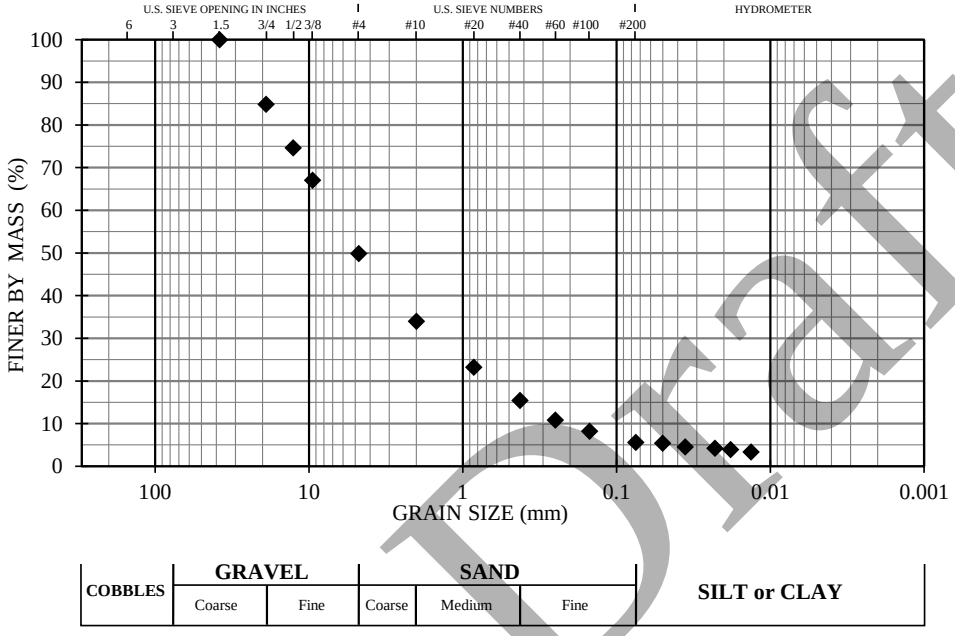
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP9A** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

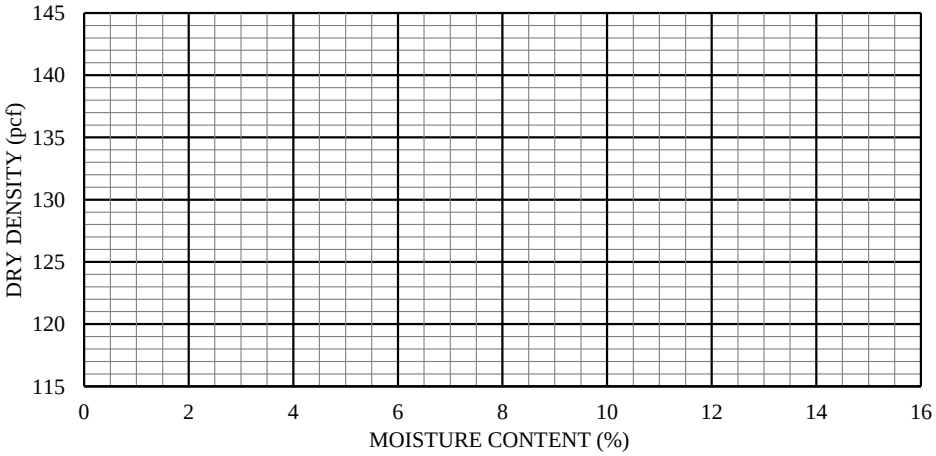
| | | | |
|---|---|---|---|
| % GRAVEL | **50.1** | USCS | **GW-GM** |
| % SAND | **44.3** | USACOE FC | **S1** |
| % SILT/CLAY | **5.6** | % PASS. 0.02 mm | **4.1** |
| % MOIST. CONTENT | **6.8** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **34.4** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.5** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **85** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **67** | |
| 4.75 | #4 | **50** | |
| 2.00 | #10 | **34** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **5.6** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0502 | 5.4 |
| 2 | 0.0358 | 4.5 |
| 5 | 0.0229 | 4.2 |
| 8 | 0.0181 | 3.9 |
| 15 | 0.0134 | 3.3 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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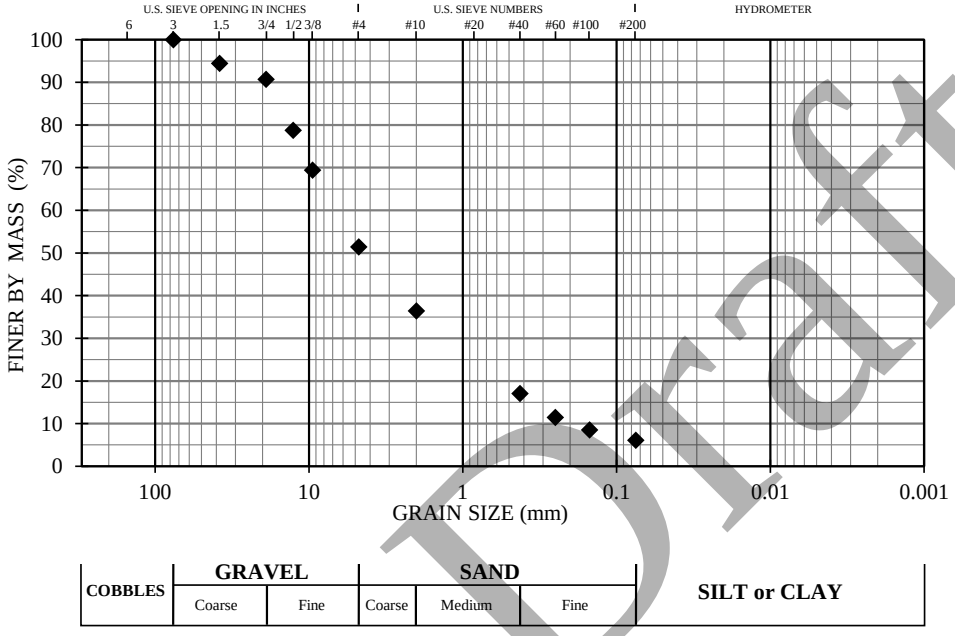
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP9B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **48.6** | USCS | **GW-GM** |
| % SAND | **45.3** | USACOE FC | **N/A** |
| % SILT/CLAY | **6.1** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **2.5** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **28.0** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.1** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



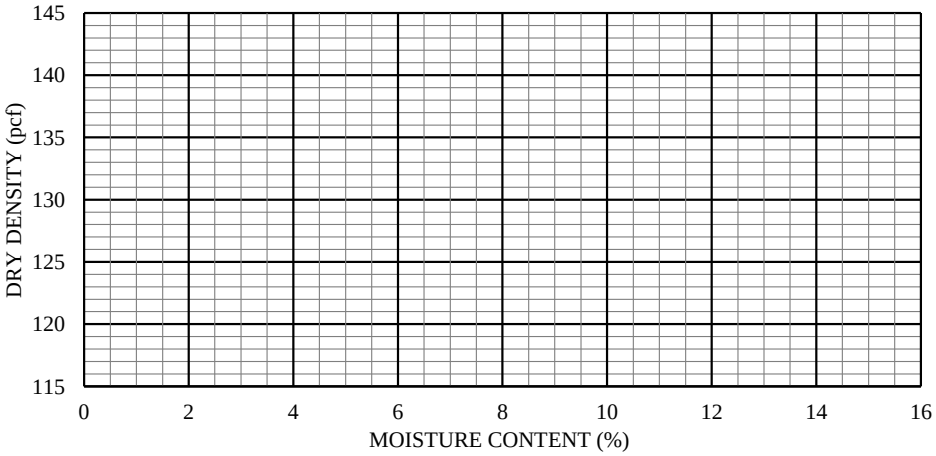

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **94** | |
| 19.00 | 3/4" | **91** | |
| 12.70 | 1/2" | **79** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **51** | |
| 2.00 | #10 | **36** | |
| 0.85 | #20 | **-54** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **6.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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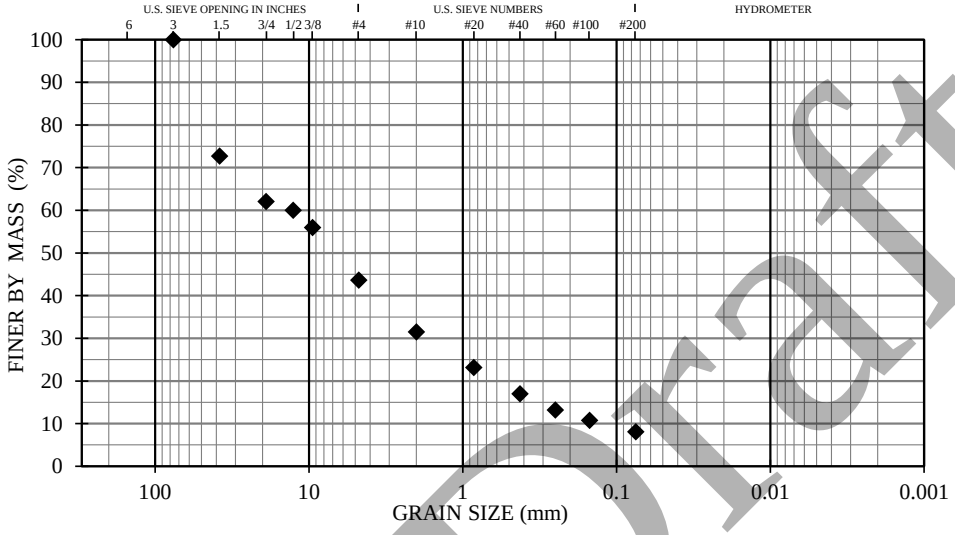
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP9B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **56.4** | USCS | **GW-GM** |
| % SAND | **35.5** | USACOE FC | **N/A** |
| % SILT/CLAY | **8.1** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **3.8** | % PASS. 0.002 mm | **N/A** |

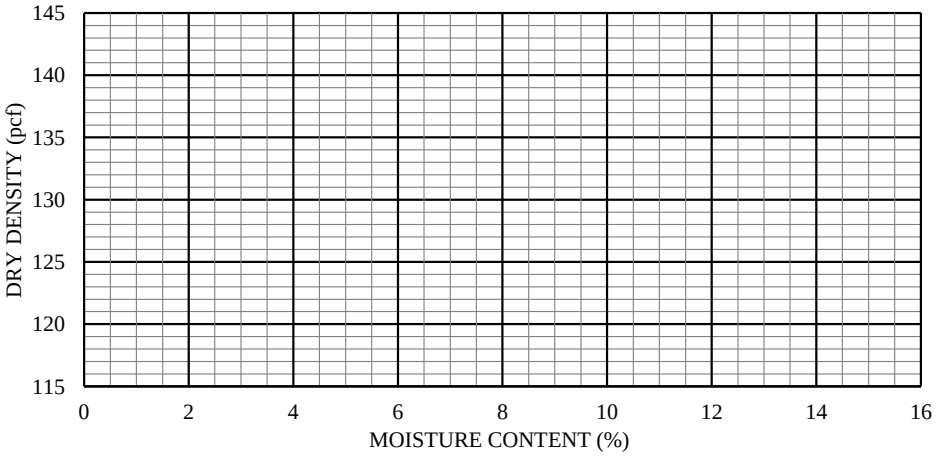
| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **99.1** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




| COBBLES | GRAVEL | | SAND | | | SILT or CLAY |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **73** | |
| 19.00 | 3/4" | **62** | |
| 12.70 | 1/2" | **60** | |
| 9.50 | 3/8" | **56** | |
| 4.75 | #4 | **44** | |
| 2.00 | #10 | **31** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **13** | |
| 0.15 | #100 | **11** | |
| 0.075 | #200 | **8.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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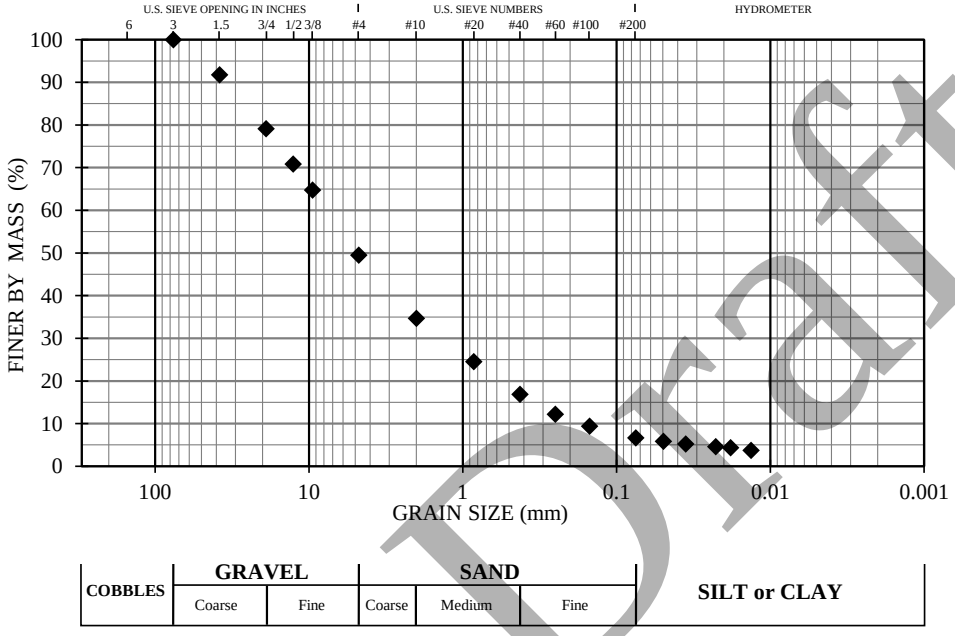
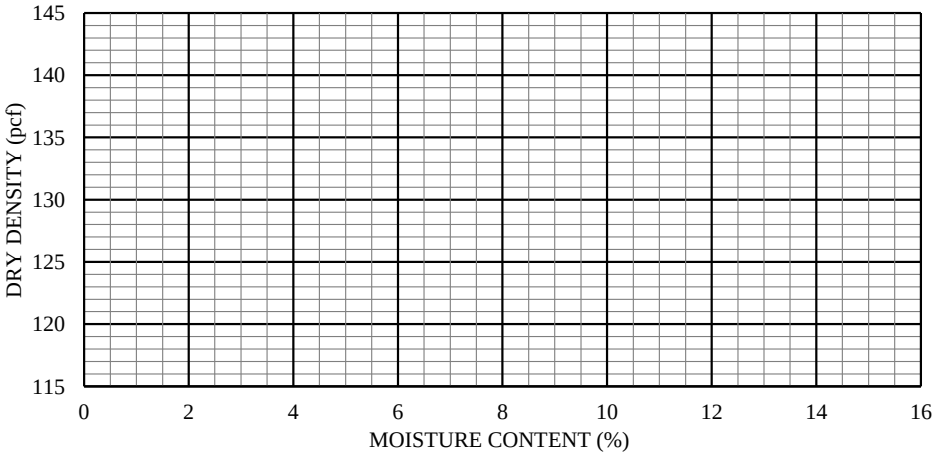
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP9B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **50.5** | USCS | **GW-GM** |
| % SAND | **42.8** | USACOE FC | **S1** |
| % SILT/CLAY | **6.7** | % PASS. 0.02 mm | **4.5** |
| % MOIST. CONTENT | **6.4** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **46.6** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.6** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **92** | |
| 19.00 | 3/4" | **79** | |
| 12.70 | 1/2" | **71** | |
| 9.50 | 3/8" | **65** | |
| 4.75 | #4 | **49** | |
| 2.00 | #10 | **35** | |
| 0.85 | #20 | **25** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **12** | |
| 0.15 | #100 | **9** | |
| 0.075 | #200 | **6.7** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0497 | 5.8 |
| 2 | 0.0355 | 5.2 |
| 5 | 0.0226 | 4.6 |
| 8 | 0.0181 | 4.3 |
| 15 | 0.0134 | 3.7 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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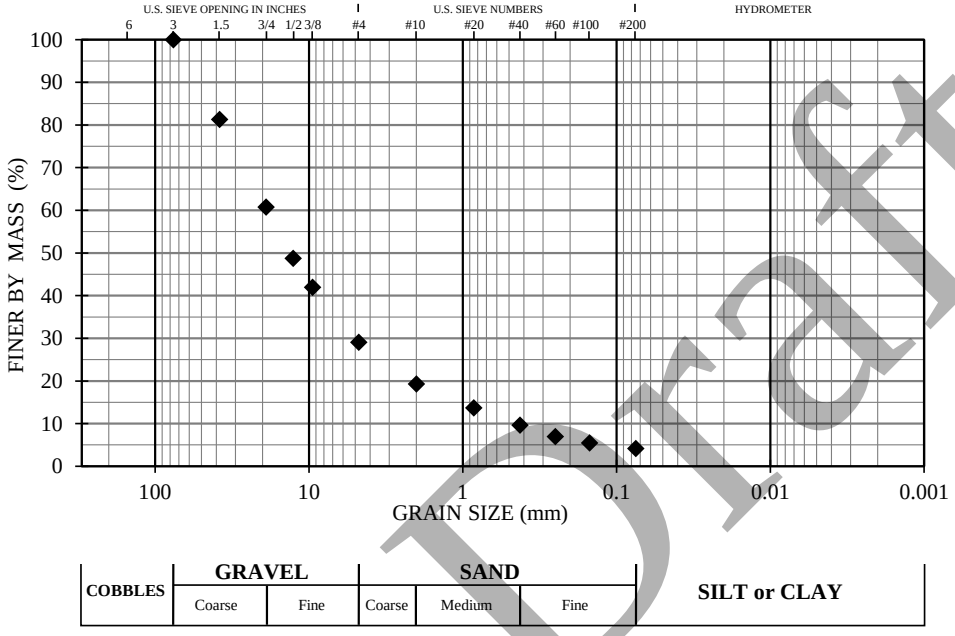
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Poorly-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

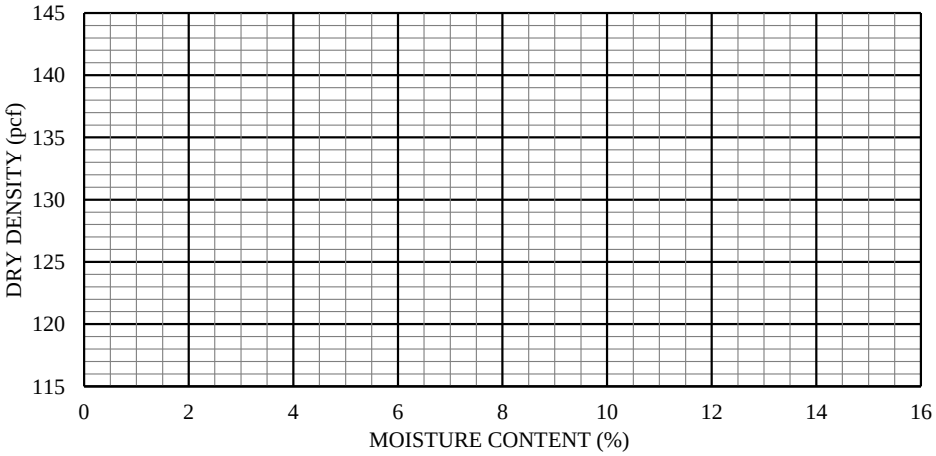
| | | | |
|---|---|---|---|
| % GRAVEL | **71.0** | USCS | **GP** |
| % SAND | **24.9** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.1** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **2.4** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **40.1** |
| COEFFICIENT OF GRADATION ($C_c$) | **3.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **81** | |
| 19.00 | 3/4" | **61** | |
| 12.70 | 1/2" | **49** | |
| 9.50 | 3/8" | **42** | |
| 4.75 | #4 | **29** | |
| 2.00 | #10 | **19** | |
| 0.85 | #20 | **14** | |
| 0.43 | #40 | **10** | |
| 0.25 | #60 | **7** | |
| 0.15 | #100 | **5** | |
| 0.075 | #200 | **4.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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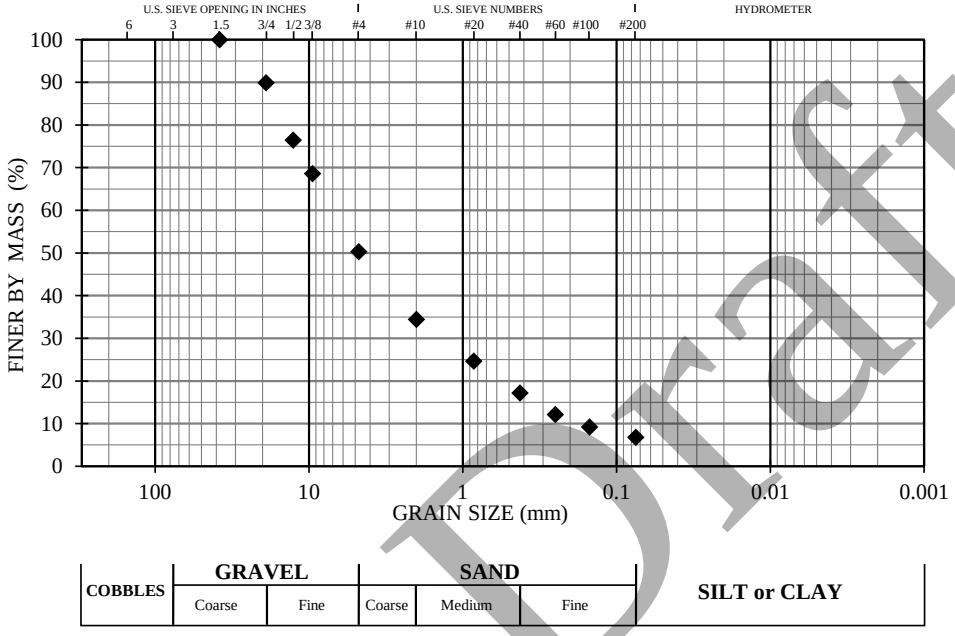
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **49.8** | USCS | **GW-GM** |
| % SAND | **43.5** | USACOE FC | **N/A** |
| % SILT/CLAY | **6.7** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **6.4** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **40.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.7** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

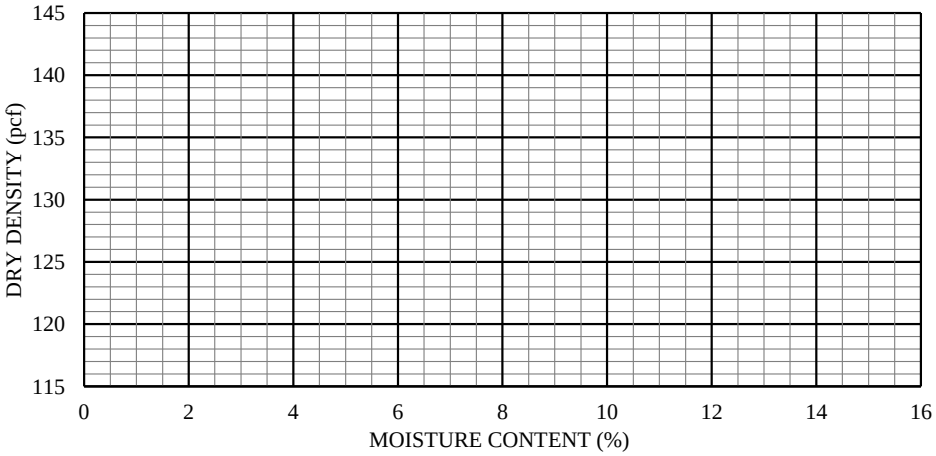
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **90** | |
| 12.70 | 1/2" | **76** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **50** | |
| 2.00 | #10 | **34** | |
| 0.85 | #20 | **25** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **12** | |
| 0.15 | #100 | **9** | |
| 0.075 | #200 | **6.7** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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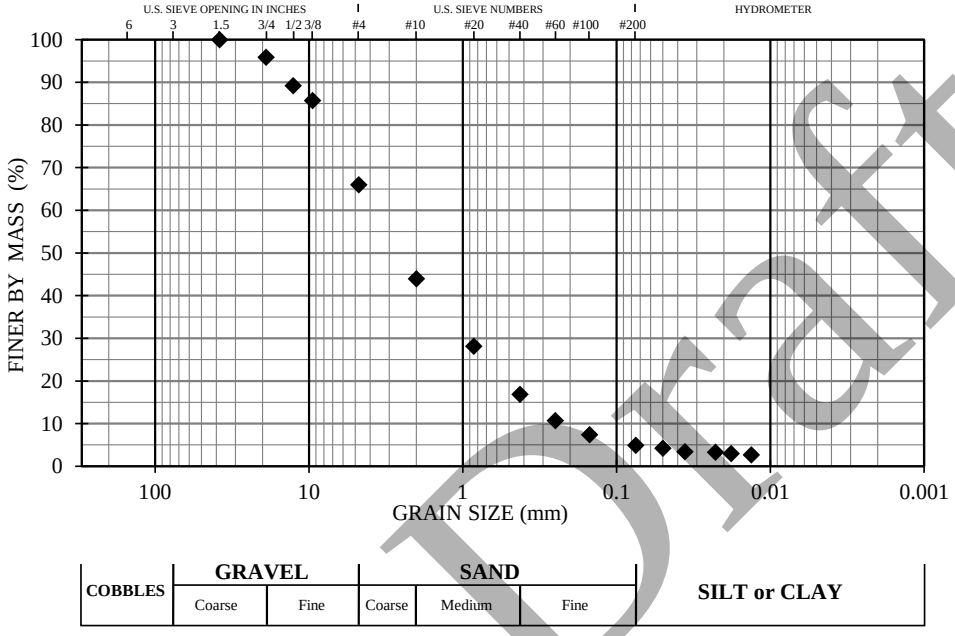
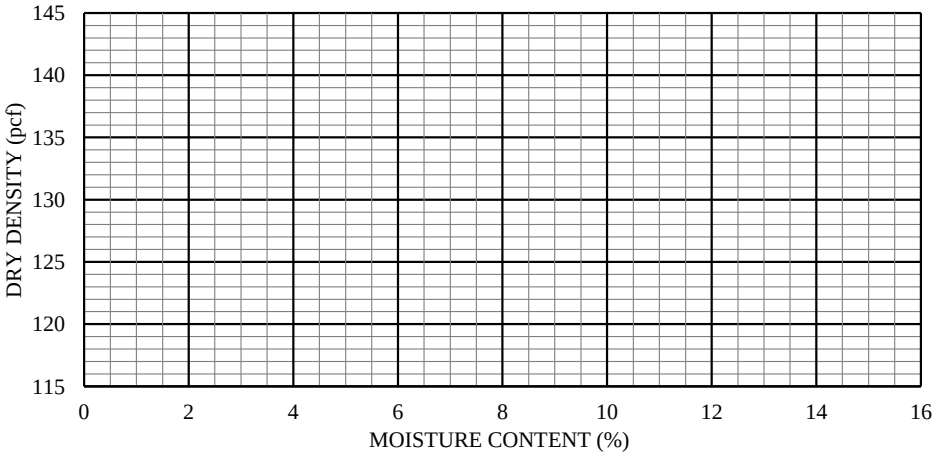
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **34.0** | USCS | **SW** |
| % SAND | **61.1** | USACOE FC | **S2** |
| % SILT/CLAY | **4.9** | % PASS. 0.02 mm | **3.1** |
| % MOIST. CONTENT | **37.9** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **17.5** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.1** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **96** | |
| 12.70 | 1/2" | **89** | |
| 9.50 | 3/8" | **86** | |
| 4.75 | #4 | **66** | |
| 2.00 | #10 | **44** | |
| 0.85 | #20 | **28** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **4.9** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0500 | 4.2 |
| 2 | 0.0360 | 3.4 |
| 5 | 0.0228 | 3.3 |
| 8 | 0.0180 | 3.0 |
| 15 | 0.0133 | 2.6 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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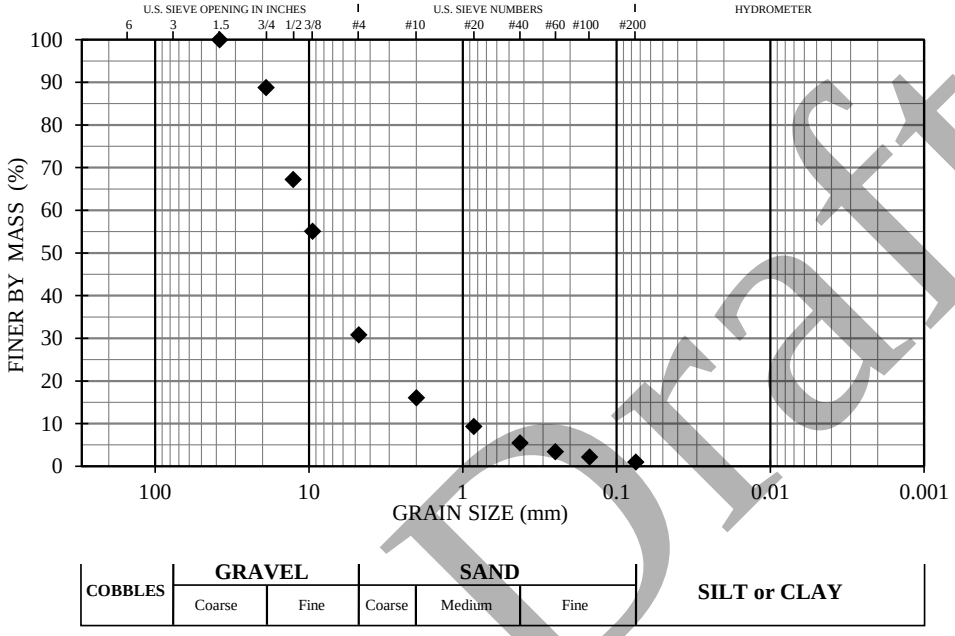
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20A** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **69.2** | USCS | **GW** |
| % SAND | **29.8** | USACOE FC | **N/A** |
| % SILT/CLAY | **1.0** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **5.9** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **11.2** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



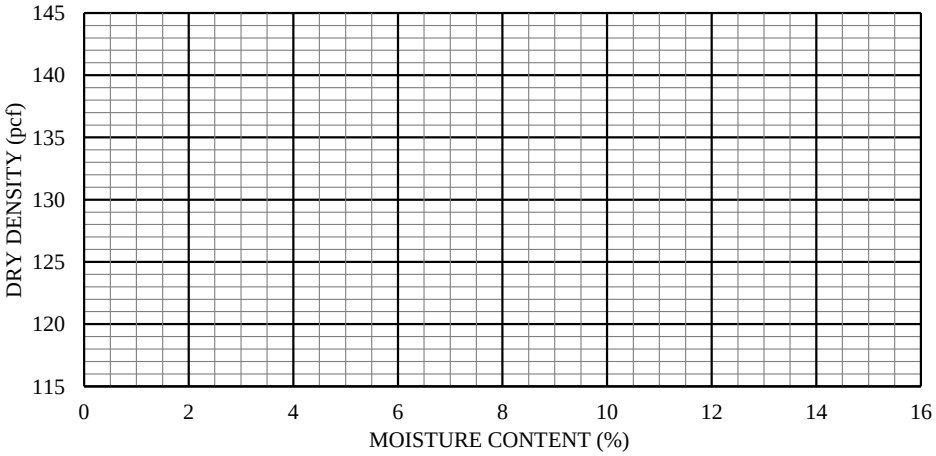

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **89** | |
| 12.70 | 1/2" | **67** | |
| 9.50 | 3/8" | **55** | |
| 4.75 | #4 | **31** | |
| 2.00 | #10 | **16** | |
| 0.85 | #20 | **9** | |
| 0.43 | #40 | **5** | |
| 0.25 | #60 | **3** | |
| 0.15 | #100 | **2** | |
| 0.075 | #200 | **1.0** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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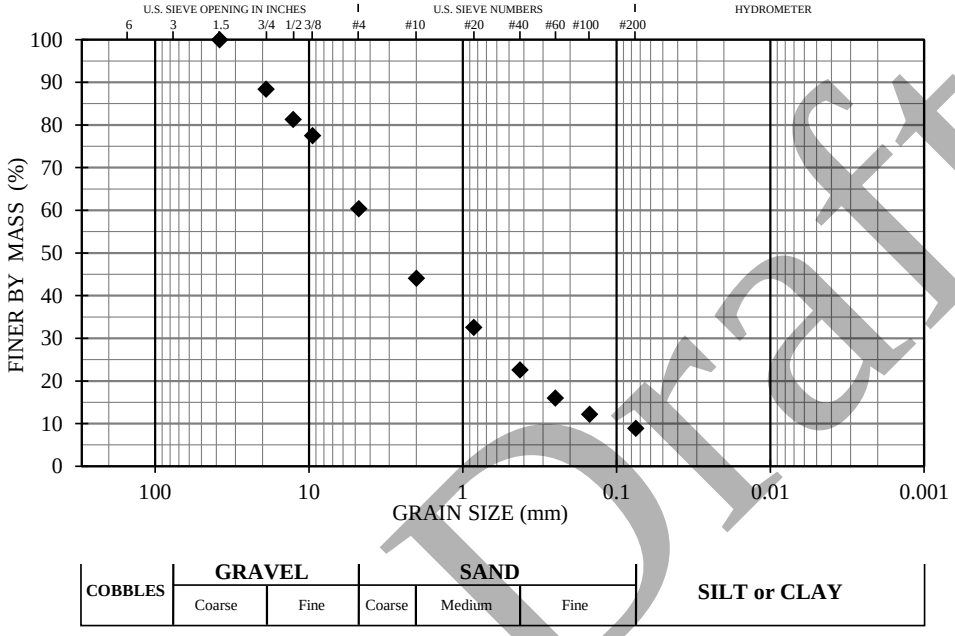
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

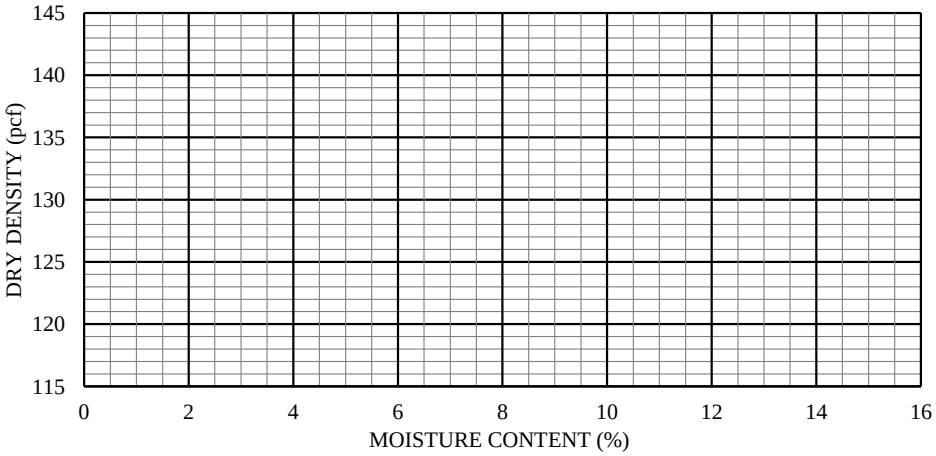
| | | | |
|---|---|---|---|
| % GRAVEL | **39.6** | USCS | **SW-SM** |
| % SAND | **51.5** | USACOE FC | **N/A** |
| % SILT/CLAY | **8.9** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **5.7** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **46.7** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.2** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **88** | |
| 12.70 | 1/2" | **81** | |
| 9.50 | 3/8" | **77** | |
| 4.75 | #4 | **60** | |
| 2.00 | #10 | **44** | |
| 0.85 | #20 | **33** | |
| 0.43 | #40 | **23** | |
| 0.25 | #60 | **16** | |
| 0.15 | #100 | **12** | |
| 0.075 | #200 | **8.9** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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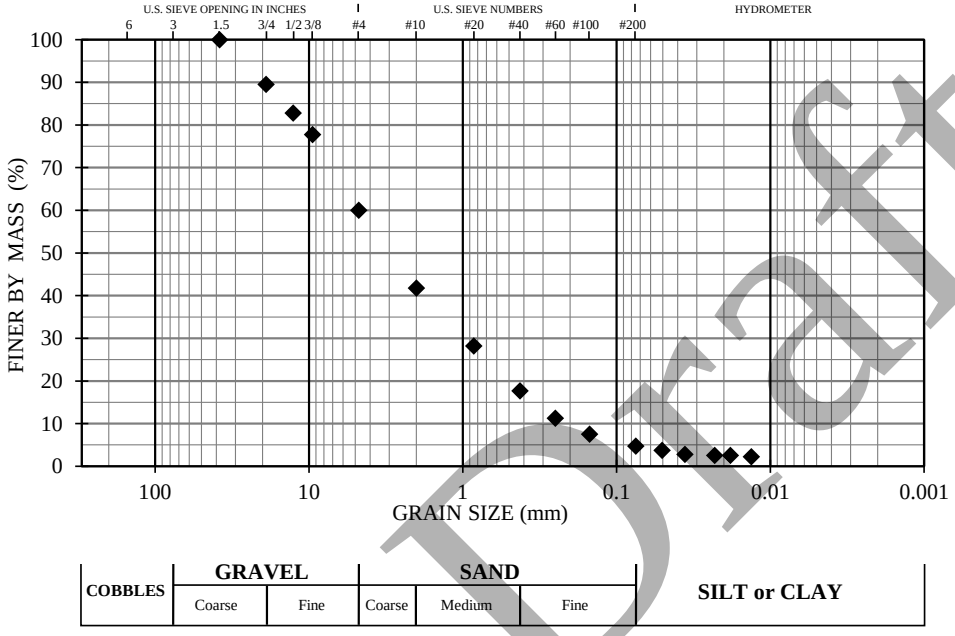
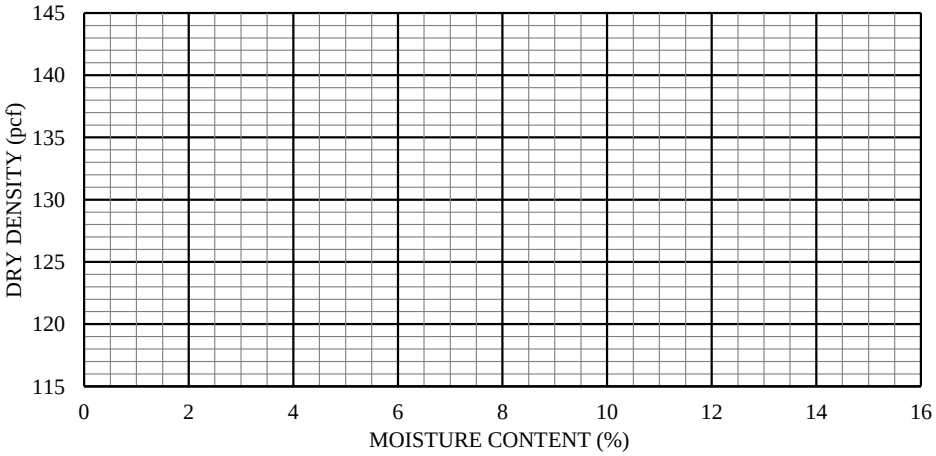
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20B** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Poorly-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **40.0** | USCS | **SP** |
| % SAND | **55.3** | USACOE FC | **NFS** |
| % SILT/CLAY | **4.7** | % PASS. 0.02 mm | **2.6** |
| % MOIST. CONTENT | **9.1** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **21.9** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.0** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **90** | |
| 12.70 | 1/2" | **83** | |
| 9.50 | 3/8" | **78** | |
| 4.75 | #4 | **60** | |
| 2.00 | #10 | **42** | |
| 0.85 | #20 | **28** | |
| 0.43 | #40 | **18** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **4.7** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0505 | 3.7 |
| 2 | 0.0360 | 2.8 |
| 5 | 0.0230 | 2.5 |
| 8 | 0.0182 | 2.5 |
| 15 | 0.0133 | 2.2 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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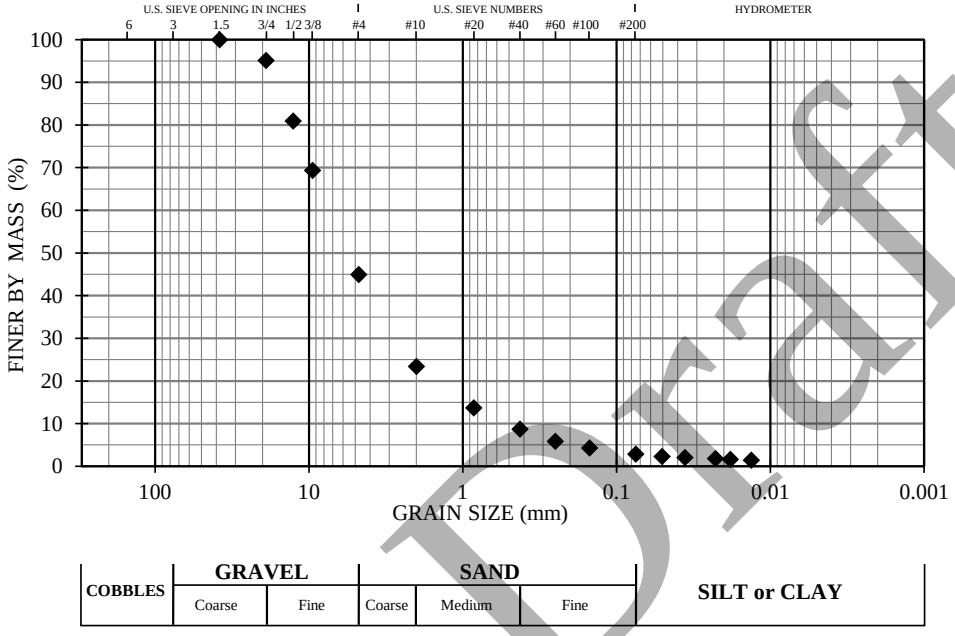
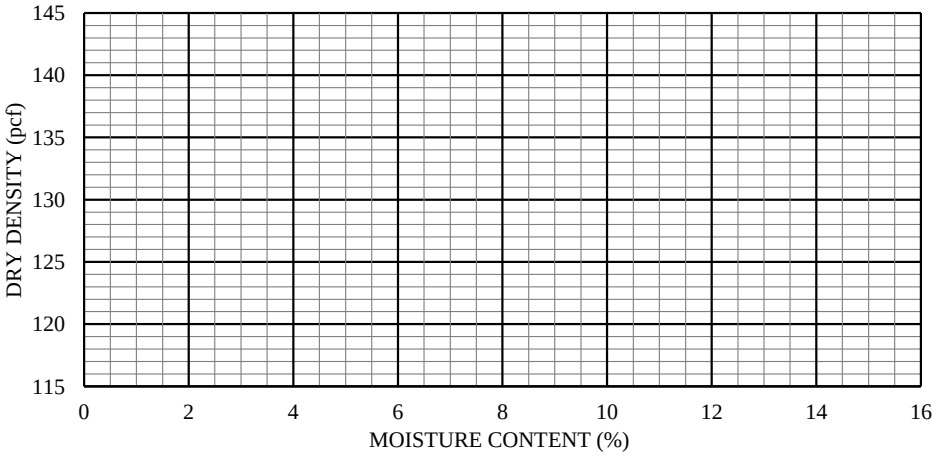
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **55.1** | USCS | **GW** |
| % SAND | **42.1** | USACOE FC | **PFS** |
| % SILT/CLAY | **2.8** | % PASS. 0.02 mm | **1.7** |
| % MOIST. CONTENT | **7.0** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **14.3** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **2.0** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **95** | |
| 12.70 | 1/2" | **81** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **45** | |
| 2.00 | #10 | **23** | |
| 0.85 | #20 | **14** | |
| 0.43 | #40 | **9** | |
| 0.25 | #60 | **6** | |
| 0.15 | #100 | **4** | |
| 0.075 | #200 | **2.8** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0505 | 2.3 |
| 2 | 0.0360 | 2.0 |
| 5 | 0.0228 | 1.8 |
| 8 | 0.0182 | 1.6 |
| 15 | 0.0133 | 1.4 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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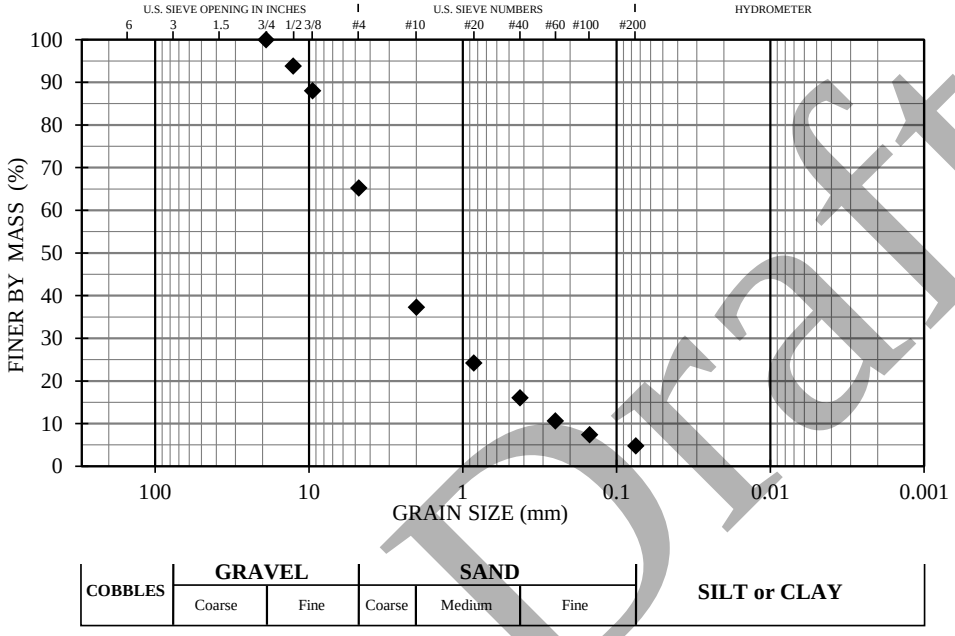
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP20B** |
| NUMBER/ DEPTH: | **S6 / 15 - 16.5'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **34.8** | USCS | **SW** |
| % SAND | **60.4** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.8** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **11.8** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **18.4** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



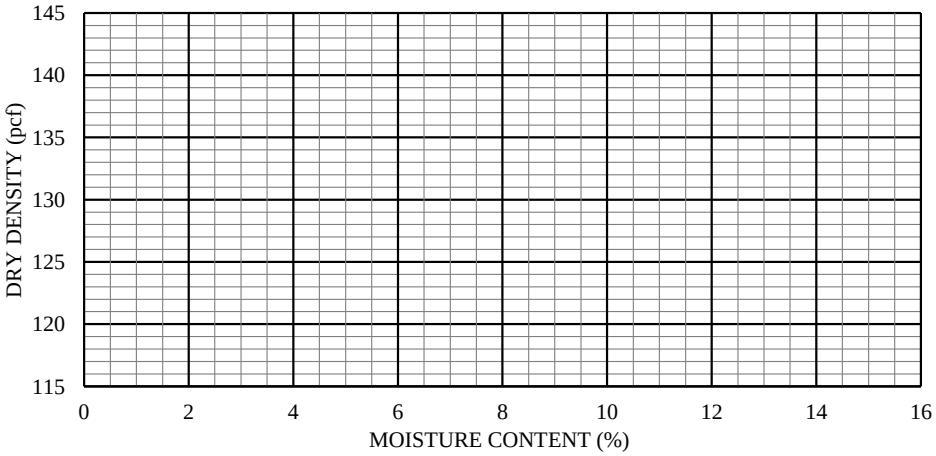

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | **100** | |
| 12.70 | 1/2" | **94** | |
| 9.50 | 3/8" | **88** | |
| 4.75 | #4 | **65** | |
| 2.00 | #10 | **37** | |
| 0.85 | #20 | **24** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **4.8** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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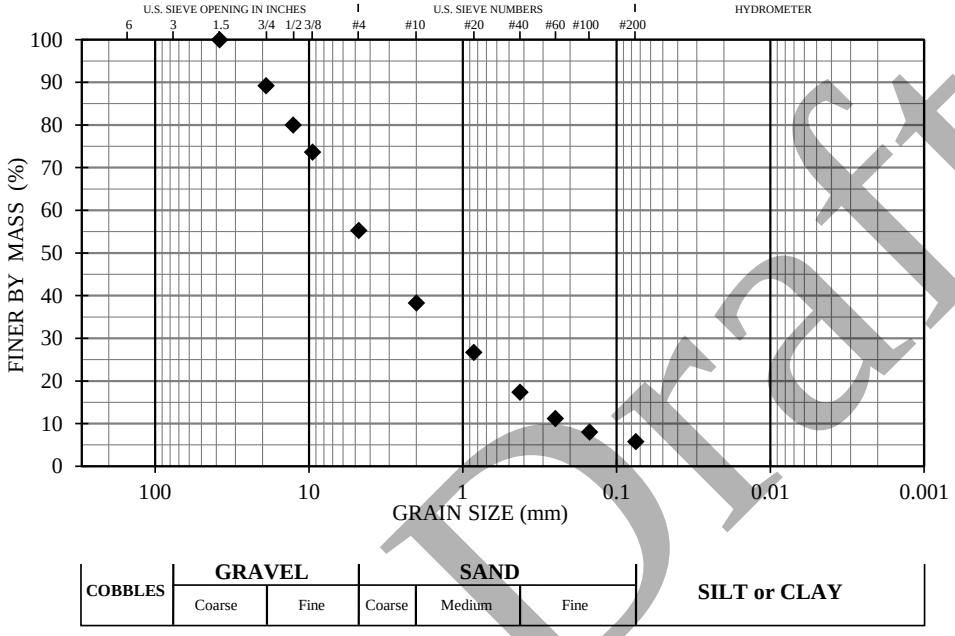
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **44.7** | USCS | **SW-SM** |
| % SAND | **49.5** | USACOE FC | **N/A** |
| % SILT/CLAY | **5.8** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **4.0** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **28.2** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.1** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

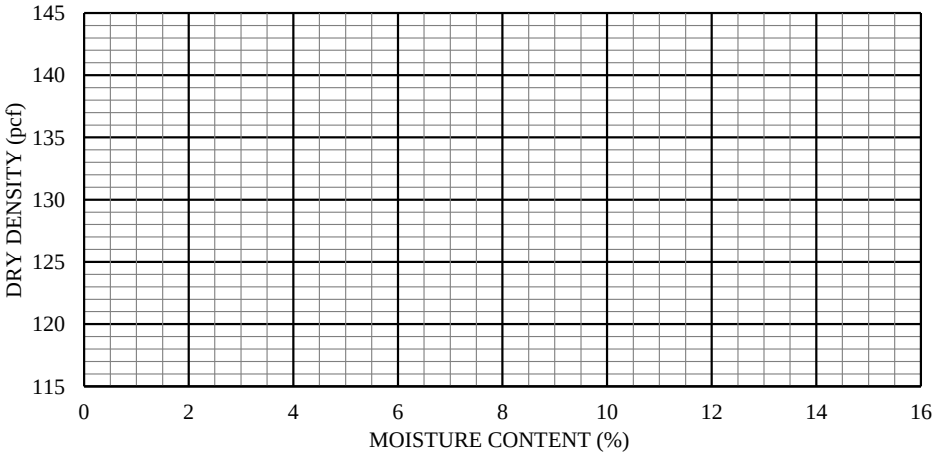
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **89** | |
| 12.70 | 1/2" | **80** | |
| 9.50 | 3/8" | **74** | |
| 4.75 | #4 | **55** | |
| 2.00 | #10 | **38** | |
| 0.85 | #20 | **27** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **5.8** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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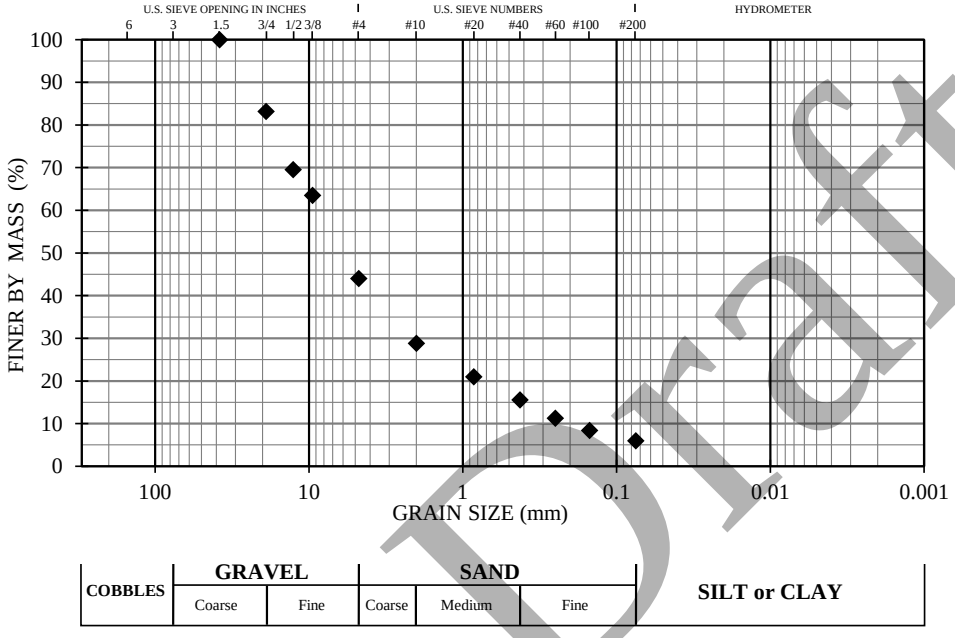
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **56.0** | USCS | **GW-GM** |
| % SAND | **38.0** | USACOE FC | **N/A** |
| % SILT/CLAY | **6.0** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **5.8** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **41.8** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.7** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

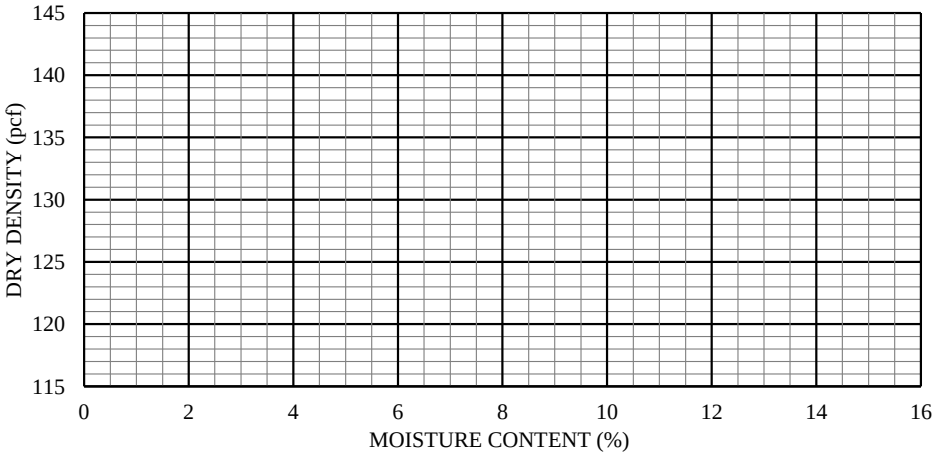
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **83** | |
| 12.70 | 1/2" | **70** | |
| 9.50 | 3/8" | **63** | |
| 4.75 | #4 | **44** | |
| 2.00 | #10 | **29** | |
| 0.85 | #20 | **21** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **6.0** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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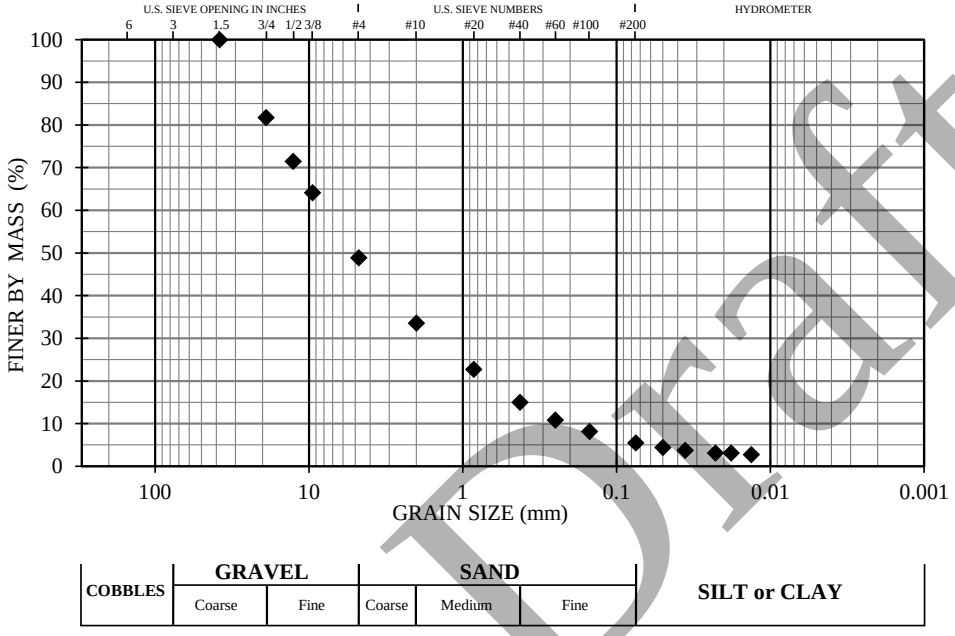
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22A** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

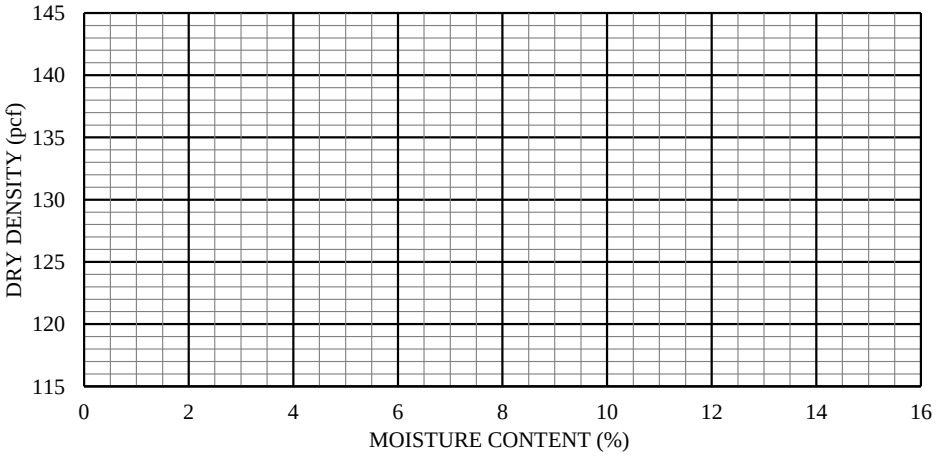
| | | | |
|---|---|---|---|
| % GRAVEL | **51.1** | USCS | **GW-GM** |
| % SAND | **43.4** | USACOE FC | **S1** |
| % SILT/CLAY | **5.5** | % PASS. 0.02 mm | **3.2** |
| % MOIST. CONTENT | **6.6** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **37.4** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.5** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **82** | |
| 12.70 | 1/2" | **71** | |
| 9.50 | 3/8" | **64** | |
| 4.75 | #4 | **49** | |
| 2.00 | #10 | **34** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **5.5** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0500 | 4.4 |
| 2 | 0.0357 | 3.7 |
| 5 | 0.0228 | 3.1 |
| 8 | 0.0180 | 3.1 |
| 15 | 0.0133 | 2.8 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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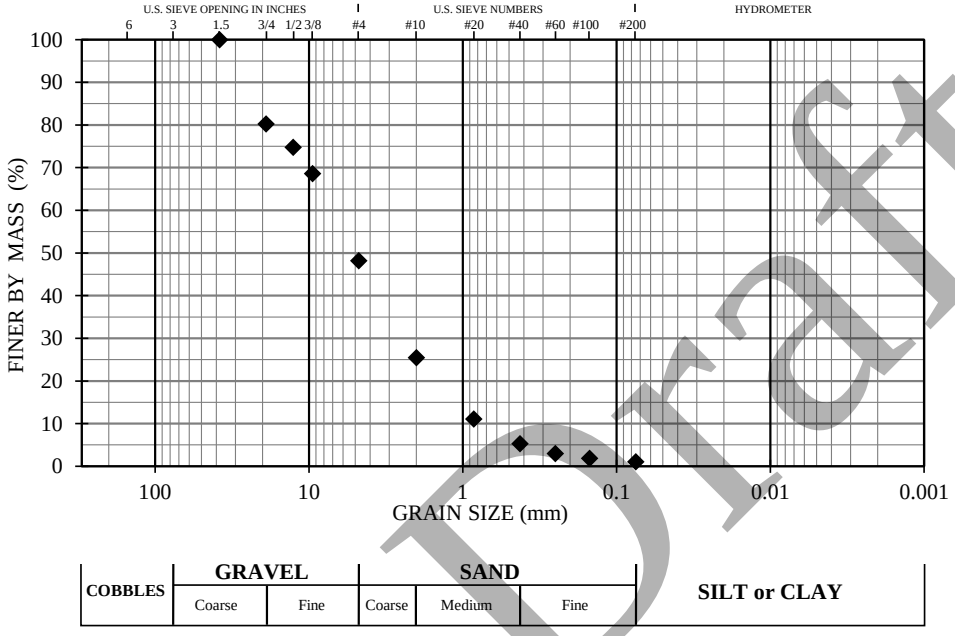
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22A** |
| NUMBER/ DEPTH: | **S6 / 15 - 16.5'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **51.8** | USCS | **GW** |
| % SAND | **47.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **1.0** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **4.1** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **9.7** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.1** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



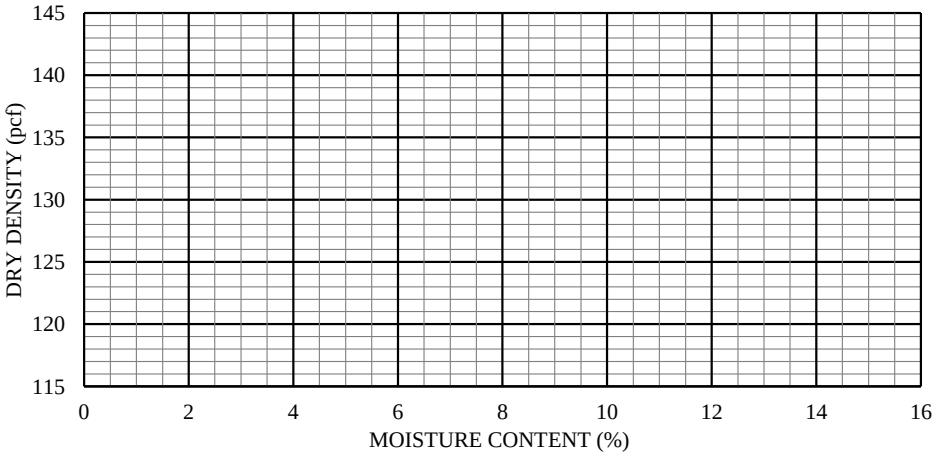

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **80** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **48** | |
| 2.00 | #10 | **25** | |
| 0.85 | #20 | **11** | |
| 0.43 | #40 | **5** | |
| 0.25 | #60 | **3** | |
| 0.15 | #100 | **2** | |
| 0.075 | #200 | **1.0** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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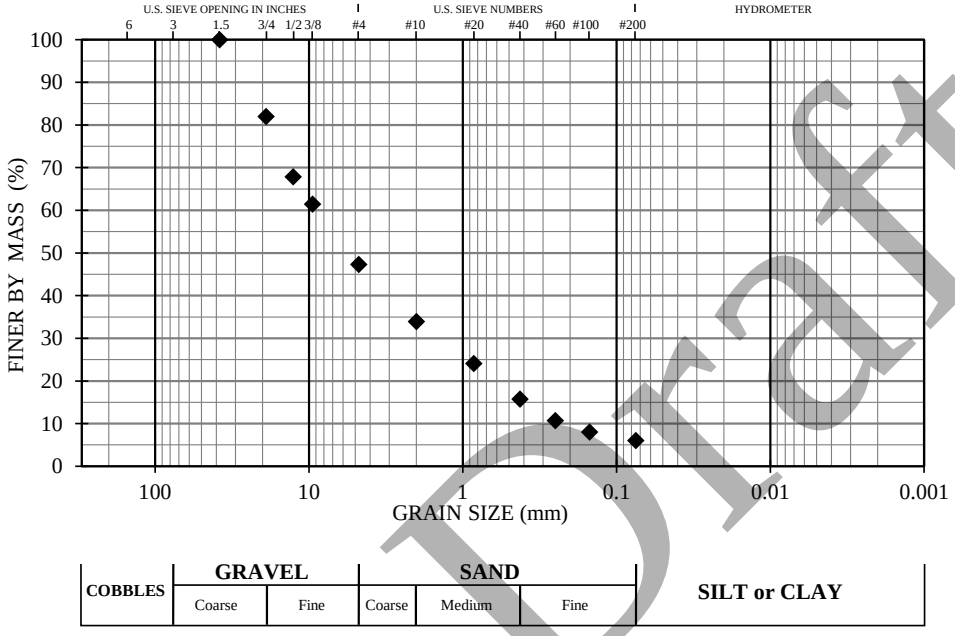
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **52.7** | USCS | **GW-GM** |
| % SAND | **41.3** | USACOE FC | **N/A** |
| % SILT/CLAY | **6.0** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **7.1** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **40.2** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.2** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



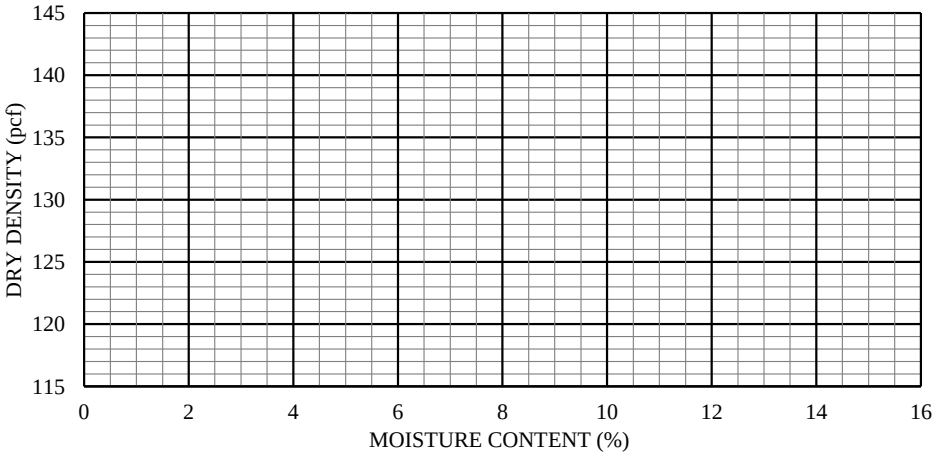

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **82** | |
| 12.70 | 1/2" | **68** | |
| 9.50 | 3/8" | **61** | |
| 4.75 | #4 | **47** | |
| 2.00 | #10 | **34** | |
| 0.85 | #20 | **24** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **6.0** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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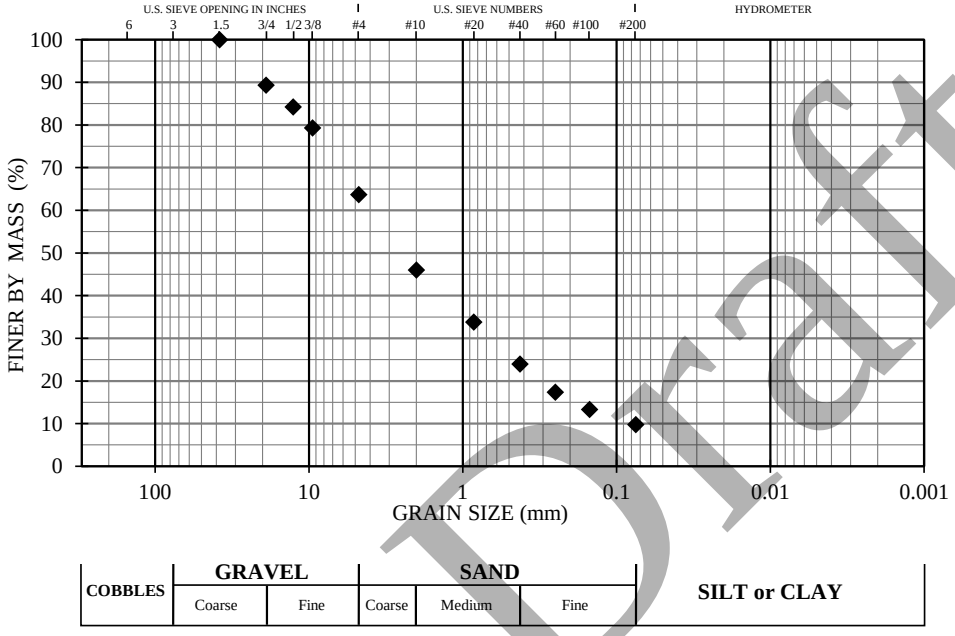
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **36.3** | USCS | **SW-SM** |
| % SAND | **54.0** | USACOE FC | **N/A** |
| % SILT/CLAY | **9.7** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **8.8** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **52.0** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.4** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



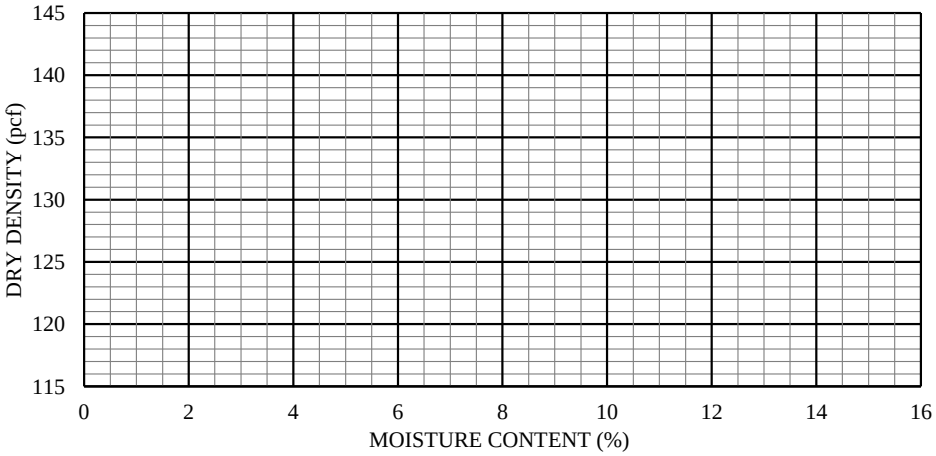

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **89** | |
| 12.70 | 1/2" | **84** | |
| 9.50 | 3/8" | **79** | |
| 4.75 | #4 | **64** | |
| 2.00 | #10 | **46** | |
| 0.85 | #20 | **34** | |
| 0.43 | #40 | **24** | |
| 0.25 | #60 | **17** | |
| 0.15 | #100 | **13** | |
| 0.075 | #200 | **9.7** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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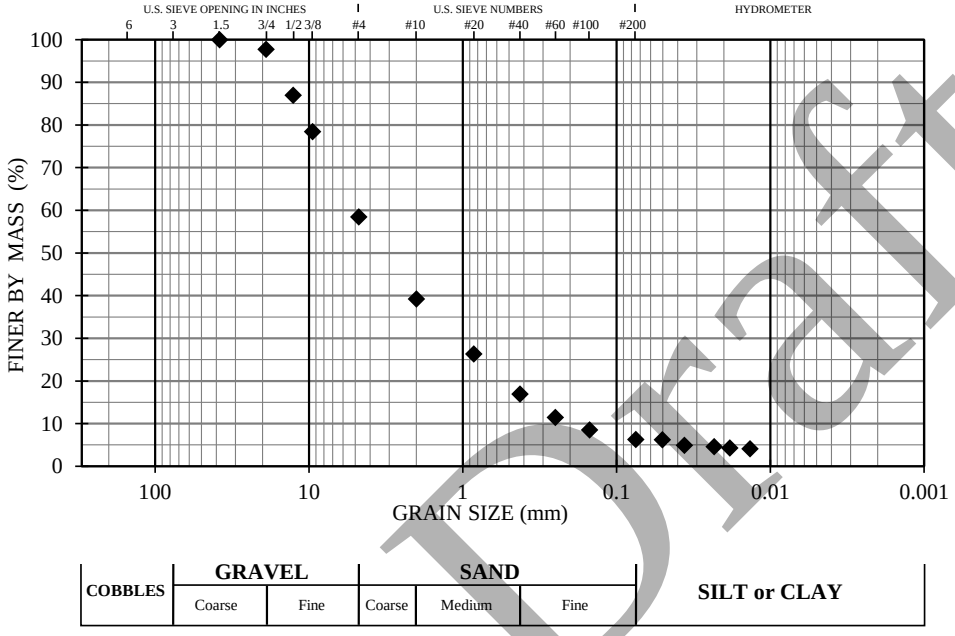
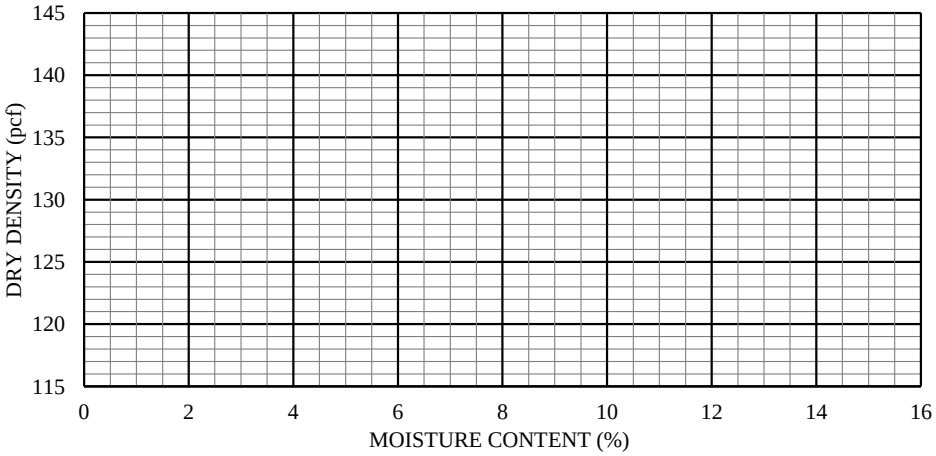
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22B** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **41.5** | USCS | **SW-SM** |
| % SAND | **52.2** | USACOE FC | **S2** |
| % SILT/CLAY | **6.3** | % PASS. 0.02 mm | **4.3** |
| % MOIST. CONTENT | **7.0** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **25.5** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.4** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **98** | |
| 12.70 | 1/2" | **87** | |
| 9.50 | 3/8" | **78** | |
| 4.75 | #4 | **58** | |
| 2.00 | #10 | **39** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **17** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **9** | |
| 0.075 | #200 | **6.3** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0503 | 6.2 |
| 2 | 0.0363 | 4.9 |
| 5 | 0.0232 | 4.6 |
| 8 | 0.0183 | 4.3 |
| 15 | 0.0135 | 4.1 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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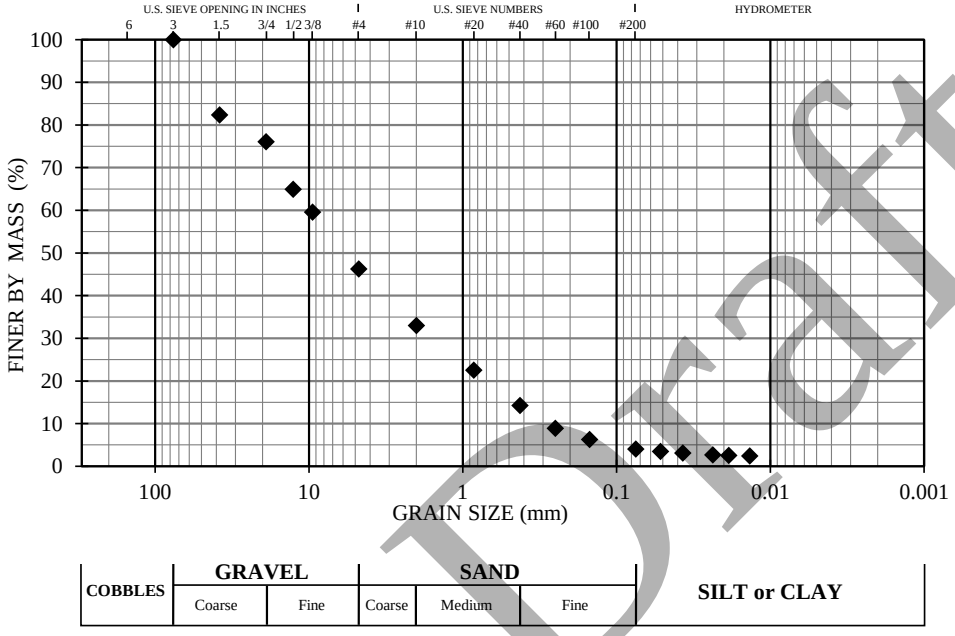
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP22B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

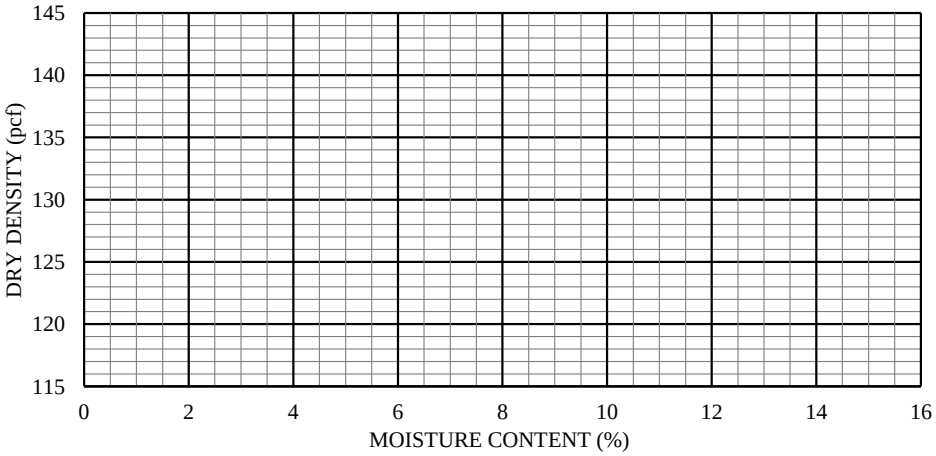
| | | | |
|---|---|---|---|
| % GRAVEL | **53.8** | USCS | **GW** |
| % SAND | **42.2** | USACOE FC | **PFS** |
| % SILT/CLAY | **4.0** | % PASS. 0.02 mm | **2.6** |
| % MOIST. CONTENT | **6.4** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **34.1** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **82** | |
| 19.00 | 3/4" | **76** | |
| 12.70 | 1/2" | **65** | |
| 9.50 | 3/8" | **60** | |
| 4.75 | #4 | **46** | |
| 2.00 | #10 | **33** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **14** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.0** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0519 | 3.5 |
| 2 | 0.0371 | 3.1 |
| 5 | 0.0236 | 2.7 |
| 8 | 0.0187 | 2.5 |
| 15 | 0.0136 | 2.4 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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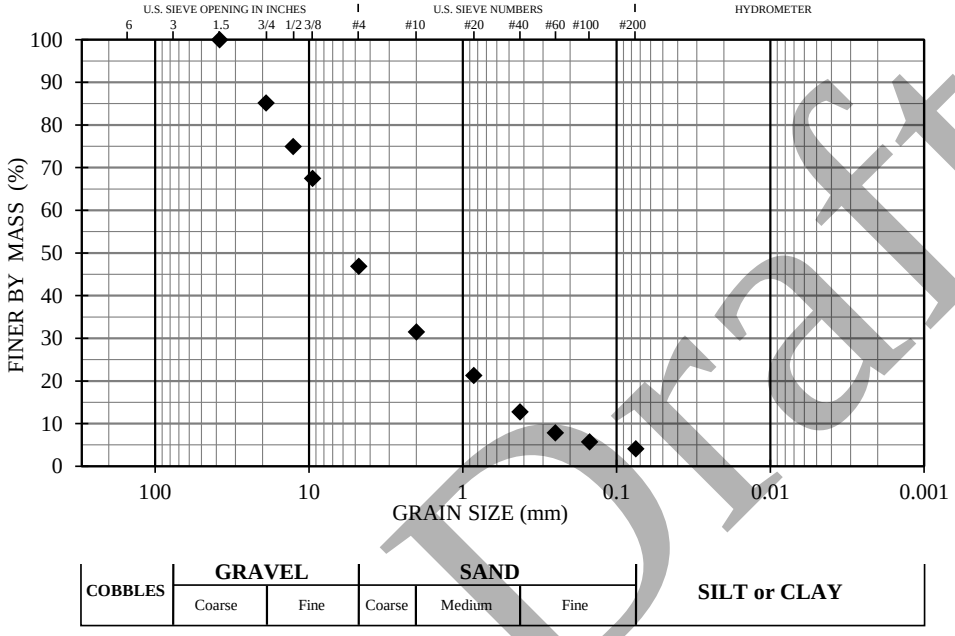
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

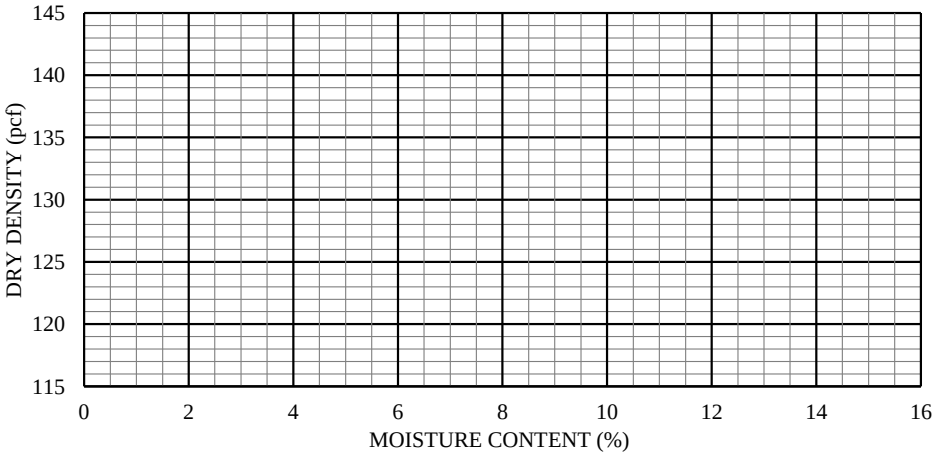
| | | | |
|---|---|---|---|
| % GRAVEL | **53.1** | USCS | **GW** |
| % SAND | **42.8** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.1** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **3.4** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **23.8** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.3** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **85** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **67** | |
| 4.75 | #4 | **47** | |
| 2.00 | #10 | **31** | |
| 0.85 | #20 | **21** | |
| 0.43 | #40 | **13** | |
| 0.25 | #60 | **8** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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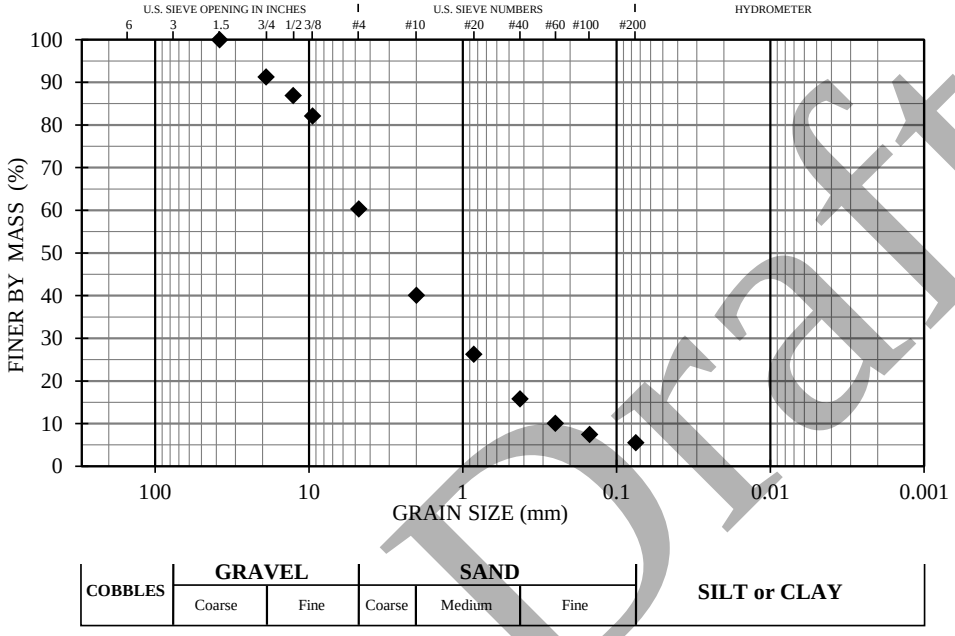
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **39.7** | USCS | **SW-SM** |
| % SAND | **54.8** | USACOE FC | **N/A** |
| % SILT/CLAY | **5.5** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **4.7** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **19.1** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.2** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



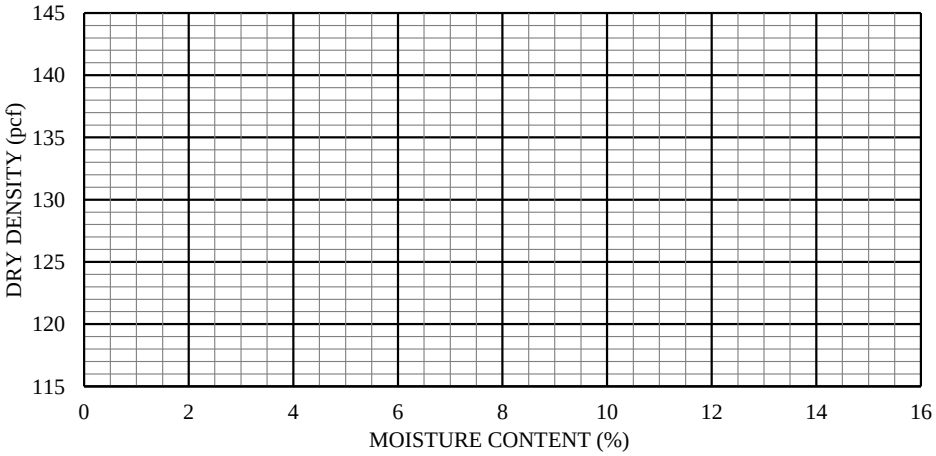

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **91** | |
| 12.70 | 1/2" | **87** | |
| 9.50 | 3/8" | **82** | |
| 4.75 | #4 | **60** | |
| 2.00 | #10 | **40** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **10** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **5.5** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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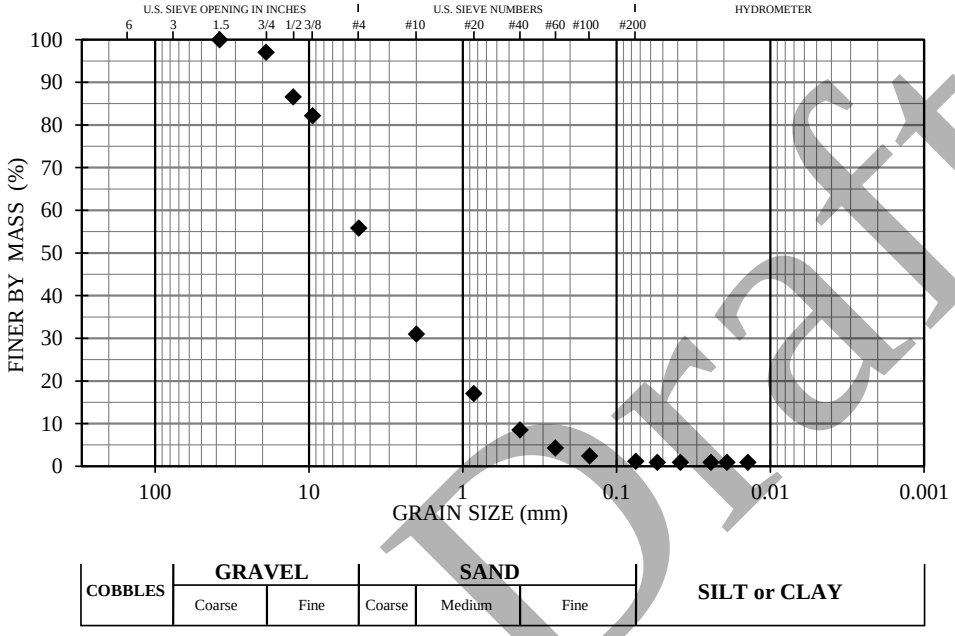
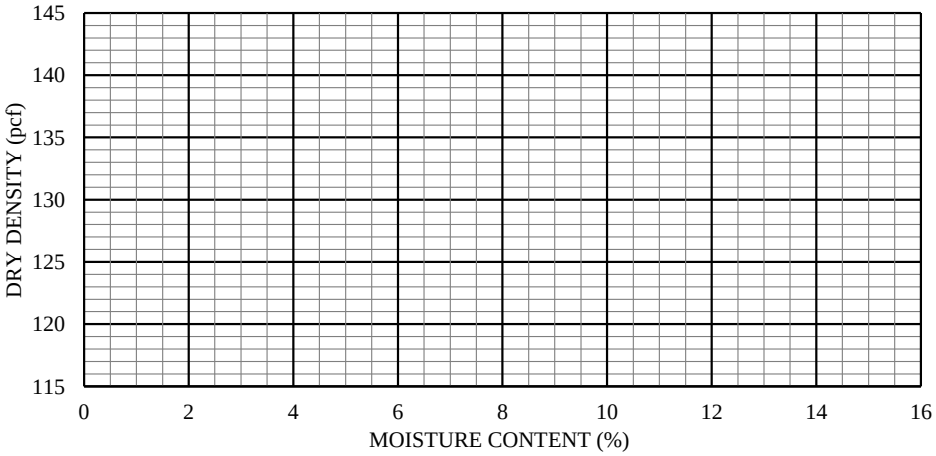
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **44.2** | USCS | **SW** |
| % SAND | **54.6** | USACOE FC | **NFS** |
| % SILT/CLAY | **1.2** | % PASS. 0.02 mm | **0.9** |
| % MOIST. CONTENT | **8.1** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **11.0** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.3** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **97** | |
| 12.70 | 1/2" | **87** | |
| 9.50 | 3/8" | **82** | |
| 4.75 | #4 | **56** | |
| 2.00 | #10 | **31** | |
| 0.85 | #20 | **17** | |
| 0.43 | #40 | **8** | |
| 0.25 | #60 | **4** | |
| 0.15 | #100 | **2** | |
| 0.075 | #200 | **1.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0543 | 0.9 |
| 2 | 0.0384 | 0.9 |
| 5 | 0.0243 | 0.9 |
| 8 | 0.0192 | 0.9 |
| 15 | 0.0140 | 0.9 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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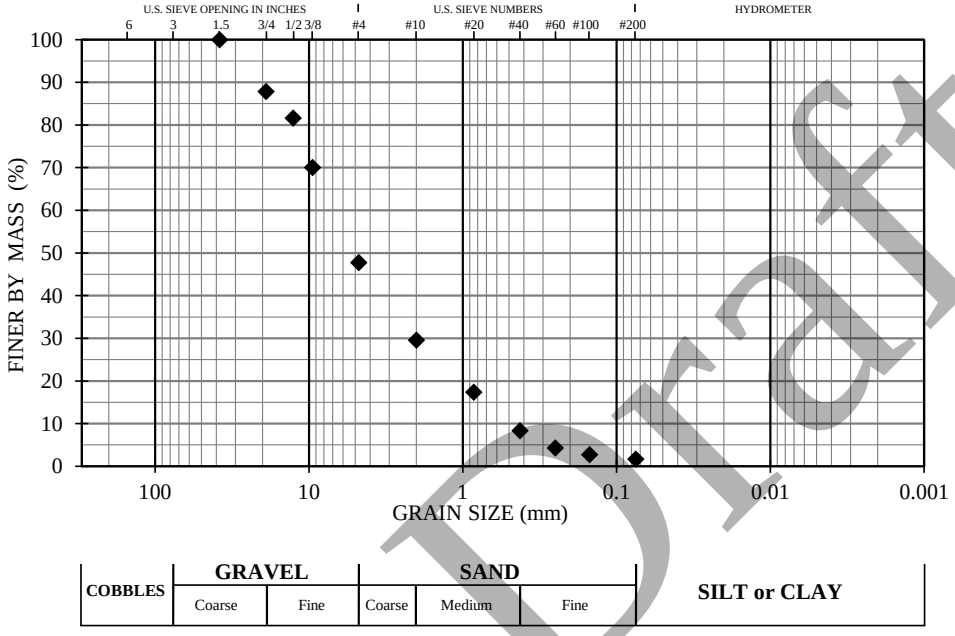
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25A** |
| NUMBER/ DEPTH: | **S5 / 12.5 - 14'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

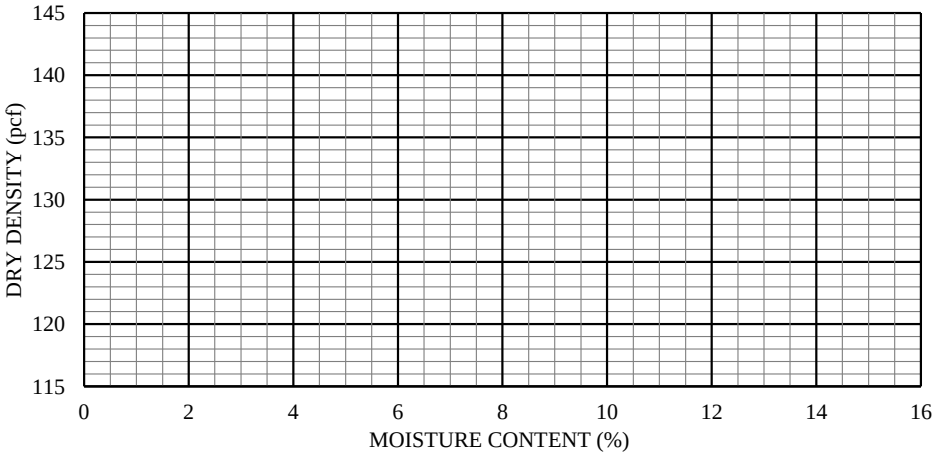
| | | | |
|---|---|---|---|
| % GRAVEL | **52.2** | USCS | **GW** |
| % SAND | **46.1** | USACOE FC | **N/A** |
| % SILT/CLAY | **1.7** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **6.8** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **14.6** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.2** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **88** | |
| 12.70 | 1/2" | **82** | |
| 9.50 | 3/8" | **70** | |
| 4.75 | #4 | **48** | |
| 2.00 | #10 | **30** | |
| 0.85 | #20 | **17** | |
| 0.43 | #40 | **8** | |
| 0.25 | #60 | **4** | |
| 0.15 | #100 | **3** | |
| 0.075 | #200 | **1.7** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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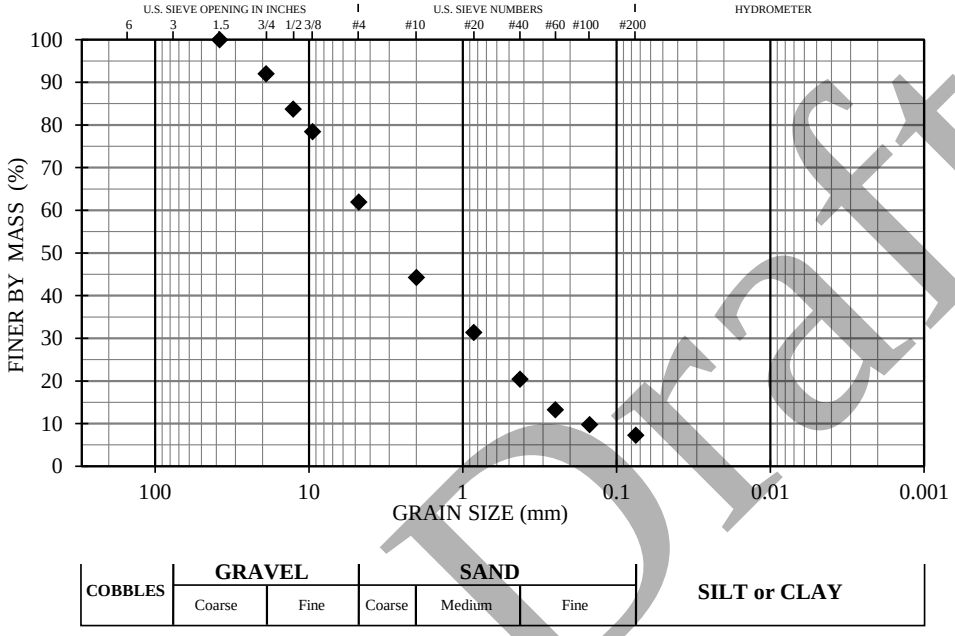
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Poorly-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

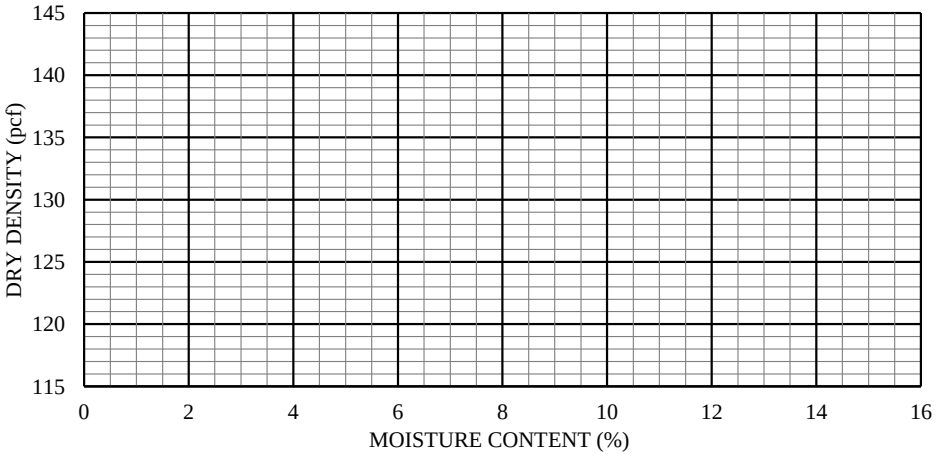
| | | | |
|---|---|---|---|
| % GRAVEL | **38.1** | USCS | **SP-SM** |
| % SAND | **54.6** | USACOE FC | **N/A** |
| % SILT/CLAY | **7.3** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **3.2** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **28.5** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **92** | |
| 12.70 | 1/2" | **84** | |
| 9.50 | 3/8" | **78** | |
| 4.75 | #4 | **62** | |
| 2.00 | #10 | **44** | |
| 0.85 | #20 | **31** | |
| 0.43 | #40 | **20** | |
| 0.25 | #60 | **13** | |
| 0.15 | #100 | **10** | |
| 0.075 | #200 | **7.3** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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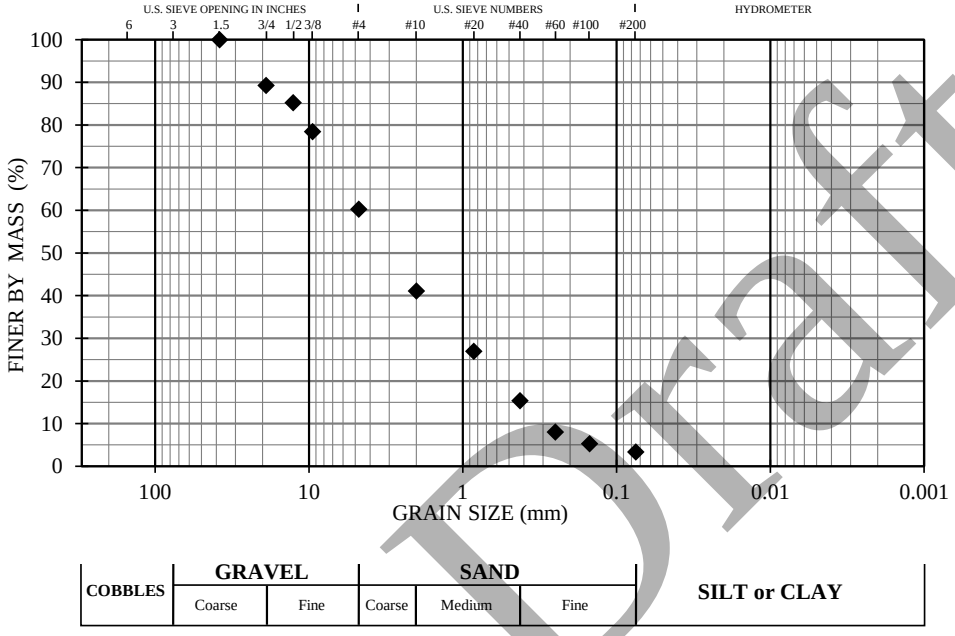
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25B** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Poorly-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **39.8** | USCS | **SP** |
| % SAND | **56.9** | USACOE FC | **N/A** |
| % SILT/CLAY | **3.3** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **8.5** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **15.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



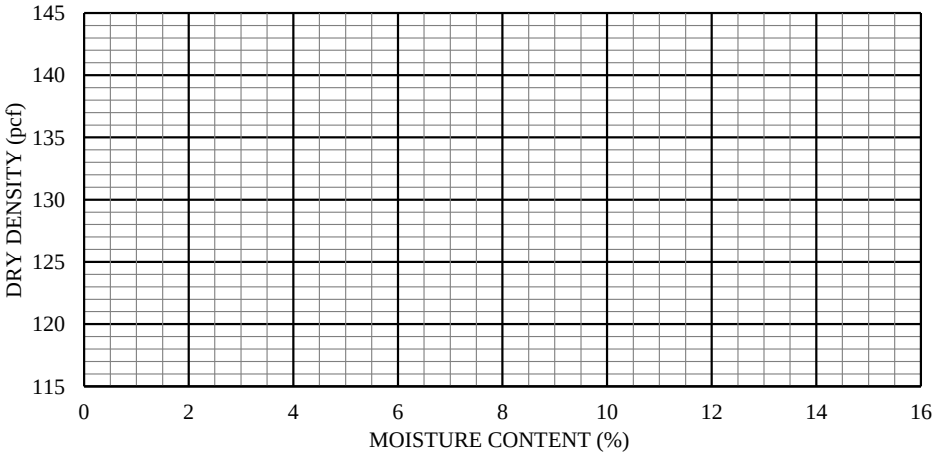

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **89** | |
| 12.70 | 1/2" | **85** | |
| 9.50 | 3/8" | **78** | |
| 4.75 | #4 | **60** | |
| 2.00 | #10 | **41** | |
| 0.85 | #20 | **27** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **8** | |
| 0.15 | #100 | **5** | |
| 0.075 | #200 | **3.3** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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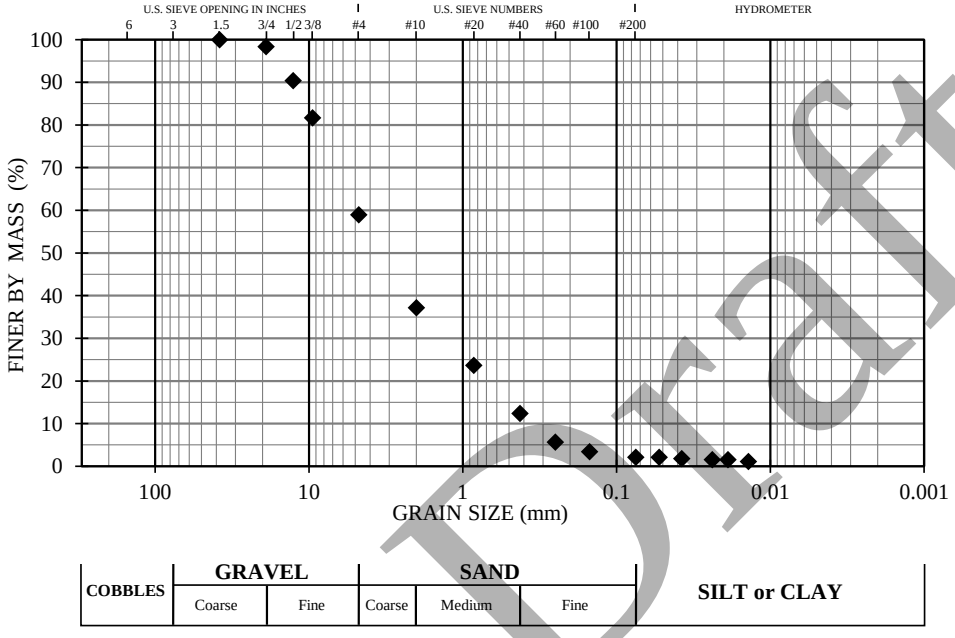
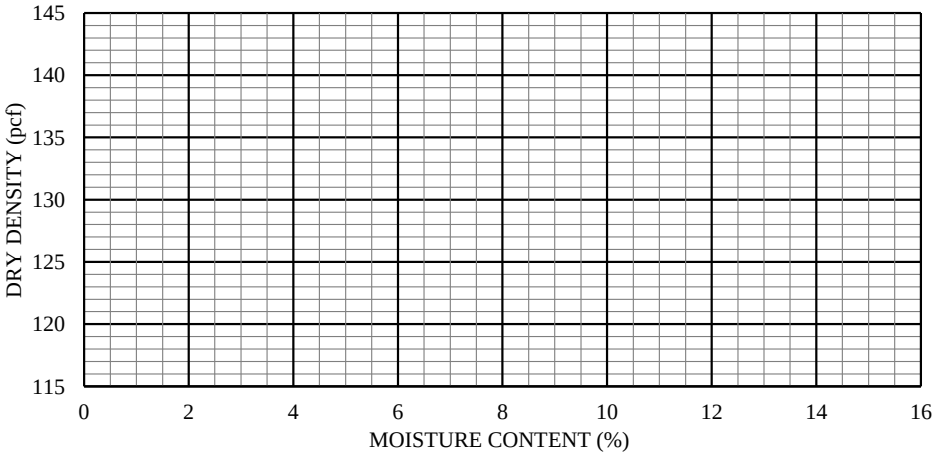
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP25B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **41.1** | USCS | **SW** |
| % SAND | **56.8** | USACOE FC | **NFS** |
| % SILT/CLAY | **2.1** | % PASS. 0.02 mm | **1.7** |
| % MOIST. CONTENT | **8.1** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **13.7** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.1** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **98** | |
| 12.70 | 1/2" | **90** | |
| 9.50 | 3/8" | **82** | |
| 4.75 | #4 | **59** | |
| 2.00 | #10 | **37** | |
| 0.85 | #20 | **24** | |
| 0.43 | #40 | **12** | |
| 0.25 | #60 | **6** | |
| 0.15 | #100 | **3** | |
| 0.075 | #200 | **2.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0528 | ~~2.1~~ |
| 2 | 0.0378 | 1.8 |
| 5 | 0.0239 | 1.6 |
| 8 | 0.0189 | 1.6 |
| 15 | 0.0139 | 1.1 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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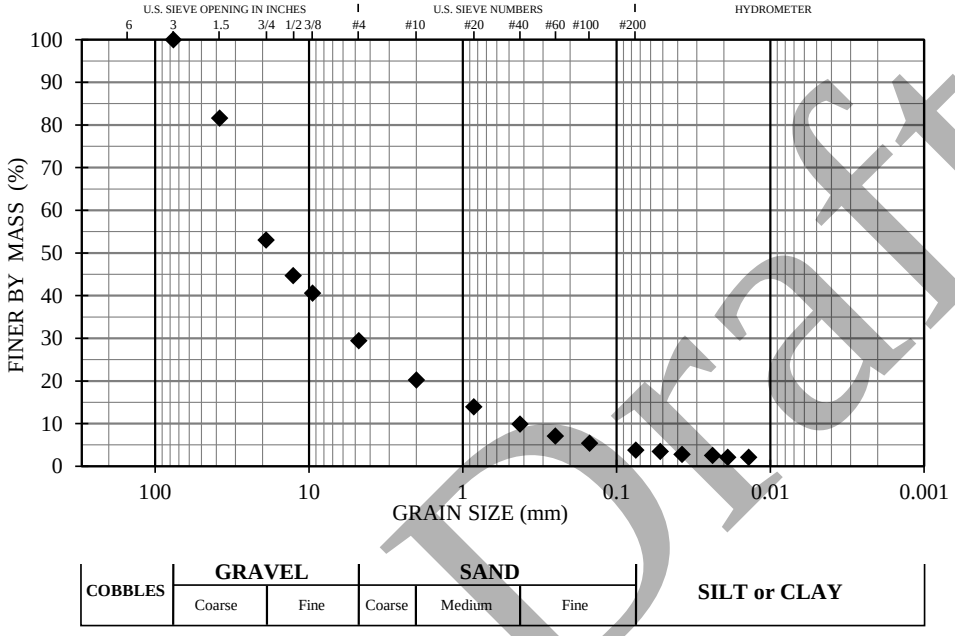
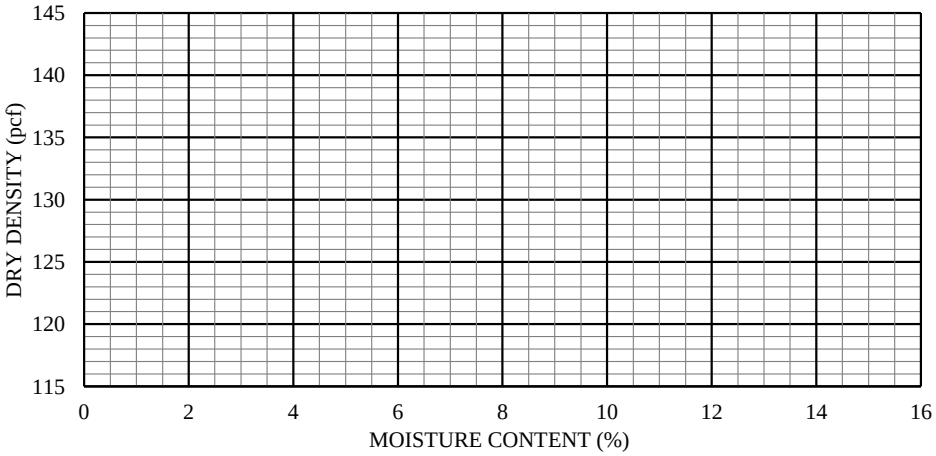
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP33A** |
| NUMBER/ DEPTH: | **S2 / 10 - 11.5'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **70.6** | USCS | **GW** |
| % SAND | **25.6** | USACOE FC | **PFS** |
| % SILT/CLAY | **3.8** | % PASS. 0.02 mm | **2.1** |
| % MOIST. CONTENT | **5.2** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **53.8** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **2.4** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **82** | |
| 19.00 | 3/4" | **53** | |
| 12.70 | 1/2" | **45** | |
| 9.50 | 3/8" | **41** | |
| 4.75 | #4 | **29** | |
| 2.00 | #10 | **20** | |
| 0.85 | #20 | **14** | |
| 0.43 | #40 | **10** | |
| 0.25 | #60 | **7** | |
| 0.15 | #100 | **5** | |
| 0.075 | #200 | **3.8** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0519 | 3.5 |
| 2 | 0.0376 | 2.8 |
| 5 | 0.0238 | 2.5 |
| 8 | 0.0189 | 2.1 |
| 15 | 0.0138 | 2.1 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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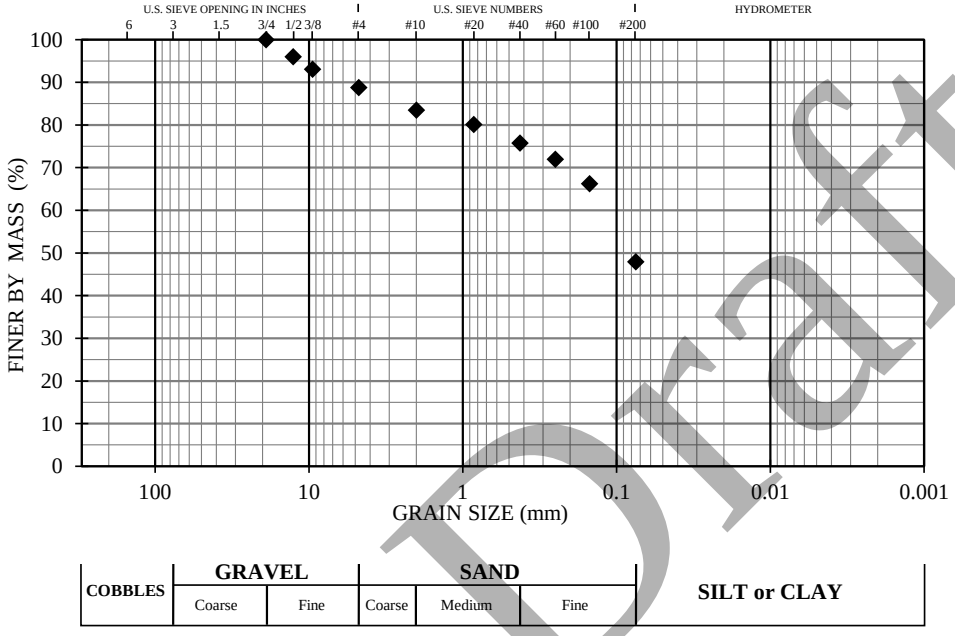
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP33A** |
| NUMBER/ DEPTH: | **S3 / 12.5 - 14'** |
| DESCRIPTION: | **Silty sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **11.2** | USCS | **SM** |
| % SAND | **40.9** | USACOE FC | **N/A** |
| % SILT/CLAY | **47.9** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **71.2** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | | **UNKNOWN** |
| COEFFICIENT OF GRADATION ($C_c$) | | | **UNKNOWN** |
| ASTM D1557 (uncorrected) | | | **N/A** |
| ASTM D4718 (corrected) | | | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | | | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



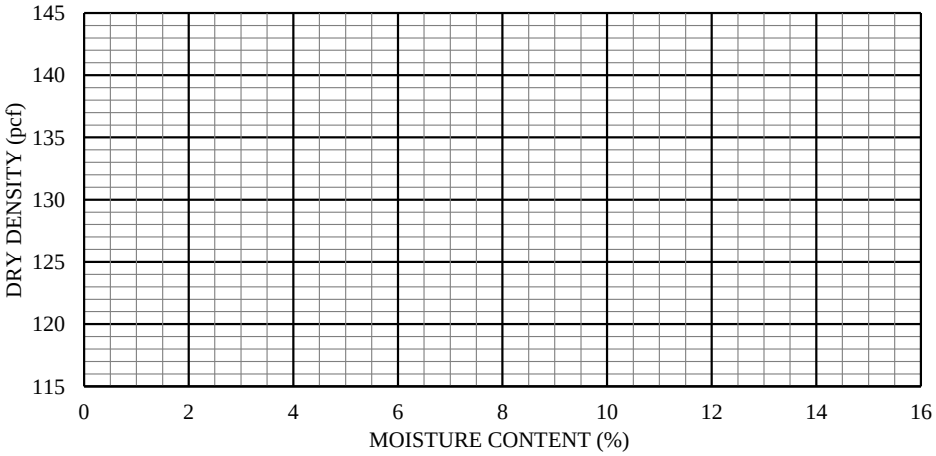

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | **100** | |
| 12.70 | 1/2" | **96** | |
| 9.50 | 3/8" | **93** | |
| 4.75 | #4 | **89** | |
| 2.00 | #10 | **83** | |
| 0.85 | #20 | **80** | |
| 0.43 | #40 | **76** | |
| 0.25 | #60 | **72** | |
| 0.15 | #100 | **66** | |
| 0.075 | #200 | **47.9** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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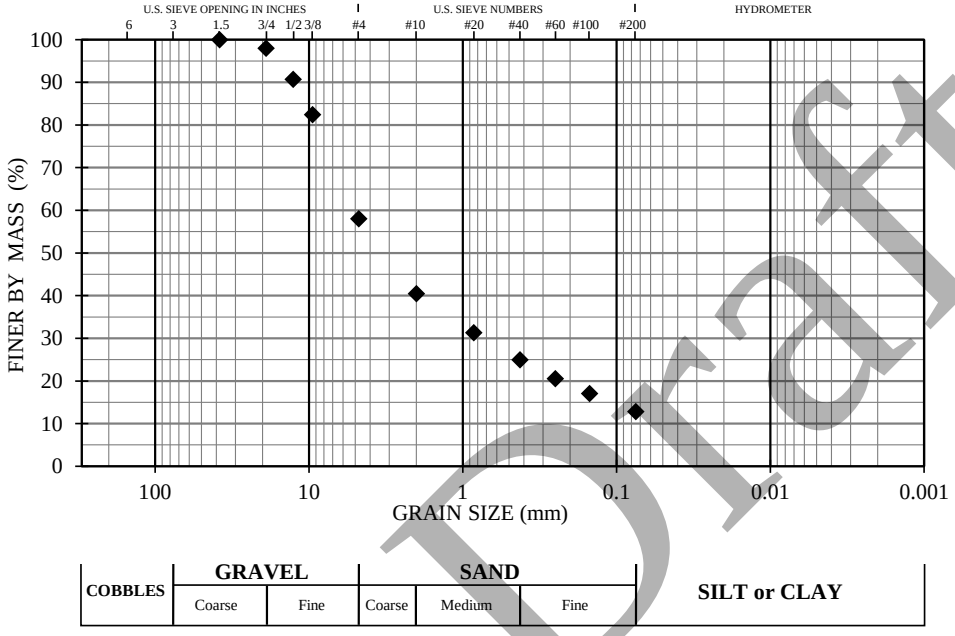
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP33B** |
| NUMBER/ DEPTH: | **S1 / 5 - 6.5'** |
| DESCRIPTION: | **Silty sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **42.0** | USCS | **SM** |
| % SAND | **45.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **12.8** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **10.1** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | | **UNKNOWN** |
| COEFFICIENT OF GRADATION ($C_c$) | | | **UNKNOWN** |
| ASTM D1557 (uncorrected) | | | **N/A** |
| ASTM D4718 (corrected) | | | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | | | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



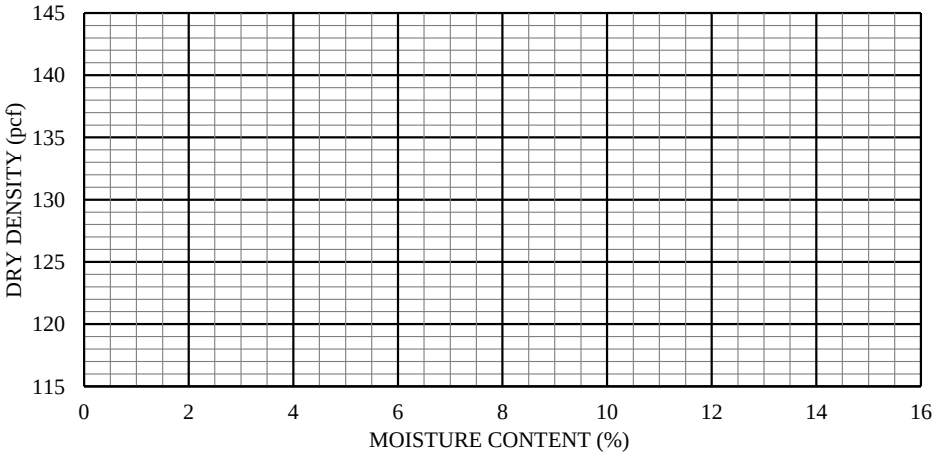

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **98** | |
| 12.70 | 1/2" | **91** | |
| 9.50 | 3/8" | **82** | |
| 4.75 | #4 | **58** | |
| 2.00 | #10 | **40** | |
| 0.85 | #20 | **31** | |
| 0.43 | #40 | **25** | |
| 0.25 | #60 | **21** | |
| 0.15 | #100 | **17** | |
| 0.075 | #200 | **12.8** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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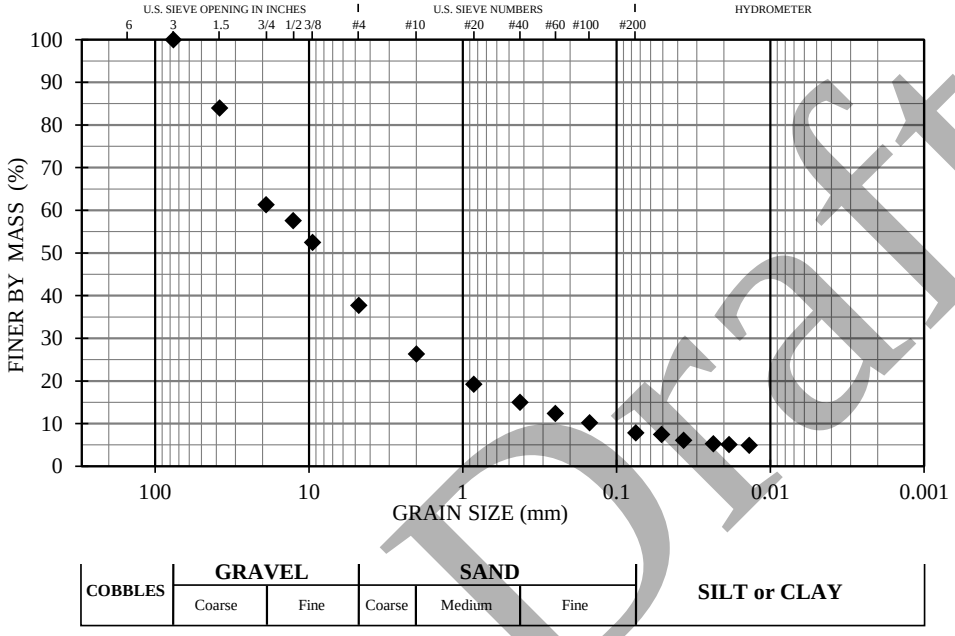
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP33B** |
| NUMBER/ DEPTH: | **S2 / 10 - 11.5'** |
| DESCRIPTION: | **Poorly-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **62.3** | USCS | **GP-GM** |
| % SAND | **29.9** | USACOE FC | **S1** |
| % SILT/CLAY | **7.8** | % PASS. 0.02 mm | **5.1** |
| % MOIST. CONTENT | **8.6** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **116.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **3.4** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

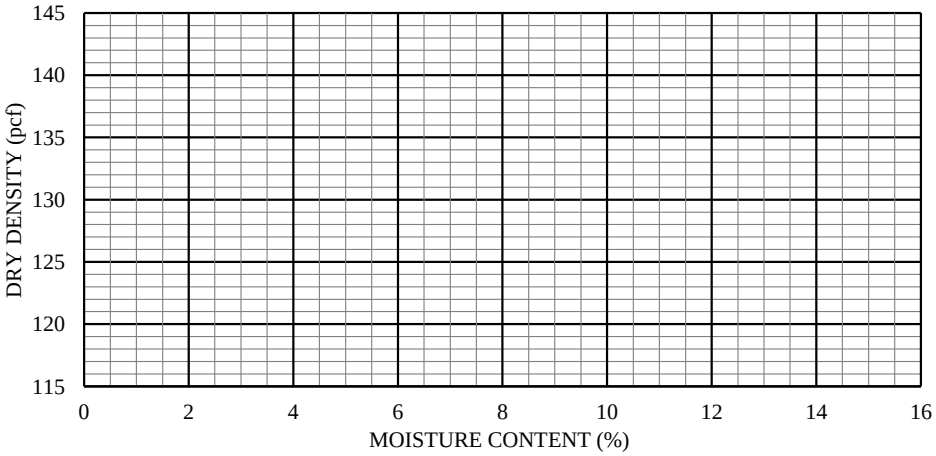
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **84** | |
| 19.00 | 3/4" | **61** | |
| 12.70 | 1/2" | **58** | |
| 9.50 | 3/8" | **52** | |
| 4.75 | #4 | **38** | |
| 2.00 | #10 | **26** | |
| 0.85 | #20 | **19** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **12** | |
| 0.15 | #100 | **10** | |
| 0.075 | #200 | **7.8** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0509 | 7.4 |
| 2 | 0.0367 | 6.1 |
| 5 | 0.0235 | 5.3 |
| 8 | 0.0186 | 5.1 |
| 15 | 0.0137 | 4.9 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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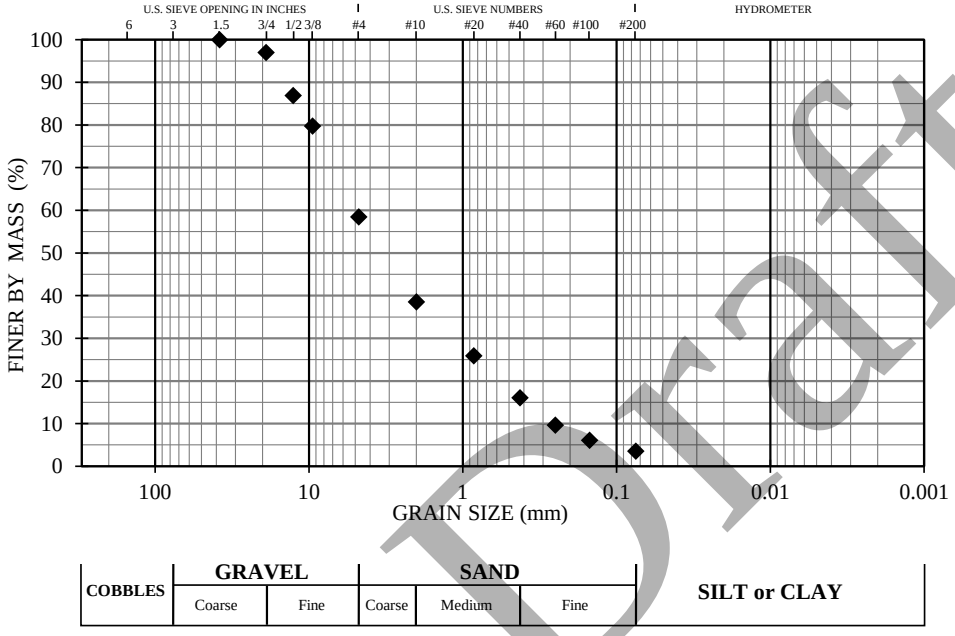
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP43A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJBC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **41.5** | USCS | **SW** |
| % SAND | **55.0** | USACOE FC | **N/A** |
| % SILT/CLAY | **3.5** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **7.4** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **19.6** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.1** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



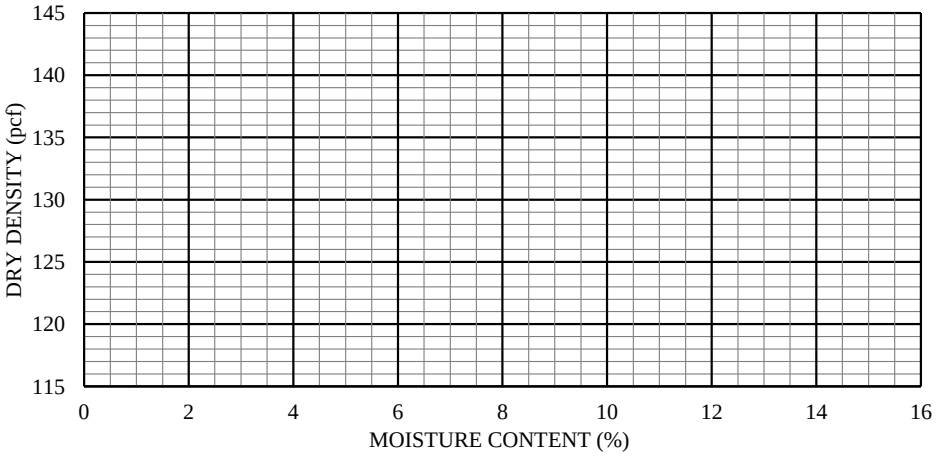

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **97** | |
| 12.70 | 1/2" | **87** | |
| 9.50 | 3/8" | **80** | |
| 4.75 | #4 | **58** | |
| 2.00 | #10 | **38** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **10** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **3.5** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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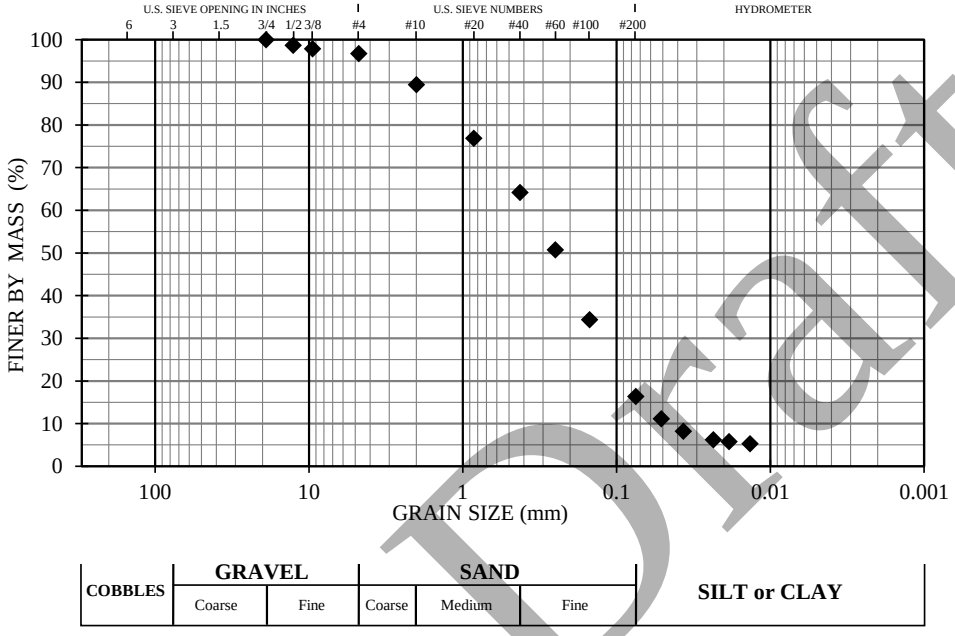
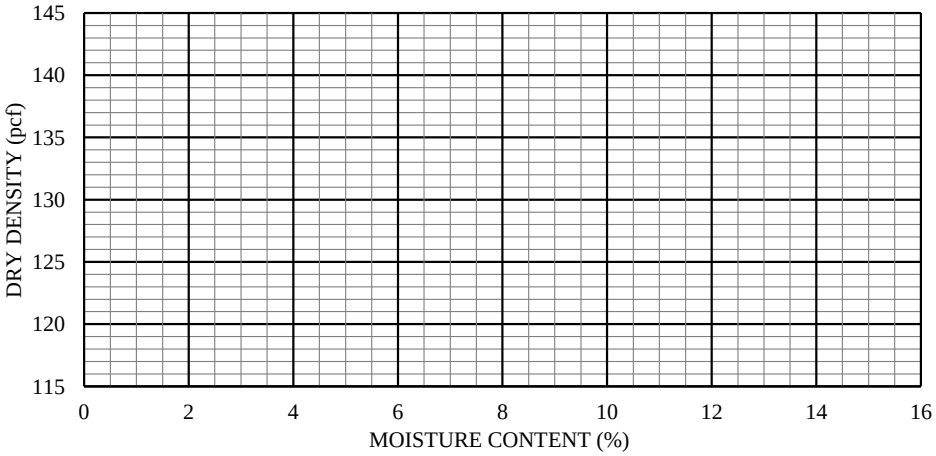
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP43A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Silty sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **3.2** | USCS | **SM** |
| % SAND | **80.4** | USACOE FC | **F2** |
| % SILT/CLAY | **16.4** | % PASS. 0.02 mm | **5.9** |
| % MOIST. CONTENT | **17.9** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **8.1** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.0** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | **100** | |
| 12.70 | 1/2" | **99** | |
| 9.50 | 3/8" | **98** | |
| 4.75 | #4 | **97** | |
| 2.00 | #10 | **89** | |
| 0.85 | #20 | **77** | |
| 0.43 | #40 | **64** | |
| 0.25 | #60 | **51** | |
| 0.15 | #100 | **34** | |
| 0.075 | #200 | **16.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0512 | 11.2 |
| 2 | 0.0368 | 8.2 |
| 5 | 0.0235 | 6.2 |
| 8 | 0.0185 | 5.7 |
| 15 | 0.0135 | 5.3 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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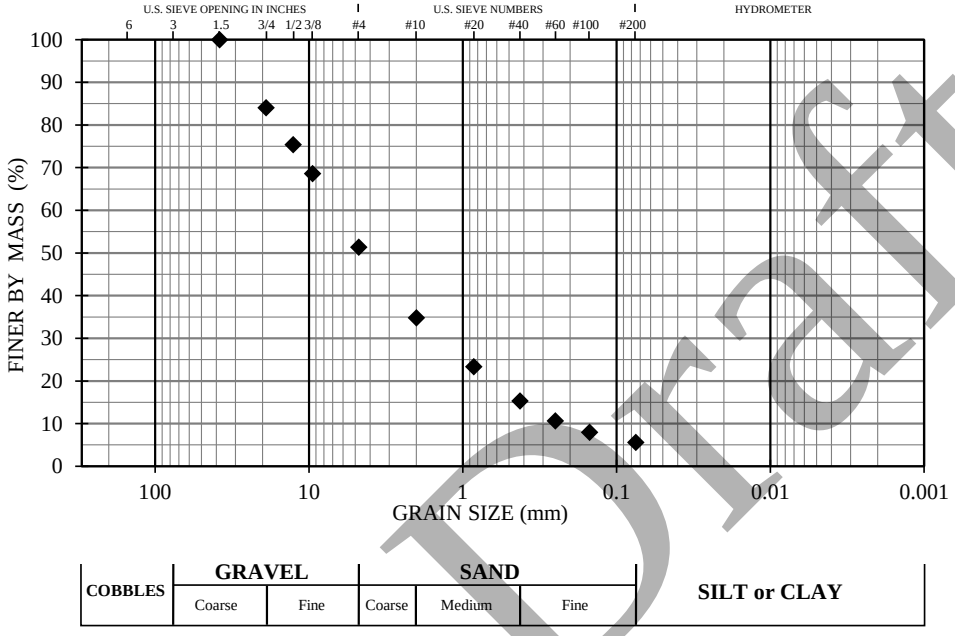
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP43B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **48.6** | USCS | **GW-GM** |
| % SAND | **45.8** | USACOE FC | **N/A** |
| % SILT/CLAY | **5.6** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **7.3** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **31.5** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.4** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

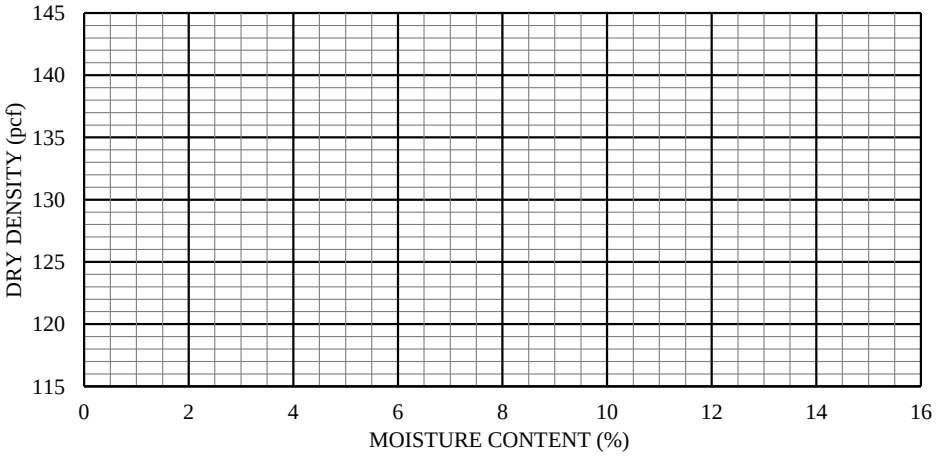
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **84** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **51** | |
| 2.00 | #10 | **35** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **5.6** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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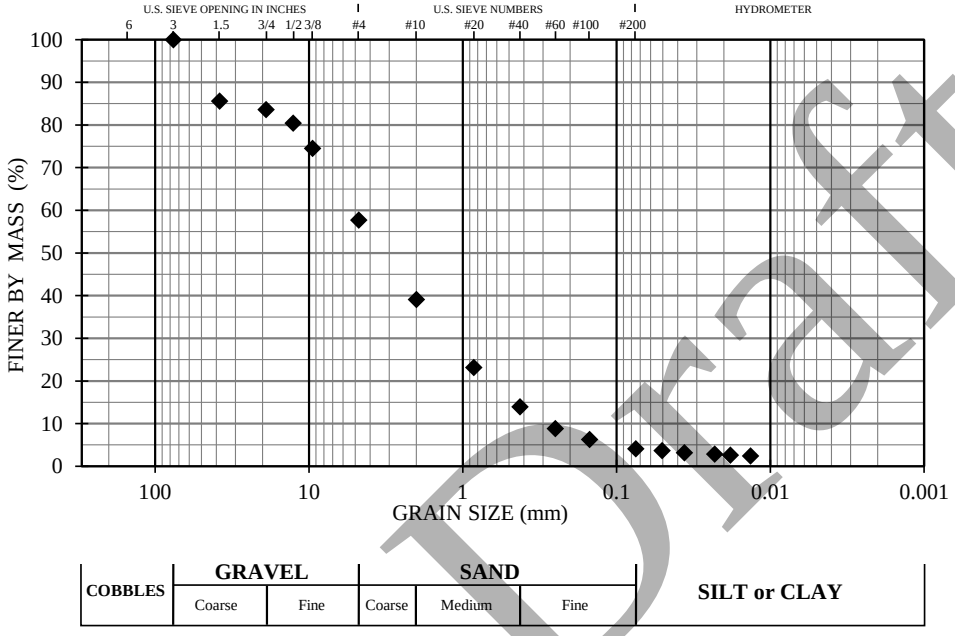
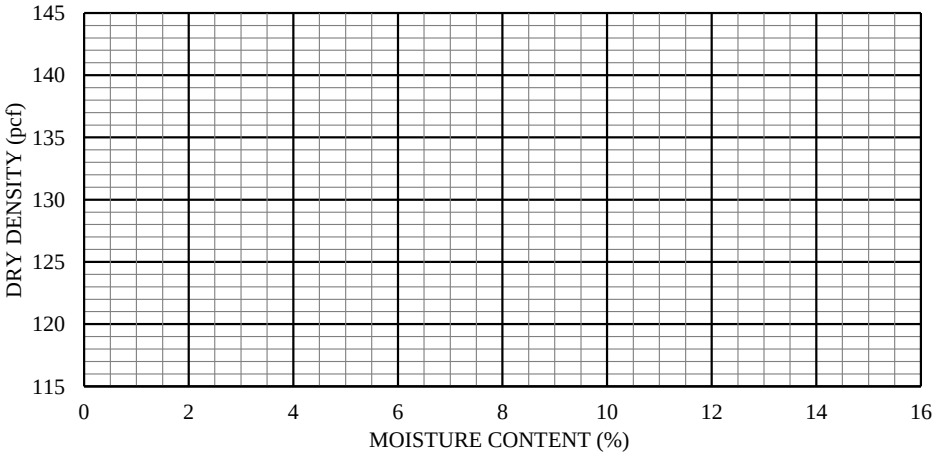
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP43B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **42.3** | USCS | **SW** |
| % SAND | **53.6** | USACOE FC | **NFS** |
| % SILT/CLAY | **4.1** | % PASS. 0.02 mm | **2.6** |
| % MOIST. CONTENT | **7.5** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **18.6** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.2** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **86** | |
| 19.00 | 3/4" | **84** | |
| 12.70 | 1/2" | **80** | |
| 9.50 | 3/8" | **75** | |
| 4.75 | #4 | **58** | |
| 2.00 | #10 | **39** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **14** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0506 | 3.7 |
| 2 | 0.0362 | 3.1 |
| 5 | 0.0230 | 2.9 |
| 8 | 0.0182 | 2.6 |
| 15 | 0.0134 | 2.4 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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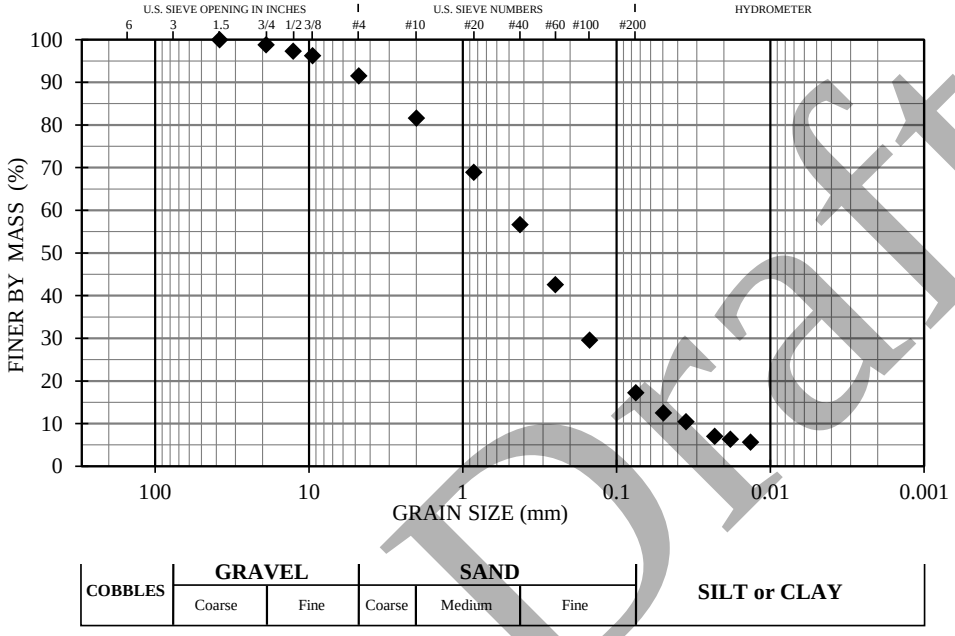
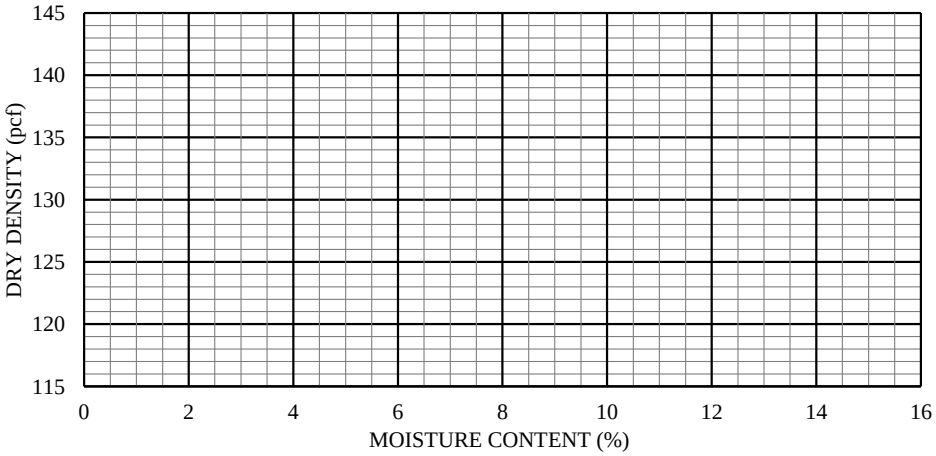
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP43B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Silty sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJCP** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **8.5** | USCS | **SM** |
| % SAND | **74.3** | USACOE FC | **F2** |
| % SILT/CLAY | **17.2** | % PASS. 0.02 mm | **6.6** |
| % MOIST. CONTENT | **46.5** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **16.0** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.3** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **99** | |
| 12.70 | 1/2" | **97** | |
| 9.50 | 3/8" | **96** | |
| 4.75 | #4 | **92** | |
| 2.00 | #10 | **82** | |
| 0.85 | #20 | **69** | |
| 0.43 | #40 | **57** | |
| 0.25 | #60 | **43** | |
| 0.15 | #100 | **30** | |
| 0.075 | #200 | **17.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0496 | 12.5 |
| 2 | 0.0354 | 10.4 |
| 5 | 0.0230 | 7.0 |
| 8 | 0.0182 | 6.4 |
| 15 | 0.0134 | 5.7 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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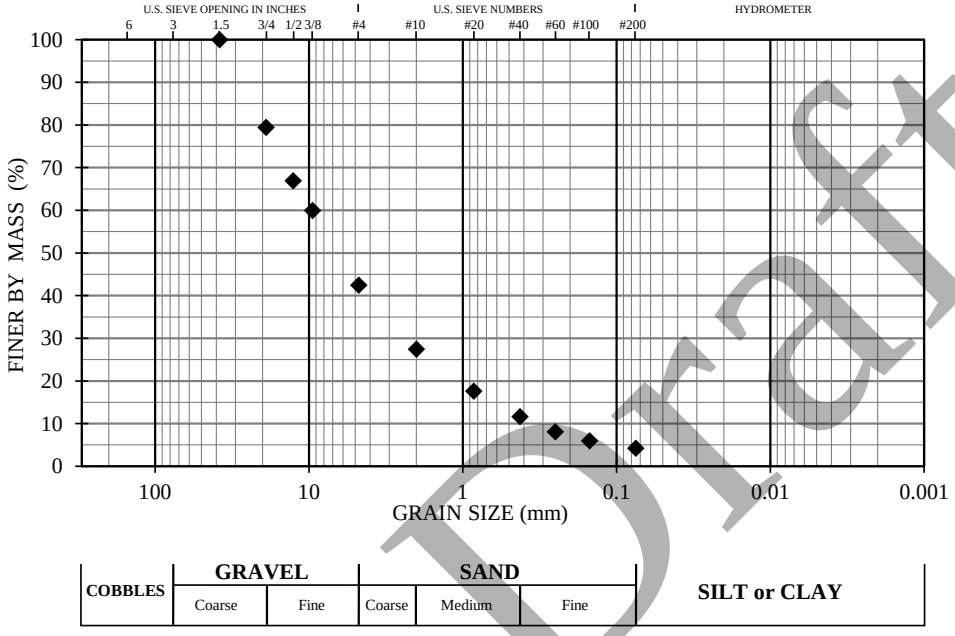
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP44A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **57.6** | USCS | **GW** |
| % SAND | **38.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.2** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **5.0** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **27.6** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



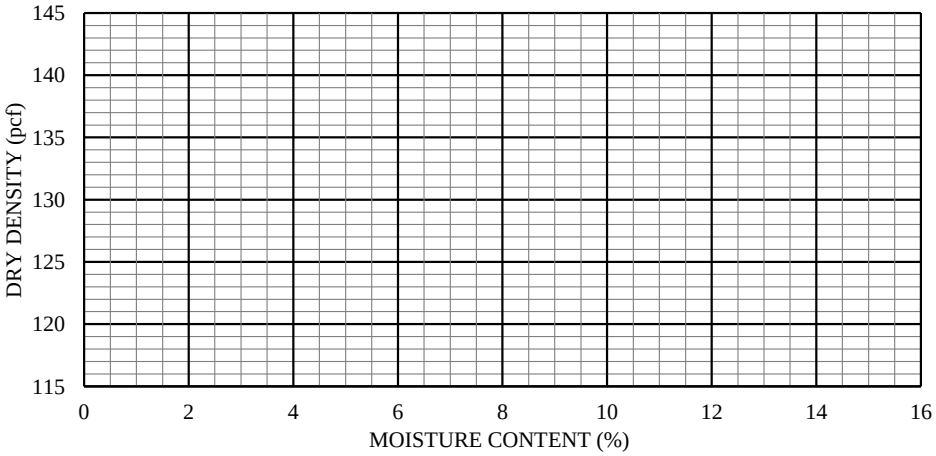

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **79** | |
| 12.70 | 1/2" | **67** | |
| 9.50 | 3/8" | **60** | |
| 4.75 | #4 | **42** | |
| 2.00 | #10 | **27** | |
| 0.85 | #20 | **18** | |
| 0.43 | #40 | **12** | |
| 0.25 | #60 | **8** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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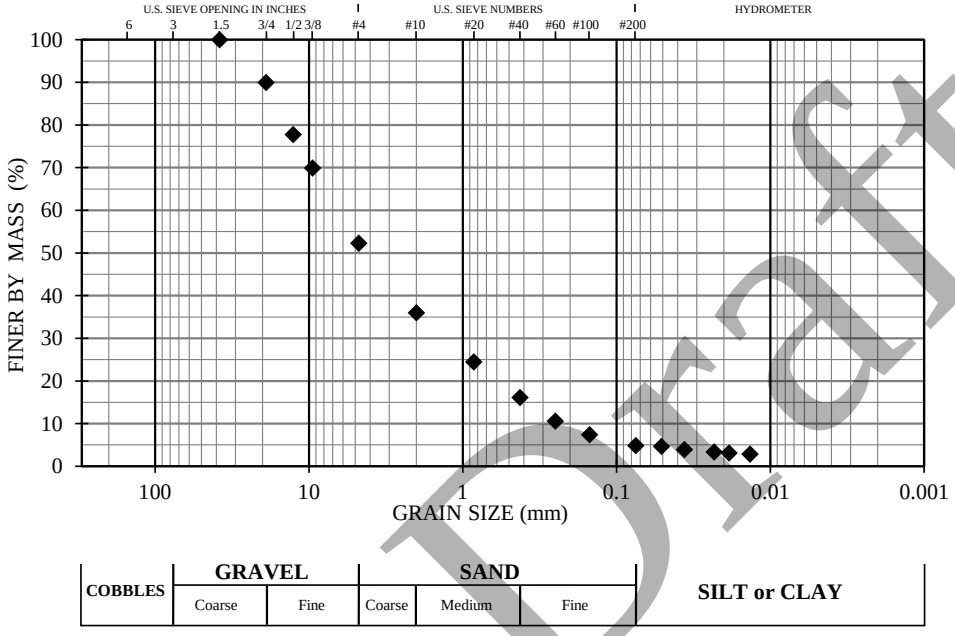
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP44A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **47.6** | USCS | **GW** |
| % SAND | **47.5** | USACOE FC | **S1** |
| % SILT/CLAY | **4.9** | % PASS. 0.02 mm | **3.2** |
| % MOIST. CONTENT | **7.2** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **29.5** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.2** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



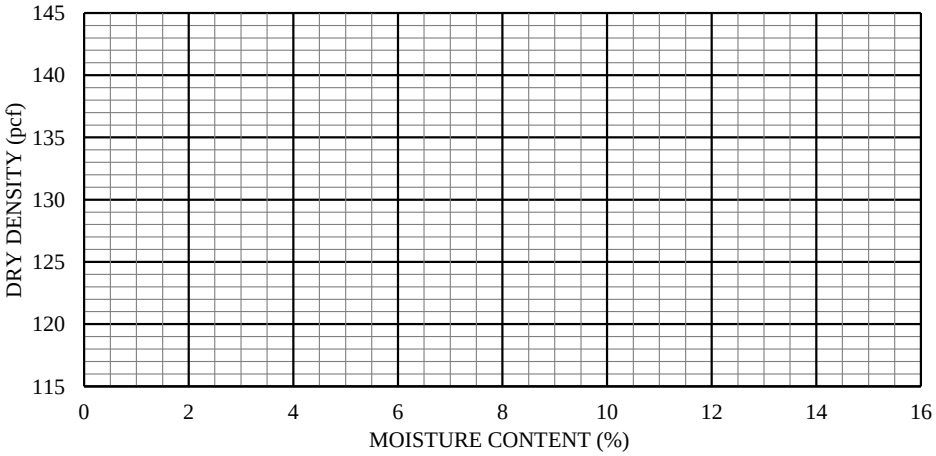

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **90** | |
| 12.70 | 1/2" | **78** | |
| 9.50 | 3/8" | **70** | |
| 4.75 | #4 | **52** | |
| 2.00 | #10 | **36** | |
| 0.85 | #20 | **24** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **4.9** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0509 | 4.6 |
| 2 | 0.0363 | 3.9 |
| 5 | 0.0232 | 3.4 |
| 8 | 0.0185 | 3.1 |
| 15 | 0.0135 | 2.9 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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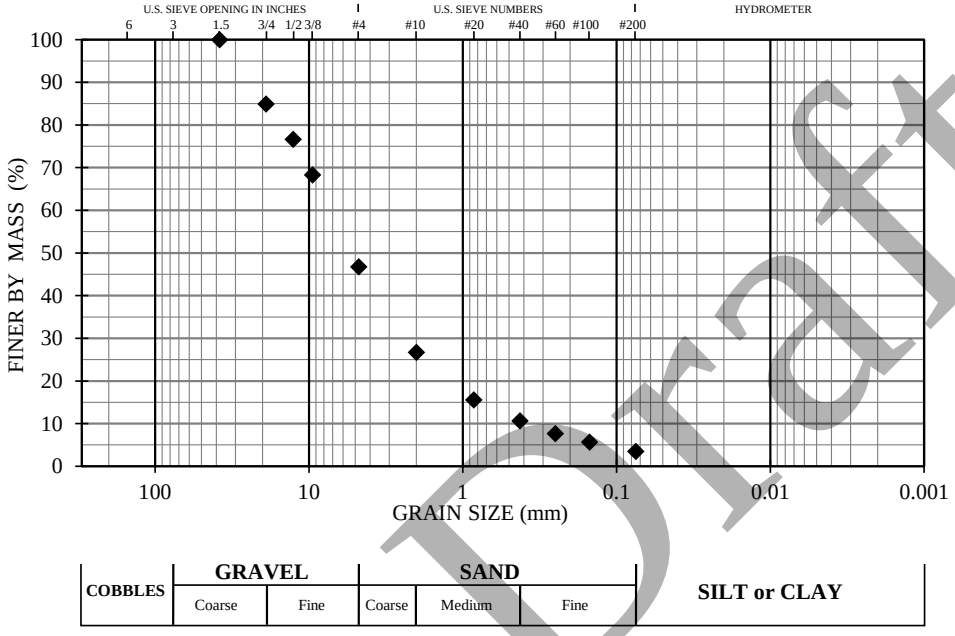
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP44A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **53.3** | USCS | **GW** |
| % SAND | **43.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **3.5** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **6.7** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **19.7** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



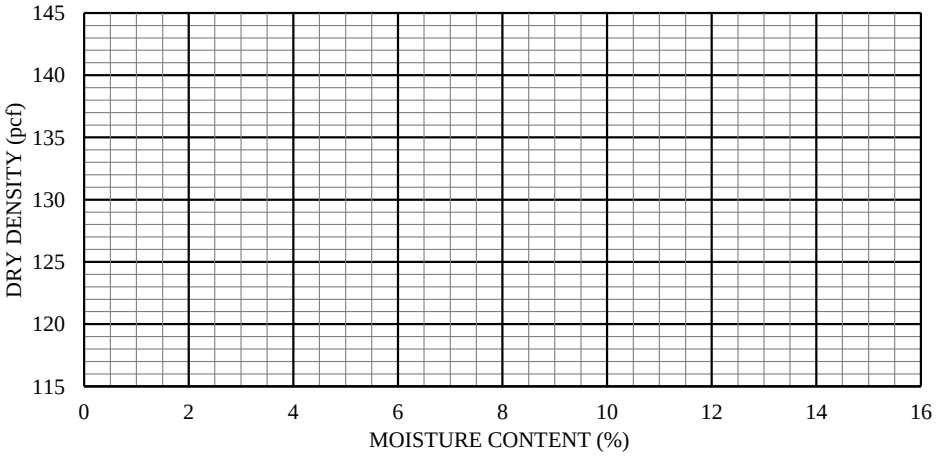

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **85** | |
| 12.70 | 1/2" | **77** | |
| 9.50 | 3/8" | **68** | |
| 4.75 | #4 | **47** | |
| 2.00 | #10 | **27** | |
| 0.85 | #20 | **16** | |
| 0.43 | #40 | **11** | |
| 0.25 | #60 | **8** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **3.5** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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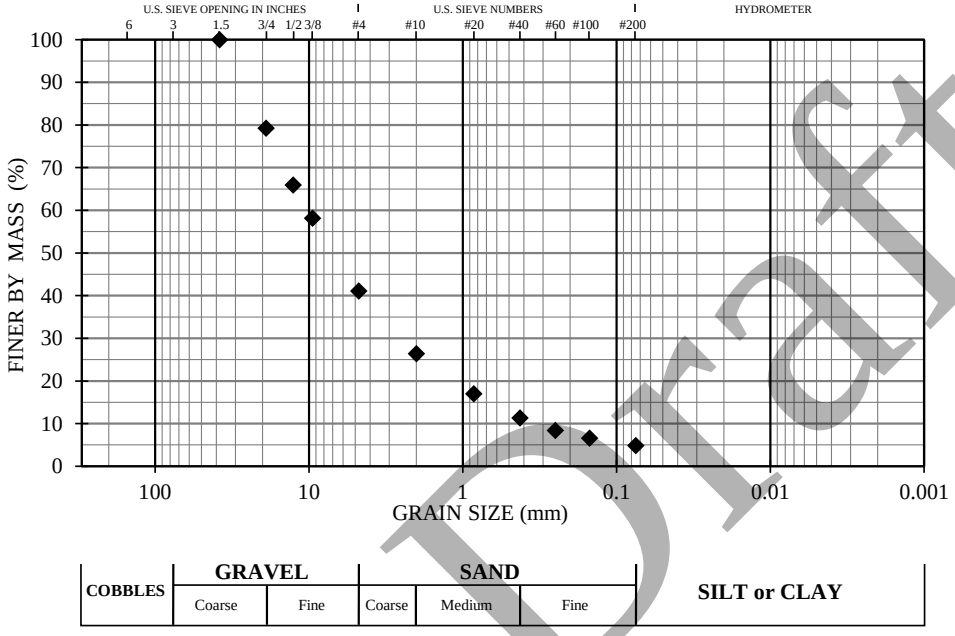
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP44B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

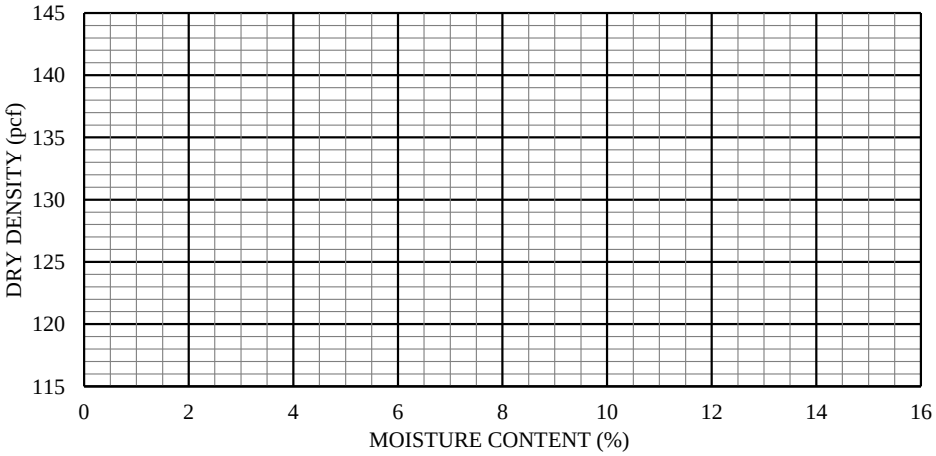
| | | | |
|---|---|---|---|
| % GRAVEL | **58.9** | USCS | **GW** |
| % SAND | **36.3** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.8** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **8.0** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **29.8** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **79** | |
| 12.70 | 1/2" | **66** | |
| 9.50 | 3/8" | **58** | |
| 4.75 | #4 | **41** | |
| 2.00 | #10 | **26** | |
| 0.85 | #20 | **17** | |
| 0.43 | #40 | **11** | |
| 0.25 | #60 | **8** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **4.8** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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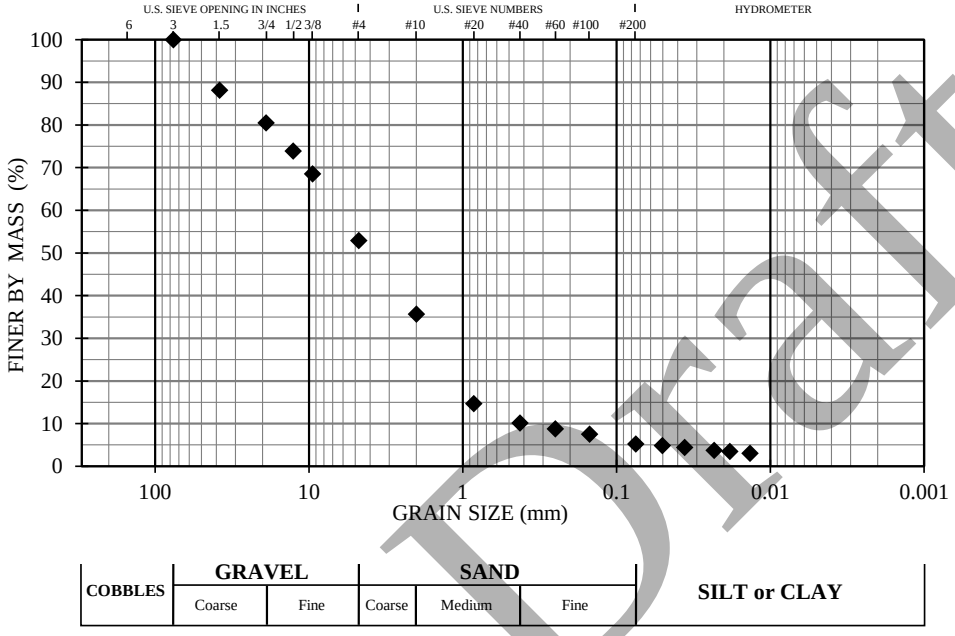
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP44B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

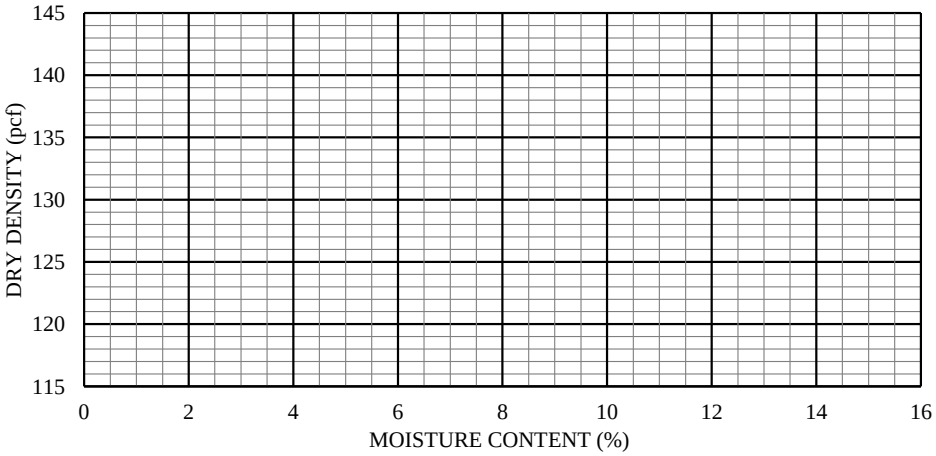
| | | | |
|---|---|---|---|
| % GRAVEL | **47.1** | USCS | **SW-SM** |
| % SAND | **47.7** | USACOE FC | **S2** |
| % SILT/CLAY | **5.2** | % PASS. 0.02 mm | **3.6** |
| % MOIST. CONTENT | **7.7** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **17.0** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **88** | |
| 19.00 | 3/4" | **81** | |
| 12.70 | 1/2" | **74** | |
| 9.50 | 3/8" | **69** | |
| 4.75 | #4 | **53** | |
| 2.00 | #10 | **36** | |
| 0.85 | #20 | **15** | |
| 0.43 | #40 | **10** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **7** | |
| 0.075 | #200 | **5.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0503 | 4.9 |
| 2 | 0.0360 | 4.4 |
| 5 | 0.0232 | 3.7 |
| 8 | 0.0184 | 3.5 |
| 15 | 0.0136 | 3.0 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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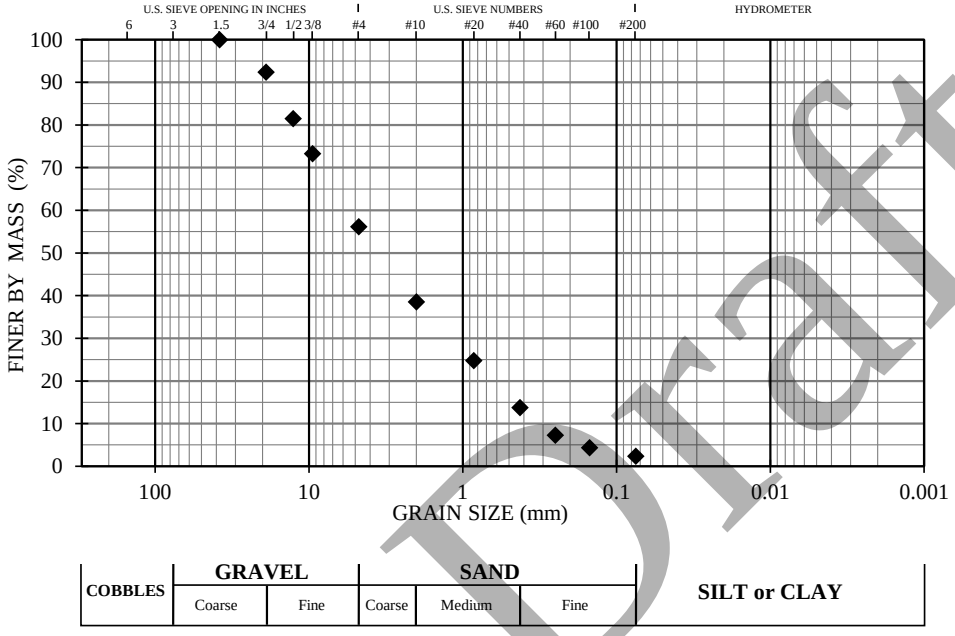
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP44B** |
| NUMBER/ DEPTH: | **S4 / 10 - 11.5'** |
| DESCRIPTION: | **Poorly-graded sand w/ gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

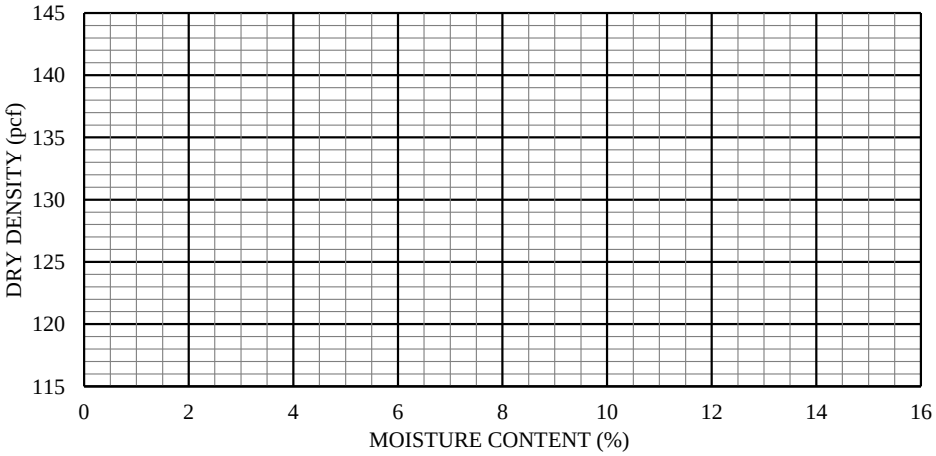
| | | | |
|---|---|---|---|
| % GRAVEL | **43.9** | USCS | **SP** |
| % SAND | **53.7** | USACOE FC | **N/A** |
| % SILT/CLAY | **2.4** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **9.3** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **18.0** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.9** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **92** | |
| 12.70 | 1/2" | **82** | |
| 9.50 | 3/8" | **73** | |
| 4.75 | #4 | **56** | |
| 2.00 | #10 | **39** | |
| 0.85 | #20 | **25** | |
| 0.43 | #40 | **14** | |
| 0.25 | #60 | **7** | |
| 0.15 | #100 | **4** | |
| 0.075 | #200 | **2.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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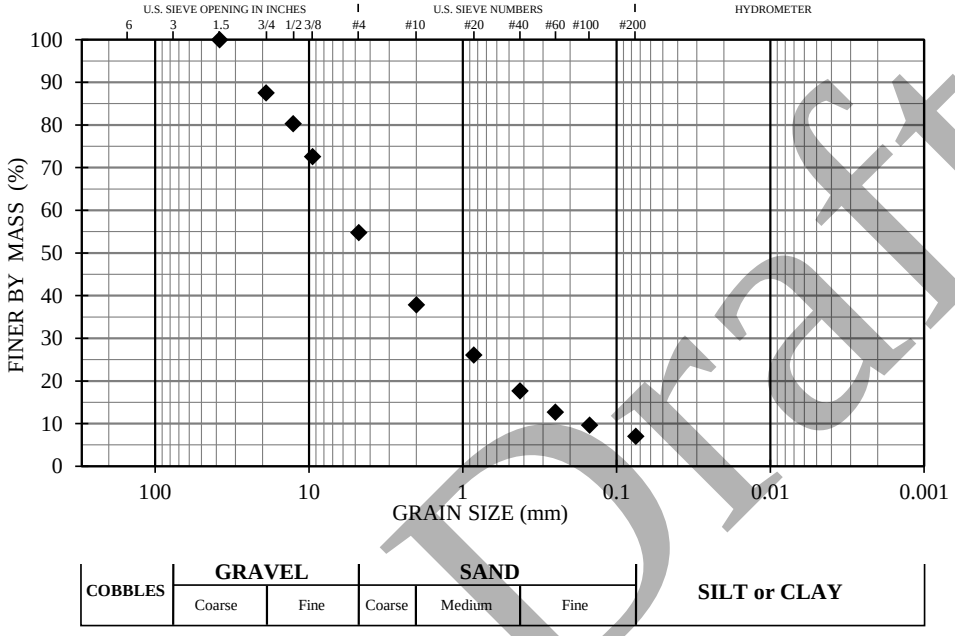
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP45A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **45.3** | USCS | **SW-SM** |
| % SAND | **47.7** | USACOE FC | **N/A** |
| % SILT/CLAY | **7.0** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **7.6** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **37.9** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.5** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



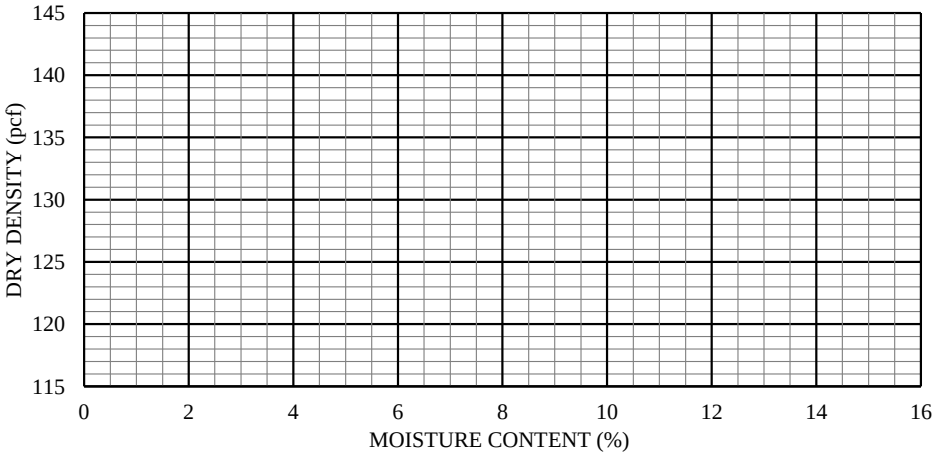

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **88** | |
| 12.70 | 1/2" | **80** | |
| 9.50 | 3/8" | **73** | |
| 4.75 | #4 | **55** | |
| 2.00 | #10 | **38** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **18** | |
| 0.25 | #60 | **13** | |
| 0.15 | #100 | **10** | |
| 0.075 | #200 | **7.0** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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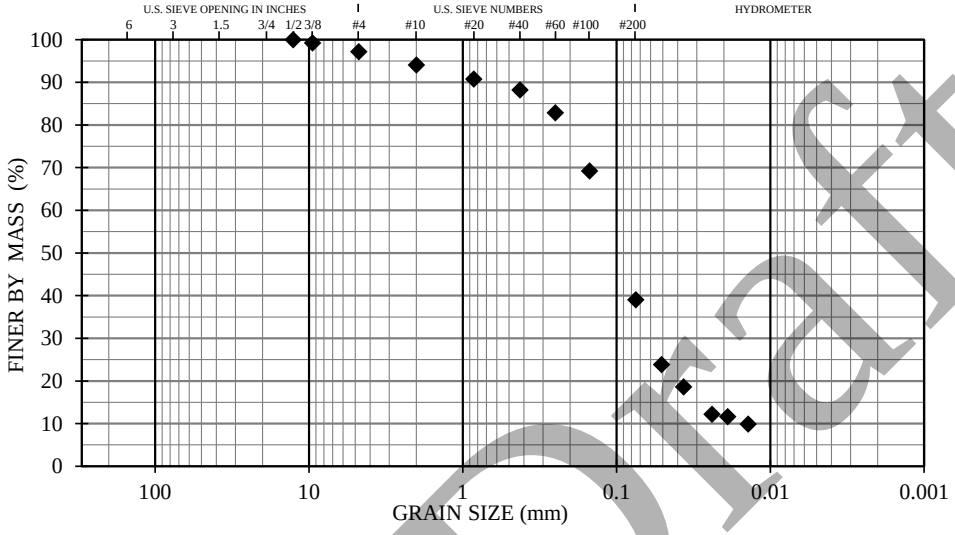
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP45A** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Silty sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **2.9** | USCS | **SM** |
| % SAND | **58.1** | USACOE FC | **F2** |
| % SILT/CLAY | **39.0** | % PASS. 0.02 mm | **12.0** |
| % MOIST. CONTENT | **25.3** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **8.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




| COBBLES | GRAVEL | | SAND | | | SILT or CLAY |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | |

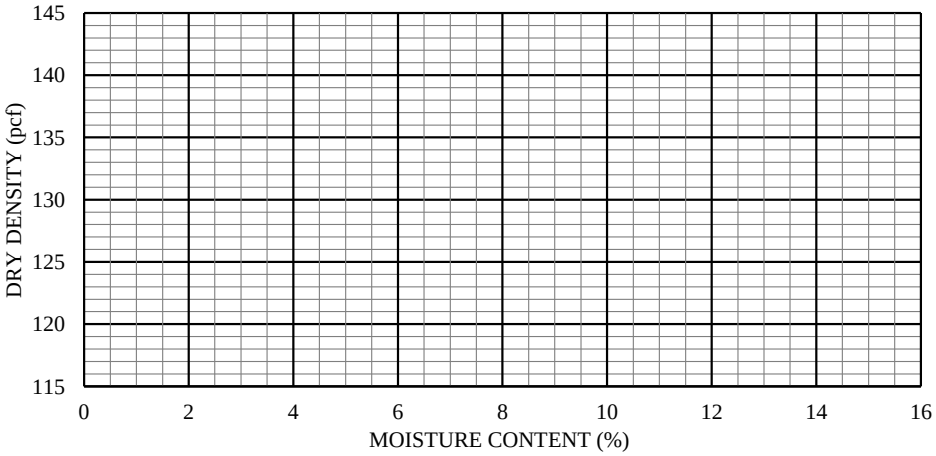
## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | | |
| 12.70 | 1/2" | **100** | |
| 9.50 | 3/8" | **99** | |
| 4.75 | #4 | **97** | |
| 2.00 | #10 | **94** | |
| 0.85 | #20 | **91** | |
| 0.43 | #40 | **88** | |
| 0.25 | #60 | **83** | |
| 0.15 | #100 | **69** | |
| 0.075 | #200 | **39.0** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0509 | 23.8 |
| 2 | 0.0367 | 18.6 |
| 5 | 0.0239 | 12.2 |
| 8 | 0.0189 | 11.6 |
| 15 | 0.0140 | 9.9 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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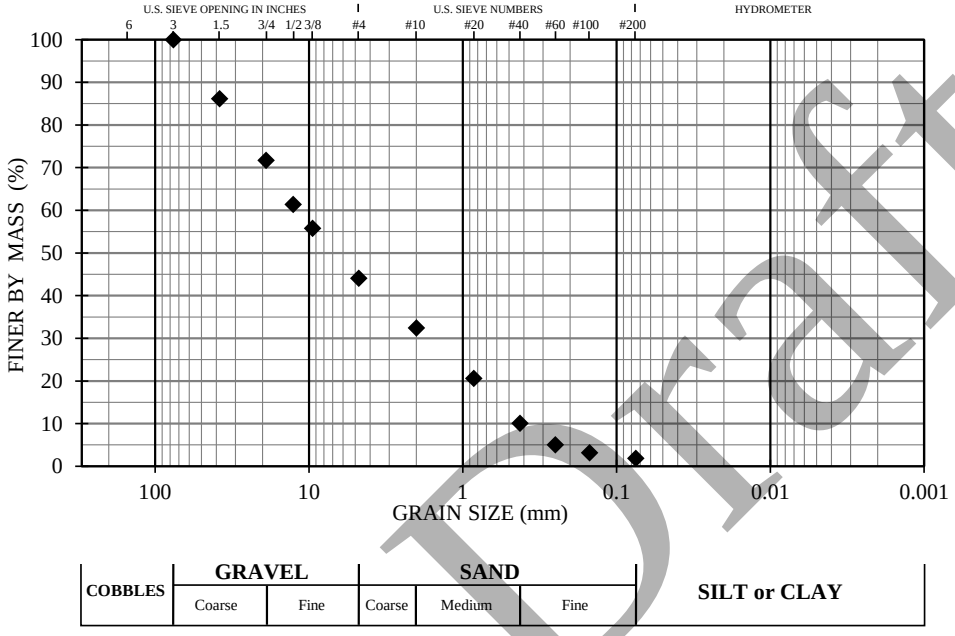
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP45A** |
| NUMBER/ DEPTH: | **S6 / 15 - 16.5'** |
| DESCRIPTION: | **Poorly-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

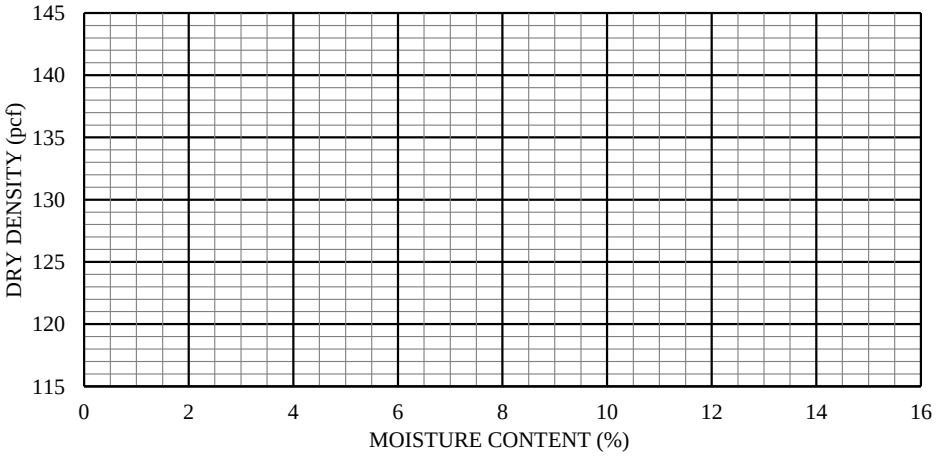
| | | | |
|---|---|---|---|
| % GRAVEL | **55.9** | USCS | **GP** |
| % SAND | **42.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **1.9** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **7.1** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **28.2** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.6** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **86** | |
| 19.00 | 3/4" | **72** | |
| 12.70 | 1/2" | **61** | |
| 9.50 | 3/8" | **56** | |
| 4.75 | #4 | **44** | |
| 2.00 | #10 | **32** | |
| 0.85 | #20 | **21** | |
| 0.43 | #40 | **10** | |
| 0.25 | #60 | **5** | |
| 0.15 | #100 | **3** | |
| 0.075 | #200 | **1.9** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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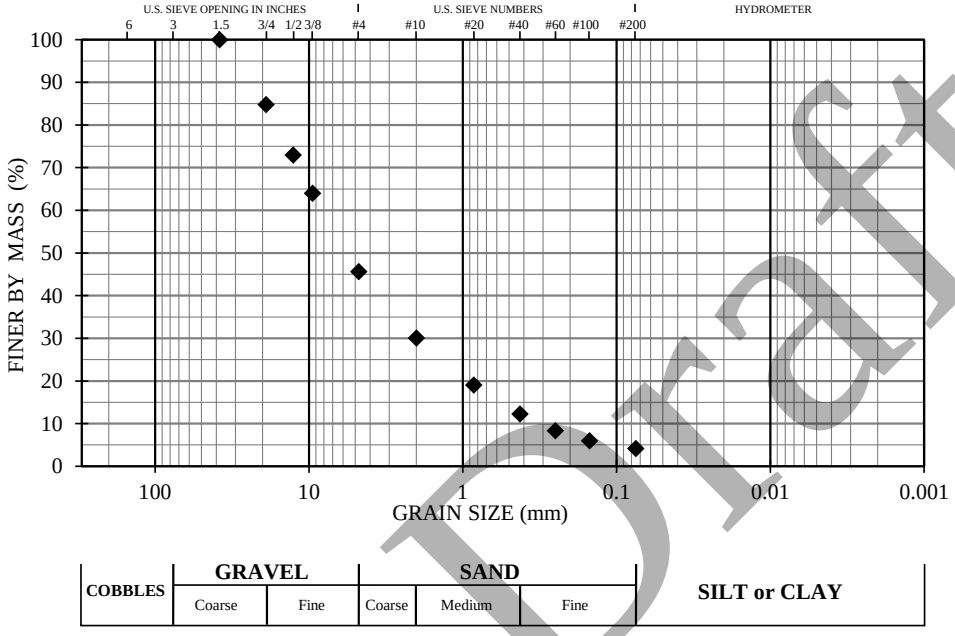
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP45B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

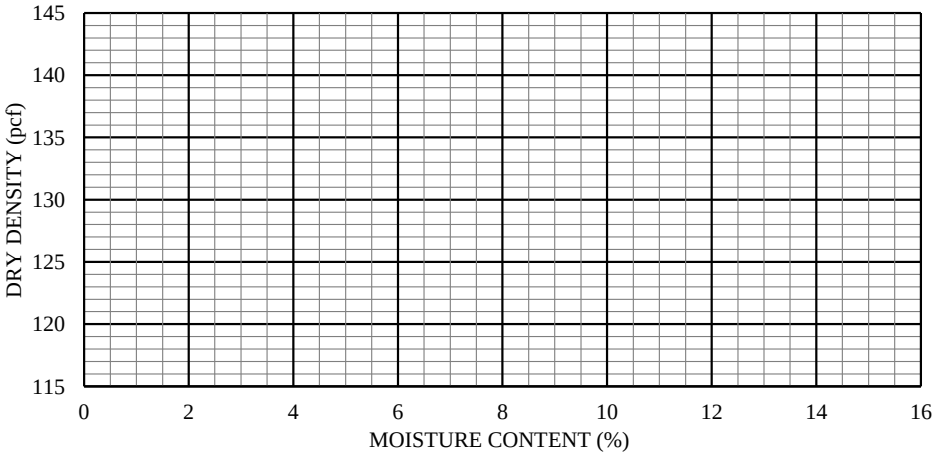
| | | | |
|---|---|---|---|
| % GRAVEL | **54.3** | USCS | **GW** |
| % SAND | **41.5** | USACOE FC | **N/A** |
| % SILT/CLAY | **4.2** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **6.6** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **26.0** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.4** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **85** | |
| 12.70 | 1/2" | **73** | |
| 9.50 | 3/8" | **64** | |
| 4.75 | #4 | **46** | |
| 2.00 | #10 | **30** | |
| 0.85 | #20 | **19** | |
| 0.43 | #40 | **12** | |
| 0.25 | #60 | **8** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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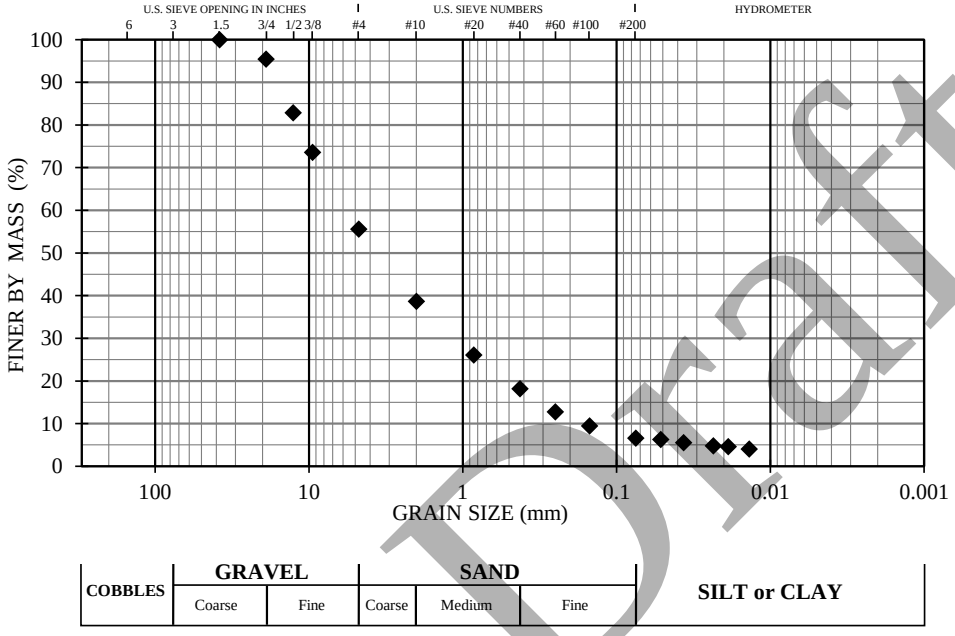
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **COP45B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

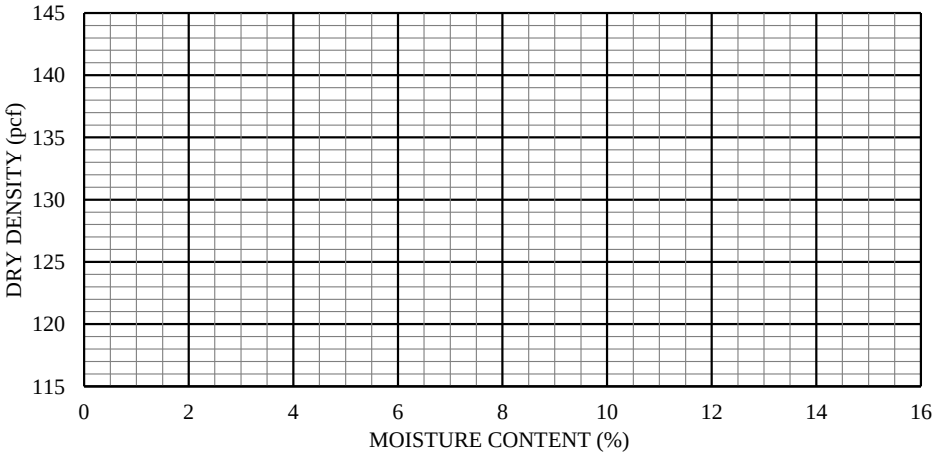
| | | | |
|---|---|---|---|
| % GRAVEL | **44.4** | USCS | **SW-SM** |
| % SAND | **49.0** | USACOE FC | **S2** |
| % SILT/CLAY | **6.6** | % PASS. 0.02 mm | **4.7** |
| % MOIST. CONTENT | **7.3** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **35.5** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.5** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **95** | |
| 12.70 | 1/2" | **83** | |
| 9.50 | 3/8" | **74** | |
| 4.75 | #4 | **56** | |
| 2.00 | #10 | **39** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **18** | |
| 0.25 | #60 | **13** | |
| 0.15 | #100 | **9** | |
| 0.075 | #200 | **6.6** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0515 | 6.3 |
| 2 | 0.0367 | 5.5 |
| 5 | 0.0235 | 4.8 |
| 8 | 0.0188 | 4.6 |
| 15 | 0.0137 | 4.1 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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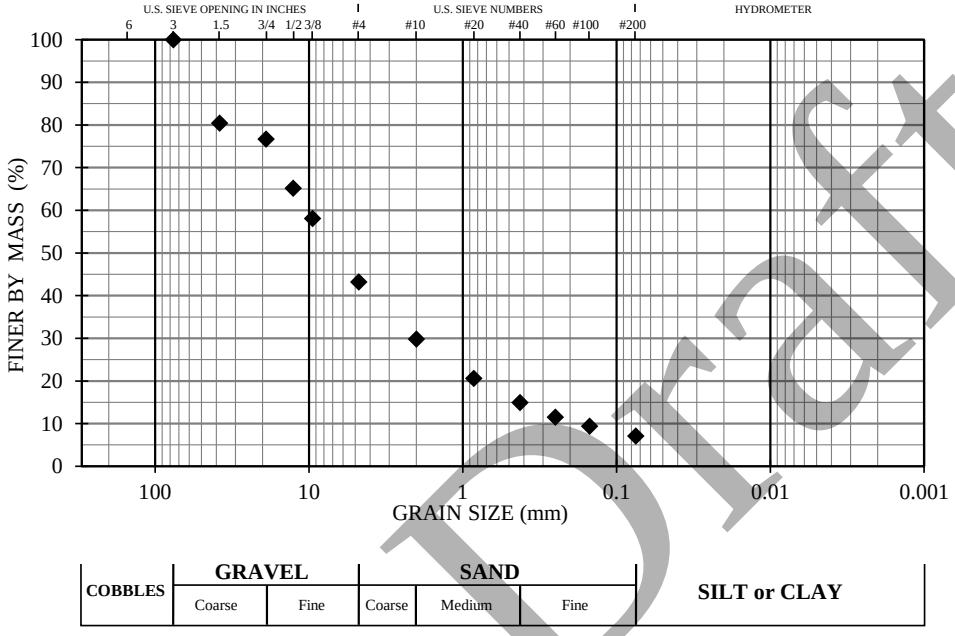
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **CAB2A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded gravel w/ silt and sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

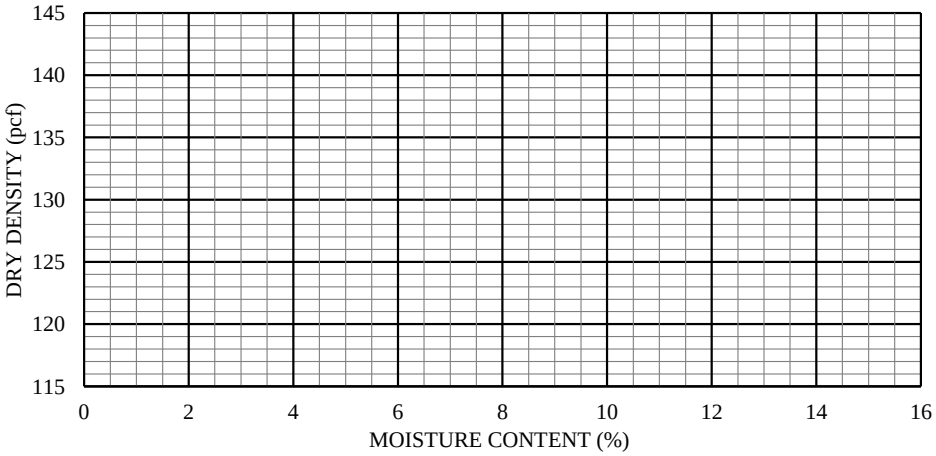
| | | | |
|---|---|---|---|
| % GRAVEL | **56.8** | USCS | **GW-GM** |
| % SAND | **36.1** | USACOE FC | **N/A** |
| % SILT/CLAY | **7.1** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **10.5** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **57.8** |
| COEFFICIENT OF GRADATION ($C_c$) | **2.2** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | **100** | |
| 38.10 | 1.5" | **80** | |
| 19.00 | 3/4" | **77** | |
| 12.70 | 1/2" | **65** | |
| 9.50 | 3/8" | **58** | |
| 4.75 | #4 | **43** | |
| 2.00 | #10 | **30** | |
| 0.85 | #20 | **21** | |
| 0.43 | #40 | **15** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **9** | |
| 0.075 | #200 | **7.1** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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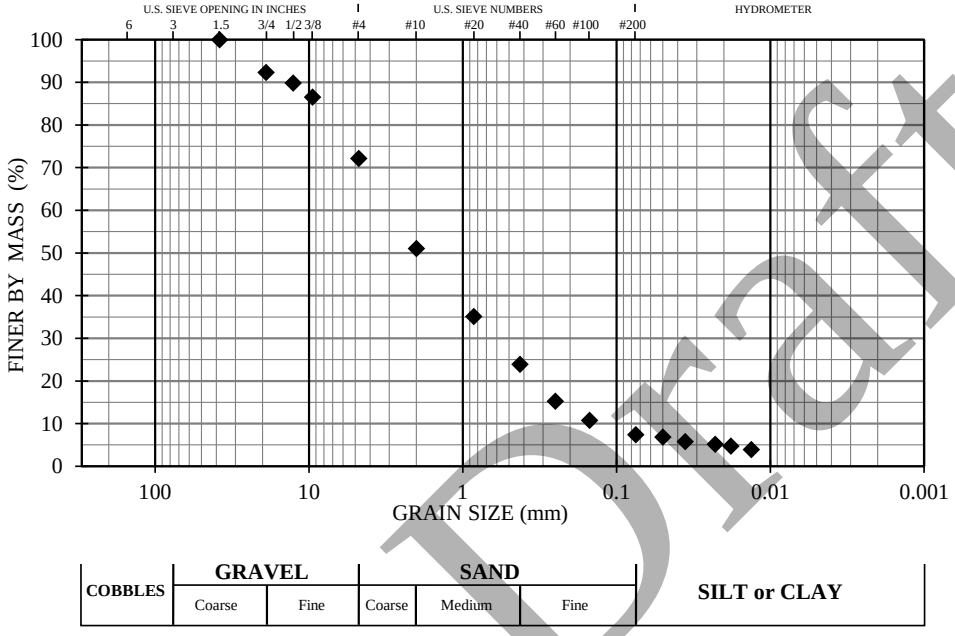
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **CAB2A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

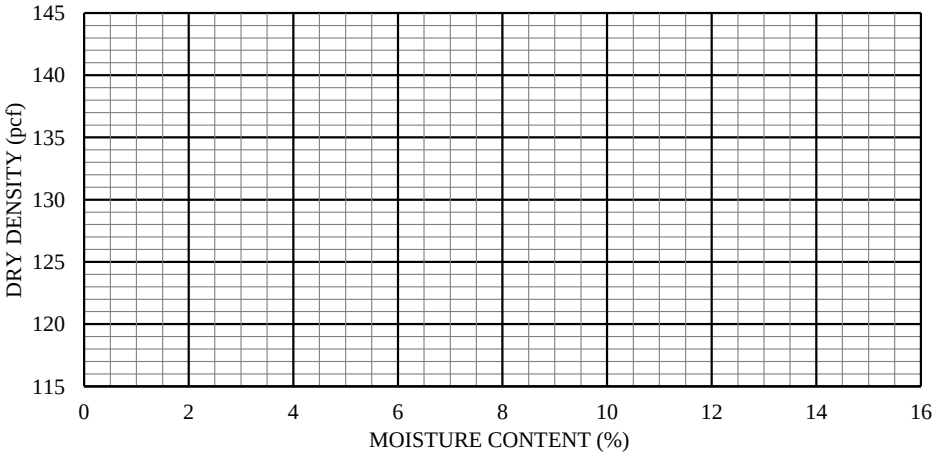
| | | | |
|---|---|---|---|
| % GRAVEL | **27.9** | USCS | **SW-SM** |
| % SAND | **64.7** | USACOE FC | **S2** |
| % SILT/CLAY | **7.4** | % PASS. 0.02 mm | **5.0** |
| % MOIST. CONTENT | **12.0** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **23.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **92** | |
| 12.70 | 1/2" | **90** | |
| 9.50 | 3/8" | **87** | |
| 4.75 | #4 | **72** | |
| 2.00 | #10 | **51** | |
| 0.85 | #20 | **35** | |
| 0.43 | #40 | **24** | |
| 0.25 | #60 | **15** | |
| 0.15 | #100 | **11** | |
| 0.075 | #200 | **7.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0500 | 6.8 |
| 2 | 0.0358 | 5.8 |
| 5 | 0.0229 | 5.2 |
| 8 | 0.0181 | 4.7 |
| 15 | 0.0133 | 3.9 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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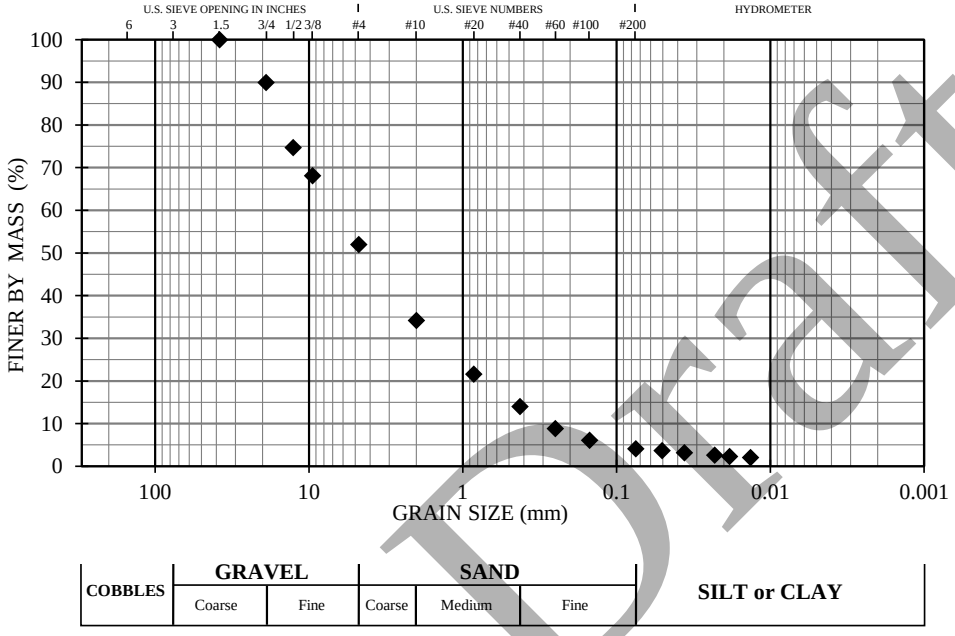
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **CAB2B** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **48.0** | USCS | **GW** |
| % SAND | **47.9** | USACOE FC | **PFS** |
| % SILT/CLAY | **4.1** | % PASS. 0.02 mm | **2.4** |
| % MOIST. CONTENT | **10.8** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **24.5** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.3** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

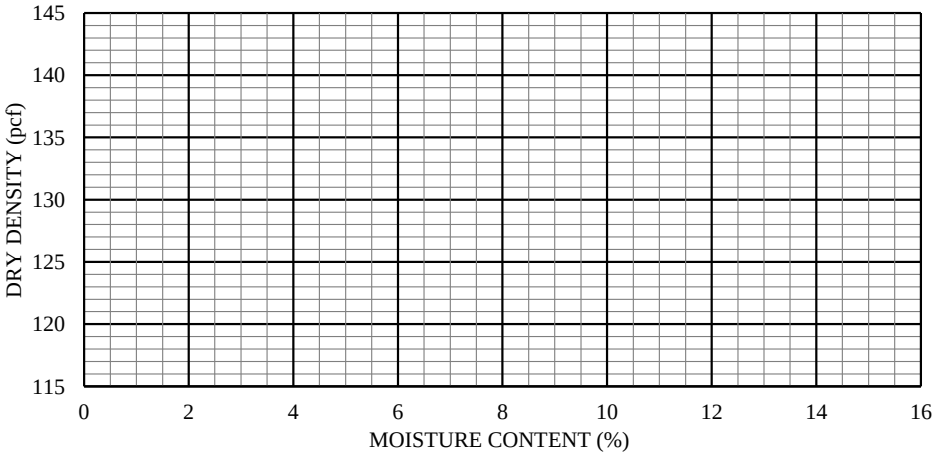
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **90** | |
| 12.70 | 1/2" | **75** | |
| 9.50 | 3/8" | **68** | |
| 4.75 | #4 | **52** | |
| 2.00 | #10 | **34** | |
| 0.85 | #20 | **22** | |
| 0.43 | #40 | **14** | |
| 0.25 | #60 | **9** | |
| 0.15 | #100 | **6** | |
| 0.075 | #200 | **4.1** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0506 | 3.7 |
| 2 | 0.0362 | 3.1 |
| 5 | 0.0230 | 2.6 |
| 8 | 0.0184 | 2.3 |
| 15 | 0.0134 | 2.0 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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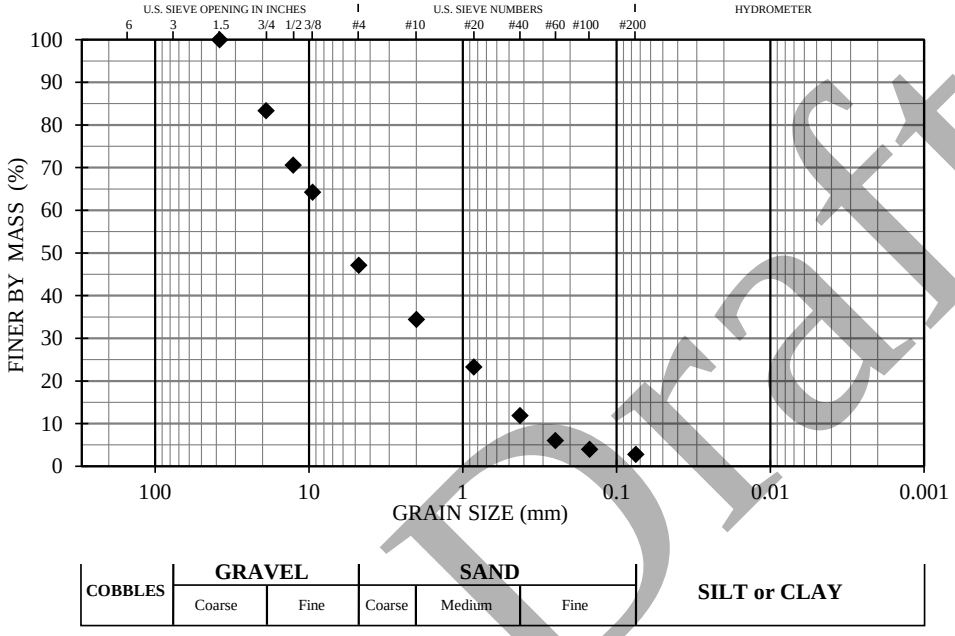
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **SHER1A** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Poorly-graded gravel w/ sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

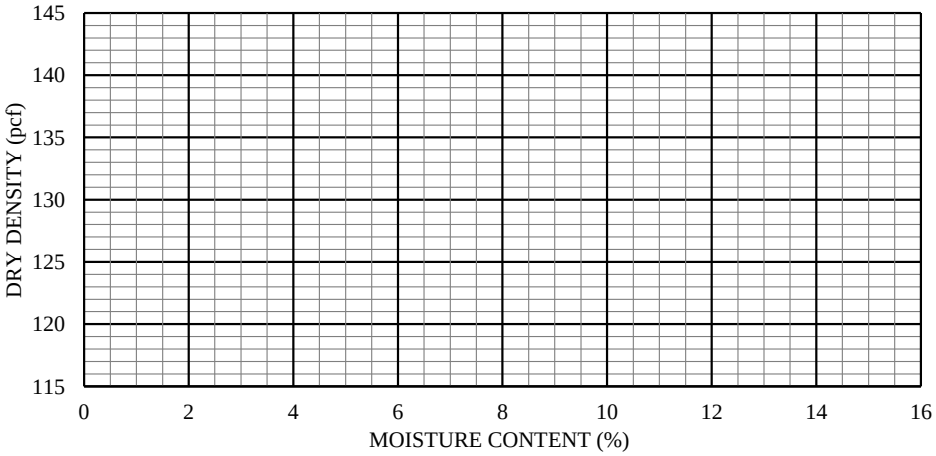
| | | | |
|---|---|---|---|
| % GRAVEL | **52.9** | USCS | **GP** |
| % SAND | **44.3** | USACOE FC | **N/A** |
| % SILT/CLAY | **2.8** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **4.7** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **22.5** |
| COEFFICIENT OF GRADATION ($C_c$) | **0.8** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **83** | |
| 12.70 | 1/2" | **71** | |
| 9.50 | 3/8" | **64** | |
| 4.75 | #4 | **47** | |
| 2.00 | #10 | **34** | |
| 0.85 | #20 | **23** | |
| 0.43 | #40 | **12** | |
| 0.25 | #60 | **6** | |
| 0.15 | #100 | **4** | |
| 0.075 | #200 | **2.8** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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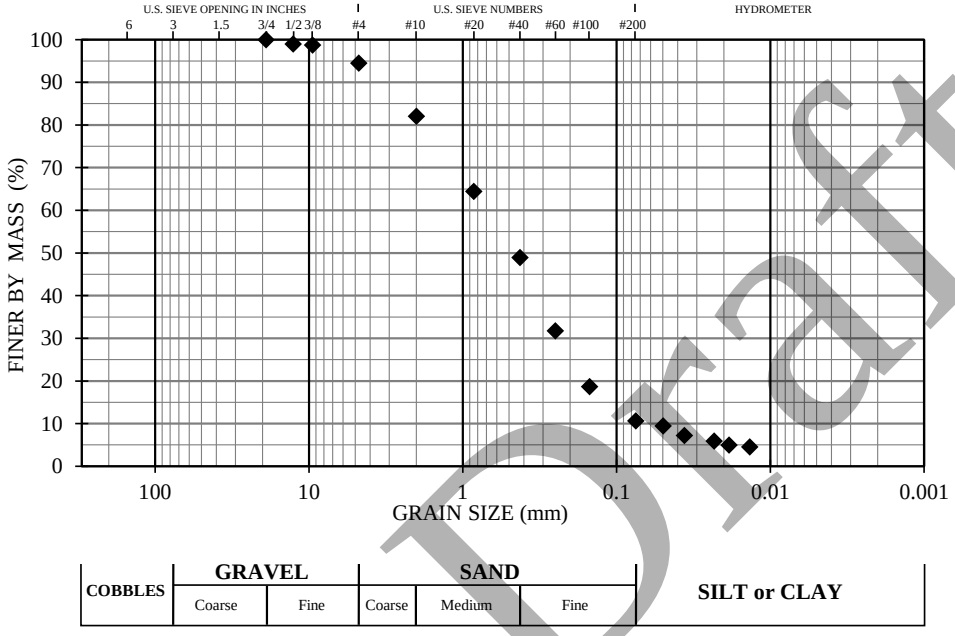
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **SHER1A** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Well-graded sand w/ silt** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

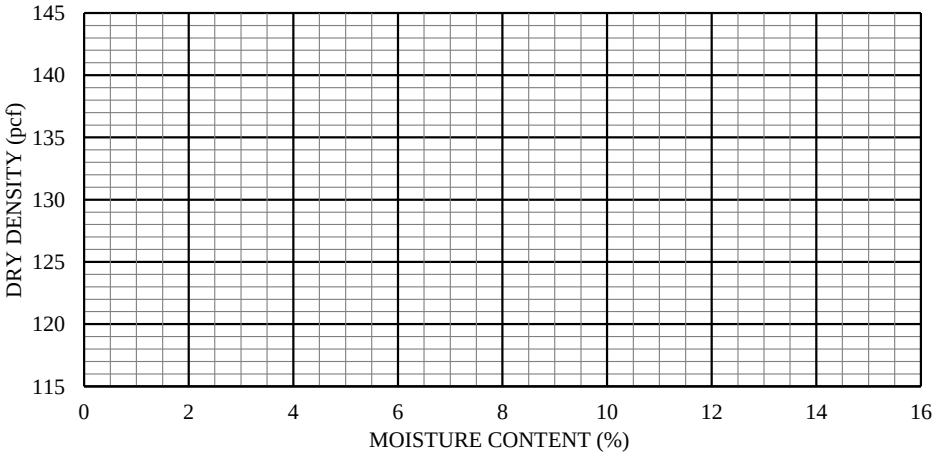
| | | | |
|---|---|---|---|
| % GRAVEL | **5.5** | USCS | **SW-SM** |
| % SAND | **83.9** | USACOE FC | **S2** |
| % SILT/CLAY | **10.6** | % PASS. 0.02 mm | **5.1** |
| % MOIST. CONTENT | **16.4** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **11.9** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.2** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | **100** | |
| 12.70 | 1/2" | **99** | |
| 9.50 | 3/8" | **99** | |
| 4.75 | #4 | **94** | |
| 2.00 | #10 | **82** | |
| 0.85 | #20 | **64** | |
| 0.43 | #40 | **49** | |
| 0.25 | #60 | **32** | |
| 0.15 | #100 | **19** | |
| 0.075 | #200 | **10.6** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0497 | 9.4 |
| 2 | 0.0363 | 7.2 |
| 5 | 0.0232 | 5.9 |
| 8 | 0.0185 | 5.0 |
| 15 | 0.0136 | 4.5 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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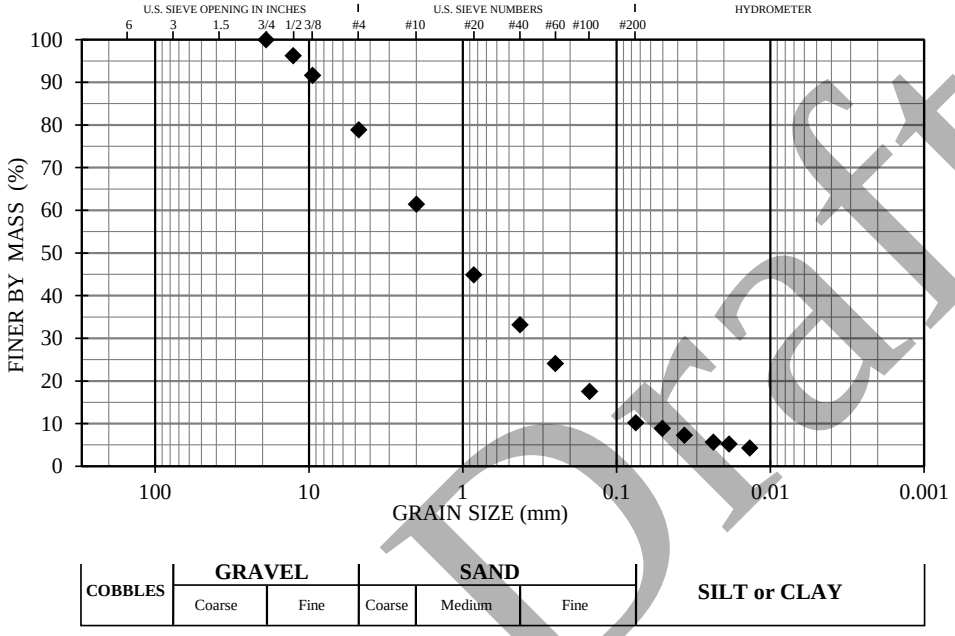
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **SHER1A** |
| NUMBER/ DEPTH: | **S5 / 12.5 - 14'** |
| DESCRIPTION: | **Poorly-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

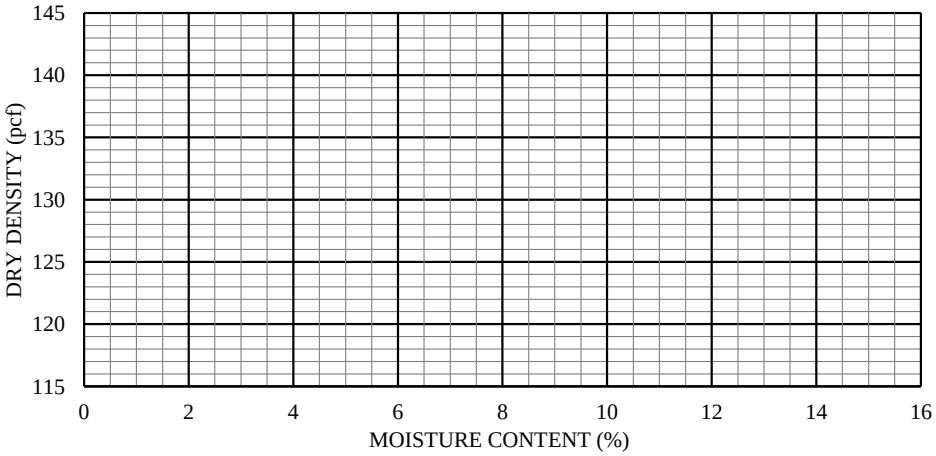
| | | | |
|---|---|---|---|
| % GRAVEL | **21.1** | USCS | **SP-SM** |
| % SAND | **68.7** | USACOE FC | **S2** |
| % SILT/CLAY | **10.2** | % PASS. 0.02 mm | **5.4** |
| % MOIST. CONTENT | **10.6** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **26.6** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | | |
| 19.00 | 3/4" | **100** | |
| 12.70 | 1/2" | **96** | |
| 9.50 | 3/8" | **92** | |
| 4.75 | #4 | **79** | |
| 2.00 | #10 | **61** | |
| 0.85 | #20 | **45** | |
| 0.43 | #40 | **33** | |
| 0.25 | #60 | **24** | |
| 0.15 | #100 | **18** | |
| 0.075 | #200 | **10.2** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0503 | 8.9 |
| 2 | 0.0363 | 7.3 |
| 5 | 0.0235 | 5.7 |
| 8 | 0.0185 | 5.2 |
| 15 | 0.0136 | 4.3 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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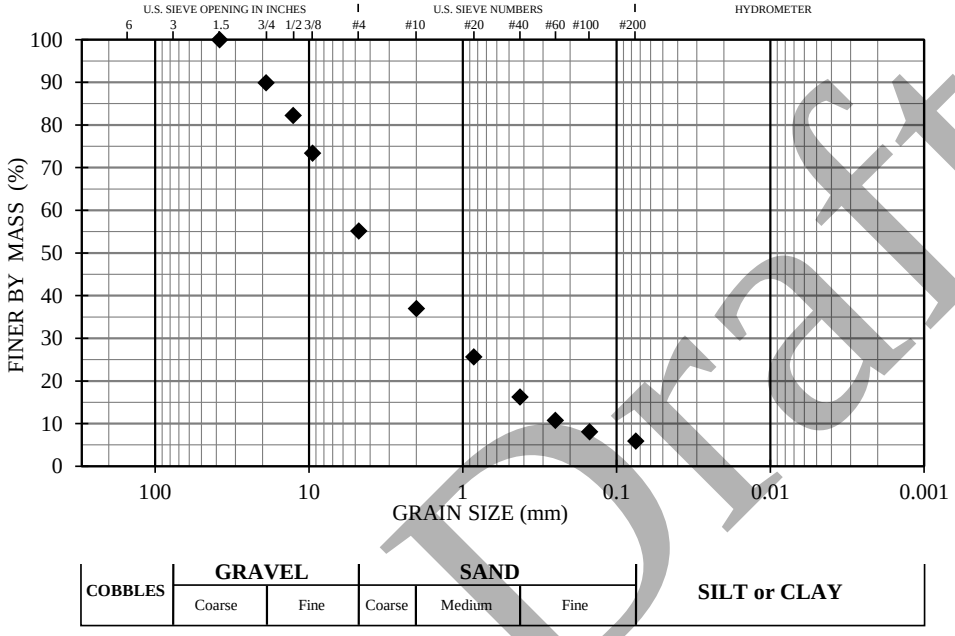
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **SHER1B** |
| NUMBER/ DEPTH: | **S1 / 2.5 - 4'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJCP** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **44.9** | USCS | **SW-SM** |
| % SAND | **49.2** | USACOE FC | **N/A** |
| % SILT/CLAY | **5.9** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **8.5** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **27.2** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **1.3** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

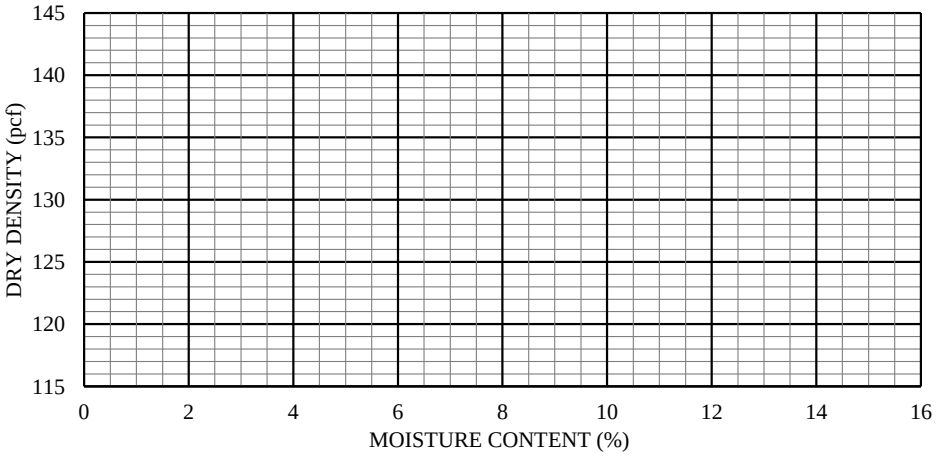
## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **90** | |
| 12.70 | 1/2" | **82** | |
| 9.50 | 3/8" | **73** | |
| 4.75 | #4 | **55** | |
| 2.00 | #10 | **37** | |
| 0.85 | #20 | **26** | |
| 0.43 | #40 | **16** | |
| 0.25 | #60 | **11** | |
| 0.15 | #100 | **8** | |
| 0.075 | #200 | **5.9** | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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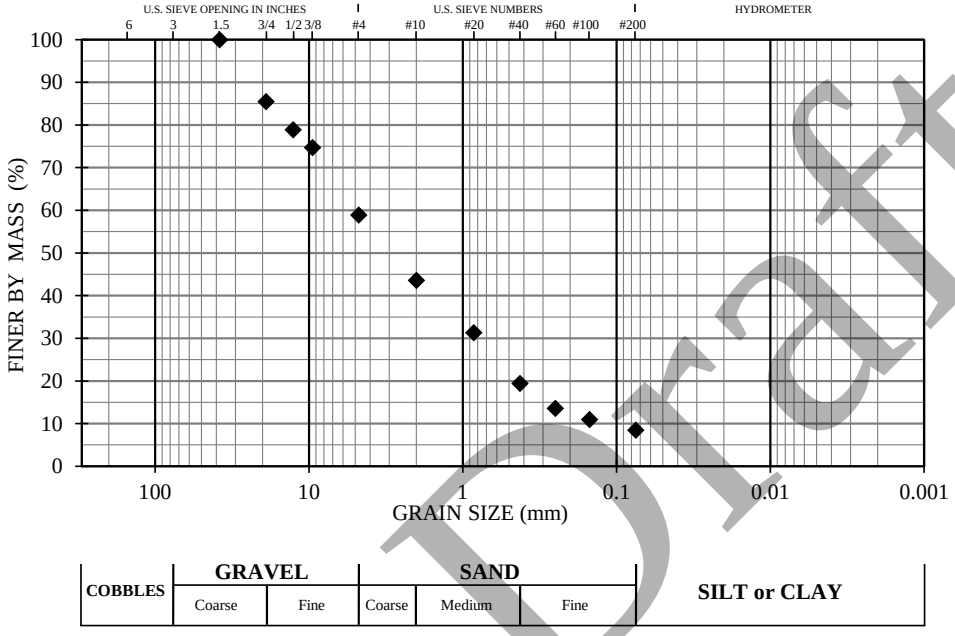
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **SHER1B** |
| NUMBER/ DEPTH: | **S2 / 5 - 6.5'** |
| DESCRIPTION: | **Well-graded sand w/ silt and gravel** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJCP** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **41.1** | USCS | **SW-SM** |
| % SAND | **50.5** | USACOE FC | **N/A** |
| % SILT/CLAY | **8.4** | % PASS. 0.02 mm | **N/A** |
| % MOIST. CONTENT | **4.7** | % PASS. 0.002 mm | **N/A** |

| | |
|---|---|
| UNIFORMITY COEFFICIENT ($C_u$) | **42.0** |
| COEFFICIENT OF GRADATION ($C_c$) | **1.0** |
| ASTM D1557 (uncorrected) | **N/A** |
| ASTM D4718 (corrected) | **N/A** |
| OPTIMUM MOIST. CONTENT. (corrected) | **N/A** |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136



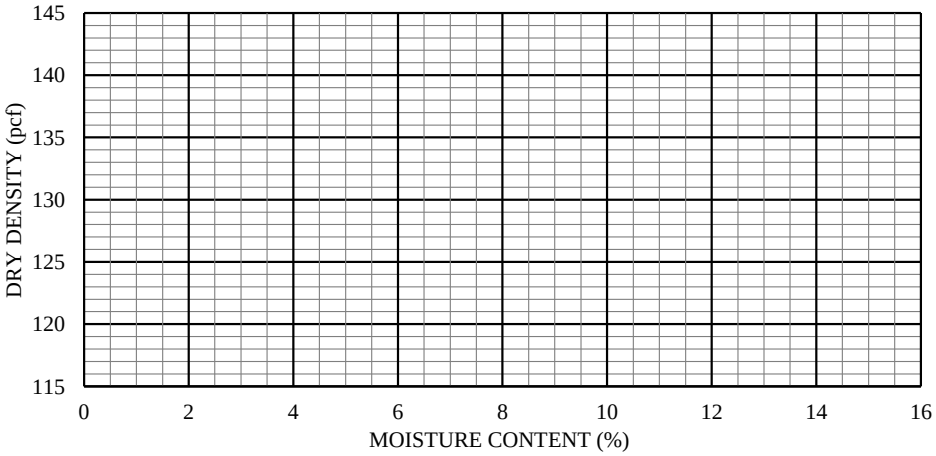

## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **85** | |
| 12.70 | 1/2" | **79** | |
| 9.50 | 3/8" | **75** | |
| 4.75 | #4 | **59** | |
| 2.00 | #10 | **44** | |
| 0.85 | #20 | **31** | |
| 0.43 | #40 | **19** | |
| 0.25 | #60 | **14** | |
| 0.15 | #100 | **11** | |
| 0.075 | #200 | **8.4** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 5 | | |
| 8 | | |
| 15 | | |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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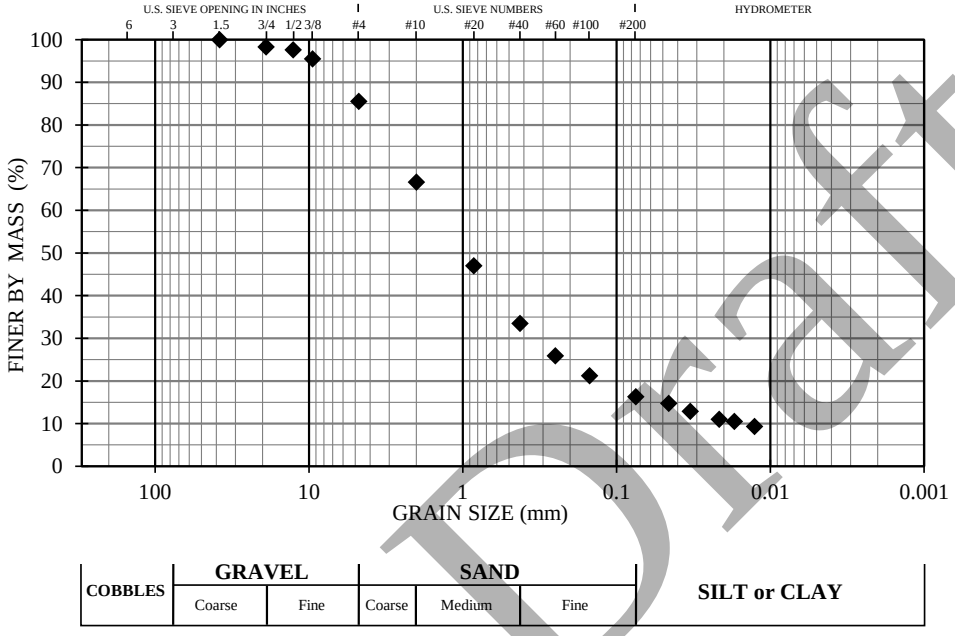
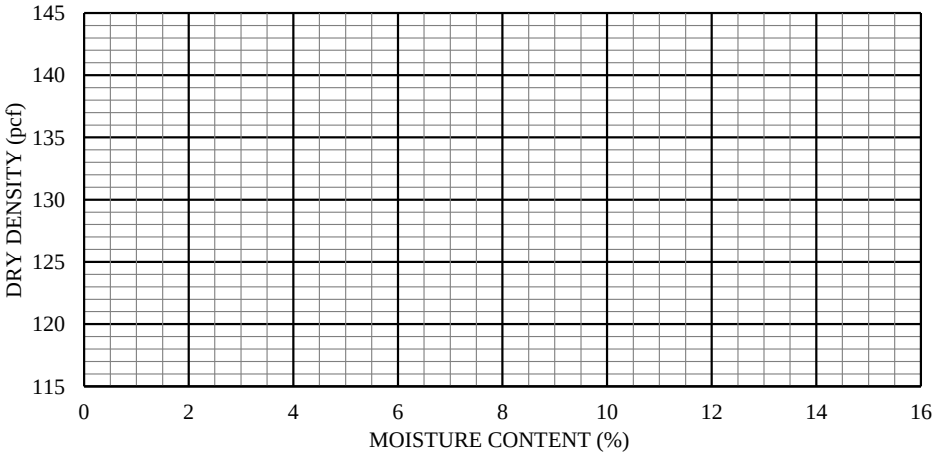
| | |
|---|---|
| PROJECT CLIENT: | **Bratslavsky Consulting Engineers, Inc.** |
| PROJECT NAME: | **USFWS Fish Passage Improvements** |
| PROJECT NO.: | **5138-18** |
| SAMPLE LOC.: | **SHER1B** |
| NUMBER/ DEPTH: | **S3 / 7.5 - 9'** |
| DESCRIPTION: | **Silty sand** |
| DATE RECEIVED: | **10/18/2018** |
| TESTED BY: | **RJPC** |
| REVIEWED BY: | **SAM** |

| | | | |
|---|---|---|---|
| % GRAVEL | **14.5** | USCS | **SM** |
| % SAND | **69.2** | USACOE FC | **F2** |
| % SILT/CLAY | **16.3** | % PASS. 0.02 mm | **11.1** |
| % MOIST. CONTENT | **7.7** | % PASS. 0.002 mm | **N/A** |
| UNIFORMITY COEFFICIENT ($C_u$) | | **106.2** | |
| COEFFICIENT OF GRADATION ($C_c$) | | **4.8** | |
| ASTM D1557 (uncorrected) | | **N/A** | |
| ASTM D4718 (corrected) | | **N/A** | |
| OPTIMUM MOIST. CONTENT. (corrected) | | **N/A** | |

## PARTICLE SIZE ANALYSIS ASTM D7928 / C136




## MOISTURE-DENSITY RELATIONSHIP ASTM D1557




## SIEVE ANALYSIS RESULT

| SIEVE SIZE (mm) | SIEVE SIZE (U.S.) | TOTAL % PASSING | SPECIFICATION (% PASSING) |
|---|---|---|---|
| | | | |
| 152.40 | 6" | | |
| 76.20 | 3" | | |
| 38.10 | 1.5" | **100** | |
| 19.00 | 3/4" | **98** | |
| 12.70 | 1/2" | **98** | |
| 9.50 | 3/8" | **95** | |
| 4.75 | #4 | **86** | |
| 2.00 | #10 | **67** | |
| 0.85 | #20 | **47** | |
| 0.43 | #40 | **33** | |
| 0.25 | #60 | **26** | |
| 0.15 | #100 | **21** | |
| 0.075 | #200 | **16.3** | |

## HYDROMETER RESULT

| ELAPSED TIME (MIN) | DIAMETER (mm) | TOTAL % PASSING |
|---|---|---|
| 0 | | |
| 1 | 0.0458 | 14.7 |
| 2 | 0.0331 | 12.9 |
| 5 | 0.0215 | 11.0 |
| 8 | 0.0171 | 10.5 |
| 15 | 0.0127 | 9.3 |
| 30 | | |
| 60 | | |
| 250 | | |
| 1440 | | |
| | | |

| | |
|---|---|
| **HYDRAULIC COND.** (ASTM D2434) | **N/A** |
| **DEGRADATION** (ATM T-313) | **N/A** |
| **PLASTICITY INDEX** ASTM 4318 | **N/A** |





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# APPENDIX C

# USGS SEISMIC SITE CLASSIFICATION REPORTS

# USGS Design Maps Summary Report

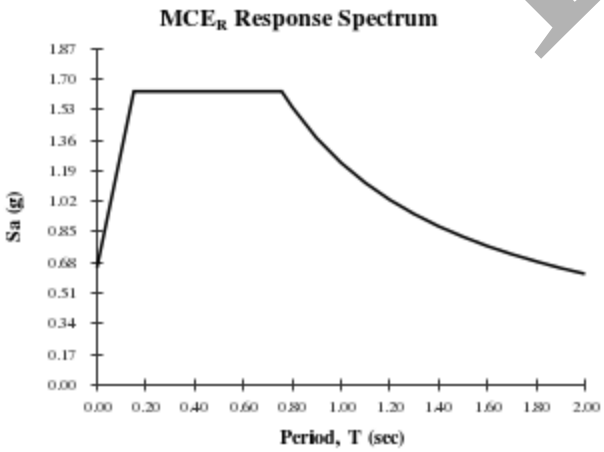
## User–Specified Input

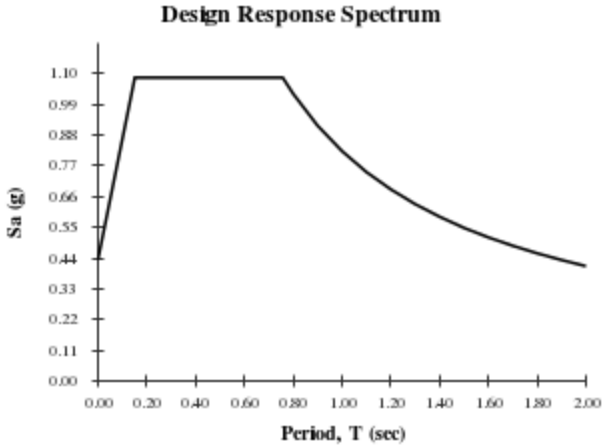
| | |
|---|---|
| **Report Title** | USFWS Fish Passage Improvements<br>Thu November 8, 2018 17:44:48 UTC |
| **Building Code Reference Document** | 2012/2015 International Building Code<br>(which utilizes USGS hazard data available in 2008) |
| **Site Coordinates** | 60.44096°N, 145.13214°W |
| **Site Soil Classification** | Site Class D – "Stiff Soil" |
| **Risk Category** | I/II/III |


## USGS–Provided Output

| | | | | | |
|---|---|---|---|---|---|
| $S_S$ = | 1.630 g | $S_{MS}$ = | 1.630 g | $S_{DS}$ = | 1.086 g |
| $S_1$ = | 0.823 g | $S_{M1}$ = | 1.234 g | $S_{D1}$ = | 0.823 g |

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.



# USGS Design Maps Detailed Report

## 2012/2015 International Building Code (60.44096°N, 145.13214°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

### Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain $S_S$) and 1.3 (to obtain $S_1$). Maps in the 2012/2015 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

**From Figure 1613.3.1(4)** [1] $S_S$ = 1.630 g

**From Figure 1613.3.1(5)** [2] $S_1$ = 0.823 g

### Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

| Site Class | $\overline{v}_s$ | $\overline{N}$ or $\overline{N}_{ch}$ | $\overline{s}_u$ |
|---|---|---|---|
| A. Hard Rock | >5,000 ft/s | N/A | N/A |
| B. Rock | 2,500 to 5,000 ft/s | N/A | N/A |
| C. Very dense soil and soft rock | 1,200 to 2,500 ft/s | >50 | >2,000 psf |
| D. Stiff Soil | 600 to 1,200 ft/s | 15 to 50 | 1,000 to 2,000 psf |
| E. Soft clay soil | <600 ft/s | <15 | <1,000 psf |
| | Any profile with more than 10 ft of soil having the characteristics:<br>• Plasticity index *PI* > 20,<br>• Moisture content *w* ≥ 40%, and<br>• Undrained shear strength $\overline{s}_u$ < 500 psf | | |
| F. Soils requiring site response analysis in accordance with Section 21.1 | See Section 20.3.1 | | |

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

## Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT $F_a$

| Site Class | Mapped Spectral Response Acceleration at Short Period | | | | |
|---|---|---|---|---|---|
| | $S_S \le 0.25$ | $S_S = 0.50$ | $S_S = 0.75$ | $S_S = 1.00$ | $S_S \ge 1.25$ |
| A | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| B | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C | 1.2 | 1.2 | 1.1 | 1.0 | 1.0 |
| D | 1.6 | 1.4 | 1.2 | 1.1 | 1.0 |
| E | 2.5 | 1.7 | 1.2 | 0.9 | 0.9 |
| F | See Section 11.4.7 of ASCE 7 | | | | |

Note: Use straight–line interpolation for intermediate values of $S_S$

**For Site Class = D and $S_S$ = 1.630 g, $F_a$ = 1.000**

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT $F_v$

| Site Class | Mapped Spectral Response Acceleration at 1–s Period | | | | |
|---|---|---|---|---|---|
| | $S_1 \le 0.10$ | $S_1 = 0.20$ | $S_1 = 0.30$ | $S_1 = 0.40$ | $S_1 \ge 0.50$ |
| A | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| B | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| C | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 |
| D | 2.4 | 2.0 | 1.8 | 1.6 | 1.5 |
| E | 3.5 | 3.2 | 2.8 | 2.4 | 2.4 |
| F | See Section 11.4.7 of ASCE 7 | | | | |

Note: Use straight–line interpolation for intermediate values of $S_1$

**For Site Class = D and $S_1$ = 0.823 g, $F_v$ = 1.500**

**Equation (16-37):** $S_{MS} = F_a S_S = 1.000 \times 1.630 = 1.630$ g

**Equation (16-38):** $S_{M1} = F_v S_1 = 1.500 \times 0.823 = 1.234$ g

Section 1613.3.4 — Design spectral response acceleration parameters

**Equation (16-39):** $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.630 = 1.086$ g

**Equation (16-40):** $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 1.234 = 0.823$ g

## Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

| VALUE OF $S_{DS}$ | RISK CATEGORY | | |
|---|---|---|---|
| | I or II | III | IV |
| $S_{DS} < 0.167g$ | A | A | A |
| $0.167g \le S_{DS} < 0.33g$ | B | B | C |
| $0.33g \le S_{DS} < 0.50g$ | C | C | D |
| $0.50g \le S_{DS}$ | D | D | D |

**For Risk Category = I and $S_{DS}$ = 1.086 g, Seismic Design Category = D**

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

| VALUE OF $S_{D1}$ | RISK CATEGORY | | |
|---|---|---|---|
| | I or II | III | IV |
| $S_{D1} < 0.067g$ | A | A | A |
| $0.067g \le S_{D1} < 0.133g$ | B | B | C |
| $0.133g \le S_{D1} < 0.20g$ | C | C | D |
| $0.20g \le S_{D1}$ | D | D | D |

**For Risk Category = I and $S_{D1}$ = 0.823 g, Seismic Design Category = D**

Note: When $S_1$ is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = E

---

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.



## References

1. *Figure 1613.3.1(4)*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(4).pdf
2. *Figure 1613.3.1(5)*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(5).pdf