



August 2026
Pettit Cove to Gratwick Riverside Park



Feasibility Study Data Gaps Work Plan

Prepared for Great Lakes National Program Office on Behalf of Glenn Springs Holdings, Inc.

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Figure 1-2	Sediment Management Areas
Figure 2-1	Target Investigation Locations

APPENDICES

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ABBREVIATIONS

CoC	chemical of concern
D/F	polychlorinated dibenzo-p-dioxins and furans
DQO	data quality objective
EDD	electronic data deliverable
EGL	Environmental Geochemistry Laboratory
FS	feasibility study
GLNPO	U.S. Environmental Protection Agency Great Lakes National Program Office
GSH	Glenn Springs Holdings
HASP	Health and Safety Plan
IDW	investigation-derived waste
LiDAR	laser imaging, detection, and ranging
NYSDEC	New York State Department of Environmental Conservation
QC	quality control
RI	remedial investigation
SMA	sediment management area
Study Area	Pettit Cove and Gratwick Riverside Park within the Niagara River Area of Concern, New York
USACE	U.S. Army Corps of Engineers
VST	vane shear test

1 Project Background and Data Quality Objectives

1.1 Project Description

In 2024, the U.S. Environmental Protection Agency Great Lakes National Program Office (GLNPO) and Glenn Springs Holdings (GSH) entered into an agreement under the Great Lakes Legacy Act to conduct a remedial investigation/feasibility study (RI/FS) within an approximate 5-mile-long nearshore reach of the Niagara River Area of Concern extending from Tonawanda to Wheatfield, New York, including Pettit Cove and Gratwick Riverside Park (Study Area; Figure 1-1). The RI/FS is intended to support future remediation of legacy chemical contamination in this reach of the Niagara River Area of Concern. The RI/FS project coordination team includes GLNPO, GSH, the New York State Department of Environmental Conservation (NYSDEC), and the U.S. Army Corps of Engineers (USACE).

1.2 Remedial Investigation Summary

The *Remedial Investigation* was completed in April 2026 (Anchor QEA 2026); key conclusions are summarized as follows:

- Historical sources of chemicals of concern (CoCs) to the Study Area include a range of industrial and non-industrial activities conducted from 1926 to 1995. These historical sources have been reduced over time as industrial activities have declined and as controls have improved. There are no longer significant ongoing CoC sources to the Study Area.
- Near-surface fine-grained sediment deposition areas, where typical thickness ranges from a few inches to several feet, are limited to nearshore zones and coves (roughly 2 to 15 feet water depth) with relatively low current velocities.
- Net sedimentation rates in the Study Area are relatively low, generally with stable subsurface sediments. Localized nearshore sediment transport may occur within portions of the Study Area.
- Identified sediment CoCs within the Study Area include polychlorinated dibenzo-p-dioxins and furans (D/F), cadmium, copper, lead, mercury, zinc, and polycyclic aromatic hydrocarbons. Because elevated sediment concentrations of all CoCs are generally co-located, a remedial plan using D/F toxic equivalency as the indicator hazardous substance will effectively reduce exposure to remaining CoCs.
- Current CoC exposure pathways include direct sediment contact by benthic organisms residing in sediments, bioaccumulation in forage fish and sport fish, and consumption of sport fish by humans.
- Nine non-contiguous sediment management areas (SMAs) of variable sizes totaling approximately 25 acres, are identified within the Study area for prospective remedial actions (Figure 1-2).

- Ecological communities within the Study Area include submerged aquatic vegetation, benthic macroinvertebrates, forage fish, and sport fish. Sport fish generally have a larger home range than forage fish. Sediment contamination within each SMA has the potential to pose risks to these ecological communities, and other wildlife receptors within the Study Area.
- Remediation of the nine identified SMAs would address ecological risks within the Study Area and would also reduce potential D/F bioaccumulation exposure to sport fish by roughly 98 percent. Thus, remediating to the site-specific D/F sediment cleanup level developed using the biota sediment accumulation factor regression in Figure 4-1 of the *Remedial Investigation* (Anchor QEA 2026) to protect wildlife would also contribute to substantial reductions in human health D/F exposure to sport fish.

1.3 Feasibility Study Data Gaps

Consistent with the 2024 agreement with GLNPO, GSH will prepare a draft FS report evaluating remedial alternatives, identifying the recommended cleanup remedy for the Study Area. Additional data are needed to support reliable remedial alternative evaluations, including narrowing the projected cost range of individual alternatives to within the FS target range of -30 percent to +50 percent. Specific data quality objectives (DQOs) for this *Feasibility Study Data Gaps Work Plan* include the following:

- **DQO 1:** Conduct a bathymetric survey of SMAs.
- **DQO 2:** Refine the areal extent and thickness of near-surface fine-grained sediment (hereafter referred to as “soft sediment”) deposits in SMAs by performing supplemental sediment probing and coring.
- **DQO 3:** Assess the feasibility of effectively dredging (and capping) soft sediment deposits by performing focused geotechnical characterization in the largest SMAs, including field vane shear tests (VSTs) and laboratory analyses (e.g., moisture content, grain size and Atterberg limits) of representative sediments targeted for remediation.
- **DQO 4:** Assess the feasibility of effectively dewatering soft sediment deposits by conducting bench-scale treatability testing (passive dewatering studies) of simulated mechanical and hydraulically dredged sediments from the largest SMAs.

2 Scope of Field Implementation

2.1 Pre-Mobilization Tasks

Prior to initiating the field work described herein, appropriate permits will be obtained, and utility mark outs will be coordinated with UDig New York.

Similar to the investigations conducted by GSH in 2025, FS data gaps sampling will be performed within navigable waters of the United States and requires a USACE permit that will be covered under Nationwide Permit No. 6 Survey Activities. The proposed work also requires a NYSDEC Protection of Water Permit. USACE and NYSDEC permit applications will be submitted using New York State's joint permit application and will require consultation with NYSDEC Division of Fish and Wildlife and the State Historic Preservation Office. The project is anticipated to be considered "Minor," which is anticipated to streamline the permitting process.

In addition, NYSDEC will send notification letters to individual property owners where sample collection is targeted on or adjacent to their properties.

2.2 Bathymetric Survey

To address DQO 1, a multibeam bathymetric survey, potentially supplemented with localized LiDAR (water penetrating) shoreline surveys as needed, will be performed within and adjacent to all SMAs in the Study Area (Figure 1-2). Quality control (QC) measures, calibrations and checks (including control points) will be conducted during the survey, and all work will conform to USACE EM1110-2-1003 Hydrographic Survey Manual standards (USACE 2013). Work will be supervised by a hydrographer certified by the National Society of Professional Surveyors and Hydrographic Society of America. The bathymetric multibeam survey will be collected to a minimum vertical accuracy to the nearest 0.1 feet and a minimum horizontal accuracy of ± 3.0 feet. Datums specific to the project (which all collected data will be referenced to) are as follows:

- Vertical datum: International Great Lakes Datum of 1985 (IGLD85)
- Horizontal datum: North American Datum of 1983 (NAD83) State Plane New York West (US Feet)

2.3 Probing to Delineate Soft Sediment

Sediment probing will be performed throughout SMAs 5 through 9 to determine the presence/absence of soft sediments and, where present, the corresponding thickness.¹ Sediment

¹ Sufficient data are currently available for SMAs 1 to 4 to characterize the areal extent and thickness of soft sediment deposits in these relatively small SMAs (Figure 1-2) to support the FS.

probing will address DQO 2 and will also inform selection of target sediment coring activities as described in Section 2.4.

Probing will be conducted at a minimum of 45 locations (Table 1) within SMAs 5 through 9 at a density of approximately 0.4 probe locations per acre² as depicted on Figure 2-1. If soft sediment deposits of 6 inches or greater are observed at the boundary of an SMA, additional step-out probing will be performed at secondary locations as needed to delineate the boundary of the SMA. The step-out probing will be conducted as outlined in Appendix A.

Probing will require use of a vessel. Field staff will follow Anchor QEA standard operating procedure (Appendix A) to conduct vessel-related work.

2.4 Targeted Sediment Coring

Sediment cores will be collected to address DQOs 3 and 4. The results of sediment probing described in Section 2.3 will be used to determine target coring locations in the largest SMAs (5 and 7)³ with the greatest sediment thickness. Subject to field modification based on probing results, approximately 20 cores will be collected in SMAs 5 and 7 (roughly one core location per acre).

2.4.1 Visual Determination of Soft Sediment Type

A vibracore or equivalent method will be used to collect sediment cores advanced to the probed depth or refusal. Consistent with the methods used for the *Supplemental Remedial Investigation Work Plan* (Anchor QEA 2025) and Appendix A, up to three attempts to collect a sediment core will be made at target locations. Each core will be retrieved, penetration and recovery measured, split open, photographed and visually characterized, including identification of soft and/or consolidated sediment types. The soft sediment portion of the core will be carefully subdivided where clear breaks exist in the predominant sediment type (e.g., sand, silt). These subdivided sections of cores will be stowed in clean plastic bags until all target cores have been logged.

2.4.2 Laboratory Geotechnical Analyses

Once cores have been logged and subdivided (as described in Section 2.4.1), a subset of representative (based on visual core characterization) core section samples will be selected in the field for laboratory geotechnical analysis to characterize the physical properties of the sediments. Subject to field modification, approximately 10 samples will be submitted to GeoTesting Express (or similarly accredited laboratory, as discussed in Section 2.5.2 of Appendix A) for geotechnical analyses, including Unified Soil Classification System classification (ASTM D2487), grain size (ASTM D6913), moisture content (ASTM D2216), and Atterberg limits (ASTM D4318). Collected

² A similar probing density was used downstream of SMA 9 during the *Supplemental Remedial Investigation Work Plan* (Anchor QEA 2025).

³ SMAs 5 and 7 comprise approximately 87% of the total contaminated soft sediment volume in the Study Area (Anchor QEA 2026).

samples will be handled and shipped in accordance with Appendix A. The results of the laboratory geotechnical analyses will support future FS evaluations.

2.5 Dewatering Treatability Tests

To address DQO 4, 15 gallons of representative (selected locations based on visual core characterization) soft sediment collected from SMA 5 or 7, along with 30 gallons of site water, will be collected and shipped in accordance with Appendix A to the Anchor QEA Environmental Geochemistry Laboratory (EGL) in Portland, Oregon, for bench scale treatability testing.

2.5.1 Sediment Slurry Dewatering Tests for Hydraulic Dredged Sediments

The hydraulic dredging process involves dislodging in situ sediment and then drawing it into the dredge suction line along with water to create a slurry for pumping through a pipeline. The amount of water entrained with the sediment varies based on several factors, including sediment type, consistency, and the dredge cut thickness relative to the suction line diameter. For typical environmental dredging projects, the volume of water added is typically 5 to 10 times the in situ volume of sediment removed, resulting in a solids content of approximately 8% to 12% by dry weight. To evaluate potential dewatering methods, EGL will prepare samples to simulate a typical hydraulic dredge slurry with a solids content of approximately 10% by dry weight.

Upon receipt at EGL, the bulk sediment will be thoroughly homogenized using a hand-held paddle mixer. Following homogenization, site water and bulk sediment will be mixed to create a sediment slurry at a solid content of 10% by dry weight in 4-ounce glass jars. Sediment slurry dewatering jar tests will then be conducted by adding different reagents into the sediment slurry jars. As detailed in Appendix A, reagent effectiveness will be qualitatively evaluated based on floc size, floc stability, floc formation rate, and supernatant water clarity to identify the most promising reagent for site-specific sediment dewatering applications.

2.5.2 Geotextile Tube Dewatering Tests for Hydraulic Dredged Sediments

EGL will mix bulk sediment with site water to create a slurry with a solid content of approximately 10% (dry weight) to simulate geotextile tube dewatering of hydraulic dredged materials. The sediment slurry will be thoroughly homogenized using a hand-held paddle mixer in a 5-gallon plastic bucket, producing approximately 15 to 25 gallons of sediment slurry. The most promising dewatering reagent determined from sediment slurry dewatering jar testing (Section 2.5.1) will be diluted to 0.5% by weight, added to the sediment slurry, thoroughly mixed using a hand-held paddle mixer, and allowed to settle for one hour. The conditioned sediment slurry will then be poured into the pillow-shaped geotextile and allowed to passively dewater. The solids (filter cake) remaining in the geotextile tube bag after passive dewatering will be tested for moisture content, specific gravity, and paint filter testing (methods provided in Appendix A) at time intervals of 0, 1, 12, 24, 48, 96, and

196 hours. Geotextile filtrate water (i.e., effluent) will be analyzed for turbidity (Standard Method 2130B) and total suspended solids (Standard Method 2540D).

2.5.3 Stabilization Tests for Mechanical Dredged Sediments

The process of mechanical dredging typically results in the structural disruption of the dredged sediments and the entrainment of water into the sediments, resulting in “bulking”—i.e., the dredged sediment occupies more volume than it did in situ. The bulking factor (the ratio of bulk to in situ volume) for mechanical dredging typically varies from about 1.1 to 1.3 (i.e., 10% to 30% volume increase) and is controlled by several factors, including material type and thickness of the dredge cut relative to bucket size (Hayes 2021). To evaluate potential dewatering/stabilization methods, EGL will prepare samples to simulate a typical mechanical dredging bulking factor of 1.2, mixing site water with bulk sediment obtained from the cores at 20% by volume (i.e., near in situ conditions). The bulked sediment will be allowed to settle overnight to simulate typical settling that occurs shortly following mechanical dredging, prior to any dewatering/stabilization amendments. The settled sediments will be analyzed for moisture content, specific gravity, paint filter test results, pH, grain size distribution, and penetrometer strength (methods provided in Appendix A).

An initial screening stabilization test will be conducted on the prepared sediments in accordance with Appendix A. During this screening phase, four amendments—EnviroBlend 90/10 CS, Calciment, Portland cement, and quicklime—will be evaluated at an application rate of 10% by dry weight. Following a 3-day curing period, the treated materials will be tested for moisture content, pH, paint filter test results, and penetrometer strength.

The most promising amendment will be selected based on the screening test results. Subsequently, optimization stabilization testing will be performed using the selected amendment. Amendment application rates of 2.5%, 5%, 7.5%, and 10% by dry weight will be evaluated. Treated materials will be cured for 1, 2, and 3 days and tested each day for moisture content, pH, paint filter test results, and penetrometer strength.

2.5.4 In-Situ Geotechnical Testing

To address DQO 3, in situ VSTs will be conducted in the field at all core locations (approximately 20; Section 2.4) following Appendix A, provided that water depth does not exceed 15 feet. VSTs will be conducted within a horizontal distance of 5 to 10 feet from each coring location to obtain an estimate of sediment undrained shear strength. At each core location, VSTs will be performed at 1-foot intervals below mudline to a maximum depth of 3 feet below mudline.

3 Field Documentation, Data Management and Health and Safety

3.1 Documentation and Record Keeping

This section defines the records that are critical to the project, identifies information that will be included in the report, and describes the data reporting format and document control procedures that will be used. Project information generated by Anchor QEA will be documented in a format that is usable by project personnel. Specification of the proper reporting format will facilitate clear and direct communication of the investigation. Project data and information will be tracked and managed from its inception in the field to its final storage area.

3.1.1 Document Control

Central project files will be maintained and overseen by the Anchor QEA Project Manager. Project records will be stored and maintained in a secure manner. Each project team member will be responsible for filing necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks but will provide such files to the central project files upon completion of each task.

3.1.2 Field Documentation

Consistent with prior RI field work (Anchor QEA 2026), field documentation will follow activity-specific tasks described in Appendix A. Field documentation will be included as part of the *Feasibility Study Report*.

3.2 Sample Handling and Custody Requirements

The primary objective of sample handling and custody procedures is to create an accurate written record that can be used to trace the possession and handling of samples from the moment of their collection, through analysis, until their final disposition. Procedures for sample labeling, handling, and reporting will comply with applicable chain-of-custody protocols. Field personnel will document sample collection, processing, custody transfers, and requested analyses using field records, sample labels, and chain-of-custody forms. Samples will remain in custody while in the possession or view of field personnel, secured under restricted access, or sealed against tampering, and custody will transfer through signed and dated chain-of-custody documentation. The laboratory will acknowledge sample receipt and maintain internal custody records during preparation and analysis. Specific protocols for sample designation, handling, packaging, shipping, and custody are presented in Appendix A.

3.3 Disposal of Investigation-Derived Waste

Sediment and water wastes generated during sediment core processing will be placed in labeled drums and documented in investigation-derived waste (IDW) logs (see example of IDW log in Appendix A). Similar to investigations conducted by GSH in 2025, waste will be characterized and disposed of as hazardous waste along with the existing GSH Durez, North Tonawanda site profile unless a large volume of IDW is generated during this investigation. If the volume is deemed too large, the IDW will be handled and disposed of separately consistent with applicable waste disposal requirements, including collecting representative samples of the IDW and analyzing for disposal parameters in accordance with the selected disposal contractors' profile requirements. Specific IDW handling procedures to be followed are provided in Appendix A.

3.4 Health and Safety

Prior to commencement of the sampling/surveys described herein, Anchor QEA will prepare a site-specific Health and Safety Plan (HASP) including a site-specific activity hazard analysis. Field staff will be current on all required health and safety training and will review and comply with the provisions of the HASP. Training requirements are outlined in Sections 2.5.1 (Field Training) and 2.5.2 (Health and Safety Training) of the *Field Sampling Plan/Quality Assurance Project Plan* (Appendix A).

4 Schedule and Reporting

As discussed in Section 2.1, prior to initiating field work herein, appropriate permits will be obtained as follows:

- Nationwide Permit No. 6 Survey Activities
- NYSDEC Protection of Water Permit

In addition, prior to initiating field work, notification letters will be sent to the appropriate individual property owners if necessary, and utility mark outs will be coordinated with UDig New York. As of August 2026, subject to access agreements and permits, field sampling/survey activities are scheduled to commence the last week of September 2026 and will last for approximately 1.5 weeks. Dewatering treatability tests and geotechnical laboratory data analysis will commence upon laboratory receipt of samples.

The dewatering treatability tests, bathymetric survey, and the geotechnical laboratory data are anticipated to be available in December 2026.

Assuming the results of the investigations satisfactorily address DQOs 1 to 4, the draft *Feasibility Study Report* is anticipated to be developed in late 2026/early 2027.

5 References

Anchor QEA, 2025. *Supplemental Remedial Investigation Work Plan*. Pettit Cove to Gratwick Riverside Park. Prepared for Great Lakes National Program Office on behalf of Glenn Springs Holdings. June 2025.

Anchor QEA, 2026. *Remedial Investigation*. Prepared for Great Lakes National Program Office on behalf of Glenn Springs Holdings. April 2026.

Hayes, D., 2021. *Dredging 101: Fundamentals of Dredging*. Presented at the Western Dredging Association (WEDA) Gulf Coast Meeting, November 16, 2021.

USACE (U.S. Army Corps of Engineers), 2013. Hydrographic Surveying. EM 1110-2-1003. November 2013.

Table

Table 1
Target Investigation Locations

SubArea	Location ID	Easting	Northing	Location Type		Investigation SOW			
				Primary	Secondary ¹	Sediment Delineation Probing	Targeted Core	Dewatering Bench Scale Test	In Situ Geotech
SMA 5	FS-5-01	1065936.368	1109906.565	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-02	1065910.045	1109776.670	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-03	1066040.376	1109723.293	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-04	1066088.749	1109618.811	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-05	1065940.992	1109616.574	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-06	1066114.037	1109475.833	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-07	1065981.903	1109436.335	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-08	1065962.437	1109273.931	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-09	1066159.249	1109291.345	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-10	1066092.713	1109154.389	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-11	1065998.961	1109066.611	X	--	X	TBD	TBD	TBD
SMA 5	FS-5-12	1066164.133	1109058.422	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-13	1066064.872	1108973.052	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-14	1066199.392	1108896.829	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-15	1066062.967	1108844.46	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-16	1065892.582	1108916.529	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-17	1065887.344	1109052.292	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-18	1065870.713	1109209.529	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-19	1065852.654	1109368.199	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-20	1065837.342	1109493.995	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-21	1065793.435	1109642.756	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-22	1065772.394	1109770.000	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-23	1065810.160	1109901.313	--	X	TBD	TBD	TBD	TBD
SMA 5	FS-5-24	1065908.067	1110009.544	--	X	TBD	TBD	TBD	TBD
SMA 6	FS-6-01	1064751.037	1111640.076	X	--	X	--	--	--
SMA 6	FS-6-02	1064650.811	1111678.548	X	--	X	--	--	--

Table 1
Target Investigation Locations

SubArea	Location ID	Easting	Northing	Location Type		Investigation SOW			
				Primary	Secondary ¹	Sediment Delineation Probing	Targeted Core	Dewatering Bench Scale Test	In Situ Geotech
SMA 7	FS-7-01	1063174.804	1113333.727	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-02	1063270.436	1113220.504	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-03	1063412.641	1113289.968	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-04	1063396.573	1113211.455	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-05	1063397.660	1113120.019	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-06	1063529.214	1113026.661	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-07	1063505.864	1112918.173	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-08	1063657.863	1112923.314	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-09	1063699.086	1112828.868	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-10	1063561.381	1112812.244	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-11	1063455.207	1112792.644	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-12	1063513.489	1112659.56	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-13	1063643.967	1112660.496	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-14	1063791.458	1112609.937	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-15	1063980.404	1112526.364	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-16	1063891.177	1112438.122	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-17	1063985.248	1112289.187	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-18	1064078.284	1112245.977	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-19	1064165.419	1112158.500	X	--	X	TBD	TBD	TBD
SMA 7	FS-7-20	1064073.537	1112127.414	X	--	X	TBD	TBD	TBD
SMA 8	FS-8-01	1062474.304	1113907.184	X	--	X	--	--	--
SMA 8	FS-8-02	1062439.689	1113844.334	X	--	X	--	--	--
SMA 8	FS-8-03	1062514.187	1113844.791	X	--	X	--	--	--
SMA 8	FS-8-04	1062573.594	1113858.279	X	--	X	--	--	--
SMA 8	FS-8-05	1062553.560	1113793.212	X	--	X	--	--	--
SMA 8	FS-8-06	1062764.952	1113734.119	X	--	X	--	--	--

Table 1
Target Investigation Locations

SubArea	Location ID	Easting	Northing	Location Type		Investigation SOW			
				Primary	Secondary ¹	Sediment Delineation Probing	Targeted Core	Dewatering Bench Scale Test	In Situ Geotech
SMA 8	FS-8-07	1062724.312	1113679.416	X	--	X	--	--	--
SMA 8	FS-8-08	1062818.881	1113664.484	X	--	X	--	--	--
SMA 8	FS-8-09	1062899.531	1113608.462	X	--	X	--	--	--
SMA 9	FS-9-01	1062036.862	1114340.155	X	--	X	--	--	--
SMA 9	FS-9-02	1061918.290	1114152.443	X	--	X	--	--	--
SMA 9	FS-9-03	1061770.567	1114257.925	X	--	X	--	--	--

Notes:

1. Secondary locations will be probed only after the following two conditions have been met: 1) probing is complete at primary locations within the subject SMA; and 2) at least 6 inches of soft sediment are observed at the adjacent primary location(s). Further, additional step-out probing may be added as needed to delineate the SMA boundary (see Section 2.3 of text).
2. "TBD" indicates that sediment probing results will be used to determine locations that will be included in the coring, bench scale testing, and in situ geotech components of the investigation scope (see Sections 2.4 and 2.5 of text).
3. In addition to the scope outlined above, a topobathymetric survey will be conducted within and adjacent to all SMAs within the Study Area (see Section 2.2 of text).

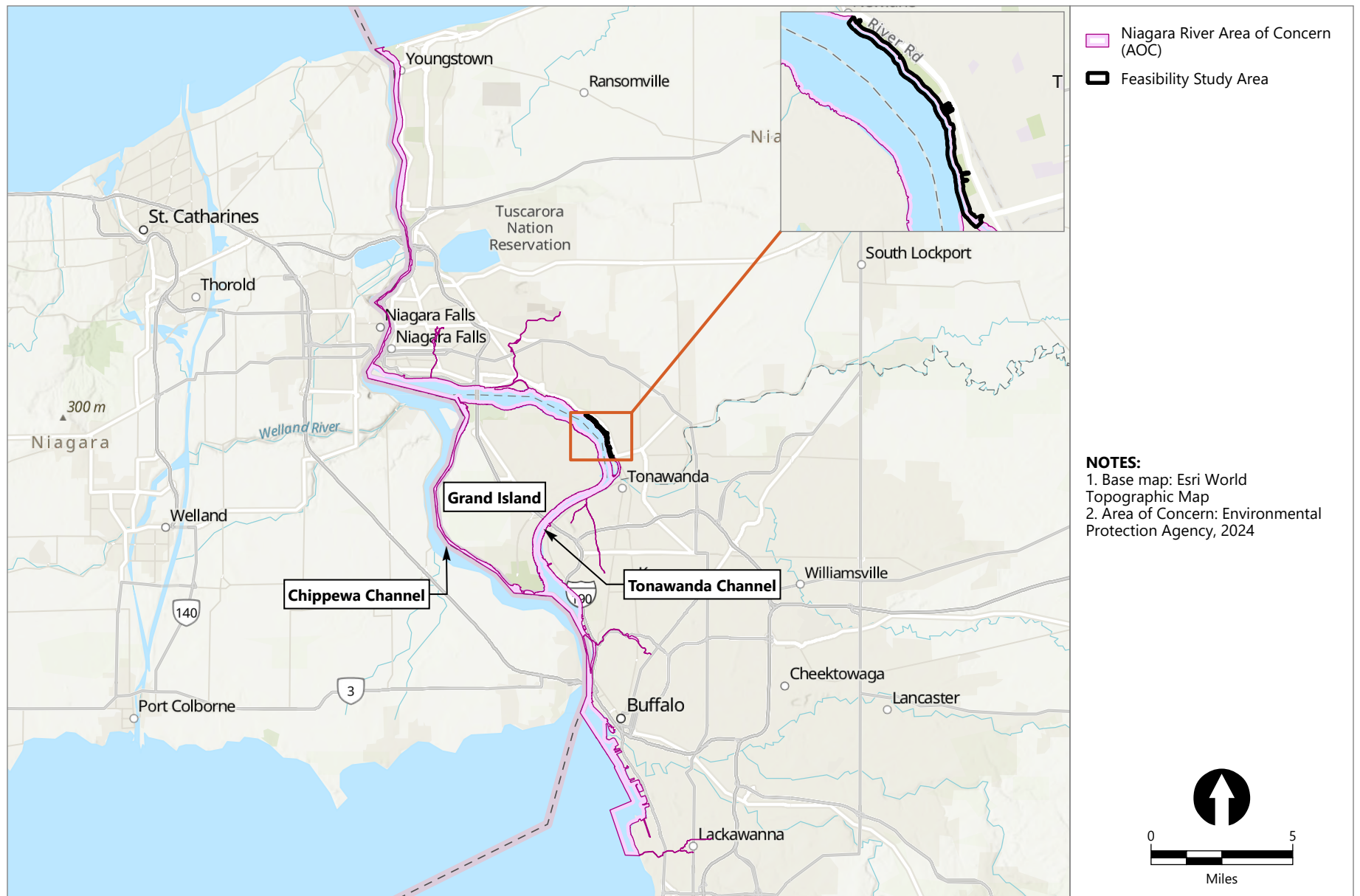
--: location is not subject to testing (not part of the SOW).

SMA: sediment management area

SOW: scope of work

TBD: to be determined

Figures



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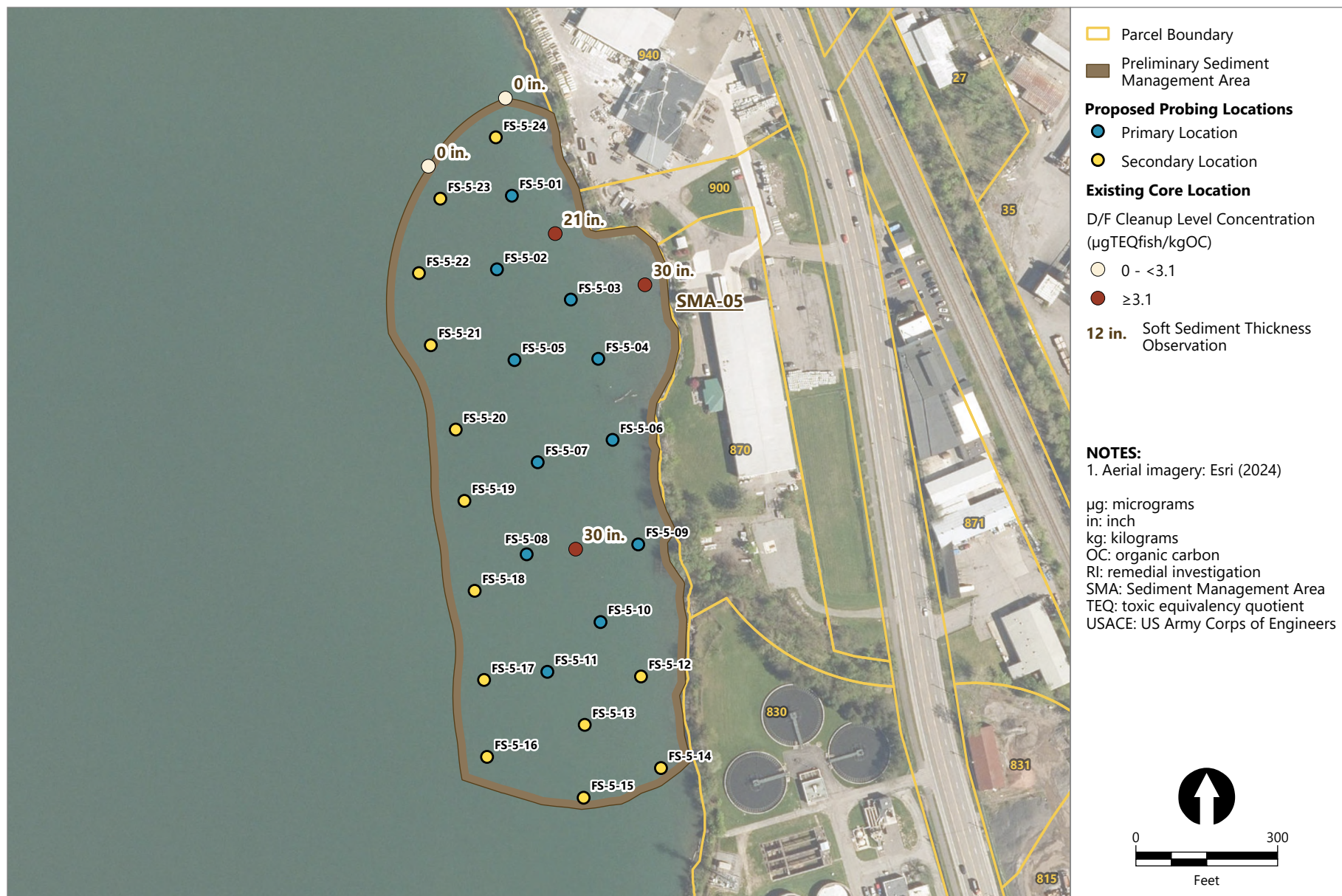
Figure 1-1
Niagara River Area of Concern
 Feasibility Study Data Gaps Work Plan
 Pettit Cove to Gratwick Riverside Park



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Figure 1-2
Sediment Management Areas
 Feasibility Study Data Gaps Work Plan
 Pettit Cove to Gratwick Riverside Park



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Figure 2-1a
Target Investigation Locations in SMA-05

Feasibility Study Data Gaps Work Plan
Pettit Cove to Gratwick Riverside Park



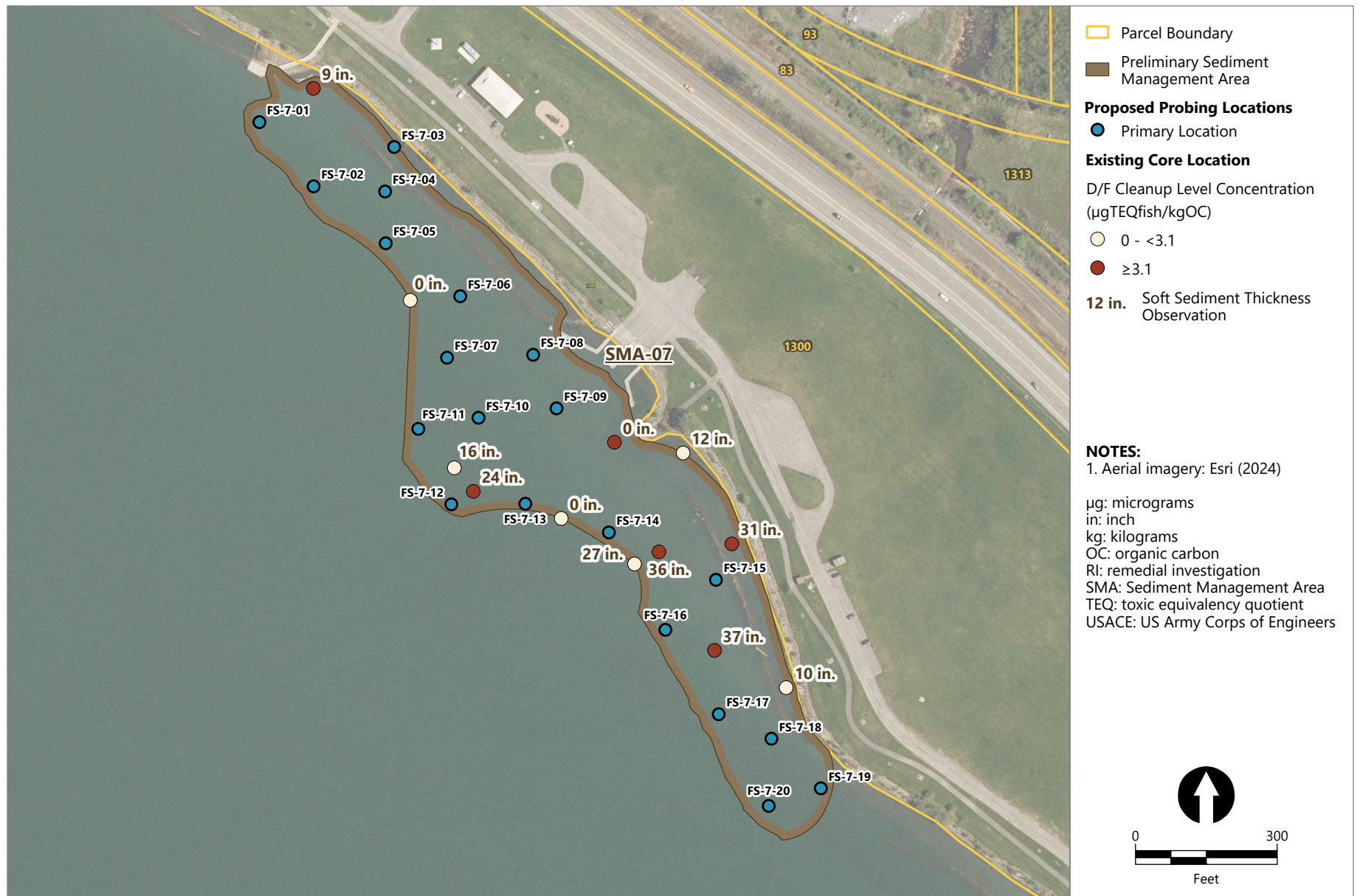
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Figure 2-1b
Target Investigation Locations in SMA-06

Feasibility Study Data Gaps Work Plan
Pettit Cove to Gratwick Riverside Park



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Figure 2-1c
Target Investigation Locations in SMA-07

Feasibility Study Data Gaps Work Plan
Pettit Cove to Gratwick Riverside Park



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Figure 2-1d
Target Investigation Locations in SMA-08

Feasibility Study Data Gaps Work Plan
Pettit Cove to Gratwick Riverside Park



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Figure 2-1e
Target Investigation Locations in SMA-09

Feasibility Study Data Gaps Work Plan
Pettit Cove to Gratwick Riverside Park

Appendix A
Field Sampling Plan/Quality Assurance
Project Plan



August 2026
Pettit Cove to Gratwick Riverside Park



Field Sampling Plan/Quality Assurance Project Plan

Prepared for
Great Lakes National Program Office on Behalf of Glenn Springs Holdings, Inc.

Period of Applicability for this QAPP starts on the date of the GLLA Quality Assurance Team Member's signature and ends 5 years after that date or until a new version of the QAPP is approved.

August 2026
Pettit Cove to Gratwick Riverside Park

Field Sampling Plan/Quality Assurance Project Plan

Prepared for

Great Lakes National Program Office
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, Illinois 60602

Prepared by

Anchor QEA
54 Genesee Street, Suite 100A
Camillus, New York 13031

On Behalf of

Glenn Springs Holdings, Inc.
7601 Old Channel Trail
Montague, Michigan 49437

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ATTACHMENTS

Attachment 1	Standard Operating Procedures (SOPs)
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Laboratory SOPs:

SOP 1.01	Sediment Slurry Dewatering Jar Test
SOP 1.02	Geotextile Tube Dewatering Test
SOP 1.03	Sediment Dewatering and Stabilization Test

Field SOPs:

SOP 1.08	Vane Shear Testing
SOP 2.08	Core Collection and Processing
SOP 2.09	Sediment Probing
SOP 5.01	Surface Water Collection
SOP 7.01	Field Records
SOP 7.03	Investigation-Derived Waste Handling
SOP 7.06	Sample Nomenclature
SOP 7.07	Sample Custody
SOP 7.08	Sample Shipping and Handling
SOP 7.11	Navigation and Boat Positioning

Laboratory Method SOPs:

GTX Methods

EGL Methods

Attachment 2 Field Audit Checklist

Attachment 3 Stage I Validation Checklist

ABBREVIATIONS

ASTM	ASTM International
DQO	data quality objective
EDD	electronic data deliverable
EGL	Anchor QEA's Environmental Geochemistry Laboratory (Portland, Oregon)
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSM	Field Safety Manager
FSP	<i>Field Sampling Plan</i>
FTL	Field Team Leader
GLLA	Great Lakes Legacy Act
GLNPO	Great Lakes National Program Office
GTX	GeoTesting Express, LLC
HASP	<i>Health and Safety Plan</i>
NYSDEC	New York State Department of Environmental Conservation
Project	Pettit Cove to Gratwick Riverside Park GLLA Project
QA	quality assurance
QA/G-5	<i>EPA Guidance for Quality Assurance Project Plans</i>
QA/R-5	<i>EPA Requirements for Quality Assurance Project Plans</i>
QAPP	<i>Quality Assurance Project Plan</i>
QC	quality control
SMA	sediment management area
SOP	Standard Operating Procedure
USACE	U.S. Army Corps of Engineers
VST	vane shear test
Work Plan	<i>Feasibility Study Data Gaps Work Plan</i>

Quality Assurance Project Plan

Pettit Cove to Gratwick Riverside Park Feasibility Study Data Gap Investigation

Prepared by

Anchor QEA

54 Genesee Street, Suite 100A

Camillus, New York 13031

KALI DENIS

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Date: 2026.09.15 13:42:25
-05'00'

Approved by: _____

Kali Denis, EPA GLLA Project Manager

Date: _____

AMBER FALKNER

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FALKNER
Date: 2026.09.15 13:46:41 -05'00'

Approved by: _____

Amber Falkner, GLLA QA Team Member

Date: _____

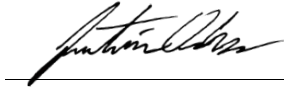
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Clay Patmont, Anchor QEA Program Manager

Date: August 25, 2026

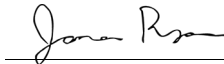
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Justin Drehs, PE, Anchor QEA Project Manager

Date: August 25, 2026

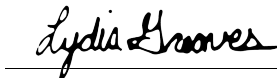
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James Ryan, Anchor QEA Field Team Leader

Date: August 25, 2026

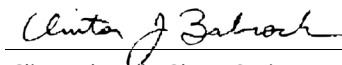
Approved by: _____



Lydia Greaves, Anchor QEA Project QA/QC Manager

Date: August 25, 2026

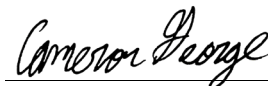
Approved by: _____



Clint Babcock, Glenn Springs Holdings, Inc, Non-Federal Sponsor

Date: August 25, 2026

Approved by: _____



Cameron George, Anchor QEA Data Validator

Date: August 25, 2026

1 Introduction

1.1 Introduction

The U.S. Environmental Protection Agency (EPA) requires that all environmental monitoring and measurement efforts mandated or supported by EPA participate in a centrally managed quality assurance (QA) and quality control (QC) program. Any party generating data under this program is responsible for implementing minimum procedures to confirm that the quality of data is known and documented. To ensure the responsibility is met uniformly, each party prepares a written quality assurance project plan covering each project it is to perform. As part of the *Feasibility Study Data Gaps Work Plan* (Work Plan), this *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP) has been prepared for the Great Lakes National Program Office (GLNPO) on behalf of Glenn Springs Holdings, Inc. Under this FSP/QAPP, Anchor QEA will collect field data needed to support future remediation of legacy chemical contamination between Pettit Cove to Gratwick Riverside Park (Tonawanda to Wheatfield, New York) within the Niagara River Area of Concern.

1.2 Document Organization

This document format is generally consistent with the EPA's *Quality Assurance Project Plan Guidance* (EPA 2025) and the *EPA Quality Assurance Project Plan Standard* (EPA 2023). QAPPs are approved by Anchor QEA's Project Manager, Project QA/QC Manager, and Field Team Leader (FTL) and are submitted to GLNPO for approval before field data collection begins. As detailed in the guidance, this FSP/QAPP is organized into the following four sections:

- Section 1 (Introduction) introduces the project, distribution list, and document approvals.
- Section 2 (Project Management) covers aspects of project management, objectives, and background information; identifies the roles and responsibilities of project personnel; defines the lines of communication; and identifies the objectives and technical approach to achieving the goals at the site.
- Section 3 (Data Generation and Acquisition) describes the design and implementation of measurement systems that will be used during the field investigation and laboratory-based testing, as well as the sampling procedures, geotechnical analyses methods, and data handling and documentation procedures. QC procedures, frequency requirements, acceptance criteria, and corrective action procedures are also provided in this section.
- Section 4 (Assessment and Oversight) describes the measures used to implement the QAPP and the procedures outlined in Section 3.
- Section 5 (Data Validation) describes the QA activities, including review of data relative to verification criteria and the Stage I Validation Checklist, that are expected to occur after the data collection and assessment phases are completed for this project.
- Section 6 (References) provides a list of the references cited in this FSP/QAPP.

1.3 Distribution List

Per QA/G-5 and QA/R-5, a distribution list that identifies stakeholders and relevant parties to be informed of QA/QC processes is provided as part of this FSP/QAPP. The key project personnel are provided in the Figure 1-1 organization chart, and a distribution and contact list is included as Table 1-1.

2 Project Management

2.1 Project Organization and Responsibilities

This section outlines the project management structure, providing direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. QA functions are explained in the following subsections. Anchor QEA is responsible for planning, conducting, and overseeing work for this project. An organizational chart presenting key Anchor QEA project personnel and chain of command is presented in Figure 1-1.

2.1.1 Project Management

EPA GLLA Project Manager—Ms. Kali Denis is the EPA GLLA Project Manager for this project. As EPA GLLA Project Manager, Ms. Denis is the primary EPA contact for the Great Lakes Legacy Act (GLLA) and is responsible for all stages of this project. The EPA GLLA Project Manager is responsible for reviewing and approving this FSP/QAPP. Ms. Denis will also serve as the primary pathway for communication between the technical reviewers (NYSDEC and USACE) and the rest of the team.

Anchor QEA Program Manager—Mr. Clay Patmont is the Anchor QEA Program Manager. Mr. Patmont is responsible for the overall program direction, coordination, and technical consistency on behalf of the non-federal sponsors. The Anchor QEA Program Manager's responsibilities include final approval and review of technical and business proposals, project deliverables, schedules, contract changes, and manpower allocations for each task as well as the resolution of problems that may arise on each task.

Anchor QEA Project Manager—Mr. Justin Drehs, PE, is the Anchor QEA Project Manager. The Anchor QEA Project Manager is responsible for reviewing, approving, and implementing the FSP/QAPP, distributing copies of the FSP/QAPP, maintaining the official approved FSP/QAPP, scheduling, personnel management, document preparation, document and data review, and communication with New York State Department of Environmental Conservation (NYSDEC), EPA, and contractors. The Anchor QEA Project Manager will coordinate with the NYSDEC Project Manager, EPA GLLA Project Manager, and other Anchor QEA staff or subcontractors (as appropriate). The Anchor QEA Project Manager will be the primary point of contact and control for matters concerning the project.

Geotechnical Laboratory Project Manager—Mr. Joeseeph Tomei of GeoTesting Express (GTX) will serve as the Geotechnical Laboratory Project Manager. The Geotechnical Laboratory Project Manager will review and implement this FSP/QAPP, oversee the geotechnical analysis of samples, oversee data compliance with the requirements of this FSP/QAPP, and communicate with the Anchor QEA FTL and Anchor QEA Project QA/QC Manager, as appropriate.

Treatability Testing Laboratory Project Manager—Mr. Masa Kanematsu will serve as the Treatability Testing Laboratory Project Manager, which includes sediment stabilization and water treatment testing that will be conducted by Anchor QEA’s Environmental Geochemistry Laboratory (EGL) in Portland, Oregon. The Treatability Testing Laboratory Project Manager will review and implement this FSP/QAPP, oversee dewatering treatability tests, oversee data compliance with the requirements of this FSP/QAPP, and communicate with the Anchor QEA FTL and Anchor QEA Project QA/QC Manager, as appropriate.

2.1.2 Quality Assurance

EPA GLLA QA Team Member—Ms. Amber Falkner will be responsible for review and approval of this FSP/QAPP. Ms. Falkner will communicate with Anchor QEA Project Manager on QA/QC-related concerns. The EPA GLLA QA Manager will also have the discretion to conduct external performance and system audits of field and laboratory activities. The EPA GLLA QA Manager will serve as the point of contact for Anchor QEA Project QA/QC Manager on any data management and validation-related activities. Ms. Falkner will communicate with Anchor QEA Project QA/QC Manager on the upload of data to the Great Lakes Sediment Database.

Anchor QEA Project QA/QC Manager—Ms. Lydia Greaves will serve as Anchor QEA Project QA/QC Manager to provide QA/QC oversight for this project. The Anchor QEA Project QA/QC Manager is responsible for implementing and administering the Anchor QEA QA/QC Program as it relates to the project. The Anchor QEA QA/QC Manager has an indirect chain of command from the Anchor QEA Project Manager. The Anchor QEA Project QA/QC Manager is responsible for reviewing, updating, and implementing the FSP/QAPP, coordinating all procedures and tasks pertaining to QA, including correspondence with the laboratories listed above on issues relating to data quality, and reporting to the EPA GLLA QA Manager and Anchor QEA Project Manager on QA issues. The Anchor QEA Project QA/QC Manager has independence from the project team/personnel responsible for data collection. The Anchor QEA QA/QC Manager will serve as the point of contact for the EPA GLLA QA Manager on quality-related matters. The Anchor QEA Project QA/QC Manager is also responsible for overseeing data verification and validation activities. Data review and QC will be supported by additional qualified Anchor QEA staff.

Anchor QEA Data Validator—Mr. Cameron George will lead the Anchor QEA data validation. Mr. George will be the point of contact for the laboratories along with the Anchor QEA Project Manager. Mr. George’s work will be overseen by the Anchor QEA Project QA/QC Manager. The Anchor QEA Data Validator’s work will be supported by additional qualified Anchor QEA staff.

2.1.3 Field Team

Anchor QEA Field Team Leader—Mr. James Ryan is the Anchor QEA FTL for this project. The Anchor QEA FTL will serve as the field activities coordinator for Anchor QEA on-site activities and will

be responsible for the daily direction of the team members (project field personnel) regarding Work Plan-specific tasks and the requirements outlined in this FSP/QAPP. The Anchor QEA FTL is responsible for reviewing and approving this FSP/QAPP. The Anchor QEA FTL will coordinate with the personnel who will be sediment probing, collecting, and processing sediment samples within the Niagara River near Gratwick Park. The Anchor QEA FTL will also coordinate with GTX for sample container deliveries and sample shipments with the laboratories. Additional responsibilities include providing training to the sample collection field staff; providing the initial technical review of deliverables and data collection activities; monitoring QC activities and responding to deficiencies identified in the field; collecting and storing original field documentation; overseeing maintenance of sampling equipment in a secure location; and monitoring field survey and sample collection tasks.

Anchor QEA Field Safety Manager—Mr. Tim Shaner will be the Anchor QEA Field Safety Manager (FSM), responsible for implementing the *Health and Safety Plan* (HASP). The Anchor QEA FSM will perform safety and health monitoring and support compliance with safety and health requirements, including those in the project-specific HASP.

2.1.4 Laboratories

GTX will serve as the laboratory for analysis of samples for Unified Soil Classification System classification (ASTM International [ASTM] D2487), grain size (ASTM D6913), moisture content (ASTM D2216), and Atterberg limits (ASTM D4318). Accreditation is discussed in Section 2.5.2.

EGL will serve as the treatability study laboratory for sediment stabilization and water treatment testing. EGL will follow standard ASTM/EPA methods, as shown in Table 2-1.

The Laboratory Project Managers will oversee the sample analyses and treatability testing and will serve as points of contact for the Anchor QEA Project QA/QC Manager.

2.1.5 Data Validation

Anchor QEA will perform data verification and validation to assess compliance with the Work Plan and this FSP/QAPP. Anchor QEA will review all field and laboratory data to determine whether requested data was received for all the samples sent for analysis and treatability testing and whether any deviations from the Work Plan occurred. Additionally, Anchor QEA will complete an EPA Stage I Validation Checklist on laboratory data packages (i.e., geotechnical data packages) on 100% of the samples collected.

The Anchor QEA Project QA/QC Manager will coordinate with laboratory(ies) on issues regarding analysis/treatability testing and associated data quality. The Anchor QEA Project QA/QC Manager will report deviations and associated impacts, if any, to the EPA GLLA QA Team Member.

2.2 Background Information/Problem Definition

A brief site description, an overview of the site history, a review of previous investigations, and discussion of why the feasibility study data gaps investigation is being performed are included in the Work Plan.

2.3 Project Description

The planned field activities are summarized in the following subsections and described in detail in the Work Plan.

2.3.1 *Field Activities*

Field activities (including bathymetric survey, probing, sediment core collection and processing, dewatering treatability testing and in situ vane shear testing [VST]) will be performed, as described in the Work Plan. Field methods for these activities are detailed in the field Standard Operating Procedures (SOPs) in Attachment 1. Details regarding sample documentation and delivery to the laboratories are also included in the Work Plan and SOPs.

All deviations from the SOPs will be recorded in the Daily Log or field logbook and on a Field Deviation Form included as an attachment to SOP 2.08 (Core Collection and Processing; Attachment 1) as well as reported to the Anchor QEA Project Manager and EPA GLLA Project Manager, before the deviations occur when possible.

2.3.2 *Laboratory Activities*

Laboratory activities, including geotechnical analyses and dewatering treatability testing, will be performed by the laboratories identified in Section 2.1.4, as described in the Work Plan and laboratory SOPs in Attachment 1.

Laboratory data will be of known and documented quality as specified by the applicable EPA guidance documents. Laboratory data will be compliant with EPA quality requirements, which require data to withstand independent review and confirmation.

The Anchor QEA Project Manager and Anchor QEA Project QA/QC Manager will be responsible for resolving data discrepancies with the laboratories and will inform the EPA GLLA Project Manager and EPA GLLA QA Manager of issues or delays.

2.3.3 *Schedule*

The project schedule is in Section 4 of the Work Plan.

2.4 Data Quality Objectives

Data quality objectives (DQOs) provide a qualitative and quantitative framework and series of planning steps based on the scientific method around which data collection programs can be designed. The use of DQOs ensures the following:

- The objectives of the investigation are clearly defined.
- The type, quantity, and quality of environmental data used in decision-making are appropriate for their intended application.
- Acceptable levels of decision error and performance goals are specified, such that the quantity and quality of data needed to support management decisions are provided.

The DQO process consists of the following seven steps (EPA 2006), which are used during the planning of the site assessment process to validate the field activities and data collection operations and to demonstrate that resulting data meet the project objectives:

1. State the problem.
2. Identify the goal of the study.
3. Identify the information inputs.
4. Define the boundaries of the study.
5. Develop the analytic approach.
6. Specify performance or acceptance criteria.
7. Develop the plan for obtaining data.

Following these seven steps supports the project plan being carefully thought out and the data collected providing sufficient information to support the key decisions that must be made. The Work Plan summarizes the DQOs derived for the project.

2.4.1 *Criteria for Measurement Data*

The quality of laboratory data is typically assessed by precision, accuracy, sensitivity, completeness, representativeness, and comparability. Because the work associated with this FSP/QAPP does not involve chemical analyses, precision and accuracy measures such as analysis of field duplicates, matrix spikes, and control samples are not part of the project plan, nor are the instrument or method detection limits used to measure sensitivity. As such, measurements of precision, accuracy, and sensitivity are not included in this FSP/QAPP. The remaining criteria include completeness, representativeness, and comparability, which will be measured as described in Sections 2.4.2 through 2.4.4.

2.4.2 *Completeness*

Completeness is typically a measure of the amount of data that are determined to be valid in proportion to the amount of data collected. Because the work associated with this FSP/QAPP does

not involve chemical analyses, completeness will be interpreted as all samples having all requested analytes measured.

2.4.3 Representativeness

Representativeness describes the degree to which sample data accurately and precisely represent a characteristic of the material being measured. Representativeness is a qualitative term that is evaluated to determine whether in situ and other field measurements are made and samples are collected in such a manner that the resulting data appropriately reflect environmental conditions. Representativeness will be established by adhering to the sampling, analysis, and testing procedures specified in the Work Plan and SOPs.

2.4.4 Comparability

Comparability is a parameter used to express the confidence with which one set of data may be compared with another. To achieve comparability in datasets, standard techniques will be used to collect and analyze representative samples and to report results. The following items enhance the comparability of datasets:

- Two datasets with the same set of variables of interest
- The same or convertible units
- Similar analyses and QA procedures
- The measurements collected at a similar time
- Similar measuring devices
- The same rules for excluding certain types of observations for both samples

To verify that data derived from this field and laboratory effort are comparable to each other and to other data produced using EPA methods or similar, the following procedures will be followed:

- Equivalent methods will be used for all sample analyses.
- Units of measure will be the same for all reporting per parameter.
- All samples will be handled and prepared in the same manner according to SOP 2.08 (Core Collection and Processing).

2.4.5 Quality Control

Overall field and laboratory QC will be established using field QC checks, as described in Section 3.5.

Fieldwork follows published procedures where available, including applicable U.S. Army Corps of Engineers (USACE) guidance manuals and standards. Additional QC procedures are incorporated into the sample collection and processing SOPs (Attachment 1) to minimize collection error. The media-specific sampling plans have been devised so the loss of any single data point will not hinder the achievement of DQOs. Multiple locations and samples are included to account for field variability.

Laboratory errors will be identified through data verification and validation procedures. Data will be flagged as appropriate, and any use restrictions will be noted.

2.5 Special Training Requirements/Certification

For sample collection tasks, it is important that field crews and laboratory staff are trained in standardized data collection requirements so the data collected are consistent among staff. Field crews will comprise individuals who are fully trained in the surveying, collection and processing of surface and subsurface sediment cores, and chain-of-custody procedures. In addition, field crews will be trained in appropriate health and safety regulations to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health.

The following subsections summarize training requirements for Anchor QEA personnel and subcontractors.

2.5.1 *Field Training*

Documentation—Team members will be trained in appropriate procedures for field documentation. The Anchor QEA Project QA/QC Manager will coordinate with the Anchor QEA FTL and Anchor QEA Project Manager to ensure documentation is transferred to an Anchor QEA internal project file folder on a real-time basis to the extent practical in an organized manner.

Sampling—Personnel operating core sampling equipment will be trained in the operation of the equipment. Staff performing sample collection will be experienced in vibracore/manual core collection methods, sediment probing and performance of vane shear tests. Staff will further review the SOPs and sign the SOP Acknowledgement Forms to certify they have read and understand the procedures prior to conducting field work.

The Anchor QEA FTL will be experienced in both documentation and sampling methods so they are responsible for providing training to the field staff responsible for sample collection and sample management activities in accordance with the Work Plan. Samples will be logged by qualified personnel with experience logging sediment according to ASTM Method D2487.

GPS—The Anchor QEA team, including the contractors implementing sample collection and surveying, will be trained in the proper use and operations of the GPS unit used to locate sampling locations prior to the commencement of field work. The GPS training should include basic functions and capabilities of the unit and the methods required to record location information to the level of accuracy required to meet the objectives of the project.

2.5.2 Laboratory Accreditation

GTX is accredited under American Association of State Highway and Transportation Officials (AASHTO); American Association for Laboratory Accreditation (A2LA), and ISO/IEC 17025:2017 - General requirements for the competence of testing and calibration laboratories.

2.5.3 Health and Safety Training

Health and safety procedures and training requirements are documented in the HASP (Anchor QEA 2026). On-site personnel will review and sign the HASP prior to the start of work.

All personnel who will participate in intrusive aspects of the field sampling program where contact with contaminated environmental media may occur must present to the Anchor QEA FTL a certificate of completion for an initial 40-hour hazardous waste operations and emergency response training course and the most recent certificate of completion for an 8-hour refresher course.

2.6 Documentation and Records

This section defines the records that are critical to the project, identifies information to be included in the reports, and describes the data reporting format and document control procedures to be used. Project information generated by Anchor QEA will be documented in a format that is usable by all project personnel. Specification of the proper reporting format will facilitate clear and direct communication of the investigation. Project data and information will be tracked and managed from its inception in the field to its final storage area.

2.6.1 Document Control

Central project files will be maintained by Anchor QEA. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing necessary project information or providing it to the Anchor QEA Project Manager responsible for the filing system. Individual team members may maintain files for individual tasks but must provide such files to the central project files upon completion of each task. Hard copy documents will be kept on file for a minimum of 7 years by Anchor QEA or at a document storage facility throughout the duration of the project, and electronic data will be maintained in the Anchor QEA environment and backed up regularly. Files are to be retained for the life of the project plus 10 years.

2.6.2 Field Documentation

Field activities will be documented in the same manner as prior investigations performed by Anchor QEA. Documentation requirements are summarized in the activity-specific field SOPs provided in Attachment 1. Field documentation will be summarized in the Feasibility Study (FS).

2.6.3 Laboratory Documentation

The laboratories will be responsible for maintaining logbooks and generating laboratory data. Raw laboratory data files and electronic and PDF data will be inventoried and maintained by the laboratory for the 10-year time period established by EPA and the laboratory.

2.6.4 Data Submittals

GTX will deliver laboratory data packages to Anchor QEA in PDF format within 30 days of sample receipt. EGL will deliver a treatability study report, as well as raw laboratory data in Excel, within 30 days of study completion. No electronic data deliverables (EDDs) will be generated by the laboratories.

The FS will provide the findings of the investigation including, but not limited to, data tables and maps depicting sample locations, laboratory reports (including Validation Checklist), and the treatability study summary report.

The Anchor QEA Project Manager will confirm that the project team has the most current version of planning documents and submittals. Laboratories are responsible for confirming the technical accuracy of their documents prior to submitting any document to Anchor QEA.

2.6.5 Project Data Assessment Records

Records of project assessments will be maintained by the Anchor QEA Project Manager and Anchor QEA Project QA/QC Manager and may include field technical system audit checklists, field performance audit checklists, laboratory performance audit checklists, Stage I Validation Checklist, and internal reviewer sign-off by the Project Manager.

3 Data Generation and Acquisition

Data generation and acquisition begins with the development of the rationale for locating and selecting environmental samples for geotechnical analyses and treatability testing and ends with the generation and reporting of data for those samples in the field and/or by the laboratories.

3.1 Sampling Process Design

Section 1.3 of the Work Plan identifies the DQOs associated with the proposed scope of the sediment investigation. Accordingly, the scope of the proposed investigations provided in the Work Plan was designed to achieve these DQOs.

3.1.1 *Sampling Approach, Methods, and Rationale*

The overall sampling approach for sediment probing, coring, and in situ VST is provided in Sections 2.3, 2.4, and 2.5.3 of the Work Plan, respectively. The laboratory-based components of the Work Plan are described in Sections 2.4.2, 2.5.1, and 2.5.2.

3.1.2 *Parameters to Be Tested and Frequency*

As shown on Table 1 and Figure 2-1 of the Work Plan, sediment probing will be conducted at a minimum of 45 locations within sediment management areas (SMAs) 5 through 9, and approximately 20 cores will be collected in SMAs 5 and 7. At each core location, a VST will be conducted, and sediment samples will be tested for geotechnical parameters. Additional volume of sediment and water will also be collected for dewatering treatability testing. No chemical analysis of sediment samples is required by the Work Plan.

3.2 Sampling Method Requirements

The use of proper sampling equipment, strict controls in the field, and appropriate chain-of-custody and field and laboratory procedures will reduce the potential for sample misrepresentation and the collection of unreliable data.

The Work Plan outlines planned sampling methods and identifies the equipment expected to be used to carry out the work. Field forms and SOPs are provided in Attachment 1.

Samples will be packaged and shipped to GTX and EGL as outlined in the Work Plan. The Anchor QEA Project QA/QC Manager and Anchor QEA FTL will ensure that sampling and geotechnical analyses/treatability testing activities adhere to the requirements of this FSP/QAPP, the Work Plan, and attached SOPs.

3.3 Sample Handling and Custody Requirements

The primary objective of sample handling and custody procedures is to create an accurate written record that can be used to trace the possession and handling of samples from the moment of their collection, through geotechnical analyses and treatability testing, until their final disposition. Sample labeling, handling, and reporting will comply with EPA-approved labeling and chain-of-custody protocols. Specific protocols for sample designation are presented in SOP 7.06 (Sample Nomenclature), and specific protocols for sample handling, packaging, shipping, and custody are presented in SOP 7.08 (Sample Shipping and Handling), provided in Attachment 1.

3.3.1 *Sample Containers and Handling*

Table 3-1 presents the required sample containers, sample preservation methods, and maximum holding times for the proposed analyses. Samples will be placed in appropriate sample containers and labeled. Samples will be packed and shipped in accordance with SOP 7.08 (Sample Shipping and Handling), provided in Attachment 1. Enough ice will be used to ensure samples are maintained within the required temperature range in case sample delivery is delayed.

3.3.2 *Documentation*

Field efforts will be documented using field logbooks or tablets, field data collection forms, electronic-generated sample labels, sample chain-of-custody records, and custody seals. In addition, hard copies of this FSP/QAPP, the Work Plan, and the HASP will be kept on site for the duration of the field effort. General information will be recorded in the field logbook (or tablet) daily, including personnel present at the site, sampling activities, and weather. Sample collection and processing information will be recorded on the appropriate forms in SOP 2.08 (Core Collection and Processing), which is provided in Attachment 1.

Sample labels will include project identification, sample identification, date/time, analysis to be performed, preservation requirements, if applicable, and sampler's initials. From the electronic database (or handwritten logbook), a chain-of-custody record will list all samples and requested analyses. Field logbooks and forms will be scanned daily (if possible) and saved electronically to the appropriate Anchor QEA internal project folder.

3.3.3 *Sample Custody—Overview*

To maintain and document sample custody, chain-of-custody procedures will be strictly followed. A sample is considered to be under custody under the following conditions:

- It is in the custodian's possession or view.
- It is in a secured location (under lock) with restricted access.
- It is in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s).

By this definition, Anchor QEA field crew collecting the samples are responsible for care and custody of the sample until it is transferred to the shipping company (further described in Section 3.3.4).

3.3.4 Chain-of-Custody Records

Chain-of-custody records will be used to track all samples from the time of sampling to the arrival of samples at the laboratory and to final sample disposition. Each chain-of-custody form will be produced using an electronic database (or handwritten logbook). Every container being shipped, delivered, or picked up by the laboratory will contain a chain-of-custody record. Field personnel will retain a signed and dated hard copy and scanned electronic copy of the chain-of-custody, whereas the original chain-of-custody and other copies (if necessary) are enclosed in a waterproof enclosure within each shipping container. The laboratory, upon receiving the samples, will sign the original chain-of-custody and retain it in the project file.

When transferring the possession of samples, the individuals relinquishing and receiving will sign, print their name, date, and note the time on the record. This record documents the transfer of samples from the custody of the sampler to that of another person, or the laboratory. Packaged samples will be accompanied by the chain-of-custody record, which identifies the contents. The sampler will retain a copy for the project file.

When applicable, the shipper's tracking number will be written on the chain-of-custody record retained by the field personnel. The Anchor QEA Project Manager is responsible for consistency of records and inclusion in the permanent project file.

3.3.5 Sampling and Packaging Procedures

Samples shipped to the laboratories will be packaged in compliance with current U.S. Department of Transportation regulations to avoid breakage or contamination. All sample caps will be tightened, and the exterior of all sample containers wiped down. In preparation for shipment to the laboratories, all samples will be packaged in accordance with the SOP 7.08 (Sample Shipping and Handling), provided in Attachment 1.

3.3.6 Sample Shipping Procedures

All samples will be shipped from the field to the appropriate laboratory for analysis, or a laboratory-provided courier will transport the samples. Table 3-2 provides the name of each laboratory, their address, and analysis type.

The following transfer of custody and shipment procedures will be followed:

- Samples will be accompanied by a completed, electronic-generated or handwritten chain-of-custody record. The sample IDs will be listed on the chain-of-custody record. When transferring the possession of samples, the individuals relinquishing (field team) and receiving

(laboratory personnel) will sign and record the date and time on the record. This record documents transfer of custody of samples from the sampler to another person, to the laboratory, or to/from a secure storage area.

- Samples will be properly packaged for overnight shipment or same-day courier collection and dispatched to the laboratory for analysis, with a separate signed chain-of-custody record enclosed in each sample box or cooler. If the cooler is being shipped to the laboratory, it will be secured shut with clear packing tape over signed and dated custody seals to prevent tampering.
- All shipments will be accompanied by the chain-of-custody record identifying the contents.

3.3.7 Laboratory Chain-of-Custody Procedures

The laboratory chain-of-custody procedures and document control will be carried out according to the laboratory procedures detailed in each laboratory's QA manual and SOPs. The laboratory representative who accepts the incoming sample shipment will sign and date the chain-of-custody record to acknowledge receipt of the samples. Once the sample transfer process is complete, the laboratory is responsible for maintaining internal logbooks and records that provide a custody record throughout sample preparation and analysis.

If more than one laboratory handles the samples, custody of the samples is maintained between laboratory sample management personnel. Within each laboratory, the analysts will maintain custody of the sample while the analysis is being performed.

3.4 Laboratory Analyses Methods Requirements

Analyses will be performed following the methods identified in Table 2-1. Detailed descriptions of the procedures, including laboratory QA/QC provisions, can be found in the laboratory SOPs (Attachment 1).

3.5 Quality Control Requirements

QC is defined as the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the established requirements. This section of the FSP/QAPP identifies the QC procedures and checks that will be used during the project to monitor the quality of various aspects of the sampling.

3.5.1 Field Quality Control Checks

Conducting the multi-beam bathymetric survey in accordance with applicable USACE guidance manuals and standards will provide sufficient quality for the design effort.¹ QC during the VSTs will

¹ This guidance includes the USACE Hydrographic Surveying manual standards (USACE 2013), which identifies the appropriate QC measures and checks during the survey work to mitigate opportunities for data quality issues. The surveys will be supervised by the National Society of Professional Surveyors, Hydrographic Society of America, Certified Hydrographer.

be established via the QA/QC measures identified in SOP 1.08 (Vane Shear Testing) in Attachment 1. QC during sample collecting and processing will be established via the QA/QC measures identified in the field-related SOPs in Attachment 1.

Field QC checks are used to assess reliability, repeatability, and statistical confidence of the data that are collected. They are designed to determine what effects activities such as sample collection, bottling, shipping, and storage have on sample integrity and that samples available for analysis in the laboratory are representative of actual site conditions. To accomplish this, an audit of field activities will occur at least once during the field investigation to ensure work is being conducted as described in the Work Plan and associated SOPs. The Field Audit Checklist template is provided in Attachment 2.

3.5.2 *Laboratory Quality Control Checks*

Internal laboratory QC procedures for the sample analyses are specified in the laboratory methods, as well as their respective laboratory SOPs in Attachment 1.

As further described in SOPs 1.02 (Jar Testing), 1.01 (Geotextile Tube Dewatering Test), and 1.03 (Stabilization Testing) in Attachment 1, QC checks to be performed by EGL during the dewatering treatability study will include the following:

- Duplicate sample to calculate reproducibility
- Method blank to assess if any analytical background contaminants are introduced during the procedure
- Temperature blank to ensure that samples are maintained at an appropriate temperature (i.e., ~4°C) during shipping

Geotechnical analyses will be performed by GTX consistent with published method standards and laboratory SOPs, including all method-required QC checks.

3.6 Instrument/Equipment Preventive Maintenance

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

3.6.1 *Field Instruments/Equipment and Calibration*

In accordance with the QA program, Anchor QEA and its subconsultants shall maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and previous experience with the equipment.

The Anchor QEA FTL will be responsible for the preparation, documentation, and implementation of the preventive maintenance program. The equipment maintenance information will be documented

on the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in the manufacturer's instruction manuals.

Field maintenance records will be verified prior to the field event. The Anchor QEA FTL will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field. For this project, maintenance inspections will include the following activities:

- The responsible party for navigation will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system. They will also abide by GLLA reporting standards (EPA 2020).
- The winch line, as well as sediment samplers, will be inspected daily for fraying, misalignment, loose connections, and any other applicable mechanical problems.
- The photoionization detector will be calibrated to manufacturer requirements.
- Field equipment associated with survey requirements will be calibrated to manufacturer requirements.

Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

3.6.2 Laboratory Instruments

In accordance with the QA program, each laboratory shall maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. The Laboratory Project Managers or designee shall be responsible for verifying compliance, as necessary. The laboratory preventative maintenance program is organized to maintain proper instrument and equipment performance and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Maintenance records will be checked according to the schedule on an annual basis and recorded by laboratory personnel.

Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure it is in proper operational condition. The Anchor QEA Project QA/QC Manager will be

promptly notified in writing if defective equipment casts doubt on the validity of laboratory data. The Anchor QEA Project QA/QC Manager will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding or turnaround times.

3.6.2.1 Laboratory Instrument/Equipment Calibration

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (e.g., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirement.

The Laboratory Project Managers will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program will be the responsibility of the respective laboratory group supervisors. Recognized procedures (EPA, ASTM, Standard Method, or manufacturer's instructions) will be used.

Physical standards (i.e., weights or certified thermometers) will be traceable to nationally recognized standards such as the National Institute of Standards and Technology.

The calibration requirements for each method and respective corrective actions will be accessible, either in the laboratory SOPs or in the laboratory's QA Plan for each instrument or laboratory method in use. All calibrations will be preserved on electronic media.

3.7 Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables that may directly or indirectly affect the quality of the project must be clearly identified and documented by field personnel. Typical examples of supplies and consumables include sample containers and sample collection and processing equipment.

Acceptance criteria must be consistent with overall project technical and quality criteria. If there are special requirements for supplies or consumables, a clear agreement should be established with the supplier (e.g., concentration of calibration gas).

Anchor QEA will provide appropriate supplies for homogenizing samples prior to filling the sample container, as required and described in SOP 2.08 (Core Collection and Processing), provided in Attachment 1.

3.8 Data Acquisition Requirements for Non-Direct Measurements

For this project, Anchor QEA and its subconsultants may acquire data from non-direct measurements (e.g., field observations during sample collection). In these instances, photographic documentation or field data sheets may be used to record the data.

Field observations are standard practice for many types of investigations. These data are used in a weight-of-evidence approach to substantiate direct measurement data. However, these data are generally not used as the only source for a decision point.

3.9 Data Management

Data management is a process for tracking data from generation in the field and/or laboratory to final use and storage. The progress of sample collection and processing will be monitored through the documentation of samples collected, processed, and shipped each day. Once the laboratories have provided final data to Anchor QEA, it will be recorded, assessed, tracked, and stored in Anchor QEA's cloud-hosted project-specific folders. Technical data, including field data and laboratory results, will be stored in project-specific folders. To certify the data are accurately recorded and stored, tracking systems will be implemented. The Anchor QEA Project QA/QC Manager and/or designee will conduct automated and manual QC checks to verify that data have been accurately recorded and appropriately stored. Corrective actions will be taken in the event that data have not been properly handled.

3.9.1 Field Measurements and Sample Collection

The field operating records to be used in this investigation will document field procedures and any measurements performed during the sampling effort. The Anchor QEA FTL will compile the field data and provide it to the Anchor QEA Project QA/QC Manager to review and upload to the project-specific network folder. Field data transferred from written records will be reviewed for accuracy and completeness. Field data (including photographs, forms, and logbooks) will be stored electronically in the project-specific network folders and/or in the paper project folders, along with supporting metadata such as author/creator of data, date, location, and a brief description. The Anchor QEA FTL and Anchor QEA Project QA/QC Manager will be responsible for the storage of field data files, either stored electronically in the project-specific network folders or in the paper project folders.

3.9.2 Laboratory Reporting and Recordkeeping

The laboratories will prepare and submit data packages to the Anchor QEA Project QA/QC Manager. GTX will transmit the laboratory data package(s) in PDF format. EGL will provide treatability test results in both PDF (treatability study report) and Excel format (raw data). All laboratory reports will be stored electronically in the project-specific network folders.

Laboratory data results received from GTX will be checked for completeness by comparing them to the chain-of-custody documentation and the workplans.

Each laboratory data package will include the following (as applicable):

- Cover letter

- Case narrative, including (as applicable) statement of samples received, description of any deviations from standard procedures, explanation of qualifications regarding data quality, and any other significant problems encountered during analysis
- Summary of sample results that will include the following information when applicable:
 - Field sample identification code and the corresponding laboratory identification code
 - Sample matrix
 - Date of sample preparation/extraction
 - Date and time of analysis
 - Mass or volume used for preparation and analysis
 - Identification of the instrument used for analysis
- Calibration data summary, where applicable
- Original data, including (where applicable)
 - Sample extraction, preparation, and cleanup logs
 - Instrument run logs
 - Instrument tunes
 - Quantitation reports
- Field and laboratory chain-of-custody documentation pertaining to each sample delivery group analyzed

The Laboratory Project Managers or appropriate personnel assigned by the Laboratory Project Managers will confirm the following: documentation is complete and legible, calculations are accurate, results are expressed in the appropriate units and number of significant figures, and the required QC checks were run and met acceptance criteria. All pages in the data packages will be consecutively numbered. Review and approval of the data will be documented by the Laboratory Project Managers.

4 Assessment and Oversight

This section details the procedures used for implementation of this FSP/QAPP.

4.1 Assessment and Response Actions

After data are received, QC procedures will be followed to evaluate data quality. The Anchor QEA QA/QC Manager will review the laboratory report to confirm it contains a detailed case narrative, sample results, and signed chain-of-custody forms. This review will also verify the correct methods and analytes reported for all sample results.

4.2 Compliance Assessments

Performance audits consist of reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory performance audits will not be conducted; however, laboratory audit reports will be made available to the Anchor QEA Project QA/QC Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. The laboratory must ensure that personnel engaged in preparation and analysis tasks have appropriate training. As part of the audit process, the laboratory will provide written details of any method modifications planned for the consultant's review.

4.3 Response and Corrective Actions

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or non-conformance of protocols identified in this document.

4.3.1 *Field Activities*

The Anchor QEA FTL or a designated qualified member of the field team will be responsible for correcting equipment malfunctions during the field sampling effort. The Anchor QEA Project QA/QC Manager will be responsible for resolving situations identified by Anchor QEA FTL that may result in non-compliance with this FSP/QAPP. Corrective measures will be documented in the field logbook and reported to the EPA GLLA QA Team Member and Project Manager (Figure 1-1).

4.3.2 *Laboratories*

GTX and EGL are required to comply with method standards and/or their laboratory SOPs (Attachment 1). The Laboratory Project Managers (Figure 1-1) will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this FSP/QAPP. GTX and EGL personnel will be responsible for reporting problems that may compromise the quality of the data.

4.4 Reports to Management

QA reports to management include verbal status reports and final laboratory reports. These reports shall be the responsibility of the Anchor QEA Project QA/QC Manager. Verbal status reports include updates from the Anchor QEA Project QA/QC Manager to the Anchor QEA Project Manager or designee on laboratory reporting progress and any issues that may require follow up. Updates will be given as needed in routinely scheduled project meetings.

The field activities and data will be documented as described in the Work Plan and the field SOPs in Attachment 1. The laboratory-based activities and results will be documented as described in the published methods and internal laboratory SOPs (Attachment 1).

The Anchor QEA Project Manager will be responsible for preparation of all other reports not listed above (e.g., FS) and will be approved as detailed on the project organizational chart shown in Figure 1-1.

5 Data Validation

The purpose of this section is to state the criteria for deciding the degree to which each dataset has met its quality specifications. Validation and verification procedures that will be conducted during sample collection and data generation are presented herein. Conformance to these procedures will certify the representativeness of the samples and that sample integrity is maintained from sample collection through analysis at the laboratories. Data generated by the laboratories will be submitted to Anchor QEA and assessed for completeness.

To document that project data quality standards are met, data verification and validation will consist of evaluating the completeness, correctness, and conformance or contractual compliance of a dataset against the method standard, SOP, or contract requirements documented in the project FSP/QAPP.

Additionally, Anchor QEA will track the data packages generated for this project through the data validation process using a Validation Checklist (Attachment 3). The data packages that will be generated include the data packages generated by GTX.

5.1 Review, Validation, and Verification Requirements

Data generated during field and laboratory activities will be reviewed and validated prior to reporting.

5.1.1 Data Review

Fieldwork, including field measurements and sample collection activities, will be performed consistent with the SOPs (Attachment 1), and raw data will be appropriately recorded in the field logbook or tablet.

Laboratory methods to be followed in this investigation are listed in Table 2-1. For each of the methods, the Laboratory Project Managers will complete a thorough review of all reports prior to release of the data.

5.1.2 Data Validation

During the validation process, laboratory data packages will be evaluated for project, method, and laboratory QC compliance, as applicable, and their validity and applicability for program purposes will be determined. Data packages will be generated for laboratory data during this project.

Completeness will be evaluated by auditing the laboratory data package(s) for the following:

- Chain-of-custody records
- Technical holding times

- Required analyses methods
- Reporting format
- Appropriate supporting data
- Case narrative
- Completeness of results

5.2 Validation and Verification Methods

Anchor QEA will review pertinent sampling and laboratory documentation to determine to what degree data have met their quality requirements as presented in this FSP/QAPP. In coordination with the Anchor QEA FTL, data verification by the Anchor QEA Project QA/QC Manager will include the following:

- **Sampling design**—Check each sample for conformity to the specifications, including type and location.
- **Sample collection procedures**—Verify that sample collection procedures were performed in accordance with procedures presented in the Work Plan and this FSP/QAPP. Any deviations shall be documented in the field logbook.
- **Sample handling**—Verify that the samples were labeled, documented, and shipped properly in accordance with procedures presented in the Work Plan and this FSP/QAPP.
- **Analysis procedures**—Verify that each sample was analyzed by the methods specified in this FSP/QAPP, as required.
- **Calibration**—Verify that the calibration of field instruments was performed in accordance with the manufacturer specifications for the equipment.

Additionally, Anchor QEA will perform an EPA Stage 1 Validation (EPA 2009) on geotechnical data packages using the Validation Checklist (Attachment 3) for 100% of the samples. Validation will be accomplished by comparing the contents of the laboratory data packages to the requirements in this FSP/QAPP, the respective methods, and the laboratory SOPs (Attachment 1).

In the event that concerns are identified during data collection, review, verification, or validation processes, the Anchor QEA Project QA/QC Manager will work with the EPA GLLA Project Manager, EPA GLLA QA Team, and, if needed, the laboratories to develop an appropriate resolution.

Findings will be included in the FS prepared by Anchor QEA, including a Stage 1 Validation checklist and the final reports received from the geotechnical laboratories. The Anchor QEA Project Manager, after consultation with the Anchor QEA Project QA/QC Manager, will be responsible for any corrective action identified during the data validation process. Initiation of laboratory corrective actions will be the responsibility of Anchor QEA Project Manager and/or Anchor QEA Project QA/QC Manager.

6 References

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- EPA, 2020. *GLLA Data Reporting Standard, Attachment 2*. January 2020.
- EPA, 2023. *Quality Assurance Project Plan Standard*. EPA CIO 2105-S-02.1. August 2023.
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Tables

Table 1-1
Project Distribution and Contact List

QAPP Recipient	Title	Organization	Telephone Number	Email Address
Kali Denis	EPA GLLA Project Manager	EPA GLNPO	312.886.6746	denis.kali@epa.gov
Amber Falkner	EPA GLLA QA Team Member	EPA GLNPO	312.886.0217	falkner.amber@epa.gov
Ben McPherson	Project Coordination Team Technical Review	NYSDEC	716.851.7220	benjamin.mcpherson@dec.ny.gov
Paul Schroeder	Project Coordination Team Technical Review	USACE ERDC	601.634.3709	paul.r.schroeder@usace.army.mil
Clint Babcock	Non-Federal Sponsor	Glenn Springs Holdings	972.687.7506	clint_babcock@oxy.com
Clay Patmont	Anchor QEA Program Manager	Anchor QEA	206.300.1543	cpatmont@anchorqea.com
Justin Drehs	Anchor QEA Project Manager	Anchor QEA	315.883.8921	jdrehs@anchorqea.com
Jim Ryan	Anchor QEA Field Team Leader	Anchor QEA	315.414.2022	jryan@anchorqea.com
Cameron George	Anchor QEA Data Validator	Anchor QEA	410.794.7780	cgeorge@anchorqea.com
Lydia Greaves	Anchor QEA Project QC Manager	Anchor QEA	206.903.3383	lgreaves@anchorqea.com
Tim Shaner	Anchor QEA Field Safety Manager	Anchor QEA	251.375.5282	tshaner@anchorqea.com
Masa Kanematsu	Treatability Testing Laboratory Project Manager	Anchor QEA (EGL)	503.972.5001	mkanematsu@anchorqea.com
Joseph Tomei	Geotechnical Laboratory Project Manager	GeoTesting Express	978.893.1241	jtomei@geotesting.com

Notes:

EGL: Anchor QEA's Environmental Geochemistry Laboratory in Portland, Oregon

EPA: U.S. Environmental Protection Agency

ERDC: Engineer Research and Development Center

GLLA: Great Lakes Legacy Act

GLNPO: Great Lakes National Program Office

NYSDEC: New York State Department of Environmental Conservation

QA: quality assurance

QC: quality control

USACE: United States Army Corps of Engineers

Table 2-1
Sediment Geotechnical Parameters and Methods

Parameter	Analytical Method
Grain size	ASTM D6913
USCS Classification	ASTM D2487
Atterberg Limits	ASTM D4318
Moisture Content	ASTM D2216
Specific Gravity	ASTM D854
Paint Filter Test	EPA SW 846 Method 9095
Turbidity	Standard Method 2130B
Total Suspended Solids	Standard Method 2540D
pH	EPA SW 846 Method 9045C
Penetrometer Strength	ASTM WK27337

Notes:

ASTM: ASTM International

EPA: U.S. Environmental Protection Agency

USCS: Unified Soil Classification System

Table 3-1
Sample Containers, Holding Times, and Preservation

Parameter	Container Size and Type ¹	Holding Time	Sample Preservation Technique
Grain size	Quarter-gallon zip-top plastic bag	None	None
USCS Classification		None	None
Atterberg Limits		None	None
Moisture Content		None	None
Jar Testing	SW: 5- to 10- gallon carboy SE: 2.5-gallon screw-top bucket	None	None
Dewatering Tests		None	None
Stabilization Tests		None	None
Specific Gravity	EGL containers ³	None	None
Paint Filter Test		None	None
Turbidity		None	None
TSS		7 days	Cool, <4°C
pH		As soon as possible	Cool, <4°C
Penetrometer Strength		None	None

Notes:

1. Sample containers may vary based on laboratory requirements.
2. Analytical methods are included in Table 2-1.
3. These tests will be done on samples generated at EGL and containers will not be needed in the field.

EGL: Environmental Geochemistry Lab

SW: Surface Water

SE: Sediment

TSS: Total Suspended Solids

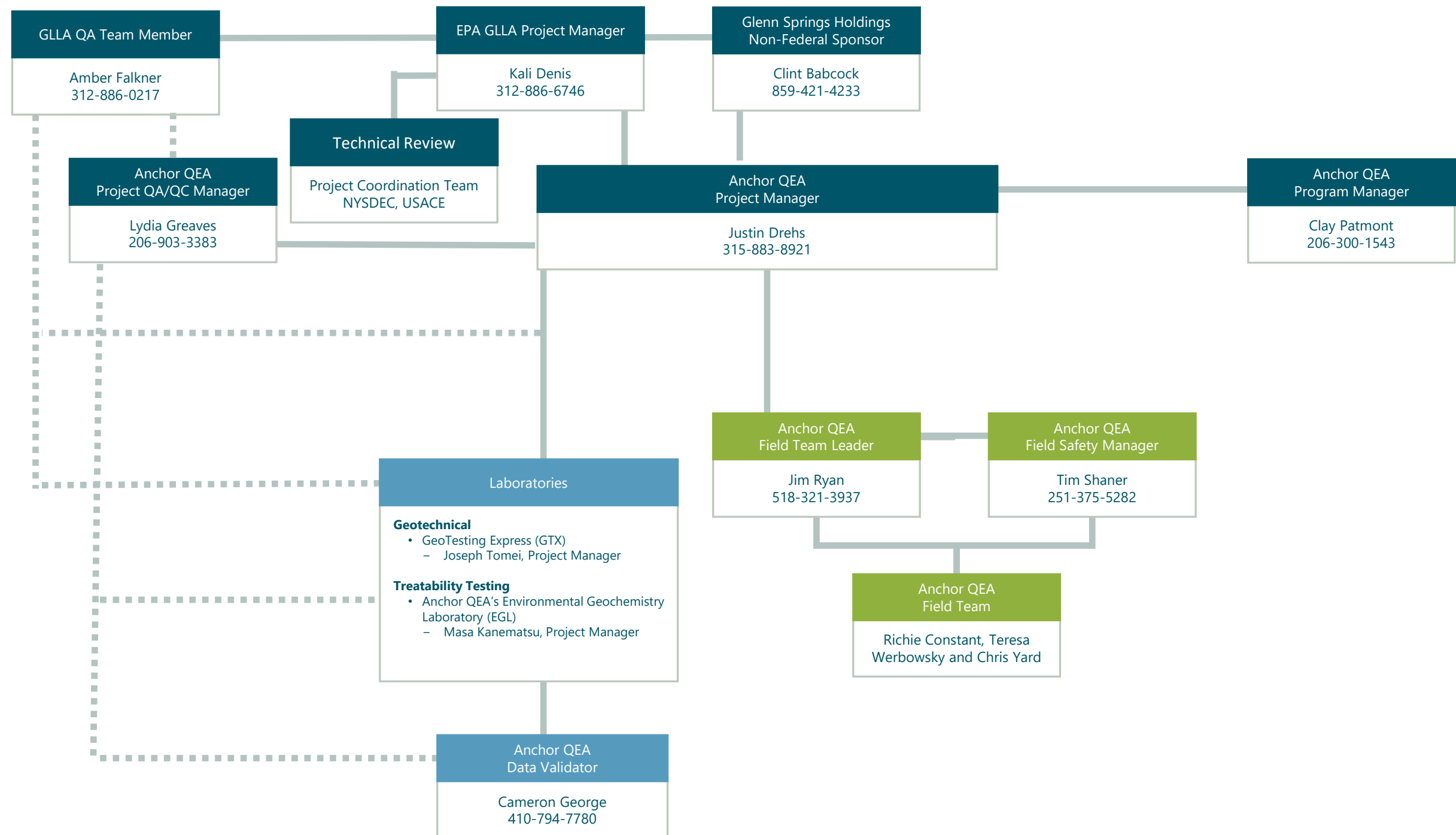
Table 3-2
Laboratory Addresses by Analysis Type

Laboratory	Laboratory Address	Sample Type	Analysis
GeoTesting Express	GeoTesting Express, LLC Attn: Sample Receiving 125 Nagog Park Acton, MA 01720	Sediment	USCS Classification, Grain Size, Moisture Content, and Atterberg Limits
Anchor QEA's Environmental Geochemistry Laboratory	Environmental Geochemistry Laboratory Attn: Masa Kanematsu (EGL Sample Receiving) 6720 South Macadam Ave., Suite 300 Portland, OR 97219	Sediment/Water Mixture	Jar Testing
			<u>Geotextile Dewatering Tests</u> Filter Cake - Moisture Content, Specific Gravity, and Paint Filter Test Filtrate Water - Turbidity and Total Suspended Solids
			<u>Stabilization Tests</u> Untreated Sediment - Moisture Content, specific gravity, pH, Paint Filter Test, grain size distribution, and Penetrometer Strength Treated Sediment - Moisture Content, pH, Paint Filter Test, and Penetrometer Strength

Note:

USCS: Unified Soil Classification System

Figure



■ ■ ■ ■ Indicates an indirect chain-of-command
 — Indicates a direct chain-of-command

Attachment 1

Standard Operating Procedures

Laboratory SOPs

Standard Operating Procedure 1.01 – Sediment Slurry Dewatering Jar Test

Standard Operating Procedure 1.01 – Sediment Slurry Dewatering Jar Test

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	Masa Kanematsu		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for sediment slurry dewatering jar test.

This SOP describes the equipment, laboratory procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), other Environmental Geochemistry Laboratory SOPs and other project-specific SOPs.

Scope and Application

This Environmental Geochemistry Laboratory (EGL) SOP is applicable to the process of bench-scale jar testing to select the best reagent for dewatering sediment slurry generated from hydraulic and mechanical dredge slurry transport. Substantive deviations from the procedures detailed in this SOP will be recorded in the laboratory's case narrative (or equivalent document).

Health and Safety

All laboratory work will be performed in accordance with the EGL Chemical Hygiene Plan (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Chemical Safety Data Sheets

The following SDSs must be reviewed prior to beginning the procedure:

- Dewatering reagents obtained from suppliers (e.g., WaterSolve, SNF)

Hazards Associated with this Standard Operating Procedure

(Note that this information is summarized in Table A.)

- Ingestion or inhalation of contaminants, chemicals, or fine particles, or skin or eye contact with contaminants or chemicals
- Breakage of glassware

Engineering Controls

- Perform work inside an operational fume hood

Administrative Controls

- Review CHP

- Review the Chemical Safety Data Sheets (SDSs)
- Review project safety analysis (PSA)
- Carry glassware with two hands
- Inspect glassware and PPE prior to use
- Place spill mats and plastic sheets to cover workspace (Step 1 of sample preparation procedure below)

Personal Protective Equipment

- Laboratory coat
- Safety goggles
- Nitrile gloves (Ansell TouchNTuff® 92-600 nitrile gloves)
- Disposable shoe cover (when handling a large volume of sediment)
- Disposable laboratory coat (to wear over a laboratory coat when handling a large volume of sediment)

Inspection Requirements

- Inspect PPE prior to use

Equipment and Supplies

The following is a list of equipment and supplies necessary to carry out the procedures contained in this SOP. Additional equipment may be required, depending on conditions.

- Balance
- Plastic sheet
- Spill mat
- Large mylar bag (18" × 24" or larger)
- Hand-held paddle mixer
- Plastic scoop
- 5-gallon plastic bucket with lid
- Aluminum weighing dishes
- Oven
- Bench-top scale
- Precision balance
- Stainless steel spatulas
- liter plastic graduated cylinder
- 100-milliliter graduated cylinder
- 100-milliliter volumetric flask
- Fume hood
- Bench guard

- 125-milliliter glass jars
- Dewatering reagents (emulsion)
- 500-milliliter or 1-liter plastic bottles
- 10-mL micropipette and disposable pipette tips

Procedure

Sediment Slurry Sample Preparation

1. Cover workspace with plastic sheets and spill mats.
2. Place a bucket containing a sediment sample in a large mylar bag. Only perform sediment mixing in the large mylar bag to prevent spillage.
3. Thoroughly homogenize the sediment sample using a hand-held paddle mixer.
4. Dry a representative subsample (approximately 20 g) in an aluminum weighing dish in the oven at 110°C overnight to obtain initial moisture content in accordance with the Moisture Content SOP (Anchor QEA, 2018).
5. Create a slurry for the hydraulic dredge slurry transport approach and/or the mechanical dredge and hopper transport, as specified in the planning documents (*for this work, only the hydraulic dredge slurry transport approach is needed*). The approach is as follows:
 - a. For the hydraulic dredge slurry transport approach, mix a sediment sample and surface water in 125-milliliter glass jars to create a slurry at the prescribed solids content (e.g., 10% on a dry-weight basis).
 - b. For mechanical dredge and hopper transport approach, add surface water at the prescribed amount (e.g., 10% by volume) to a sediment sample in a 1-gallon bucket to raise the sediment water content (e.g., adding 100-mL of surface water to 1,000-mL of a sediment sample). Allow sediments to settle overnight, extract the mixture supernatant, and save for jar testing conditioning program below.

Dewatering Reagent Preparation

1. Dilute each dewatering emulsion product down to 0.5% to prepare the required volume of diluted emulsion solution. For example, mix 1 mL of the dewatering emulsion product with deionized water to prepare 200 mL of diluted solution.
2. Store the diluted emulsion solutions in plastic bottles for later use.

Jar Testing

1. Dispense 100 mL aliquots of the test sample (either sediment slurry to simulate hydraulic dredging or slurry supernatant to simulate mechanical dredging, as applicable) in multiple 125 mL glass jars.

2. Using a 10 mL micropipette, add a pre-determined volume (approximately 1-5 mL) of a different diluted emulsion solution to each glass jar.
 - a. Seal the glass jars and moderately tumble by hand 5 to 7 times.
 - b. After shaking, place jars on bench top and allow contents to settle.
3. Immediately after the shaking step above, observe the test samples for floc sedimentation rate, floc appearance (e.g., size and strength), and supernatant water clarity. Rate each parameter on a scale of 1-5 and identify the top-performing conditioning programs.

Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) samples are collected during the procedure. The QA/QC samples are described as follows:

- Duplicate samples should be prepared and analyzed at a project-appropriate rate, with at least one duplicate to check the reproducibility.

Project Closeout

Residual sediment slurry should not enter drains until a waste determination has been performed. Lab personnel and project managers will coordinate to characterize and dispose of the remaining materials from the experiment if necessary. The final products can be disposed of as described in Table 1.

Table 1
Items for Disposal

Products for Disposal	Disposal Procedure
Supernatant from the mixing jars	Collect the supernatant from the mixing jars, treat it with granular activated carbon (for trace organics) or iron oxide materials (for trace metals), as appropriate. After confirming the concentrations of the contaminants of interest meet the requirements for drain disposal, dispose of the treated supernatant by pouring it down the drain.
Remaining diluted dewatering reagents	Pour down the drain with tap water running.

References

Anchor QEA Environmental Geochemistry Laboratory Standard Operating Procedure: #201 Moisture Content (revised 2018).

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Standard Operating Procedure 1.02 – Geotextile Tube Dewatering Test

Standard Operating Procedure 1.02 – Geotextile Tube Dewatering Test

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	Masa Kanematsu		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for geotextile tube dewatering test.

This SOP describes the equipment, laboratory procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), other Environmental Geochemistry Laboratory SOPs and other project-specific SOPs.

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to the passive dewatering of sediment slurry using a pillow-shaped permeable geotextile bag (ASTM 2013). Substantive deviations from the procedures detailed in this SOP will be recorded in the laboratory's case narrative (or equivalent document).

Health and Safety

All laboratory work will be performed in accordance with the EGL Chemical Hygiene Plan (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Chemical Safety Data Sheets

The following SDSs must be reviewed prior to beginning the procedure:

- Coagulation/flocculation reagent (provided by suppliers)

Hazards Associated with this Standard Operating Procedure

- Ingestion or inhalation of contaminants, chemicals, or fine particles, or skin or eye contact with contaminants or chemicals

Engineering Controls

- Use an operational fume hood when handling dry samples and chemicals to avoid ingestion, inhalation, or eye contact
- Operate the oven inside of an operational fume hood

Administrative Controls

- Review CHP

- Refer to the Chemical Safety Data Sheets (SDSs)
- Review project safety analysis (PSA) if additional personal protective equipment (PPE) may be required
- Place spill mats, plastic sheets, and spill containment pallet to cover workspace
- Use plastic bags to contain sediment slurry spill from a bucket
- Inspect PPE prior to use

Personal Protective Equipment

- Laboratory coat
- Safety goggles
- Nitrile gloves (Ansell TouchNTuff® 92-600 nitrile gloves)
- Disposable shoe cover
- Disposable laboratory coat (to wear over a laboratory coat)

Inspection Requirements

- Inspect PPE prior to use

Equipment and Supplies

The following is a list of equipment and supplies necessary to carry out the procedures contained in this SOP. Additional equipment may be required, depending on conditions.

- 1 cubic foot capacity "pillow-sized" geotextile tube bag (available from Solmax)
- Clear polyvinyl chloride (PVC) stand pipe (2" inner diameter, ~40" length)
- Wide-mouth plastic funnel
- Spill containment pallet
- Bench-top stand and clamps
- Plastic sheet
- Spill mat
- Large plastic or Mylar zip bag (18" x 24" or larger)
- Hand-held paddle mixer
- Plastic scoop
- 5-gallon plastic buckets with lid
- 1-liter plastic graduated cylinder
- 1-liter volumetric flask
- 1-liter plastic bottle
- 1-gallon plastic buckets
- Fume hood
- Bench guard
- Aluminum weighing dishes

- Oven
- Bench-top scale
- Precision balance
- Stainless steel spatula
- 4-ounce glass jar

Procedure

Sediment Slurry Preparation

1. Wear the PPE listed above including disposable shoe covers and disposable laboratory coat (to wear on a laboratory coat).
2. Cover workspace with plastic sheets and spill mats.
3. Place a spill containment pallet on the plastic sheets and spill mats.
4. Place a 5-gallon bucket containing a sediment sample in a large plastic bag on the spill containment pallet. Sediment mixing will be performed in the large plastic bag to prevent spillage.
5. Thoroughly homogenize the sediment sample using a hand-held paddle mixer.
6. Take a subsample of the sediment and surface water to generate 55 to 95-liters (i.e., 15 to 25 gallons) of a sediment slurry at the prescribed solids content (e.g., 10% on a dry-weight basis) in a 5-gallon plastic bucket. The moisture content of the sediment shall be determined following other EGL SOPs.
7. Thoroughly homogenize the sediment slurry prepared using a hand-held paddle mixer.
8. Add a dewatering reagent (diluted dewatering emulsion product down to 0.5% by weight) to the sediment slurry and thoroughly mix using a hand-held paddle mixer and settle for 1 hour.

Geotextile Tube Dewatering Testing

1. Wear the PPE listed above including disposable shoe cover and disposable laboratory coat (to wear on a laboratory coat).
2. Soak a geotextile tube bag in prefiltered surface water collected from a study area until fabric is fully soaked and saturated. Do not use de-ionized water or water from any other source.
3. Cover workspace with plastic sheets and spill mats.
4. Assemble the geotextile tube apparatus as shown in Figure 1. Make sure bench-top or stand on which the geotextile tube bag is placed on top of is capable of safely holding 50 pounds.
5. Pour the conditioned sediment slurry into the geotextile tube through a funnel to the PVC connector and allow the material to passively dewater. **Caution:** The PVC pipe should be lifted off the bottom of the geotextile tube bag by a bench-top stand and clamps; otherwise, the introduced slurry may back up in the PVC pipe and overflow. Fill the geotextile tube bag with sediment slurry as rapidly as possible until the sediment slurry rises in the PVC stand pipe.

6. Collect filtrate water (i.e., effluent) from the geotextile tube bag at the slurry dewatering process. Analyze the filtrate samples for project-specific parameters, which may include turbidity and total suspended solids).
7. At the sampling intervals of 0, 1, 12, 24, 48, and 196 hours (unless otherwise specified by the project), collect samples of the filter cake (solids retained within the geotextile tube bag) and perform the following analyses. Perform additional analyses, as specified in the project-specific work plan.
 - a. Moisture Content (ASTM D2216, EGL SOP #201)
 - b. Specific Gravity (ASTM D854, EGL SOP #704)
 - c. Paint Filter (EPA SW 846 Method 9095, EGL SOP #1008)

Figure 1
Example of Geotextile Tube Setup to Collect Filtrate



Source of left image: Infrastructure Alternatives, Inc.

Quality Assurance/Quality Control

Duplicate samples of filter cake and filtrate should be collected at a project-appropriate rate, with at least one duplicate to calculate the reproducibility.

Project Closeout

Residual sediment slurry should not enter drains until a waste determination has been performed. Lab personnel and project managers will coordinate to characterize and dispose of the remaining materials from the experiment if necessary. The final products can be disposed of as described in Table 1.

Table 1
Items for Disposal

Products for Disposal	Disposal Procedure
Remaining filtrate water	Treat the remaining filtrate water with activated carbons (for trace organics) or iron oxides (for trace metals), confirm that contaminant concentrations meet requirements for drain disposal prior to pouring down the drain.
Residual filter cake	Dispose of the filter cake after confirming that it passes the Paint Filter Liquids Test and that, if applicable, the concentrations of the contaminants of concern meet the applicable disposal requirements.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

ASTM (ASTM International), 2013. *ASTM D7880/D7880M-13, Standard Test Method for Determining Flow Rate of Water and Suspended Solids Retention from a Closed Geosynthetic Bag*. West Conshohocken, PA: ASTM International.

J.F. Brennan Company, Inc. "Treatability Testing of Dredged Materials: Brennan." *J.F. Brennan Company, Inc.*

Standard Operating Procedure 1.03 – Sediment Dewatering and Stabilization Test

Standard Operating Procedure 1.03 – Sediment Dewatering and Stabilization Test

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01

Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	Masa Kanematsu		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for sediment dewatering stabilization test.

This SOP describes the equipment, laboratory procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), other Environmental Geochemistry Laboratory SOPs and other project-specific SOPs.

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to the evaluation of various dewatering amendments in sediment mixtures to identify the most effective dewatering amendment(s) for stabilization and determine the appropriate dosage. Substantive deviations from the procedures detailed in this SOP will be recorded in the laboratory's case narrative (or equivalent document).

Health and Safety

All laboratory work will be performed in accordance with the EGL Chemical Hygiene Plan (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Chemical Safety Data Sheets

The following SDSs must be reviewed prior to beginning the procedure:

- Cementitious reagents (the reagents used may vary depending on the project; refer to the project-specific planning documents)
 - Portland Cement I
 - Quick Lime
 - Calciment (Mintek Resources)
 - EnviroBlend 90/10 CS (Premier Magnesia, LLC)

Hazards Associated with this Standard Operating Procedure

- Ingestion or inhalation of contaminants, chemicals, cement, or fine particles, or skin or eye contact with contaminants, cement, or chemicals

Engineering Controls

- Use an operational fume hood when handling cement and dewatered or dried sediments
- Operate the oven inside of an operational fume hood

Administrative Controls

- Review CHP
- Refer to the Chemical Safety Data Sheets (SDSs) section herein
- Review project safety analysis (PSA)
- Inspect PPE prior to use
- Place spill mats and plastic sheets to cover workspace

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell TouchNTuff® 92-600 nitrile gloves)
- Disposable shoe cover (when handling a large volume of sediment)
- Disposable laboratory coat (to wear over a laboratory coat when handling a large volume of sediment)

Inspection Requirements

- Inspect PPE prior to use

Equipment and Supplies

The following is a list of equipment and supplies necessary to carry out the procedures contained in this SOP. Additional equipment may be required, depending on conditions.

- Precision balance
- Plastic sheet
- Spill mat
- Large plastic zip bag (18" × 24" or larger)
- Hand-held paddle mixer
- Plastic or stainless-steel scoop
- 5-gallon plastic bucket with lid
- Stainless steel spatulas
- Aluminum weighing dishes
- Oven
- Bench-top scale
- Stainless steel bowl

- Fume hood
- Bench guard
- 1-liter plastic graduated cylinder
- 1-gallon plastic bucket with lid
- 2 x 4 inch plastic cylinder molds
- Cement amendments
- EPA pre-cleaned 1-liter jars

Procedure

Sediment Dewatering and Stabilization Testing

1. Wear the PPE listed above
2. Cover workspace with plastic sheets and spill mats
3. Prepare test samples in project-specified manner. For mechanical dredge and hopper transport approach, add surface water at the prescribed amount (e.g., 10% by volume) to a sediment sample in a 1-gallon bucket to raise the sediment water content (e.g., adding 100-mL of surface water to 1000-mL of a sediment sample).
4. Thoroughly homogenize bulk sediments using a handheld paddle mixer.
5. Allow sediments to settle overnight, extract the supernatant, and save for jar testing conditioning program if desired.
6. After removal of remaining supernatant, thoroughly homogenize bulk sediments using a handheld paddle mixer.
7. Prior to mixing samples with amendments, analyze the homogenized sediments to establish baseline conditions, including the following parameters (the analyses performed may vary depending on the project, see project-specific planning documents):
 - a. Grain size (ASTM D6913)
 - b. Moisture content (ASTM D2216)
 - c. Paint filter (EPA SW 846 Method 9095)
 - d. pH (EPA SW 846 Method 9045C)
 - e. Strength by pocket penetrometer (ASTM WK27337)
 - f. Toxicity Characteristic Leaching Procedure (TCLP)
8. Transfer the homogenized sediment into separate containers for each amendment treatment. The volume of sediment should be sufficient to fill multiple 2 × 4-inch plastic cylinder molds designated for the different analyses described below.
9. Mix an amendment into each subsample at a specific dosage using a hand-held paddle mixer.
10. Perform the following analyses on the cured materials in the 2 × 4-inch plastic cylinder molds at time intervals specified in the project-specific planning documents (e.g., 0, 1, 2, and 3 days).
Perform additional analyses, as specified in the project-specific work plan:

- a. Percent solids (Standard Method 2540G)
- b. Moisture content (ASTM D2216)
- c. Paint filter (EPA SW 846 Method 9095)
- d. pH (PA SW 846 Method 9045C)
- e. Strength by pocket penetrometer (ASTM WK27337)

Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) samples are collected during the procedure. The QA/QC samples are described as follows:

- **Replicate samples:** Duplicate or replicate samples should be prepared and analyzed at a project-appropriate rate, with at least one duplicate to calculate the reproducibility. The reproducibility is determined for duplicate samples as shown in Equation 1.
- **Temperature blank:** A temperature blank will be prepared to ensure that samples are maintained at an appropriate temperature (i.e., ~4°C) during shipping to the analytical laboratory.

Equation 1

$$RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2) \div 2}$$

where:

RPD = relative percent difference
 X_1 = larger result value
 X_2 = smaller result value

Project Closeout

Residual sediment slurry should not enter drains until a waste determination has been performed. Laboratory personnel and project managers will coordinate to characterize and dispose of the remaining materials from the experiment if necessary. The final products can be disposed of as described in Table 1.

Table 1
Items for Disposal

Items for Disposal	Disposal Procedure
Remaining homogenized bulk sediment and filter cake	Dewater remaining bulk sediment with 5% amendment, then dispose in the trash.

References

- ASTM International. 2024. ASTM D6913/D6913M-24, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis. ASTM International, West Conshohocken, Pennsylvania.
- ASTM International. 2024. ASTM D2216-24, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. West Conshohocken, PA: ASTM International.
- U.S. Environmental Protection Agency (EPA). 1996. *Method 9095, Paint Filter Liquids Test*. In *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*. Office of Resource Conservation and Recovery, Washington, DC.
- U.S. Environmental Protection Agency (EPA). 1995. Method 9045C: Soil and Waste pH. In *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*. Washington, DC.
- ASTM International. WK27337. *New Test Method for Pocket Penetrometer Test*. ASTM International, West Conshohocken, PA.
- Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Field SOPs

Standard Operating Procedure 1.08 – Vane Shear Testing

Standard Operating Procedure 1.08 – Vane Shear Testing

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for vane shear testing in sediments. Vane shear testing will be conducted to measure the in situ undrained shear strength of the sediments (ASTM D2573-01 Standard Test Method for Field Vane Shear Test in Cohesive Soil). This method is appropriate for clay, silt, and other fine-grained materials. This method is not appropriate for sand, gravel, or other highly permeable materials that may partially drain during the tests. The vane shear tests will be conducted with a RocTest Model M-3 Field Inspection Vane Tester or equivalent.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to vane shear testing. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project Health and Safety Plan (HASP). The HASP will be followed during all activities conducted by Anchor QEA staff.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)
- Vane Shear Test Logs
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Sampling vessel (unless wading) and necessary GPS navigation and communication equipment
- Approved project-specific planning documents and HASP
- Appropriate personal protective equipment (PPE) and clothing as defined in the HASP
- Vane shear apparatus (RocTest Model M-3 Field Inspection Vane Tester or equivalent) with torque-reading head, extension rods, blade vanes of varying size, and slip coupling
- Hand tools and supplies (e.g., rubber mallet, hammer, pipe wrenches, clamps, weighted measuring tape)
- Blank vane shear test logs

Pre-Testing Procedures

Pre-testing activities will be completed prior to commencing vane shear testing and include the following:

- Review the HASP for potential hazards, appropriate PPE, and safety meetings to be conducted prior to and during collection.
- Check weather conditions prior to leaving the dock and throughout the day for changing conditions.

Vane Shear Testing Procedures

Vane shear tests will be conducted from a vessel or by wading in the water. The following methods will be used to conduct the vane shear tests:

1. Use a minimum of a two-person crew to operate the vane shear test apparatus and vessel (where necessary to access the testing location).
2. Assemble the Model M-3 Field Inspection Vane Tester or equivalent. The vane shear apparatus consists of a torque-recording head, boring rods, a slip coupling, and a vane. The vane will be selected based on the type of sediment expected (a large vane for soft sediment ranging to a small vane for stiff sediment; a “dummy” vane is used to test the internal resistance in the boring

rods). Select the largest vane (based upon the “dummy” vane) that can be advanced based on field conditions.

3. Measure the depth from a reference point (e.g., the water surface) to the top of the sediment using a weighted tape.
4. Insert or push the vane shear test apparatus into the sediment to the depth of the soft sediment to be tested. Do not rotate the apparatus during insertion. Blows, vibration, and rotation used to advance the vane may affect the measurements. Avoid pounding or vibrating in the vane. Use a direct push.
5. Verify that the recording head is set to zero.
6. Rotate the vane shear apparatus clockwise, holding only the handle of the apparatus. Rotate the apparatus as slowly as feasible while maintaining a constant rate of rotation.
7. Note any resistance during the initial rotation until the slip coupling engages. This value is the resistance of rods. Alternately, measure the rod resistance using the dummy vane.
8. Continue rotating the vane shear torque head until the sediment in the formation fails. Failure is indicated when the rods and vane turn at the same rate as the head or resistance decreases. Continue to hold the head steady and allow the torque in the tool to be dissipated at the vane end of the apparatus.
9. Record the maximum torque by observing the position of the hash mark on the torque gauge. This is the peak resistance of the rods and the vane. The peak resistance should be corrected by multiplying the peak resistance by the appropriate correction factor for the vane size used, as provided by the vane manufacturer. The difference between the corrected peak resistance and the dummy vane resistance is the peak shear strength of the sediment.
10. Determine the remolded strength by quickly rotating the vane and rods (five to ten times) using the wrenches provided, if needed, until the resistance in the vane is constant. Begin the remolded strength test within 1 minute but not more than 5 minutes from the completion of the quick rotations.
11. Re-zero the scale hash marks on the measuring head.
12. Slowly rotate the vane assembly until failure is noted. Read and record the maximum torque on the gauge. This measurement is the remolded shear strength, subject to the corrections discussed in Step 9 for peak shear strength.
13. Advance the vane to the next test depth interval if appropriate based on stratigraphy (i.e. clay and silt present) and advance in 1-foot intervals as appropriate through the depth of soft sediment (3-foot maximum per location).
14. Repeat the test steps to test the next depth interval until all appropriate intervals have been tested.
15. Stiffer zones may be encountered with depth. If the larger vane cannot be advanced to the proposed depth, withdraw the test apparatus and replace the vane with a smaller vane. Reinsert

the apparatus and advance the new vane to the proposed test depth. Conduct the vane shear test as described previously.

16. Remove visible sediment from the vane shear test apparatus following completion of the tests at all required depths in given location.
17. Move to the next test location.

Quality Assurance/Quality Control

It is the responsibility of the Field Team Leader to periodically check and ensure that vane shear testing procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachments

Attachment A Required Field Logs

- Daily Log
- Vane Shear Test Log
- Field Deviation Form

Standard Operating Procedure 2.08 – Core Collection and Processing

Standard Operating Procedure 2.08 – Core Collection and Processing

Standard Operating Procedure Acknowledgement Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for collecting and processing sediment samples.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to the collection and visual determination of soft sediment type, collection and processing of sediment samples for laboratory analysis and collection and processing of bulk sediments for dewatering treatability tests. Sediment will be collected using a vibracore or manual methods from a vessel (sediment coring pontoon vessel or similar). Sediment processing procedures are also described in this SOP.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the *Health and Safety Plan* (HASP). The HASP will be followed during all activities conducted by all Anchor QEA field personnel. Utility clearance will be performed prior to any intrusive work.

Staff Qualifications

Field personnel executing these procedures must read, be familiar with, and comply with the requirements of this SOP and all associated project planning documents. All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses and to participate in a medical monitoring program before engaging in core collection activities. In addition, field personnel will be directly supervised by qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)
- Sediment Core Collection Log
- Sediment Core Processing Log
- Soil/Sediment Classification Field Guide
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Sampling vessel equipped with necessary GPS navigation and communication equipment
- Approved project-specific planning documents and HASP
- Appropriate personal protective equipment and clothing as defined in the HASP
- Field tablet with target locations and differential global positioning system (DGPS) capable of submeter accuracy
- Calibrated steel rod for poling
- Vibracore sampler and necessary support equipment
- Manual coring equipment
- 4-inch (outer-diameter) thin-walled (or similar) transparent polycarbonate tubes and caps to fit
- Core catchers
- Generator
- Hack saw
- Tape measure
- Electrical tape
- Duct tape
- Core collection field forms or field database

The following additional equipment is needed for processing cores:

- Folding table
- Canopy
- Measuring tape
- Electric drill and bits
- Labels
- Cordless shears

- Camera
- Dry erase board and markers
- Plastic sheeting
- Aluminum foil
- Paper towels
- Absorbent pads
- Disposable aluminum pans
- Plastic spoons
- Stainless steel bowls
- Disposable mixing tools
- Core caps
- Duct tape
- Resealable plastic bags
- Contractor garbage bags
- Laboratory containers (as specified in the FSP/QAPP)
- Coolers, packing material, and ice

Pre-Core Collection Procedures

Pre-sampling activities will be completed prior to commencing sediment coring and include the following:

- Review the HASP for potential hazards, appropriate PPE, and safety meetings to be conducted prior to and during collection.
- Check weather conditions prior to leaving the dock and throughout the day for changing conditions.

Core Collection Procedures—Vibracoring

Vibracores will be collected using the following procedures:

1. Confirm utility locate has been performed and any existing utilities have been clearly marked or the absence of any utilities has been confirmed. Utilities will be cleared before sampling begins. This may be accomplished through notifying UDig NY online or by phone at 811).
2. The vessel will be navigated to the selected sample location post probing activities (see SOP 7.11 – Navigation and Boat Positioning).
3. The water depth will be measured using a weighted tape or survey rod. The date, time, and water depth (to the nearest 0.1 foot) will be recorded.
4. Confirm sediment thickness is similar to initial probe by re-probing sediment (as discussed in SOP 2.09 Sediment Probing). If the sediment thickness is not similar, probe around the vessel to locate similar sediment thickness and adjust vessel position accordingly.

5. Sediment core samples will be collected following the procedures outlined, as appropriate, targeting the full soft sediment depth indicated by the sediment probing prior to sampling. Similarly, select a core tube of appropriate length based on sediment probing conducted prior to sampling (see SOP 2.09 – Sediment Probing).
6. Attach a clean core catcher to the bottom of a clean tube.
7. Mount the tube onto the vibracore head and secure with the attached clamp.
8. Lower the coring apparatus (with the core tube attached) vertically through the water column, until the river bottom is reached.
9. For vibracoring, activate the vibracore at the sediment-water interface. Continue to operate the vibracore until a penetration of approximately 12 inches less than the total core tube length is achieved or refusal is met.
10. Measure and record the depth of core tube penetration into the sediment in the Sediment Core Collection Log (Attachment A). Penetration should be recorded for each coring attempt.
11. Pull the coring apparatus up out of the river bottom (using a winch as needed) and raise it to the surface while maintaining the core in a vertical position.
12. Before the bottom of the tube breaks the water surface, place a cap over the bottom to prevent the loss of material from the corer. Secure the cap in place with duct tape when brought onboard the vessel.
13. The retrieved core will be secured in an upright position for measurements. Any disturbed sediment will be allowed to settle completely within the core tube, and the recovered sediment length will be measured.
14. Estimate the recovered length of the sediment core with a tape measure and note it in the Sediment Core Collection Log sheet (Attachment A). Draw a line on the core tube with a permanent marker to indicate the length of field recovery and write the recovery in inches on the tube adjacent to this line.
15. Compare the length of the recovered core with the core penetration depth.
16. Evaluate the retrieved sediment core for acceptance based on the following criteria:
 - a. Overlying water is present, and the surface is intact.
 - b. The core tube appears intact without obstruction or blocking.
 - c. Recovery is greater than 70% of the drive length.
17. If sediment core acceptance criteria are not achieved, the core will be rejected. Up to three attempts will be made to achieve the acceptance criteria. Subsequent attempts will be made within 10 feet of previous attempt, staying within the property boundary the target location is in. The retrieved core from each attempt will be retained. After three attempts, the core with the highest recovery percentage will be retained and sampled. The contents of the rejected cores will be discarded in accordance with SOP 7.03 (Investigation-Derived Waste Handling).
18. The accepted core tube will be labeled with the sample station number, the date and time the sample was collected, and an arrow pointing to the top of the core.

19. The appearance and length of the core sample will be evaluated by examination through the clear plastic core liner. Any stratigraphic intervals or other salient features, including the total length of the native material, will be noted in the field database or on the Sediment Core Collection Log sheet (Attachment A).
20. The cores will be sealed tightly and kept upright to prevent leakage or disturbance during transport to the processing area.

Core Collection Procedures—Manual

1. Repeat Steps 1 through 5 listed above.
2. Attach core tube to a push core device (or similar) and lower it to the sediment surface.
3. Note the start point on the push corer at the water surface and advance the core tube down through the sediment a distance of 6 inches less than the core tube length or until refusal is met.
4. Coring device may be advanced by manually pushing down or with a slide hammer or sledge.
5. Note the endpoint on the push corer at the water surface to measure the penetration distance.
6. Raise the coring device back up through the water either manually or with a winch.
7. Repeat Steps 12 through 20 above.

Sediment Core Collection Log

Field conditions and drive notes for sediment coring (vibracore sampler, manual sampler) will be recorded in the field database or on a Sediment Core Collection Log (an example is provided in Attachment A). The logs will include the following information:

- The sample station identification
- Water depth and time of measurement
- Geographic position of the actual coring location as determined by GPS
- Date and time of collection of each sediment core sample
- Names of field personnel collecting and handling the samples
- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort
- Length of drive penetration and recovery measurements
- Qualitative notation of apparent resistance of sediment column to coring (i.e., how the core drove)

Sample Processing

1. Disposable materials will be placed in heavy-duty plastic trash bags disposed of as municipal solid waste in accordance with the procedures for investigation-derived waste (IDW).

2. Drain any overlying water from the core by drilling a small hole or making a saw cut just above the sediment/water interface.
3. Lay the core tube on a workbench covered with plastic sheeting or aluminum foil. Place plastic sheeting and absorbent pads or paper towels below or next to the core to collect residual water or spills that occur. Measure the total length of the core and record.
4. Secure the core horizontally on the table, remove the bottom core cap, and, using electric shears, cut the polycarbonate tube longitudinally, from the bottom of the core to the top. Rotate the core tube cut longitudinally along the opposite side to split the core in half. Avoid disturbing the sediment as much as possible.
5. Write the core ID on a dry erase board or equivalent, and **photograph the core with the ID visible in the photograph.**
6. Record a physical description of the core on the Sediment Core Processing Log (Attachment A) using the Soil/Sediment Classification Field Guide (Attachment A). Characteristics include the general soil type based on the Unified Soil Classification System, approximate grain size, presence of observable biota, odor, and color. Classification of grain size will be a qualitative observation, with the following types denoted: silt, fine sand, medium sand, coarse sand, clay, organic matter, and gravel. The approximate proportion of each soil type within each sample will be estimated (i.e., primary, some, little, or trace).
7. Identify any changes in sediment character within the core. If changes in stratigraphy are observed, then the nature and approximate length of the various layers will be recorded. Evidence of changes in stratigraphy include an abrupt change in grain size (e.g., from silt to sand) or change in color or odor.
8. Use a new disposable plastic or stainless-steel utensil to separate the target intervals of the core. Target sampling intervals will include subdivided sections of the soft sediment portion of the core where clear breaks exist in the predominant sediment type (e.g., sand, silt). These subdivided sections of cores will be stowed in clearly labeled (with the location ID, time and depth interval) clean plastic bags until all target cores have been logged.
9. Once all cores have been logged, representative samples will be selected for laboratory geotechnical analyses and treatability testing in coordination with the project manager. Fill the appropriately labeled containers with sediment and package them for shipment to the laboratories in accordance with SOP 7.08 – Sample Shipping and Handling. The samples will be placed in coolers, and chilled to 4°C with ice packed in zip-top bags.
10. Ship sediment geotechnical samples (with corresponding chain-of-custody forms) accordingly via overnight delivery service or courier in accordance with SOP 7.08 – Sample Shipping and Handling.

After removing loose sediment (to the extent practicable), core tubes, processing equipment, and utensils will be placed in heavy-duty plastic trash bags and disposed of as municipal solid waste. Any

sediment or water will be containerized and disposed of in accordance with SOP 7.03 – Investigation-Derived Waste Handling.

Quality Assurance/Quality Control

Entries in the field forms will be double-checked by field staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP. As stated in the FSP/QAPP, due to only testing for geotechnical properties, equipment and trip blanks will not be collected; there will also be no collection of field duplicates.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Sediment Core Collection Log
- Sediment Core Processing Log
- Soil/Sediment Classification Field Guide
- Field Deviation Form

Standard Operating Procedure 2.09 – Sediment Probing

Standard Operating Procedure 2.09 – Sediment Probing

Standard Operating Procedure Acknowledgement Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for collecting and processing sediment samples for chemical analysis.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to collecting sediment depth and sediment type by probing. This information will be collected using a steel or equivalent calibrated probing rod off the side of coring vessel.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the *Health and Safety Plan* (HASP). The HASP will be followed during all activities conducted by all Anchor QEA field personnel. Utility clearance will be performed prior to any intrusive work.

Staff Qualifications

Field personnel executing these procedures must read, be familiar with, and comply with the requirements of this SOP, all associated project planning documents. All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses and to participate in a medical monitoring program before engaging in core collection activities. In addition, field personnel will be directly supervised by qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)
- Sediment Core Collection Log
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Sampling vessel equipped with necessary GPS navigation and communication equipment
- Approved project-specific planning documents and HASP
- Appropriate personal protective equipment and clothing as defined in the HASP
- Field tablet with target locations and differential global positioning system (DGPS) capable of submeter accuracy
- Calibrated steel rod for probing
- Tape measure
- Hand-held sonar device or survey rod

Pre-Probing Procedures

Pre-probing activities will be completed prior to commencing sediment probing and include the following:

- Review the HASP for potential hazards, appropriate PPE, and safety meetings to be conducted prior to and during collection.
- Check weather conditions prior to leaving the dock and throughout the day for changing conditions.

Sediment Probing Procedures

1. Confirm utility locate has been performed and any existing utilities have been clearly marked or the absence of any utilities has been confirmed. Utilities will be cleared before sampling begins. This may be accomplished through notifying UDig NY online or by phone at 811).
2. The vessel will be navigated to the selected probing location (see SOP 7.11 – Navigation and Boat Positioning).
3. The water depth will be measured using a weighted tape, hand-held sonar device or survey rod. The date, time, and water depth (to the nearest 0.1 foot) will be recorded.
4. Sediment probing will be performed with a 1/2-inch-diameter steel rod marked in 1-foot increments.

5. Lower the probing rod to the sediment surface and note the measurement on the rod at the water surface. Advance the rod through the sediment until refusal is reached and note the measurement on the rod at the water surface. Repeat this step up to three times in the vicinity of the first probing location. Record time, date, sediment type, and penetration depth.

Sediment Probing Collection Log

Field conditions and probing notes for sediment probing will be recorded in the field log book. The probe collection logs will include the following information:

- The target station identification
- Water depth and time of measurement
- Geographic position of the actual coring location as determined by GPS
- Probing depth of three attempts
- Observations made during sample collection, including weather conditions, complications, and other details associated with the probing effort
- Qualitative notation of apparent substrate type (i.e., sandy/cobbles/silt/clay/hard bottom etc.)

Quality Assurance/Quality Control

Field notes will be double-checked by field staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP. Substantial deviations from the SOP will be discussed with the Project Manager and documented in a Field Deviation Form (Attachment A).

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Field Deviation Form

Standard Operating Procedure 5.01 – Surface Water Collection

Standard Operating Procedure 5.01 – Surface Water Collection

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01

Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the collection of surface water for treatability testing.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform bulk surface water collection to support the dewatering treatability tests. The details within this SOP should be used in conjunction all other the associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to collecting surface water for treatability testing purposes. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project Health and Safety Plan (HASP). The HASP will be followed during all activities conducted by Anchor QEA field staff.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved HASP and project-specific planning documents
- Appropriate personal protective equipment (PPE) and clothing as defined in the HASP
- Black ballpoint pens or Sharpie permanent markers (or equivalent)
- Boat, including the necessary navigational and communication equipment
- Grab sampling device (5-gallon buckets or similar)
- Sample shipment containers (water carboy or similar)
- Plastic cable ties
- Weight bearing line or cable (i.e., 1/4- or 1/2-inch diamond braided polypropylene rope)
- Paper towels

Surface Water Collection and Processing Procedures

Pre-Collection Activities

Pre-collection activities will be completed prior to collecting surface water and include the following:

- Review the HASP for potential hazards, appropriate PPE, and safety meetings to be conducted prior to and during collection.
- Check weather conditions prior to leaving the dock and throughout the day for changing conditions.
- Location for surface water collection will be co-located with collection of bulk sediments for dewatering treatability tests (see SOP 2.08 Core Collection and Processing).
- The vessel will be navigated to the selected sample location(s) (see SOP 7.11 – Navigation and Boat Positioning).

Direct Method (Hand Dipping)

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples directly into the sample container(s). Using adequate protective clothing, access the sampling station by appropriate means.

For rivers and shallow stream stations, place the sample container under the water surface while pointing it upstream; the container must be upstream of the collector. Avoid disturbing the substrate.

For lakes and other impoundments, collect the sample under the water surface while avoiding surface debris and boat wake.

When using the direct method, do not use pre-preserved sample bottles because the collection method may dilute the concentration of preservative necessary for proper sample preservation.

Processing

Surface water processing will be performed on the boat. Processing will be performed as follows:

- Transfer the collected water from the grab sampler container to the laboratory container(s).
- Assign each collection location with a unique alphanumeric location ID number as specified in SOP 7.06 (Sample Nomenclature). Each container will have an adhesive plastic or waterproof paper label affixed to it and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection: project name, Sample ID, and date and time of collection.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that surface water sample collection and processing procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Field Deviation Form

Standard Operating Procedure 7.01 – Field Records

Standard Operating Procedure 7.01 – Field Records

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01

Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the documentation of field activities during implementation of field tasks.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to maintaining sample collection forms, electronic forms, photographs, and electronically recorded field measurements. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project Health and Safety Plan (HASP). The HASP will be followed during all activities conducted by Anchor QEA staff.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily log (or field log book, as dictated by project planning documents)
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved project-specific HASP and planning documents
- Daily logs
- Field forms and records
- Waterproof pen
- Camera
- Electronic field application (if applicable)
- Whiteboard with erasable markers

Field Documentation Procedures

Field team members will keep a daily record of significant events, observations, and measurements in log books, paper field forms or electronically. If field forms are used, all field activities will be recorded on forms specific to the collection activity and will be maintained by the field team leader. Field notes should be maintained for all field activities (e.g., the collection of samples or the gathering of environmental data). The on-site field representative will record on the daily log forms information pertinent to the field task, including, at a minimum, the following information:

- Project name
- Field staff on site
- Health and safety discussions
- Location and sample IDs
- Observations made during sample collection, including weather conditions, complications, and other details
- Sampling method and description of activities
- Name, telephone number, and category of site visitors (e.g., client, regulatory, municipal, or general public)
- Meetings in the field associated with sampling or installation activities

In addition, deviations from any SOP will be recorded in the Field Deviation Form.

Field notes shall be written in water-resistant paper log books or on preprinted forms, and all field documentation will be made using an indelible, waterproof-ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank pages or lines in the field log book will be lined out, dated, and initialed at the end of each sampling day. The field forms will be scanned into the project-specific cloud-hosted folder as convenient during the sampling event or upon completion of each sampling event.

If an electronic field application is used, the above information will be entered into a field laptop, tablet, or smartphone. Field logs may be printed if hard copies are required. Data will be uploaded to the project-specific cloud-hosted folder.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that field documentation procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Field Deviation Form

Standard Operating Procedure 7.03 – Investigation-Derived Waste Handling

Standard Operating Procedure 7.03 – Investigation-Derived Waste Handling

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the proper disposal of investigation-derived waste (IDW; i.e., soil, water, personal protective equipment [PPE], and other potentially contaminated materials) generated during implementation of field work.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to the handling of potentially contaminated waste. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan* (HASP). The HASP will be followed during all activities conducted by Anchor QEA staff.

Job safety analyses will be prepared as part of the HASP for IDW handling. The following specific health and safety issues must be considered for management of IDW:

- IDW should be placed in secondary containment to minimize risk of a release to the environment whenever practical.
- Appropriate PPE must be worn during IDW handling activities.
- Potential hazards related to management of IDW in a public area and potential hazards to the public must be addressed before activities begin and as conditions change (e.g., waste secured away from public).

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Anchor QEA field staff and subcontractors will have completed current company-required health and safety training (e.g., 40-hour hazardous waste operations training, site-specific training, first aid and cardiopulmonary resuscitation [CPR] training), as needed.

Field Records

The field records associated with the activities described in this SOP are critical project documents. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Investigation-Derived Waste Log
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved project-specific HASP and planning documents
- Appropriate PPE and clothing as defined in the HASP
- U.S. Department of Transportation (DOT)-approved 55-gallon open- or closed-top drums, roll-off or Baker tank with lid for collection of solids and liquids
- Garbage bags
- 5- to 10-gallon buckets or carboys to be used as satellite waste-collection containers
- 55-gallon DOT chemical drums (as needed)
- Drum pad or secondary containment
- Drum cart
- Bung tool to open closed-top drums (as needed)
- Drum wrenches to tighten open-top drum lids
- Spill kits
- Labels and tags
- Drum log forms
- Drum marking crayons (or similar)

Secondary Containment Area

Prior to storage of IDW, a secondary containment area should be established as follows:

1. Identify a location where IDW can be stored. The area should be relatively flat and secure so that any IDW and associated equipment to be stored is not at risk of being disturbed, stolen, or tampered with.
2. Once the storage area has been selected, construct a secondary containment. Pre-made secondary containments can be used or new containments can be constructed, but either should be able to contain solids and/or liquids spilled within the secondary containment.
3. If a secondary containment is constructed, a minimum of 2- by 4-inch lumber or similar material will be used and wrapped in plastic. The lumber will be arranged into a square or rectangular shape so that the plastic wraps over the lumber, creating a lip with plastic stretching between.
4. Once the plastic sheeting has been stretched, IDW drums can be placed within the secondary containment.

Waste Disposal Procedures

Materials that are known or suspected to be contaminated with hazardous substances through the actions of sample collection are said to be IDW. These wastes are classified into the following two categories:

1. Solid materials consisting of soils, used core tubes, used PPE, and other materials used in the handling, processing, and storage of sediment
2. Liquid wastes

Each type of material will be handled in a manner described in this SOP.

Solid Waste

Solid residual wastes generated during field activities will consist of two types of materials: soil (sediment) and non-soil solids. Soil wastes could include discarded soil or waste soil generated during sampling activities. Non-soil wastes may include items such as used PPE (e.g., gloves, Tyvek suits, and plastic sheeting). Loose soil will be removed from non-soil waste items prior to disposal, to the extent practical.

Soil and non-soil wastes will be segregated and containerized in closed 5-gallon buckets or trash bags, as necessary and appropriate, and secured. Non-soil solids will be disposed of as municipal waste. Soil wastes will be transferred into labeled 55-gallon drums (or dedicated roll-off container). Soil wastes placed in labeled 55-gallon drums (or dedicated roll-off container) will be stored temporarily pending characterization and transfer to an approved disposal facility.

Wastewater

Wastewater may be generated and temporarily containerized in carboys or 5-gallon buckets during sample collection. Wastewater will be transferred to 55-gallon closed-top, lined drums or in a large, contaminated-liquid waste tank until the material is characterized and transferred off site for disposal.

IDW Management

Soil and water wastes generated will be placed in labeled drums or dedicated roll-off containers for disposal. Individual drums will be tracked using sequential numbers. Sequential drum numbers and the type of material placed in each drum will be indicated on the top and sides of the drums using a drum-marking crayon, and this information will be recorded in a log. Placement of soil, non-soil, and/or liquid waste into sequentially numbered disposal drums will be documented in IDW logs (see example of IDW log in Attachment A) listing the sample ID from which waste material originated.

Information recorded on the IDW logs will include the following:

- Sequential drum number
- Type of waste stored in drum (e.g., wet soil or water)
- Accumulation start and end dates
- Hazardous waste manifest number and date
- Transport contractor name and date of pickup

A composite sample may be collected and analyzed for compounds specific to the project disposal facility at the frequency required by the disposal facility or project manager/client.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that IDW handling and disposal procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachment

Attachment A Required Field Logs

- Investigation-Derived Waste Log
- Field Deviation Form

Standard Operating Procedure 7.06 – Sample Nomenclature

Standard Operating Procedure 7.06 – Sample Nomenclature

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01

Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for creating sample IDs and labeling sample containers.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to labeling procedures for environmental samples. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan* (HASP). The HASP will be followed during all activities conducted by Anchor QEA staff.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved project-specific HASP and planning documents
- Waterproof labels
- Indelible ink pen

Sample Labeling Procedures

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample ID (XX [Sample Matrix]-XX [Sediment Management Area ID] -XX [Unique Location ID] -XX [depth interval sampled in feet])
- Date and time of collection (YYMMDD)
- Preservative type (if applicable)
- Required analyses
- Sampler's name or initials

Samples will be uniquely identified with a sample ID that, at a minimum, specifies sample matrix, sample number, sample location, and type of sample.

Sample matrix identifiers are as follows:

- SO: soil
- SS: surface sediment
- **SC: sediment core**
- CS: core composite sample
- TA: tissue
- WG: groundwater
- **WS: surface water**
- WST: stormwater
- WX: porewater

For samples collected at specific depths, either in soil or water, the depth interval is added in the sample ID.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that sample labeling procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park.
July 2026.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Field Deviation Form

Standard Operating Procedure 7.07 – Sample Custody

Standard Operating Procedure 7.07 – Sample Custody

Standard Operating Procedure Acknowledgement Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures to ensure the integrity of sample custody throughout the sample collection and shipping process.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to the storage requirements, chain-of-custody (COC) procedures, and delivery of samples to the laboratories for analyses or bench scale dewatering studies. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project Health and Safety Plan (HASP). The HASP will be followed during all activities conducted by Anchor QEA staff.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Chain-of-Custody (COC) Form
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved project-specific HASP and planning documents
- Bound, waterproof field logbooks
- Black-ink ballpoint pens or permanent markers (or equivalent)
- Custody tape or seals
- Sample labels
- COC forms (use waterproof paper if available)
- Waterproof bags for COCs
- Clear-plastic sealing tape
- Coolers
- Ice
- Temperature blanks (typically provided by the laboratory)
- Trash bags for cooler liners

Sample Chain-of-Custody Procedures

As few people as possible should handle the samples.

Each sample generated in the field will be assigned a unique identification number. A label will be attached to each container used for sampling. Labels will be applied to the container, not the lid, whenever possible. The lid will also be labeled with the sample identification written in waterproof, indelible black ink as a backup for the container label.

When practical, the project identification, sample matrix, laboratory designation/analyses requested, field sample identification code, and preservation will be typed or printed onto the label before sampling. Completion of the sample labels (including the field team staff's initials and the date and time of sample collection) will occur prior to filling the sample containers, if possible, to avoid placing labels on wet surfaces. Labels will be completed in waterproof, indelible black ink. Individual samples will be properly labeled and securely sealed (with an official seal or piece of tape over the lid, extending onto the sample bottle) before being placed in the container for shipment to the laboratory.

Samples are considered to be in one's custody if they are as follows: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s).

Field COC procedures shall be followed from the time a sample is collected until it is relinquished to the laboratory (either in person or to a shipper). The principal document used to track possession

and transfer of samples is the COC form. A COC form shall be filled out in duplicate and initiated when the first sample is collected and updated continuously through the sampling event. A new COC form shall be prepared for each day of field sampling. Information to be entered on the COC form includes the following:

- Project identification (project and task number)
- Sample identification
- Time and date of sampling
- Sample matrix (e.g., sediment or water)
- Number of containers for each sample
- Analyses requested
- Preservative, if applicable
- Grab or composite sample designation, if applicable
- Signatures of field team staff/sample custodian
- Field team staff's remarks
- Destination (e.g., laboratory name and location)
- Page number (e.g., 1 of 2, 2 of 2)
- Air bill or other shipping number, if applicable
- Any special instructions

All data entries will be made using a waterproof, indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank lines and spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody. A COC form will accompany each cooler of samples to the laboratories. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. One copy of the COC form should be placed in a waterproof bag and attached to the inside lid of each sample cooler. In the event that sediment subsamples are being sent to different laboratories, separate COC forms should be prepared for each laboratory and each sample cooler. A custody seal should be placed on the sample cooler when it is not in the custody of a member of the sampling team.

When samples are relinquished, either to the laboratory or for shipment, the COC form must be completed by the sample deliverer (except in the case of a commercial carrier such as FedEx). It should include the printed and signed name of the deliverer, the organization that person represents, date and time of sample relinquishment, and method of shipment, if appropriate.

A completed copy of the laboratory-verified COC form will be distributed via email or fax to the Anchor QEA Project QC Manager within 24 hours of sample receipt at the laboratory. The original will be retained by the laboratory.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that sample COC procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

Attachment

Attachment A Required Field Logs

- Chain-of-Custody Form
- Field Deviation Form

Standard Operating Procedure 7.08 – Sample Shipping and Handling

Standard Operating Procedure 7.08 – Sample Shipping and Handling

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the packaging and shipping of samples.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to the transport of samples to prevent breakage and maintain temperature. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the *Health and Safety Plan* (HASP). The HASP will be followed during all activities conducted by all Anchor QEA field personnel.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)
- Chain-of-Custody (COC) Form
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved project-specific HASP and planning documents
- Appropriate personal protective equipment (PPE) and clothing as defined in the HASP
- Bound, waterproof field log books
- Black, ballpoint pen or Sharpies (or equivalent)
- Inert packing material (e.g., cardboard, bubble wrap, etc.)
- Sample containers as specified in the FSP/QAPP
 - Quart or gallon ZipLoc bags for sediment geotechnical analytical samples
 - ULINE Screw Top Pails, or similar, for bulk sediment treatability testing
 - EPC3000 Cubitainer, or similar, for site water treatability testing
- COC forms
- Contractor-grade trash bags or similar for cooler liners
- Sample labels
- Insulated coolers
- Custody seals
- Shipping tape
- Sealable plastic bags
- Temperature blanks (typically provided by the laboratory)
- Ice
- Overnight courier waybills or shipping forms, as needed

Sample Storage, Handling, and Shipping Procedures

Sample Holding and Storage

Observance of proper holding times and conditions during sample storage and shipment prior to laboratory analysis is critical to obtaining quality data from a sampling event. Immediately after collection, samples should be stored in refrigerators (if available) or insulated coolers with sufficient ice to maintain an ambient temperature of approximately 4°C until receipt by the laboratory. Specific sample holding times and conditions for specific matrices and analyses are listed in the FSP/QAPP.

It is most practical to use wet ice to store samples in the field. Ice can be purchased on the way to the project site or obtained from an on-site freezer. Ice should be bagged, and a liner should be placed in the sample coolers to prevent leakage as the day goes on. Labels should be covered in clear packing tape to prevent labels from smearing and falling off during cooler storage. Ice should be placed around the samples and the temperature blank inside of the coolers.

Chain of Custody

Most projects will require COC procedures. Field COC procedures should be followed from the time a sample is collected until it is relinquished to the laboratory (either in person or to a shipper). COC procedures are covered in SOP 7.07 Sample Custody.

Sample Shipping

All samples should be shipped or hand delivered to the laboratories immediately after completion of sampling to minimize the number of people handling samples and to protect sample quality and security. The following guidelines apply sediment samples that will be shipped by courier to the laboratory.

- Shipping containers should be free of defects to withstand rough treatment during shipping.
- Samples should be packed tightly with dividers or bubble wrap separating containers and filling any empty space within shipping boxes so the jars are held securely.
- Sample coolers should be packed with ice to maintain an ambient sample temperature of approximately 4°C until delivery to the laboratory. Wet or synthetic ice can be used, but either type should be packed in a manner that will preclude leaking inside the sample cooler. A temperature blank (typically supplied by the laboratory) can be placed in the sample cooler along with samples.
- All coolers must be leakproof or lined with a leakproof plastic liner. Leaking coolers will not be delivered by some couriers.
- A COC record for each shipping container should be filled out completely.
- The original COC should be protected from damage by placing it into a re-sealable plastic bag and attaching to the inside of the cooler lid.
- A custody seal should be attached so the shipping container cannot be opened without breaking the seal.
- If the laboratory does not provide a courier, shipping containers should be sent by a carrier that will provide a delivery receipt (such as FedEx) to confirm that the contract laboratory received the samples and serve as a backup to the COC record.
- Sample shipments by common carrier or air freight must be packaged and labeled according to U.S. Department of Transportation regulations or the international Air Transportation Association requirements. Packaging must account for suspected types and levels of contaminants in the samples as well as chemicals used to preserve the samples.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that sample handling and shipping procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park.
July 2026.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Chain-of-Custody Form
- Field Deviation Form

Standard Operating Procedure 7.11 – Navigation and Boat Positioning

Standard Operating Procedure 7.11 – Navigation and Boat Positioning

Standard Operating Procedure Acknowledgment Form

Project Number: 260049-02.01 Project Name: Pettit Cove to Gratwick Riverside Park

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company
8/25/26	James Ryan		Anchor QEA

Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the navigation and positioning of boats.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the activities described in the previous paragraph. The details within this SOP should be used in conjunction with all other associated project planning documents, such as the *Feasibility Study Data Gaps Work Plan* (Work Plan; Anchor QEA 2026), *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP), and other project-specific SOPs.

Scope and Application

This SOP is applicable to accessing sampling and monitoring locations by boat. Substantive deviations from the procedures detailed in this SOP will be recorded in the field log book or Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the *Health and Safety Plan* (HASP). The HASP will be followed during all activities conducted by all Anchor QEA field personnel. Utility clearance will be performed prior to any intrusive work.

Staff Qualifications

Field staff executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and all associated project planning documents. Field staff will be under the direct supervision of qualified professionals who are experienced in performing the tasks described in this SOP, as approved by the project manager.

Field Records

The field records associated with the activities described in this SOP are critical project documents that will be used in data interpretation. Field logs may be included in the subsequent reports presenting the results of the field program.

Field team members will keep a daily record of significant events, observations, and measurements in the field logs. The required field logs and records are included in Attachment A and are described as follows:

- Daily Log (or field log book, as dictated by project planning documents)
- Boater Safety Checklist
- Field Deviation Form

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved project-specific HASP and planning documents
- Appropriate personal protective equipment (PPE) and clothing as defined in the HASP
- Daily float plan that lists stations to be sampled, access points along the study area, and sample transfer or transport locations
- Black, ballpoint pen or Sharpie markers (or equivalent)
- PPE as required by the HASP, including personal floatation devices as required
- Sampling vessel equipped with necessary differential global positioning system (DGPS) navigation and communication equipment
- Depth finder (electronic or manual)
- Boat spuds and/or an anchor system to stabilize boat on station
- Predetermined sampling coordinates/waypoints and location figures

Pre-Launch Collection Procedures

Pre-launch activities will be completed prior to commencing work on the water and include the following:

- Review the HASP for potential hazards, appropriate PPE, and safety meetings to be conducted prior to and during collection.
- Check weather conditions prior to leaving the dock and throughout the day for changing conditions.

Horizontal Positioning Procedures

Horizontal positioning will be determined using a DGPS based on predetermined target coordinates. Sample locations may be modified based on field conditions. Measured geographic coordinates for station positions will be logged and reported as described in the Work Plan. Information to be recorded will include DGPS make and model, horizontal and vertical datums, units, and method of obtaining real-time corrections.

The following procedures describe the steps used to establish position at a location, as well as the steps to adjust the positioning for the collection of additional samples:

1. Sampling locations to be occupied will be selected by the field team leader and communicated to the field team staff each day. Coordinates for each sampling location will be entered as a waypoint into the DGPS unit. The accuracy of each entry will be checked against the coordinates established in the Work Plan.

2. The DGPS antenna will be maintained in a safe location that accurately represents the actual sample or measurement collection point (e.g., mounted to the top of the davit or A-frame used for raising or lowering the sampling equipment).
3. Using the navigation setting on the DGPS, the boat operator will navigate within 10 feet of the target location.
4. For sediment sampling, the boat will be secured on station by lowering spud poles or anchors. Under some conditions, the boat may not be anchored based on safety as determined by the vessel operator.
5. Once the boat is on location, the coordinates from the DGPS unit will be noted. With the boat on location, the coordinates will be stored electronically in the DGPS unit and recorded on the appropriate field form.
6. For positioning to a recorded probing location, or if multiple attempts are needed at a sampling location, the boat will be moved within the radius of 10 or fewer feet from the target coordinates. The boat will be repositioned by allowing it to rotate around the spud pole, by adjusting an anchor line, or motoring unattached until the new position for the sampling device has been established. The new position will be recorded on the appropriate field form and stored electronically in the DGPS unit.

Vertical Elevation Measurement Procedures

The vertical elevation measurement procedures are as follows:

1. At each sampling station where elevation data is required, the water depth (from the top of the water level surface to the top of sediment surface) will be determined using a calibrated weighted line, depth finder, or tape measure.
2. The date and time of the measurement will be recorded on the appropriate data form.
3. Vertical elevation of the water surface at each sampling location will be measured with a DGPS unit or local staff gauge and recorded in IGLD85.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that boat positioning procedures are in conformance with those stated in this SOP. In addition to the procedures above, the DGPS will have the capability to produce the information required in the U.S. Environmental Protection Agency (EPA) Great Lakes Legacy Act (GLLA) guidance (Attachment A; EPA 2020).

References

Anchor QEA, 2026. *Feasibility Study Data Gaps Work Plan*. Pettit Cove to Gratwick Riverside Park. July 2026.

EPA (U.S. Environmental Protection Agency), 2020. *GLLA Data Reporting Standard, Attachment 2*.
January 2020.

Attachment

Attachment A Required Field Logs

- Daily Log (or field log book, as dictated by project planning documents)
- Boater Safety Checklist
- Field Deviation Form
- GLLA guidance

Attachments

Field Logs

Locational Data Checklist and Metadata Recording Form

This document accompanies the *Great Lakes Legacy Act Data Reporting Standard*, which provides detailed data reporting guidance for GLLA projects, including electronic data deliverables (EDD) requirements. GLLA data providers should review this document prior to collecting data. Copies of completed forms should be uploaded to the GLLA Data Submission Site on GLNPO.net with the complete GLLA data submission.

Contact Information

Contact Name: _____ Phone Number: _____
Affiliation: _____ E-mail Address: _____

Study Information

Project Title: _____
Site Name: _____
Sampling Start Date: _____ Sampling End Date: _____

Preparation Activities (please confirm each activity in the boxes to the right)

1. Sampling staff are trained in GPS Field Data Collection and have familiarized themselves with the GPS unit used for this project (certified training recommended). ☐
2. Determined window of satellite availability. <https://www.gnssplanning.com> ☐
3. Locate at least one control point to assess GPS accuracy.
For assistance locating control points, visit <http://www.ngs.noaa.gov/datasheets> or <http://www.geocaching.com/mark/>. This may not be feasible if the GPS unit is mounted to a vessel.* ☐
4. If a control point cannot be located, establish at least one reference point.* ☐

Data Collection Activities (please confirm each activity in the boxes to the right)

1. GPS unit was configured to collect data only when the following requirements were met:
 - a. A minimum of four satellites ☐
 - b. Position dilution of precision (PDOP) ≤ 6 ☐
 - c. Satellite elevation $\geq 15^\circ$ above the horizon ☐
 - d. A minimum signal-to-noise ratio (refer to GPS user manual for recommendation) ☐
2. Collected point data based on the nearest base station's logging interval. ☐
3. Collected point data for a period of at least 1 minute per location. ☐
4. Reported locational data in WGS 84 or NAD 83 (please specify _____). ☐

Please provide an explanation if a box was not checked for any of the responses above and specify deviations (include sample IDs if applicable):

*At minimum, collect on the first day of sampling prior to beginning data collection and on the last day of sampling following data collection. It is recommended to collect at the start and end of each sampling day. Record on page 2.

GPS Unit Specifications

GPS brand and model number: _____
Model accuracy: _____

Data Processing

Which of the following best describes any data correction that may have been performed:

- | | |
|--|--|
| ☐ real-time correction - specify type _____ | ☐ post processed differential correction - provide base station id and location _____ |
| ☐ no correction | ☐ other, please specify _____ |

Quality Information

Describe any difficulties in collecting locational data: _____

Data Provider:

Confirm required information has been provided.

Signature Date

Daily Boat Checklist

Boat ID: _____	Boat Operator: _____
Project/Location: _____	Crew: _____
Date: _____	Visitors: _____

Item	Yes	No	N/A	Comments
Vessel Registration Numbers Displayed				
Vessel Registration Documentation on Board				
PFDs - One Available Per Person				
PFDs - Condition/Inspection				
First Aid Kit				
Eye Wash Solution				
Fire Extinguisher				
Visual Distress Signal				
Sound Producing Device				
Navigation Lights				
Paddle				
Rescue Ring				
Project Health and Safety Plan				
Cellular phone				
Spill kit				
PPB (Hard hats, safety glasses, steel toe boots, etc.)				
Cold Weather Suit - Float coat required at water temp of 40-50°F. Float coat and bibs or 1-piece suit required at water temp < 40°F.				
GFI				
Radio Check				
Clear Deck, Work Area				
Drinking Water				
Sunscreen				
Fuel Level				
Drain Plug				
Float Plan				
Anchor/Spuds				
Review Boating JSAs				
Bilge Pump Operational				
Boat Hull in Sound Condition				

N/A = Not applicable

Chain of Custody Record & Laboratory Analysis Request



Page ____ of ____ Turnaround Requested: 30 days

Anchor Contact: _____

Lab Contact:		Proj. Name:			Analyses Requested										Notes/ Comments:	
Lab:		Proj. Number:														
Address:		Sampler:														
Phone:		Shipping Method:														
Fax:		AirBill:														
Sample ID	Sample Date	Sample Time	Sample Martix	# Containers												

Relinquished: (Signature)		Relinquished: (Signature)		Relinquished: (Signature)		Special Instructions/Notes	
Printed Name:		Printed Name:		Printed Name:			
Company:		Company:		Company:			
Date/Time:		Date/Time:		Date/Time:			
Received By:		Received By:		Received By:			
Printed Name:		Printed Name:		Printed Name:			
Company:		Company:		Company:		# of Coolers:	Cooler Temp(s):
Date/Time:		Date/Time:		Date/Time:		COC Seals Intact?	Bottles Intact?



Sediment Core Collection Log

Page of _

Job: _____
Job No: _____
Field Staff: _____
Contractor: _____
Vertical Datum: _____

Station ID: _____
Attempt No. _____
Date: _____
Logged By: _____
Horizontal Datum: _____

Field Collection Coordinates:

Lat/Northing: _____

Long/Easting: _____

A. Water Depth

DTM Depth Sounder: _____

DTM Lead Line: _____

B. Water Level Measurements

Time: _____

Tide Height: _____

Source: _____

C. Mudline Elevation

Recovery Measurements (prior to cuts)

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length: _____

Drive Penetration: _____

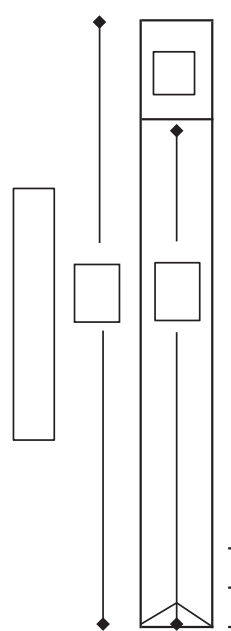
Headspace Measurement: _____

Recovery Measurement: _____

Recovery Percentage: _____

Total Length of Core To Process: _____

Drive Notes:



Sections To Process:

A:
B:
C:
D:

Core Field Observations and Description:

Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

Daily Log



PROJECT NAME: _____ **DATE:** _____

SITE ADDRESS: _____ **PERSONNEL:** _____

WEATHER:	WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY	
		SUNNY	CLOUDY		RAIN		?		TEMPERATURE:		° F	.	° C
											[Circle appropriate units]		

TIME	COMMENTS
------	----------

See notes on bottom of page for detailed logging

Equipment on site:	
--------------------	--

[illegible]

Notes: Work performed, phone calls made, problems issues/resolutions, visitors on site, deviations from the Workplan
Safety infractions, important comments/instructions to contractors

Signature: _____

Field Deviation Form

Deviation No. ____

Deviation subject:

-

Project name:

-

Standard procedure for field activity:

-

Reason for deviation:

-

Description of deviation:

-

Special equipment, materials, or personnel required:

-

Initiator's name:	Date:
Project Manager:	Date:



IDW Medium:
Soil
Soiled PPE

SOIL/SEDIMENT CLASSIFICATION FIELD GUIDE

SOIL/SEDIMENT DESCRIPTION COMPONENTS: USCS name (USCS symbol): density/consistency, moisture, color, list gravel/silt/sand by %; additional remarks

Density of Coarse-grained (Cohesionless) Soils		Consistency of Fine-grained (Cohesive) Soils			
Density	Standard Penetration (N; blows/foot)	Consistency	Standard Penetration (N; blows/foot)	Unconfined Compressive Strength (tsf)	Manual Penetration Test
Very Loose	0 to 4	Very Soft	0 to 2	<0.25	Thumb will penetrate soil more than 1 inch
Loose	4 to 10	Soft	2 to 4	0.25 to 0.5	Thumb will penetrate soil about 1 inch
Medium Dense	10 to 30	Medium Stiff	4 to 8	0.5 to 1	Molded by moderate to firm finger pressure
Dense	30 to 50	Stiff	8 to 15	1 to 2	Readily indented by thumb, difficult to penetrate
Very Dense	More than 50	Very Stiff	15 to 30	2 to 4	Readily indented by thumbnail
		Hard	More than 30	>4	Indented with difficulty by thumbnail

	Gray
	Gray-brown
	Olive-brown
	Olive
	Olive-gray
	Dark brown
	Red-gray
	Red-brown
	Brown
	Red
	Light brown
	Tan
	Yellow-brown
	Red-yellow
	Yellow

Moisture Content	
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible, free water

Particle Shape/Angularity	
Description	Criteria
Rounded	Near-spherical or oval
Sub-rounded	Primarily rounded corners and edges
Sub-angular	Slightly rounded corners and edges
Angular	Sharp corners and edges

Grain Size			
Soil Component	Anthropogenic Component	Size Range (U.S. Standard Sieve)	Approximate Size
Boulders	Blocks	>12 inches	larger than basketball
Cobbles	Pieces	3 to 12 inches	fist to basketball
Gravel	Fragments	3/4 to 3 inches	thumb to fist
		#4 to 3/4 inches	pea to thumb
Sand	Particles	#10 to #4	rock salt to pea
		#40 to #10	sugar to rock salt
		#200 to #40	flour to sugar
Fine Grained	Specks	Pass #200	finer than flour

Charts for Estimating Percentages (After Compton, 1962)					
					
					
5%	7%	10%	15%	20%	25%

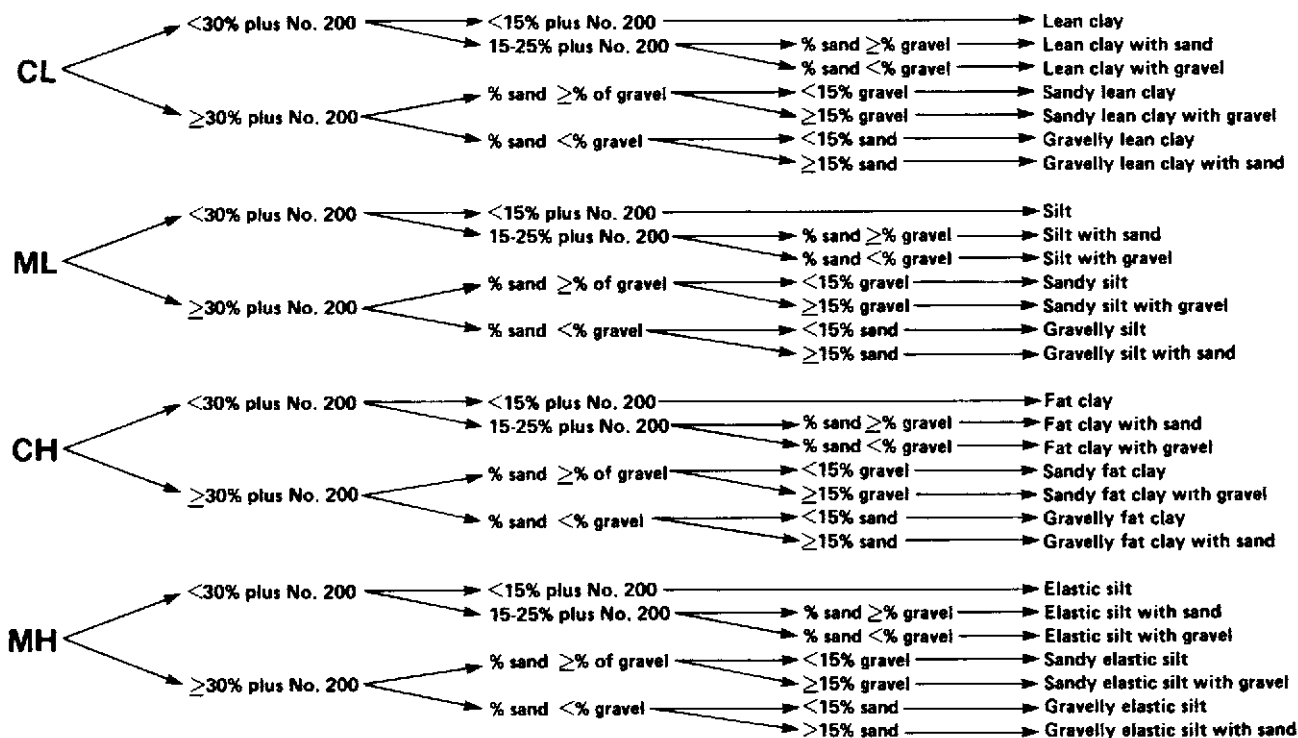
Index of Plasticity	
Description	Criteria
Non-plastic	A 1/8 inch (3 mm) thread cannot be rolled at any water content. Has definite structure but can easily be separated or crumbled. Is readily rinsed off sampling equipment. Breaks easily when pieces are dried.
Low Plasticity	A thread can barely be rolled.
Medium Plasticity	A thread is easily rolled. Stays together relatively well when molded (i.e., behaves like Play-Doh). Can be washed off sampling equipment easily. Requires some effort to break when pieces are dried.
High Plasticity	A thread is easily rolled, and can be rerolled several times. Can be easily molded and stays together very well, but takes effort to rinse off of sampling equipment. Difficult to break when pieces are dried.

Criteria for Describing Soil Structure	
Decomposed	Visible signs of breakdown, applicable to organic matter and rock.
Homogeneous	Same color and appearance throughout.
Interbedded	Alternating soil layers of different composition.
Lens	A very thin cohesive layer, less than .5-inch thick.
Layer	A general term for material lying essentially parallel to the surfaces against which it was formed (.5-inch to 12-inch thick).
Varved	A cyclic sedimentary couplet consisting of a coarser and a finer layer, representing variation in depositional energy.
Washed	Material missing in core tube due to loss through the bottom of sampler due to improper closing.

SOIL/SEDIMENT CLASSIFICATION FIELD GUIDE

GROUP SYMBOL

GROUP NAME

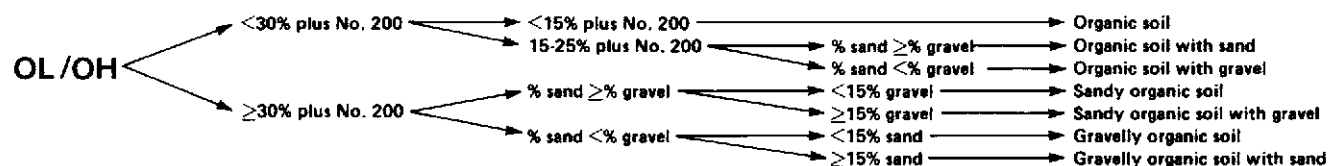


NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)

GROUP SYMBOL

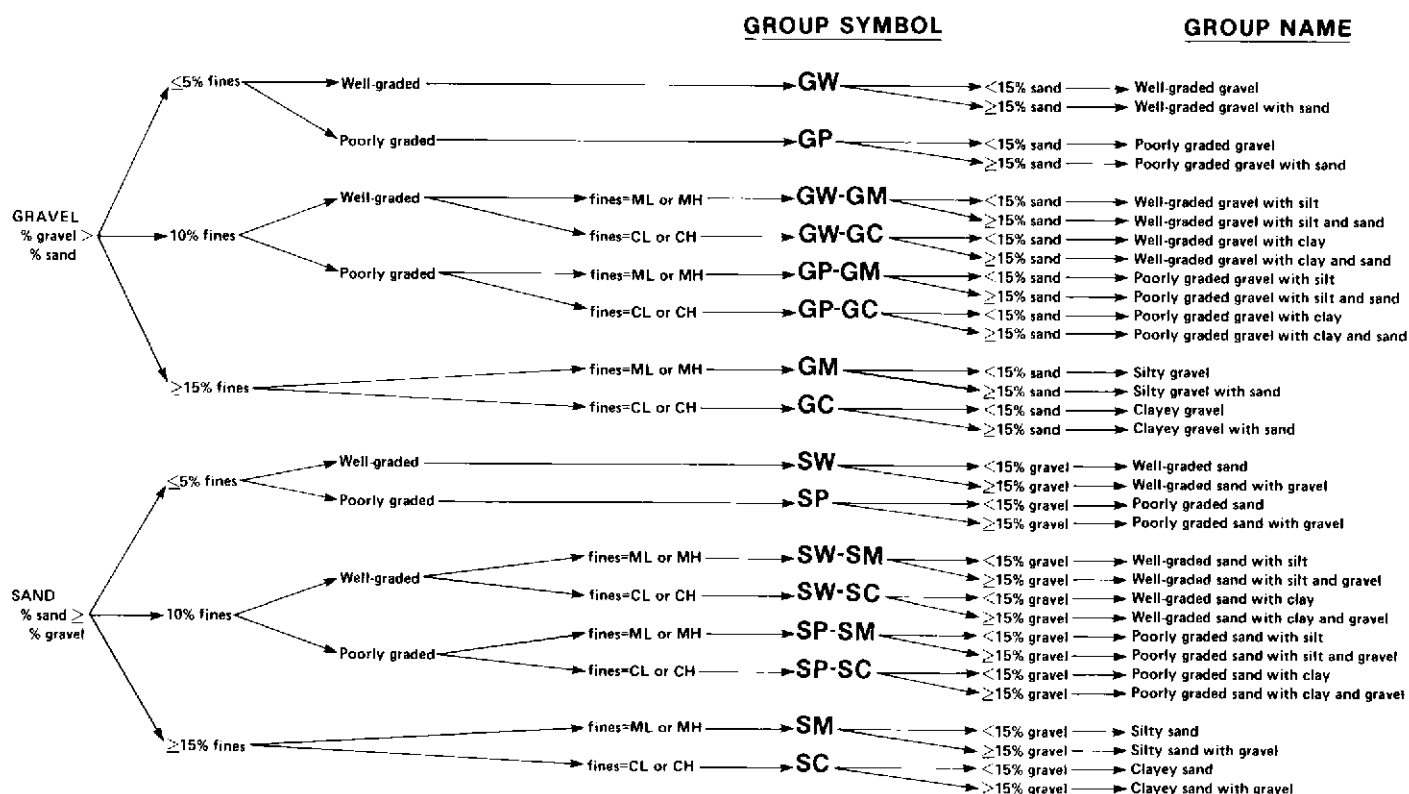
GROUP NAME



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)

SOIL/SEDIMENT CLASSIFICATION FIELD GUIDE



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)

NOTE: The following terminology is optional, and should be used with caution. Consult the Anchor QEA Project Manager prior to field use. Use caution when describing odors, sheens, and nonaqueous phase liquid (NAPL) to avoid exposure to potentially hazardous chemicals. Do not sniff the sample or bring it close to your face. If unexpected contamination is encountered, stop work, clear personnel from the area, and contact the Anchor QEA Project Manager for further instruction.

Criteria for Describing Odors	
Relative Intensity	Odor Types
Trace (faint)	Petroleum-like (e.g., diesel, No. 2 fuel oil, kerosene, or gasoline)
	Hydrogen sulfide-like (H ₂ S-like)
Moderate (obvious)	Organic-like (e.g., septage)
	Solvent-like (e.g., alcohol)
Strong (overwhelming)	Tar-like (e.g., hot asphalt or roofing tar)

Criteria for Describing Sheens			
Relative Intensity	Sheen Color		Description Components
Trace, <25% of surface covered	Rainbow	Multicolored	1. Intensity 2. Sheen color 3. Sheen distribution (e.g., continuous, present as .5-inch spots) 4. Depth interval over which sheen is present Distinguishing hydrocarbon-sheen from biological sheen: If disturbed, a hydrocarbon sheen will typically coalesce, where an inorganic sheen will break apart and has a blocky appearance. Distinguish biological sheens if obvious.
Moderate, 25 to 75% of surface covered			
Heavy, >75% of surface covered	Silver or Metallic	Metallic, silver/gray-colored	

Criteria for Describing Nonaqueous Phase Liquid (NAPL) and/or Separate Phase Material (SPM)		
Relative Amounts and/or Distribution of NAPL/SPM	Description Components	
Blebs	Describes the occurrence of discrete droplets of separate phase liquid, but for the most part, the sediment matrix does not contain NAPL. Describe the estimated size and number of blebs. NAPL present as a coating on the sediment grains; may be present in the pore space, but not as a free separate phase liquid. The degree of coating should be described as light, moderate, or heavy. NAPL is present on the sediment surface and in the pore spaces. NAPL appears as a liquid on the surface of the sample when the sample is disturbed. Depending on viscosity, NAPL may freely drain from the sample.	
Coated		
Wetted		
	1. Relative amount of NAPL 2. Color 3. Viscosity 4. Distribution of NAPL 5. Density 6. Depth interval over with NAPL is present	

Sediment/Soil Core Processing Log



Job: _____
 Job No. _____
 No. of Sections: _____
 Drive Length: _____
 Recovery: _____
 % Recovery: _____
 Notes: _____

Station ID: _____
 Date/Time: _____
 Core Logged By: _____
 Attempt #: _____
 Type of Core | Direct Push | Vibracore | Diver Core
 Diameter of Core (inches) _____
 Core Quality | Good | Fair | Poor | Disturbed

Recovered Length (cm)	Size % Gravel	Size % Sand	Size % Fines	Classification and Remarks (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (cm)	PID	Sample	Summary Sketch

Field Vane Shear Log

Project: _____

Location: _____

Technician: _____

Date: _____

ROCTEST H-60 / Humboldt H-4227 Vane Tester	
<u>Vane Diameter</u>	<u>Vane constant (a)</u>
16mm (0.63")	1.95
20mm (0.79")	1.00
25.4mm (1")	0.49
32mm (1.25")	0.24
50.8mm (2")	0.06
65mm (2.56")	0.03

$$S_U = \alpha \times \text{Scale}$$

Horizontal Datum: _____

[illegible]

Note: If used, dummy vane reading is subtracted from peak and remolded vane reading when calculating strength

Laboratory Method SOPs



Notes on GTX Chain of Custody, Sample Storage and Sub-sampling Procedures

Sample Chain of Custody

GTX does not require the use of chain of custody (COC) forms for incoming samples unless samples are contaminated. If our clients wish to maintain sample COC forms, we will accommodate such requests. COC forms list the client (and contact information), project name, sample identification and the specific tests requested for each sample. The COC form is signed and dated by the person providing GTX with the samples ("relinquished by") and signed and dated by the GTX personnel receiving the samples ("received by"). These forms are kept in the project folder throughout the time the samples remain in GTX's custody. If samples are returned to the client upon the completion of testing, the COC form is then signed and dated by GTX personnel ("relinquished by") and signed and dated by personnel receiving the samples ("received by"). If samples are simply discarded, the date is noted on the COC form. In either case, a copy of the COC form is maintained in the project folder.

Sample Storage, Handling and Sub-sampling

Samples are stored in GTX's laboratory under standard laboratory atmospheric conditions unless a specific request is made for differing conditions or a test standard dictates otherwise. GTX's laboratory is closed to the public and entrance is restricted to only employees of GTX or those permitted by GTX to enter. At the request of our clients, samples can be kept in a locked storage area within the laboratory. Undisturbed Shelby tube samples are stored upright in a moist room to minimize sample disturbance and moisture loss.

Only technicians assigned to perform testing on samples are given access to samples. Samples are taken from storage, processed and sub-sampled according to assigned test standards, then returned to the storage area. Shelby tube samples are re-sealed using a plastic cap and electrical tape.

Once testing is completed on samples, they are moved to a holding area and stored for a minimum of sixty days before final disposition (return to client, disposal, treated then discarded, etc.).

Michael Pratt

Standard Operating Procedure

ASTM D2216

Technical Information

<u>Reference Number:</u>	ASTM D2216-19
<u>Test Method Title:</u>	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock Mass
<u>Test Property:</u>	Moisture content
<u>Test Specimen Size:</u>	As per test method based on maximum particle size
<u>Number of Test Specimens:</u>	1 or, as required by other testing representative based on type of sample: Undisturbed: mix sample by hand or take random samples throughout test sample, combine and mix Disturbed: take a representative cross-section of material for test
<u>Test Equipment:</u>	Oven capable of maintaining 60 or 110 ±5 °C Balance readable to 0.01 gram with 200 gram capacity or readable to 0.1 grams with >200 gram capacity Numbered specimen containers Desiccator

Standard Operating Procedure

1. Determine and record mass of a clean, dry specimen container.
2. Select a representative test specimen based on largest particle size. (See chart in test standard for guidance.) Place moist test specimen into container. Determine and record mass of container and moist test specimen using proper balance based specimen size.
3. Place the container with moist specimen in the oven at 110 °C (unless highly organic or gypsum, in which case use 60°C). Dry material to constant mass.
4. Once specimen has dried to constant mass, remove from oven and place into desiccator. Allow cooling to room temperature (or until container can be held comfortably in hands).
5. Measure and record mass of dried specimen and container with the same type of balance used to measure the before drying mass.
6. Calculate the moisture content of the material as follows:

$$w = [(M_{cws} - M_{cs}) / (M_{cs} - M_c)] \times 100$$

Standard Operating Procedure

ASTM D2216

where:

w = moisture content, %
 M_{cws} = mass of container and wet specimen, g
 M_{cs} = mass of container and dry specimen, g
 M_c = mass of container, g

7. Report: sample identification, moisture content of specimens to the nearest 0.1% or 1 % based on sample size used, description of material, temperature of drying oven if other than 110 °C, size and amount of material (if any) that was excluded from the test specimen.

Michael Pratt

Standard Operating Procedure

ASTM D2487

Technical Information

<u>Reference Number:</u>	ASTM D2487-17
<u>Test Method Title:</u>	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
<u>Test Property:</u>	Engineering classification of soil
<u>Test Specimen Size:</u>	If only grain size is required, size is based on the maximum particle size up to 60 kg; if Atterberg limits are also required, an additional 200 g of soil passing the #40 sieve is required
<u>Number of Test Specimens:</u>	1
<u>Test Equipment:</u>	Equipment required for performing grain size analysis (ASTM D422 or D6913) and Atterberg limits (ASTM D4318), plasticity chart and cumulative grain size curve

Standard Operating Procedure

Sample Preparation

1. Wet preparation is typically used to determine Atterberg limits and grain size analysis.

Test

2. Perform grain size analysis in accordance with ASTM D422 or D6913 (hydrometer not required) and Atterberg limits in accordance with ASTM D4318. If the soil has a dark color and an organic odor when moist or warm, an oven-dried liquid limit shall be performed. Dry the sample at 110 +/- 5°C to a constant weight, then rehydrate and perform a liquid limit test.

Classification Determination

3. Input all grain size, Atterberg limit and oven-dried liquid limit (if necessary) into the Laboratory Information Management System software. The software will classify the soil according to the USCS.
4. Report the following: group name, group symbol and results of laboratory analysis

Michael Pratt

Standard Operating Procedure

ASTM D4318

Technical Information

<u>Reference Number:</u>	ASTM D4318-17
<u>Test Method Title:</u>	Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
<u>Test Property:</u>	Plasticity of soils
<u>Test Specimen Size:</u>	150-200 grams of material passing the #40 sieve 100 grams of as received soil for Moisture Content Determination
<u>Number of Test Specimens:</u>	1 (representative sample obtained by quartering, mixing or splitting)
<u>Test Equipment:</u>	Liquid limit device Flat grooving tool Drying containers Balance readable to 0.01 gram with 500 gram capacity Ground glass plate Spatula #40 sieve Wash bottle Distilled Water Drying oven capable of maintaining 110 ± 5 °C Drying Plate/vacuum pump apparatus Soil Blender with mixing cup

Standard Operating Procedure

The Atterberg Limit Test requires the As Received Moisture content determination to be reported. If no other assigned testing requires the As Received Moisture content determination, follow ASTM D 2216 and obtain the result for the sample.

GTX requires a daily IRM check of the equipment to include, but is not limited to: the wear of the grooving tool, the drop height of the Liquid Limit device cup and the wear spot on the base under the cup at the point of impact of the Liquid Limit device. Do not use equipment that is not comply with the IRM tolerances, found on the IRM log.

SAMPLE PREPARTION (wet method)

1. If sample has little or no material retained on the #40 sieve, prepare specimen of 150-200 g by mixing thoroughly with distilled water on glass plate or mixing dish using a spatula. If desired, soak the material in a mixing/storage dish with a small amount of water to soften the material before the start of mixing. Adjust the water content of the soil and mix again to bring to a consistency that would require between

Standard Operating Procedure

ASTM D4318

25-35 blows. Remove >#40 sieve material by hand if small percentage is present. If water has been added to specimen place in a covered dish and allow to cure for a minimum of 16 hours.

2. If large percentage of >#40 sieve material is present, obtain a large enough specimen which will contain 150-200 g of material passing the #40 sieve. Place specimen in mixing cup and cover with distilled water. Mix into slurry, pass specimen through a #40 sieve and discard >#40 material. Reduce the amount of water using the drying plate/vacuum pump apparatus. Do not allow sample to over dry. Dry until sample is at a consistency that would require between 25-30 blows. Water has been added to the specimen so place in a covered dish and allow to cure for a minimum of 16 hours.

SAMPLE PREPARATION (dry method)

1. If sample is received dry, pass the material through a #40 sieve, and adjust the moisture content and mix thoroughly to bring the soil to a consistency that would require between 25-35 blows. Place specimen in a covered dish and allow to cure for a minimum of 16 hours.

LIQUID LIMIT DETERMINATION (multipoint method)

1. Before starting test, remix thoroughly in its dish adjusting the water content slightly, as necessary.
2. Fill the liquid limit cup even with front rim, to a depth that allows a full height cut with grooving tool. Keep the unused material covered with a wet towel in the mixing dish.
3. Form a groove in the soil from the highest point to the lowest point on the rim of the cup using the beveled edge facing forward of the grooving tool. Keep the tool perpendicular to cup from back to front by using an arc type motion. If the groove cannot be made in one stroke without tearing the soil, cut the groove in layers a little deeper with each cut, without tearing the soil.
4. Inspect the underside of the Liquid Limit Device, making sure the underside of the cup and base are clean. Lift and drop the cup at a rate of 1.9-2.1 drops per second until the two halves of the soil pat come in contact at the bottom of the groove along a distance of 0.5 inch. The base of the machine shall not be held with a hand while the crank is being turned. Record number of blows required. Take approximately 10 g of material from the closed area, perpendicular to the groove and place into a pre-weighed drying container. Measure and record mass to nearest 0.01 g. Cover the container.
5. Remove balance of material from cup and remix with soil in dish. Clean the cup.
6. By wetting the remaining material, adjust the blow counts so a distribution of blow counts is obtained. One point between 35 and 25 blows, another point between 20 and 30 blows, and a third point between 25 and 15 blows. For each point repeat steps 1 through 6.

PLASTIC LIMIT DETERMINATION

1. Obtain about 20 grams of soil prepared for the Liquid Limit test and dry by blotting with paper towels until it can be rolled without sticking to the glass plate.
2. To determine plastic limit, roll three to four threads of 1.5-2.0 grams of material down to a 1/8 inch

Standard Operating Procedure

ASTM D4318

diameter for a total sample weight of at least 6 grams.

3. Roll the material on a glass plate with the palm of your hand until a thread of uniform diameter of 1/8 inch is obtained (80-90 strokes per minute). This should take no longer than 2 minutes.
4. Ball up and repeat step 3 again. Repeat until 1/8 inch diameter cannot be obtained (thread crumbles under the pressure required for rolling). The only requirement for continuing is that the threads are able to be reformed into a ball and rolled out again.
5. Gather portions of the crumbled thread together and place into a pre-weighed container. Measure and record mass to nearest 0.01 g.
6. Repeat steps 2 through 5 one more time.
7. Dry all materials to a constant mass in oven with the temperature required for the material type being tested. Weigh again to the nearest 0.01 g.
8. Calculate the plasticity index as follows:

$$PI = LL - PL$$

where:

PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit

9. If either the liquid limit or plastic limit could not be determined, or if the plastic limit is equal to or greater than the liquid limit, report the soil as non-plastic.
10. Report: sample identification, as received moisture content, sample preparation procedure, liquid limit, plastic limit and plasticity index to the nearest whole number, and non-plastic if applicable.

Michael Pratt

Standard Operating Procedure

ASTM D6913 Method B Single Sieve Set Sieving

Technical Information

<u>Reference Number:</u>	ASTM D6913
<u>Test Method Title:</u>	Standard Test Methods for Particle-Size Distribution Gradation) of Soils Using Sieve Analysis
<u>Test Property:</u>	Grain Size Analysis for samples with all material passing a No. 4 sieve.
<u>Test Specimen Size:</u>	Depends on test samples maximum particle size. See ASTM D6913 Table 2 below. Specimen size is generally on the order of 50 to 500 g.



TABLE 2 Minimum Mass Requirement for Specimen

Maximum Particle Size of Material (99 % or more passes)		Minimum Dry Mass of Specimen, g or kg ^A	
Alternative Sieve Designation	Maximum Particle Size, mm	Method A Results Reported to Nearest 1 %	Method B Results Reported to Nearest 0.1 %
No. 40	0.425	50 g	75 g
No. 10	2.00	50 g	100 g
No. 4	4.75	75 g	200 g ^B
3/8 in.	9.5	165 g ^C	0
3/4 in.	19.0	1.3 kg ^C	0
1 in.	25.4	3 kg ^C	0
1-1/2 in.	38.1	10 kg ^C	0
2 in.	50.8	25 kg ^C	0
3 in.	76.2	70 kg ^E	0

^A Specimen masses should not significantly exceed (by more than about 50 %) the presented values because excessively large specimens may result in sieve overloading, (see 11.3) and increase the difficulty of specimen processing.

Number of Test Specimens: 1 representative sample obtained by quartering, mixing or splitting

Standard Operating Procedure

ASTM D6913 Method B Single Sieve Set Sieving

Test Equipment:

Fine Sieve Set:

3/8 in., No. 4, No. 10, No. 20, No. 40, No. 60, No.100, No. 140,
No.200
Washing Sieve, No. 200 (75- μ m)
Washing Sink with Spray Nozzle
Mechanical Sieve Shaker
Balances (readable to 0.01 g)
Drying Oven $110^{\circ} \pm 5^{\circ}$ C
Sample and Specimen Containers
Sieve Brushes
Wash bottle
Spatula
Stirring Rod

Optional Items

Splitter/Riffle Box or Quartering equipment
Mortar and Rubber-Covered Pestle (for breaking up aggregations of
dried soil.)
Low Temperature Drying Oven not to exceed 60° C
Sodium hexametaphosphate dispersant solution:
Make a solution by using 40 g of sodium hexametaphosphate
and 1,000 g distilled, deionized, or demineralized water

Standard Operating Procedure

ASTM D6913 Method B – Single Sieve Set Sieving (Use for samples containing **no** particles larger than a #4 sieve.)

Sample Preparation:

1. Confirm that the sample contains no plus No. 4 material.
2. Record the weight of an empty tare.
3. If the sample is large, collect a 100–200 g representative sub-sample of and place it in the tare weighed in step 2 above. For smaller samples, place the entire sample in the weighed tare from set 2 above. This sample will be used as a moisture content sample and the sieve test sub-specimen. Record the wet weight of the [sub-specimen + tare] and oven dry at $110^{\circ} \pm 5^{\circ}$ C.

Sieve Test:

1. Record the weight of the [oven-dried sub-specimen + tare] dried in Sample Preparation step 3 above.
2. Disperse the dried sub-specimen by soaking in water for at least 5 minutes before washing. Difficult samples can be dispersed using a sodium hexametaphosphate solution and/or an ultrasonic bath.
3. Wash the dispersed specimen on a #200 wash sieve, using tap water. Collect the wash water and dispose of the fine soil properly. Do not let the fines run down the drain.

Standard Operating Procedure

ASTM D6913 Method B Single Sieve Set Sieving

The material in the wash sieve may be lightly manipulated by hand, to facilitate the washing, taking care not to lose any of the soil. Do not exert any downward pressure on the wash sieve as this may damage the sieve.

Fine material can clog the screen. Care should be taken not to let the wash sieve fill with too much water when clogging occurs. Prevent clogging by lightly tapping the sides of the sieve with your hand or tapping on the bottom of the screen with a fingertip.

4. Transfer the washed +200 in. fraction of soil back into the same tare and oven dry at $110^{\circ} \pm 5^{\circ} \text{C}$.
5. Sieve the dried specimen using the standard fine sieve set, which includes the following sieve sizes:
No. 4, No. 10, No. 20, No. 40, No. 60, No.100, No. 140, No.200

Additional screens may be added as requested by the client.

6. Shake the sieve sample for a minimum 10 minutes. (The "Standard Shaking Period" is verified annually based on the procedure in ASTM D 6913.)
7. Avoid overloading individual sieves. Refer to ASTM Table 3 below for maximum sieve loading. If necessary, shake overloaded sieves in multiple batches.
8. Cumulatively record the weights of the oven-dried material retained on each of the fine sieves. Place the material, sieve by sieve, into a tared weighing container and record the cumulative weight. At least one sieve in the sieving process shall have 100 percent passing.

Standard Operating Procedure

ASTM D6913 Method B Single Sieve Set Sieving

TABLE 3 Overloading Limits for Standard Sieve Set

Alternative Sieve Designation	Standard Sieve Designation	Number of Grain Layers on Given Sieve	Maximum Mass Retained on 200-mm (8-in.) Diameter Sieve, g ^A	Maximum Mass Retained on 305-mm (12-in.) Diameter Sieve, g	Maximum Mass Retained on 370- by 590-mm (14.6- by 22.8-in.) Sieve, g
3 in.	75 mm	0.8	2 700	6 100	18 000
2 in.	50 mm	0.9	2 000	4 500	13 000
1-½-in.	37.5 mm	0.9	1 500	3 400	10 000
1 in.	25 mm	1	1 100	2 500	7 000
¾ in.	19.0 mm	1	900	2 000	6 000
⅝ in.	9.5 mm	1.25	550	1 200	3 600
No. 4	4.75 mm	1.5	325	730	2 000
No. 10	2.00 mm	2	180	410	1 000
No. 20	850 µm	3	115	260	800
No. 40	425 µm	4	75	170	500
No. 60	250 µm	5	60	140	400
No. 100	150 µm	6	40	90	300
No. 140	106 µm	6	30	70	200
No. 200	75 µm	6	20	50	100

Calculations:

1. Use initial moisture content and initial wet weight of test specimen to calculate initial dry weight of test specimen. Use reporting software to enter data and calculate % passing and retained for each sieve size.

Report:

1. The datasheet shall include the following:
 - Project identification, boring number, sample number, depth,
 - Visual classification of the soil being tested
 - Test method used (Method A)
 - Sample preparation - moist, air dried, or oven dried, etc.
 - Any material excluded from the specimen.
 - Indicate that composite sieving was used and the size of the designated separating sieve.
 - If material is retained on the designated separating sieve size in finer sieve set, then document that the percent retained does not exceed 2 % criterion.
 - Indicate if the ultrasonic bath or shaking apparatus or both were used during the dispersion process.

Standard Operating Procedure

ASTM D6913 Method B Single Sieve Set Sieving

- Any prior testing performed on specimen
- All mass measurements.
- Tabulation of percent passing for each sieve to 0.1%.

2. The report shall include the following:

- Project identification, boring number, sample number, depth,
- Classification or visual classification of the soil being tested
- Any material excluded from the specimen.
- Any prior testing performed on specimen
- A graph of the percent passing versus log of particle size in mm

ASTM Comments:

Some materials that are not soils, but are made up of particles may be tested using this method.

This test method is **not** applicable for the following soils:

1. Soils containing fibrous peat that will change in particle size during the drying, washing, or sieving procedure.
2. Soils containing extraneous matter, such as organic solvents, oil, asphalt, wood fragments, or similar items. Such extraneous matter can affect the washing and sieving procedures.
3. Materials that contain cementitious components, such as cement, fly ash, lime, or other stabilization admixtures.

This test method may **not** produce consistent test results within and between laboratories for the following soils:

1. Friable soils in which the sieving processes change the gradation of the soil. Typical examples of these soils are some residual soils, most weathered shales and some weakly cemented soils such as hardpan, caliche or coquina.
2. Soils that will not readily disperse such as glauconitic clays or some dried plastic clays.

To test these soils, this test method must be adapted, or altered, and these alterations documented.

Michael Pratt

Moisture Content

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to determining the moisture content by mass of soil, rock, and similar materials in accordance with ASTM International (ASTM) Method D2216 (ASTM 2010). The procedures for determining moisture content outlined in this SOP will be followed, and any deviations must be noted in your laboratory notebook.

Moisture content can be calculated on a wet mass basis (Equation 1) or dry mass basis (Equation 2). Moisture content is most commonly calculated on a wet mass basis in the EGL, though some projects may require moisture content determination on a dry mass basis. Check with project managers before proceeding.

Health and Safety

All laboratory work will be performed in accordance with the *EGL Chemical Hygiene Plan* (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Hazards and controls associated with this SOP are listed in the following sections and explicitly linked in **Table A**. Hazards associated with project-specific media are addressed in the Project Safety Analysis (PSA) document.

Chemical Safety Data Sheets

No chemicals are used in this procedure.

Hazards Associated with this Standard Operating Procedure

- Inhalation, ingestion, and skin or eye contact with contaminants or small particles
- Skin contact with heated surface of oven

Engineering Controls

- Perform work in an operational fume hood.

Administrative Controls

- The indicator light on the outside of the oven shows when the oven is on.

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell® TouchNTuff® 92-600)
- Oven mitts on top of gloves (when transferring samples to and from the oven)

Inspection Requirements

- Inspect personal protective equipment (PPE) prior to use.
- Confirm fume hood face velocity prior to use.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP; additional equipment may be required:

- Drying oven
- Analytical balance of appropriate precision
- Aluminum weigh-boats
- Ceramic or metal pan
- Stainless steel bowl and spoon

Procedure

1. Label aluminum weigh-boats in duplicate for each sample.
2. Determine and record the mass of the labeled weigh-boats.
3. Homogenize the sample.
4. Transfer approximately 20 grams (g) of material to each weigh-boat.
Note the presence of woody debris or larger grains and increase sample mass as appropriate.
5. Measure and record the mass of the container and wet sample.
6. Place the weigh-boats in a ceramic or metal pan.
7. Dry for a minimum of 18 hours at $105^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Ensure that all dry samples have been removed before placing samples in the oven.
8. Remove the samples from the oven.
9. Immediately measure and record the mass of the container and dry sample.

Calculations

Calculate the total solids and moisture content on a wet mass basis as shown in Equation 1. If calculating moisture content on a dry mass basis, use Equation 2.

Equation 1 (Wet Basis)

$$MC_{wet} = \frac{(M_{ws} - M_{wb}) - (M_{ds} - M_{wb})}{(M_{ws} - M_{wb})} \times 100$$

$$TS = \frac{(M_{ds} - M_{wb})}{(M_{ws} - M_{wb})} \times 100 = (1 - MC) \times 100$$

where:

MC_{wet}	=	moisture content (%) (wet basis)
M_{ws}	=	mass of the wet sample and the weigh-boat (g)
M_{ds}	=	mass of the dry sample and the weigh-boat (g)
M_{wb}	=	mass of the weigh-boat (g)
TS	=	total solids (%)

Equation 2 (Dry Basis)

$$MC_{dry} = \frac{(M_{ws} - M_{wb}) - (M_{ds} - M_{wb})}{(M_{ds} - M_{wb})} \times 100$$

where:

MC_{dry}	=	moisture content (%) (dry basis)
M_{ws}	=	mass of the wet sample and the weigh-boat (g)
M_{ds}	=	mass of the dry sample and the weigh-boat (g)
M_{wb}	=	mass of the weigh-boat (g)

Quality Assurance/Quality Control

Moisture content should be determined in duplicate if enough sample is available. The reproducibility is determined for duplicate samples as shown in Equation 3.

Equation 3

$$RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2)/2}$$

where:

RPD = relative percent difference

X_1 = larger result value

X_2 = smaller result value

If RPDs exceed 30%, notify the EGL task lead and discuss the RPD results within the scope of the project. In cases where RPDs exceed 30%, the data may still be of good quality. High RPDs may result from sample heterogeneity or other factors.

Closeout

The unused media from this experiment can be disposed of as described in Table 1. Project-specific media disposal is outlined in the Project Closeout Plan (PCP). If other unforeseen media is generated from this procedure, laboratory personnel and project managers will coordinate to characterize and dispose of those materials in accordance with federal, state, and local regulations.

Table 1
Disposal of Remaining Media

Remaining Media	Disposal Considerations	Disposal Procedure
Dried soil or sediment	Refer to PCP for potentially regulated constituents.	Refer to PCP for project-specific disposal methods.

Reference

ASTM (ASTM International), 2010. ASTM D2216. Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. West Conshohocken, PA:
ASTM International.

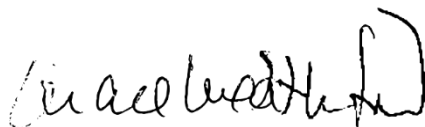
Data Sheet

Sample	Replicate	Weigh-Boat Mass (g)	Mass of Wet Sample + Weigh-Boat (g)	Mass of Dry Sample + Weigh-Boat (g)

Note:
g: gram

Standard Operating Procedure Approval Page

This standard operating procedure, Moisture Content, has been reviewed and is approved for use in the Environmental Geochemistry Laboratory.

Signature:  Date: 06/25/2025
Grace Weatherford, Chemical Hygiene Officer

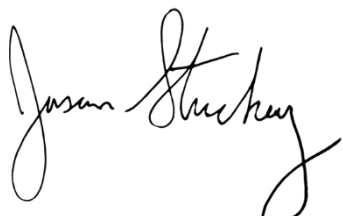
Signature:  Date: 06/25/2025
Jason Stuckey, EGL Manager

Table A

Hazards

Table A
Hazards

Potential Hazard(s)	Engineering Controls	Administrative Controls (Includes Work Practices)	PPE	Inspection Requirements
Inhalation, ingestion, and skin or eye contact with contaminants or small particles	Perform work in an operational fume hood.	--	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.
Skin contact with heated surface of oven	--	The indicator light on the outside of the oven shows when the oven is on.	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600) - Oven mitts	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.

Notes:

--: not applicable

PPE: personal protective equipment

Grain Size Analysis of Soils and Sediment

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to determination of the grain size distribution of soils in accordance with ASTM International (ASTM) D422 (ASTM 2007). The procedures for extraction outlined in this SOP will be followed, and any deviations must be noted in your laboratory notebook.

Health and Safety

All laboratory work will be performed in accordance with the *EGL Chemical Hygiene Plan* (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Hazards and controls associated with this SOP are listed in the following sections and explicitly linked in **Table A**. Hazards associated with project-specific media are addressed in the Project Safety Analysis (PSA) document.

Chemical Safety Data Sheets

No chemicals are used in this procedure.

Hazards Associated with this Standard Operating Procedure

- Inhalation, ingestion, and skin or eye contact with contaminants or small particles
- Skin contact with heated surfaces of oven

Engineering Controls

- Perform work in an operational fume hood.

Administrative Controls

- The indicator light on the outside of the oven shows when the oven is on.

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell® TouchNTuff® 92-600)
- Oven mitts on top of gloves (when transferring samples to and from the oven)

Inspection Requirements

- Inspect personal protective equipment (PPE) prior to use.
- Confirm fume hood face velocity prior to use.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP; additional equipment may be required:

- Analytical balance appropriate for mass range
- Standard sieve set(s)
- Drying oven (110°C)
- Sample tray
- Aluminum weigh-boats

Procedure

1. Oven-dry the sample for 24 hours at $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
 - a. A sample size of approximately 100 grams (g) is recommended.
2. Record the total sample mass.
Wet-sieve the sample using a U.S. standard No. 200 (75 micrometer [μm]) sieve to wash off fines (silt and clay). *Note: shake the sample vigorously prior to wet-sieving to remove as much of the fines as possible; discard the portion passing the No. 200 sieve.*
3. Oven-dry the portion retained on the No. 200 sieve for 24 hours at $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
4. Weigh and record the portion retained on the No. 200 sieve.
5. Determine mass of "fines" (silt and clay) removed by wet-sieving as the difference between the total dry sample mass and the dry mass retained on the No. 200 sieve after wet-sieving.
6. Dry-sieve the retained sample using the U.S. standard sieve set (mechanical shaker preferred to ensure complete separation).

Table 1
Grain Size Distribution Overview

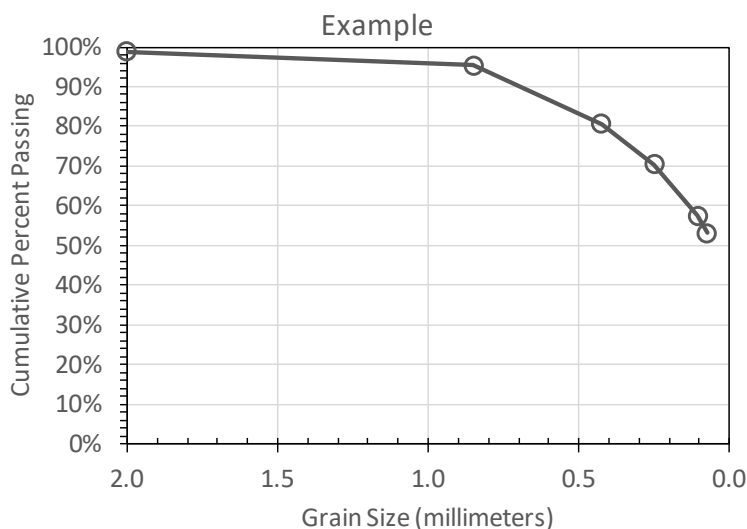
Standard Sieve	Particles Retained (millimeters)	Particle Description
No. 10	2.0	Gravel
No. 18	1.0	Sand
No. 35	0.5	
No. 60	0.25	
No. 120	0.125	
No. 200	0.075	
Passing No. 200	<0.075	Fines (silt and clay)

7. Record the mass of sample retained on each sieve as well as the mass passing for the No. 200 sieve.
8. As appropriate, the grain size classification for engineers may be substituted (Dietrich et al. 1982):
 - a. Retained No. 10 sieve: Gravel
 - b. Passing No. 10 but not No. 18: Very coarse sand
 - c. Passing No. 18 but not No. 35: Coarse sand
 - d. Passing No. 35 but not No. 60: Medium sand
 - e. Passing No. 60 but not No. 140: Fine sand
 - f. Passing No. 140 but not No. 200: Very fine sand

Reporting

The data will be reported as a table of the cumulative percent passing by grain size and a graphical representation of the grain size distribution (Figure 1).

Figure 1
Example Reporting



Sieve	Grain Size (mm)	Percent Passing
#10	2.0	98.8%
#18	1.0	95.4%
#35	0.50	80.6%
#60	0.25	70.5%
#125	0.125	57.4%
#200	0.074	53.1%

Quality Assurance/Quality Control

Duplicate or replicate samples should be analyzed at a project appropriate rate, with at least one duplicate or replicate sample per event.

The reproducibility is determined for duplicate samples as shown in Equation 1.

Equation 1

$$RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2) \div 2}$$

where:

RPD = relative percent difference
 X_1 = larger result value
 X_2 = smaller result value

If relative percent differences (RPDs) exceed 30%, notify the EGL task lead and discuss the RPD results within the scope of the project. In cases where RPDs exceed 30%, the data may still be of good quality. High RPDs may result from sample heterogeneity or other factors.

Closeout

The remaining media from this experiment can be disposed of as described in Table 2.

Project-specific media disposal is outlined in the Project Closeout Plan (PCP). If other unforeseen media is generated from this procedure, laboratory personnel and project managers will coordinate to characterize and dispose of those materials in accordance with federal, state, and local regulations.

Table 2
Disposal of Remaining Media

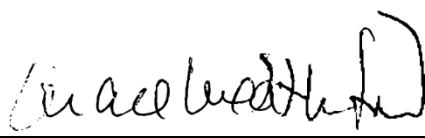
Remaining Media	Disposal Considerations	Disposal Procedure
Dried soil or sediment	Refer to PCP for potentially regulated constituents.	Refer to PCP for project-specific disposal methods.

References

- ASTM (ASTM International), 2007. *ASTM D422-63(2007)e2 – Standard Test Method for Particle-Size Analysis of Soils (Withdrawn 2016)*. West Conshohocken, Pennsylvania: ASTM International.
- Dietrich, R.V., J.T. Dutro, and R.M. Foote, editors, 1982. *AGI Data Sheets: For Geology in the Field, Laboratory, and Office, Volume 1*. Alexandria, Virginia: American Geological Institute.

Standard Operating Procedure Approval Page

This standard operating procedure, Grain Size Analysis of Soils and Sediment, has been reviewed by and is approved for use in the Environmental Geochemistry Laboratory.

Signature:  Date: 06/25/2025
Grace Weatherford, Chemical Hygiene Officer

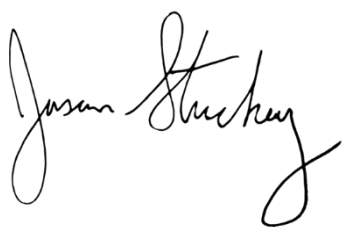
Signature:  Date: 06/25/2025
Jason Stuckey, Laboratory Manager

Table A

Hazards

Table A
Hazards

Potential Hazard(s)	Engineering Controls	Administrative Controls (Includes Work Practices)	PPE	Inspection Requirements
Inhalation, ingestion, and skin or eye contact with contaminants or small particles	Perform work in an operational fume hood.	--	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.
Skin contact with heated surface of oven	--	The indicator light on the outside of the oven shows when the oven is on.	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600) - Oven mitts	- Inspect PPE prior to use.

Notes:

--: not applicable

PPE: personal protective equipment

Paint Filter Liquids Test

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to the evaluation of free liquids in a representative solid sample by the paint filter test method (modified Environmental Protection Agency method 9095B; EPA 2004). The procedures in this SOP will be followed, and any deviations must be noted in your laboratory notebook.

Health and Safety

All laboratory work will be performed in accordance with the *EGL Chemical Hygiene Plan* (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Hazards and controls associated with this SOP are listed in the following sections and explicitly linked in **Table A**. Hazards associated with project-specific samples are addressed in the Project Safety Analysis (PSA) document.

Chemical Safety Data Sheets

No chemicals are used in this procedure.

Hazards Associated with this Standard Operating Procedure

- Inhalation, ingestion, and skin or eye contact with contaminants or small particles
- Breakage of glassware

Engineering Controls

- Perform work in an operational fume hood.

Administrative Controls

- Carry glassware with two hands. Use brush and dustpan to sweep large pieces of glass. Use sticky tape or tweezes/forceps to pick up tiny pieces of glass. Do not pick up broken glass with hands.

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell® TouchNTuff® 92-600)

Inspection Requirements

- Inspect personal protective equipment (PPE) prior to use.
- Confirm fume hood face velocity prior to use.
- Inspect glassware prior to use.

Equipment and Supplies

The following equipment may be necessary to carry out the procedures in this SOP; additional equipment may be required:

- Conical fine-meshed paint filter (mesh number $60 \pm 5\%$)
- 100-milliliter (mL) beaker or graduated cylinder
- Funnel
- Ring stand or tripod

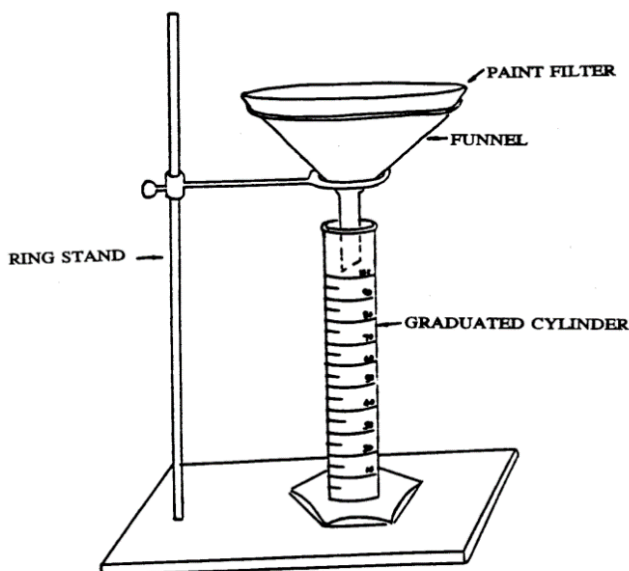
Procedure

1. The test should be performed on a minimum of 100 grams (g) or 100 mL of a representative sample.
 - a. If 100 g or 100 mL is not sufficiently representative of the sample, a larger volume may be used in multiples of 100 mL or 100 g (i.e., 200, 300, 400 mL or g). When larger samples are used, the sample will be divided into 100 g or 100 mL portions and tested separately. If any portion contains free liquids, the entire sample is considered to have free liquids.
 - b. If the sample is measured volumetrically, then it should lack major air spaces or voids.
2. Assemble the test apparatus as shown in Figure 1.
 - a. The funnel must allow at least 1 inch of the filter mesh to protrude and should have a large open mouth to support the paint filter but not interfere with the movement of the liquid that passes through the filter mesh into the beaker.
3. Place the sample in the paint filter.
 - a. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh.
 - b. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.
 - c. If the test material does not conform to the shape of the paint filter (i.e., sorbent pads or pillows), the sample should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the material with scissors, shears, a knife, or other such device to preserve as much of the original integrity of the material as possible.
 - d. The particles to be tested should be reduced in size to smaller than 1 centimeter (cm) (i.e., should be capable of passing a 9.5 millimeter standard sieve). Grinding sorbent

materials should be avoided as this may destroy the integrity of the sorbent and produce fine particles which would normally not be present.

- e. For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.
4. Allow sample to drain for 5 minutes into the beaker.
5. If any portion of the test material collects in the beaker in the 5-minute period, then the material is deemed to contain free liquids for purposes of 40 *Code of Federal Regulations* 264.314 and 265.314.

Figure 1
Paint Filter Test Apparatus



Quality Assurance/Quality Control

Duplicate samples should be analyzed on a routine basis. If the duplicates yield contradictory results, then a third replicate should be performed and duplicate analyses should be performed for other samples to evaluate whether samples are adequately homogenized and representative.

Closeout

The remaining media from this experiment can be disposed of as described in Table 1. Project-specific media disposal is outlined in the Project Closeout Plan (PCP). If other unforeseen media is generated

from this procedure, laboratory personnel and project managers will coordinate to characterize and dispose of those materials in accordance with federal, state, and local regulations.

Table 1
Disposal of Remaining Media

Remaining Media	Disposal Considerations	Disposal Procedure
Solid material remaining in the paint filter	Refer to PCP for potentially regulated constituents.	Refer to PCP for project-specific disposal methods.
Free liquids collected in the beaker	Refer to PCP for potentially regulated constituents.	Refer to PCP for project-specific disposal methods.

Reference

EPA (U.S. Environmental Protection Agency), 2004. Method 9095B Paint Filter Liquids Test (Revision 2): EPA 9095B. Accessed January 19, 2023. Available at:
https://www.epa.gov/sites/default/files/2015-12/documents/9095b_0.pdf.

Standard Operating Procedure Approval Page

This standard operating procedure, Paint Filter Liquids Test, has been reviewed is approved for use in the Environmental Geochemistry Laboratory.

Signature:  Date: 07/20/2026
Grace Weatherford, Chemical Hygiene Officer

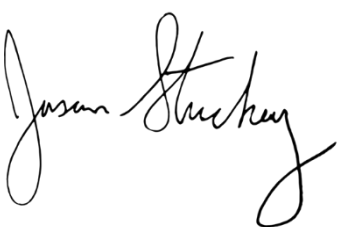

Signature: _____ Date: 07/20/2026
Jason Stuckey, EGL Manager

Table A

Hazards

Table A
Hazards

Potential Hazard(s)	Engineering Controls	Administrative Controls (Includes Work Practices)	PPE	Inspection Requirements
Inhalation, ingestion, and skin or eye contact with contaminants or small particles	Perform work in an operational fume hood.	--	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.
Breakage of glassware	--	- Carry glassware with two hands. - Use brush and dustpan to sweep large pieces of glass. - Use sticky tape or tweezes/forceps to pick up tiny pieces of glass. - Do not pick up broken glass with hands.	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Inspect glassware prior to use.

Notes:

--: not applicable

PPE: personal protective equipment

Soil pH

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to determination of soil pH in accordance with the method described in *Methods of Soil Analysis: Chemical Analysis* (Thomas 1996) and ASTM International (ASTM) Method D4972 (ASTM 2019). The procedures outlined in this SOP will be followed, and any deviations must be noted in your laboratory notebook.

Health and Safety

All laboratory work will be performed in accordance with the *EGL Chemical Hygiene Plan* (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Hazards and controls associated with this SOP are listed in the following sections and explicitly linked in **Table A**. Hazards associated with project-specific samples are addressed in the Project Safety Analysis (PSA) document. Occupational exposure limits (OELs) for chemicals used in this SOP are attached as **Table B**.

Chemical Safety Data Sheets

The following Safety Data Sheets (SDSs) must be reviewed prior to beginning the procedure:

- Calcium chloride
- Potassium chloride
- pH buffer standards (4.01, 7.00, 10.01)
- pH electrode storage solution

Hazards Associated with this Standard Operating Procedure

- Inhalation, ingestion, and skin or eye contact with contaminants or small particles
- Breakage of glassware

Engineering Controls

- Perform work in an operational fume hood.

Administrative Controls

- Carry glassware with two hands. Use brush and dustpan to sweep large pieces of glass. Use sticky tape or tweezers/forceps to pick up tiny pieces of glass. Do not pick up broken glass with hands.

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell® TouchNTuff® 92-600)

Inspection Requirements

- Inspect personal protective equipment (PPE) prior to use.
- Confirm fume hood face velocity prior to use.
- Inspect glassware prior to use.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP (additional equipment may be required):

- pH meter
- Combination electrode (calibrate prior to use)
- pH buffers in a sample appropriate range (typically 4, 7, and/or 10)
- Deionized (DI) water
- Beakers
- Potassium chloride
- Calcium chloride

Procedure

1. Calibrate the pH electrode. For best results, the buffer solutions and reagent water should be at the same temperature (e.g., room temperature).
2. Weigh 20 grams (g) of homogenized soil or sediment into a beaker.
3. Add 20 g of DI water.
4. Mix thoroughly to generate a slurry.
5. Allow the slurry to settle for 1 hour.
6. Measure pH in the solution (immediately above the settled material).
7. Rinse the electrode with DI water.

8. Measure the pH of the buffer solution nearest sample pH every third sample at a minimum to confirm calibration (solution should be within 0.1 pH units of the known value). Recalibrate if necessary.

Alternative Procedures

1. The pH may be determined on a dry weight basis by air-drying the samples prior to the procedure.
2. The soil pH may also be measured as pH_{KCl} or pH_{CaCl2}.
 - a. The reagent water is replaced with a 1 molar (M) solution of potassium chloride to evaluate the influence of exchangeable aluminum on soil pH.
 - b. The reagent water is replaced with a 0.01 M solution of calcium chloride to displace exchangeable hydronium (H₃O⁺).
3. Slurry may be centrifuged if fine particles are not settling within 10 minutes.

Quality Assurance/Quality Control

Duplicate or replicate samples should be analyzed at project appropriate rate, with at least one duplicate per event. The reproducibility is determined for duplicate samples as shown in Equation 1.

Equation 1

$$RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2) \div 2}$$

where:

RPD	=	relative percent difference (%)
X ₁	=	larger result value
X ₂	=	smaller result value

If relative percent differences (RPDs) exceed 10%, notify the EGL task lead and discuss the RPD results within the scope of the project. In cases where RPDs exceed 10%, the data may still be of good quality. High RPDs may result from sample heterogeneity or other factors.

Closeout

The remaining media from this experiment can be disposed of as described in Table 1. Project-specific media disposal is outlined in the Project Closeout Plan (PCP). If other unforeseen media is generated from this procedure, laboratory personnel and project managers will coordinate to characterize and dispose of those materials in accordance with federal, state, and local regulations.

Table 1
Disposal of Remaining Media

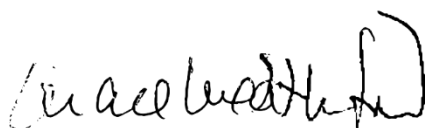
Remaining Media	Disposal Considerations	Disposal Procedure
Extraction reagents (1 M potassium chloride or 0.01 M calcium chloride)	Potassium chloride and calcium chloride are not regulated waste materials.	Dispose of remaining product down the drain with an excess of running tap water.
pH buffers	Aqueous solutions with a pH <2 or >12.5 carry the federal waste code of Corrosivity (EPA 2024). Additionally, the municipal discharge guideline requires a pH of 5.0 to 11.5 for drain disposal (City of Portland 2019).	pH-neutralize to 5.0 to 11.5 and dispose of down the sink with an excess of running tap water.
Soil residues mixed with water or potassium chloride or calcium chloride	Potassium chloride and calcium chloride are not regulated waste materials. Refer to PCP for potentially regulated constituents in the soil.	Decant the standing water or salt solution and pour down the drain with an excess of running tap water. Refer to PCP for project-specific disposal methods of the sample media.

References

- ASTM (ASTM International), 2019. *D4972 Standard Test Method for pH of Soils*.
- City of Portland, 2019. Sanitary Discharge and Pretreatment Program Administrative Rules: ENB – 4.03. Accessed June 2, 2023. <https://www.portland.gov/sites/default/files/2020-06/enb-4-03-sanitary-discharge-and-pretreatment-program-7-19-465822.pdf>.
- EPA (U.S. Environmental Protection Agency), 2024. Defining Hazardous Waste: Listed, Characteristic and Mixed Radiological Wastes. Accessed November 11, 2024. <https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes>.
- Thomas, G.W., 1996. "Soil pH and Soil Acidity: Procedure for Soil pH Measurement." In *Methods of Soil Analysis. Part 3: Chemical Methods*. Editor, D.L. Sparks. Madison, Wisconsin: Soil Science Society of America; pp. 487–488.

Standard Operating Procedure Approval Page

This standard operating procedure, Soil pH, has been reviewed and is approved for use in the Environmental Geochemistry Laboratory.

Signature:  Date: 07/24/2026
Grace Weatherford, Chemical Hygiene Officer

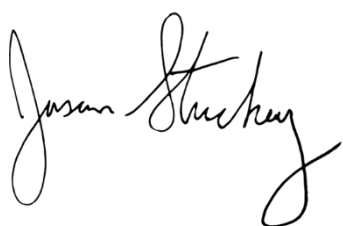
Signature:  Date: 07/24/2026
Jason Stuckey, Laboratory Manager

Table A

Hazards

Table A
Hazards

Potential Hazard(s)	Engineering Controls	Administrative Controls (Includes Work Practices)	PPE	Inspection Requirements
Inhalation, ingestion, and skin or eye contact with contaminants or small particles	Perform work in an operational fume hood.	--	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.
Breakage of glassware	--	- Carry glassware with two hands. - Use brush and dustpan to sweep large pieces of glass. - Use sticky tape or tweezes/forceps to pick up tiny pieces of glass. - Do not pick up broken glass with hands.	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Inspect glassware prior to use.

Notes:

--: not applicable

PPE: personal protective equipment

Table B

Occupational Exposure Limits

Table B
Occupational Exposure Limits

SOP No.	Title	Chemicals Used	CAS Number	Exposure Routes	Symptoms	Target Organs	OEL (ppm)	NIOSH/ OSHA/ ACGIH Values	Vapor Pressure (mmHg)	Ionization Potential (eV)	First Aid
305	Soil pH	Potassium Chloride	7447-40-7	Inhalation, ingestion, skin and/or eye contact	None reasonably foreseeable	Eyes, skin, respiratory system	--	--	--	--	Eye: Rinse with plenty of water. Remove contact lenses. Skin: Remove contaminated clothing. Rinse skin with water/shower Breathing: Remove to fresh air. Swallow: Drink plenty of water. Consult doctor if feeling unwell.
305	Soil pH	Calcium Chloride	10043-52-4	Inhalation, ingestion, skin and/or eye contact	Serious eye damage/eye irritation	Eyes, skin, respiratory system	--	--	--	--	Eye: Irrigate immediately. Seek medical attention. Skin: Water flush immediately. Breathing: Remove to fresh air. Give oxygen as needed. Seek medical attention if symptoms occur. Swallow: Do NOT induce vomiting. Medical attention.
305	Soil pH	pH buffers	--	Inhalation, ingestion, skin and/or eye contact	None reasonably foreseeable	Eyes, skin, respiratory system	--	--	--	--	Eye: Rinse with plenty of water. Remove contact lenses. Skin: Remove contaminated clothing. Rinse skin with water/shower Breathing: Remove to fresh air. Swallow: Drink plenty of water. Consult doctor if feeling unwell.

Notes:
--: not applicable
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service
eV: electronvolt
mmHg: millimeter of mercury
NIOSH: National Institute for Occupational Safety and Health
OEL: occupational exposure limit
OSHA: Occupational Safety and Health Administration
ppm: part per million
SOP: Standard Operating Procedure

Specific Gravity of Soils

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to determining the specific gravity of soil, rock, and similar materials in accordance with ASTM International (ASTM) Method D854-23 (ASTM 2024). The procedures outlined in this SOP will be followed, and any deviations must be noted in your laboratory notebook.

Health and Safety

All laboratory work will be performed in accordance with the EGL Chemical Hygiene Plan (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the laboratory manager, as specified in the CHP.

Hazards and controls associated with this SOP are listed in the following sections and explicitly linked in **Table A**. Hazards associated with project-specific samples are addressed in the Project Safety Analysis (PSA) document.

Hazards Associated with this Standard Operating Procedure

- Inhalation, ingestion, and skin or eye contact with contaminants or small particles
- Breakage of glassware

Engineering Controls

- Perform work in an operational fume hood.

Administrative Controls

- Carry glassware with two hands.

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell® TouchNTuff® 92-600)

Inspection Requirements

- Inspect personal protective equipment (PPE) prior to use.
- Confirm fume hood face velocity prior to use.
- Inspect glassware prior to use.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP; additional equipment may be required:

- Analytical balance of appropriate precision
- Deionized (DI) water
- No. 4 sieve (4.75-millimeter [mm])
- Spatula
- Thermometer or temperature probe
- Pycnometer with a minimum capacity of 250 milliliter (mL)
- Vacuum pump and tubing
- Micropipette and pipette tips
- Vortex mixer
- Beaker
- Funnel

Procedure

Note that samples can be either oven dried or used at their natural moisture content. Soils with a high organic content or with fines that are low compressible are difficult to rewet after having been oven-dried. These soils should be tested at their natural water content first and the oven-dried weight determined at the end of the test.

Pycnometer Calibration

1. Label an empty, clean, and dry pycnometer.
2. Determine the mass of the empty pycnometer using an analytical balance.
3. Repeat the measurement five times and determine the average mass of the empty pycnometer (see Table 2).
4. Fill to the calibration line with reagent water and determine the mass.
5. Measure the temperature of the reagent water.
6. Repeat both the mass and temperature measurements five times to determine the average values.

Sample Preparation

1. Homogenize the moist soil sample using a spatula.
2. Sieve sample through a No. 4 sieve to remove materials that are larger than 4.75 mm.
3. Determine the total solids on a subsample.
4. Transfer an aliquot of the moist soil sample to a beaker and record the exact mass of the sample (see Table 3). Use approximately 25-, 50-, and 100-gram (g) aliquot for 100-, 250-, and 500-mL pycnometers, respectively.

5. Add reagent water to the soil sample sufficient to generate a slurry.

Specific Gravity Determination

1. Agitate the beaker containing the soil slurry using a vortex mixer.
2. Pour the soil slurry into the calibrated pycnometer.
3. Rinse any soil particles remaining in the beaker and funnel into the pycnometer.
4. Add reagent water until the flask is 2/3 full.
5. Apply vacuum to the pycnometer for 2 hours to remove any air bubbles entrained in the soil.
6. Fill the pycnometer to the calibration line, use a pipette to fill dropwise until the bottom of the meniscus is at the calibration mark.
7. Record the total combined mass of the flask, soil sample, and water.
8. Measure the temperature of the test mixture.

Calculations

Calculate the temperature corrected mass of the flask and water (Equation 1).

Equation 1

$$M_{FW,t} = M_F + (V_W * \rho_{W,t})$$

where:

$M_{FW,t}$	=	temperature corrected mass of flask and reagent water (g)
M_F	=	mass of the empty, dry flask (g)
V_W	=	volume of water contained in the flask, corrected for temperature (mL)
$\rho_{W,t}$	=	density of water at the test temperature (gram per milliliter [g/mL])

Note: Values are tabulated in the method and provided in Figure 1.

Calculate the specific gravity of the soil at the test temperature (Equation 2).

Equation 2

$$SG_t = \frac{M_s}{M_{FW,t} - (M_{FWS} - M_s)}$$

where:

- SG_t = specific gravity of the soil at the test temperature (gram per centimeter cubed [g/cm³])
- M_s = soil mass (dry weight basis) (g)
- $M_{FW,t}$ = temperature-corrected mass of flask and reagent water (g) from Equation 1
- M_{FWS} = total mass of the flask, water, and soil (g)

Calculate the specific gravity of the soil at the standard reporting temperature of 20°C (Equation 3).

Equation 3

$$SG = K * SG_t$$

where:

- SG = specific gravity of the soil (g/cm³)
- K = temperature coefficient for the test temperature
- SG_t = specific gravity of the soil at the test temperature (g/cm³)

Note: Temperature coefficients are tabulated in the method and provided in Figure 1.

Figure 1**Density of Water and Temperature Coefficient for Various Temperatures (Method D854 Table 2)**

Temperature (°C)	Density (g/mL) ^B	Temperature Coefficient (K)	Temperature (°C)	Density (g/mL) ^B	Temperature Coefficient (K)	Temperature (°C)	Density (g/mL) ^B	Temperature Coefficient (K)	Temperature (°C)	Density (g/mL) ^B	Temperature Coefficient (K)
15.0	0.99910	1.00090	16.0	0.99895	1.00074	17.0	0.99878	1.00057	18.0	0.99860	1.00039
.1	0.99909	1.00088	.1	0.99893	1.00072	.1	0.99876	1.00055	.1	0.99858	1.00037
.2	0.99907	1.00087	.2	0.99891	1.00071	.2	0.99874	1.00054	.2	0.99856	1.00035
.3	0.99906	1.00085	.3	0.99890	1.00069	.3	0.99872	1.00052	.3	0.99854	1.00034
.4	0.99904	1.00084	.4	0.99888	1.00067	.4	0.99871	1.00050	.4	0.99852	1.00032
.5	0.99902	1.00082	.5	0.99886	1.00066	.5	0.99869	1.00048	.5	0.99850	1.00030
.6	0.99901	1.00080	.6	0.99885	1.00064	.6	0.99867	1.00047	.6	0.99848	1.00028
.7	0.99899	1.00079	.7	0.99883	1.00062	.7	0.99865	1.00045	.7	0.99847	1.00026
.8	0.99898	1.00077	.8	0.99881	1.00061	.8	0.99863	1.00043	.8	0.99845	1.00024
.9	0.99896	1.00076	.9	0.99879	1.00059	.9	0.99862	1.00041	.9	0.99843	1.00022
19.0	0.99841	1.00020	20.0	0.99821	1.00000	21.0	0.99799	0.99979	22.0	0.99777	0.99957
.1	0.99839	1.00018	.1	0.99819	0.99998	.1	0.99797	0.99977	.1	0.99775	0.99954
.2	0.99837	1.00016	.2	0.99816	0.99996	.2	0.99795	0.99974	.2	0.99773	0.99952
.3	0.99835	1.00014	.3	0.99814	0.99994	.3	0.99793	0.99972	.3	0.99770	0.99950
.4	0.99833	1.00012	.4	0.99812	0.99992	.4	0.99791	0.99970	.4	0.99768	0.99947
.5	0.99831	1.00010	.5	0.99810	0.99990	.5	0.99789	0.99968	.5	0.99766	0.99945
.6	0.99829	1.00008	.6	0.99808	0.99987	.6	0.99786	0.99966	.6	0.99764	0.99943
.7	0.99827	1.00006	.7	0.99806	0.99985	.7	0.99784	0.99963	.7	0.99761	0.99940
.8	0.99825	1.00004	.8	0.99804	0.99983	.8	0.99782	0.99961	.8	0.99759	0.99938
.9	0.99823	1.00002	.9	0.99802	0.99981	.9	0.99780	0.99959	.9	0.99756	0.99936
23.0	0.99754	0.99933	24.0	0.99730	0.99909	25.0	0.99705	0.99884	26.0	0.99679	0.99858
.1	0.99752	0.99931	.1	0.99727	0.99907	.1	0.99702	0.99881	.1	0.99676	0.99855
.2	0.99749	0.99929	.2	0.99725	0.99904	.2	0.99700	0.99879	.2	0.99673	0.99852
.3	0.99747	0.99926	.3	0.99723	0.99902	.3	0.99697	0.99876	.3	0.99671	0.99850
.4	0.99745	0.99924	.4	0.99720	0.99899	.4	0.99694	0.99874	.4	0.99668	0.99847
.5	0.99742	0.99921	.5	0.99717	0.99897	.5	0.99692	0.99871	.5	0.99665	0.99844
.6	0.99740	0.99919	.6	0.99715	0.99894	.6	0.99689	0.99868	.6	0.99663	0.99842
.7	0.99737	0.99917	.7	0.99712	0.99892	.7	0.99687	0.99866	.7	0.99660	0.99839
.8	0.99735	0.99914	.8	0.99710	0.99889	.8	0.99684	0.99863	.8	0.99657	0.99836
.9	0.99732	0.99912	.9	0.99707	0.99887	.9	0.99681	0.99860	.9	0.99654	0.99833
27.0	0.99652	0.99831	28.0	0.99624	0.99803	29.0	0.99595	0.99774	30.0	0.99565	0.99744
.1	0.99649	0.99828	.1	0.99621	0.99800	.1	0.99592	0.99771	.1	0.99562	0.99741
.2	0.99646	0.99825	.2	0.99618	0.99797	.2	0.99589	0.99768	.2	0.99559	0.99738
.3	0.99643	0.99822	.3	0.99615	0.99794	.3	0.99586	0.99765	.3	0.99556	0.99735
.4	0.99641	0.99820	.4	0.99612	0.99791	.4	0.99583	0.99762	.4	0.99553	0.99732
.5	0.99638	0.99817	.5	0.99609	0.99788	.5	0.99580	0.99759	.5	0.99550	0.99729
.6	0.99635	0.99814	.6	0.99607	0.99785	.6	0.99577	0.99756	.6	0.99547	0.99726
.7	0.99632	0.99811	.7	0.99604	0.99783	.7	0.99574	0.99753	.7	0.99544	0.99723
.8	0.99629	0.99808	.8	0.99601	0.99780	.8	0.99571	0.99750	.8	0.99541	0.99720
.9	0.99627	0.99806	.9	0.99598	0.99777	.9	0.99568	0.99747	.9	0.99538	0.99716

Quality Assurance/Quality Control

Duplicate samples should be analyzed at a project appropriate rate, with at least one duplicate per event. Duplicate reproducibility is determined as the relative percent difference (RPD) (Equation 4).

Equation 4

$$RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2) \div 2}$$

where:

RPD = relative percent difference
*X*₁ = larger result value
*X*₂ = smaller result value

If RPDs exceed 30%, notify the EGL task lead and discuss the RPD results within the scope of the project. In cases where RPDs exceed 30%, the data may still be of good quality. High RPDs may result from sample heterogeneity or other factors.

Closeout

The remaining media from this experiment can be disposed of as described in Table 1. Project-specific media disposal is outlined in the Project Closeout Plan (PCP). If other unforeseen media is generated from this procedure, laboratory personnel and project managers will coordinate to characterize and dispose of those materials in accordance with federal, state, and local regulations.

Table 1
Disposal of Remaining Media

Remaining Media	Disposal Considerations	Disposal Procedure
Soil or sediment mixed with water	Refer to the PCP for potentially regulated constituents.	Refer to the PCP for project-specific disposal methods. Dewatering is recommended for most disposal methods; this may be achieved by cement amendment.

Reference

ASTM (ASTM International), 2024. ASTM D854-23. Standard Test Methods Specific Gravity of Soil Solids by the Water Displacement Method. West Conshohocken, PA: ASTM International.

Table 2
Data Sheet Pycnometer Flask Calibration

Apparatus	Replicate	Mass (g)	Temperature (°C)	Average (g)
Clean, dry flask	1		--	
	2		--	
	3		--	
	4		--	
	5		--	
Flask + reagent water	1			
	2			
	3			
	4			
	5			

Note:

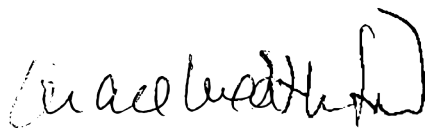
--: not applicable

Table 3
Data Sheet

Sample	Mass of Soil (g)	Total Solids	Mass of Flask, Soil, and Water (g)	Test Temperature (°C)

Standard Operating Procedure Approval Page

This standard operating procedure, Specific Gravity of Soils, has been reviewed and is approved for use in the Environmental Geochemistry Laboratory.

Signature:  Date: 08/18/2025
Grace Weatherford, Chemical Hygiene Officer

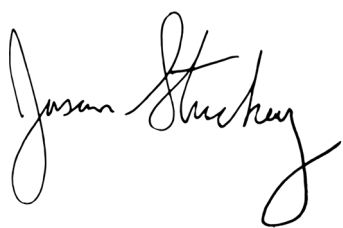
Signature:  Date: 08/18/2025
Jason Stuckey, Laboratory Manager

Table A

Hazards

Table A
Hazards

Potential Hazard(s)	Engineering Controls	Administrative Controls (Includes Work Practices)	PPE	Inspection Requirements
Inhalation, ingestion, and skin or eye contact with contaminants or small particles	Perform work in an operational fume hood.	--	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.
Breakage of glassware	--	Carry glassware with two hands.	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Inspect glassware prior to use.

Notes:

--: not applicable

PPE: personal protective equipment

Unconfined Strength by Pocket Penetrometer

Scope and Application

This Environmental Geochemistry Laboratory (EGL) standard operating procedure (SOP) is applicable to the estimation of the unconfined compressive strength of a sample by pocket penetrometer. The procedures in this SOP will be followed, and any deviations must be noted in your laboratory notebook.

Health and Safety

All laboratory work will be performed by approved staff in accordance with the *EGL Chemical Hygiene Plan* (CHP) by staff approved by the laboratory manager and chemical hygiene officer. Approval to work in the EGL requires orientation to laboratory safety procedures and potential hazards under the guidance of the Laboratory Manager, as specified in the CHP.

Hazards and controls associated with this SOP are listed in the following sections and explicitly linked in **Table A**. Hazards associated with project-specific media are addressed in the Project Safety Analysis (PSA) document.

Hazards Associated with this Standard Operating Procedure

- Inhalation, ingestion, and skin or eye contact with contaminants or small particles

Engineering Controls

- Perform work in an operational fume hood.

Administrative Controls

- None

Personal Protective Equipment

- Laboratory coat
- Safety glasses
- Nitrile gloves (Ansell® TouchNTuff® 92-600)

Inspection Requirements

- Inspect personal protective equipment (PPE) prior to use.
- Confirm fume hood face velocity prior to use.

Equipment and Supplies

The following equipment may be necessary to carry out the procedures in this SOP; additional equipment may be required:

- Appropriate sample or test container
- Pocket penetrometer
- Adapter foot

Procedure

1. The test should be performed on an intact, undisturbed, representative sample.
2. The sample container or test container walls must be of sufficient distance away from the penetrometer location such that confinement from the walls does not impact the test results.
3. Hold the penetrometer vertically above the sample surface, a minimum of 2 inches from the edge of the sample surface.
4. Press the penetrometer into the sample with steady pressure until the calibration mark is even with the surface of the sample.
5. Record the strength value.
6. Repeat the measurement (not in the same location) twice and record the strength value.
7. For low-strength samples, attach the adapter foot and repeat the measurement. The value measured with the adapter foot is divided by 16 to obtain the strength value.

Quality Assurance/Quality Control

Penetrometer readings should be performed in triplicate. In addition, duplicate or replicate samples should be analyzed at a project-appropriate rate, with at least one duplicate per event. Duplicate reproducibility is determined as the relative percent difference (RPD) (Equation 1).

Equation 1

$$RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2) \div 2}$$

where:

<i>RPD</i>	=	relative percent difference
X_1	=	larger result value
X_2	=	smaller result value

If RPDs exceed 30%, notify the EGL task lead and discuss the RPD results within the scope of the project. In cases where RPDs exceed 30%, the data may still be of good quality. High RPDs may result from sample heterogeneity or other factors.

Closeout

The remaining media from this experiment can be disposed of as described in Table 1.

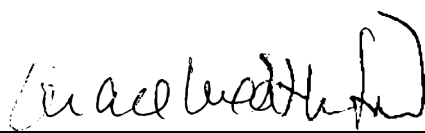
Project-specific media disposal is outlined in the Project Closeout Plan (PCP). If other unforeseen media is generated from this procedure, laboratory personnel and project managers will coordinate to characterize and dispose of those materials in accordance with federal, state, and local regulations.

Table 1
Disposal of Remaining Media

Remaining Media	Disposal Considerations	Disposal Procedure
Soil or sediment	Refer to the PCP for potentially regulated constituents.	Refer to the PCP for project-specific disposal methods.

Standard Operating Procedure Approval Page

This standard operating procedure, Unconfined Strength by Pocket Penetrometer, has been reviewed and is approved for use in the Environmental Geochemistry Laboratory.

Signature:  Date: 08/18/2025
Grace Weatherford, Chemical Hygiene Officer

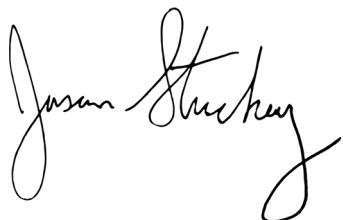
Signature:  Date: 08/18/2025
Jason Stuckey, Laboratory Manager

Table A

Hazards

Table A
Hazards

Potential Hazard(s)	Engineering Controls	Administrative Controls (Includes Work Practices)	PPE	Inspection Requirements
Inhalation, ingestion, and skin or eye contact with contaminants or small particles	Perform work in an operational fume hood.	--	- Safety glasses - Laboratory coat - Nitrile gloves (Ansell® TouchNTuff® 92-600)	- Inspect PPE prior to use. - Confirm fume hood face velocity prior to use.

Notes:

--: not applicable

PPE: personal protective equipment

Attachment 2

Field Audit Checklist

Field Audit Checklist

Instructions: Review this checklist to ensure field work is conducted as proposed.

Site:	
Field Personnel:	
Date:	

- ☐ Have daily toolbox safety meetings been conducted?
- ☐ Have daily emails to project team been sent to help track project status and to keep key Anchor QEA team members up to date with the field program?
- ☐ Does the on-site field lead have contact information for all subcontractors on site?
- ☐ Has the laboratory courier been contacted (if needed) to pick up samples at the end of the day?
If courier is not being used, has time been allocated to deliver samples to shipping center?
- ☐ Has the HASP been reviewed and signed by all field personnel and has the work been performed in accordance with the HASP (including proof of certification for all personnel)?
- ☐ Do any Job Safety Analyses need to be updated?
- ☐ Have the project Work Plan, QAPP, and HASP been reviewed by each field team member?
Is there a hardcopy of each on site?
- ☐ Have sampling procedures such as acceptance criteria, sample description, homogenization, and decontamination of equipment been conducted as described in the Work Plan and QAPP?
- ☐ Have there been any substantial changes from the Work Plan, QAPP, or HASP?
 - ☐ If yes, have the PM, EPA, and NYSDEC been notified?
- ☐ Is investigation-derived waste being stored, labeled, and tracked properly (if generated)?

Attachment 3

Stage 1 Validation Checklist

Data Completeness Checklist (USEPA Stage 1)

Project: Pettit Cove to Gratiwick Riverside Park **Date:** MM/DD/YYYY

Project #: 260049-02.01 **Laboratory:** GeoTesting Express, Inc.

SDG(s): SDG Number(s)

Analysis and Method: Atterberg limits (ASTM International [ASTM] D6913), grain size (ASTM D6913), moisture content (ASTM D2216), USCS Soil Classification (ASTM D2487)

Yes	No	N/A	
☐	☐	☐	COCs filled out correctly?
☐	☐	☐	Sample IDs, collection dates and times, and date and time of lab receipt documented?
☐	☐	☐	Sample receipt conditions documented?
☐	☐	☐	Requested analyses completed?
☐	☐	☐	Target analyte list and correct units reported?
☐	☐	☐	Requested methods used for sample handling, preparation, cleanup, and analyses?
☐	☐	☐	Associated analyses dates present?
☐	☐	☐	Holding times met (from sampling date to preparation and preparation to analysis), where applicable?
☐	☐	☐	Other issues?

Notable Deviations: